**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

# COURSE STRUCTURE AND SYLLABUS

## For UG – R20

## B. TECH – ELECTRONICS AND INSTRUMENTATION ENGINEERING

*(Applicable for batches admitted from 2020-2021)*


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# COURSE STRUCTURE

**I Year – I SEMESTER**

| S. No | Course Code | Course Name | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | | Mathematics – I | 3 | 0 | 0 | 3 |
| 2 | | Applied Chemistry | 3 | 0 | 0 | 3 |
| 3 | | Communicative English | 3 | 0 | 0 | 3 |
| 4 | | Programming for Problem Solving Using C | 3 | 0 | 0 | 3 |
| 5 | | Engineering Drawing | 2 | 0 | 2 | 3 |
| 6 | | English Communication Skills Laboratory | 0 | 0 | 3 | 1.5 |
| 7 | | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 8 | | Programming for Problem Solving Using C Lab | 0 | 0 | 3 | 1.5 |
| **Total Credits** | | | | | | **19.5** |

**I Year – II SEMESTER**

| S. No | Course Code | Subjects | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | | Mathematics – II | 3 | 0 | 0 | 3 |
| 2 | | Applied Physics | 3 | 0 | 0 | 3 |
| 3 | | Object Oriented Programming through Java | 2 | 0 | 2 | 3 |
| 4 | | Network Analysis | 3 | 0 | 0 | 3 |
| 5 | | Basic Electrical Engineering | 3 | 0 | 0 | 3 |
| 6 | | Electronic components & Measuring Instruments Workshop | 0 | 0 | 3 | 1.5 |
| 7 | | Basic Electrical Engineering Lab | 0 | 0 | 3 | 1.5 |
| 8 | | Applied Physics Lab | 0 | 0 | 3 | 1.5 |
| 9 | | Environmental Science | 3 | 0 | 0 | 0 |
| **Total Credits** | | | | | | **19.5** |

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**II B.Tech - I Semester**

| S. No. | Category | Subjects | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PC | Electronic Devices and Circuits | 3 | 1 | 0 | 3 |
| 2 | PC | Signals and Systems | 3 | 1 | 0 | 3 |
| 3 | PC | Switching Theory and Logic Design | 3 | 1 | 0 | 3 |
| 4 | PC | Electronic Measurements and Instrumentation | 3 | 1 | 0 | 3 |
| 5 | BS | Mathematics-III | 3 | 1 | 0 | 3 |
| 6 | LC | Electronic Devices and Circuits Lab | 0 | 0 | 3 | 1.5 |
| 7 | LC | Electronic Measurements and Instrumentation Lab | 0 | 0 | 3 | 1.5 |
| 8 | LC | Digital System Design Lab | 0 | 0 | 3 | 1.5 |
| 9 | | Skill oriented course *(Computational Techniques using MATLAB and Lab VIEW) | 1 | 0 | 2 | 2 |
| | | **Total Credits** | | | | **21.5** |

**II B.Tech - II Semester**

| S. No. | Category | Subjects | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PC | Electronic Circuits Analysis | 3 | 1 | 0 | 3 |
| 2 | ES | Linear Control Systems | 3 | 1 | 0 | 3 |
| 3 | PC | Microprocessor and Micro controllers | 3 | 1 | 0 | 3 |
| 4 | PC | Integrated Circuits and applications | 3 | 1 | 0 | 3 |
| 5 | HS | Managerial Economics and Financial Analysis | 3 | 0 | 0 | 3 |
| 6 | LC | Electronic Circuit Analysis LAB | 0 | 0 | 3 | 1.5 |
| 7 | LC | Microprocessor and Micro controllers Lab | 0 | 0 | 3 | 1.5 |
| 8 | LC | Integrated Circuits and applications Lab | 0 | 0 | 3 | 1.5 |
| 9 | | Skill Course (Python Programming) | 1 | 0 | 2 | 2 |
| | | **Total Credits** | | | | **21.5** |

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**III B.Tech I Semester**

| S. No. | Category | Subjects | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | | Digital Signal Processing | 3 | 0 | 0 | 3 |
| 2 | | Transducers and Sensors | 3 | 0 | 0 | 3 |
| 3 | | Industrial Instrumentation | 3 | 0 | 0 | 3 |
| 4 | | Professional Elective courses (PE1) | 3 | 0 | 0 | 3 |
| 5 | | Open Elective (OE1) | 3 | 0 | 0 | 3 |
| 6 | | Transducers and Sensors Lab | 0 | 0 | 3 | 1.5 |
| 7 | | Digital Signal Processing Lab | 0 | 0 | 3 | 1.5 |
| 8 | | SCILAB | **1** | **0** | **2** | **2** |
| 9 | | Indian Traditional Knowledge | 2 | 0 | 0 | 0 |
| 10 | | Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester) | 0 | 0 | 0 | 1.5 |
| | | **Total Credits** | | | | **21.5** |
| 11 | | **Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)** | 4 | 0 | 0 | **4** |

| **PE1:** | **HONOR COURSES** | **MINOR COURSES** |
|---|---|---|
| 1. Principles of Communication Engineering | 1. Computer Networks | 1. Signals and Systems |
| 2. PLCs and SCADA | 2. Artificial Intelligence | 2. Analog and Digital Communications |
| 3. IOT Sensor Technology | 3. CMOS Analog IC Design | 3. Principles of Electronics |
| 4. EMI/EMC | 4. Advanced Sensors | 4. Principles of Instrumentation |

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## III B. Tech II Semester

| S. No. | Category | Subjects | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PC | Process Control Instrumentation | 3 | 0 | 0 | 3 |
| 2 | PC | VLSI Design | 3 | 0 | 0 | 3 |
| 3 | PC | Analytical Instrumentation | 3 | 0 | 0 | 3 |
| 4 | PE | Professional Elective courses(PE2) | 3 | 0 | 0 | 3 |
| 5 | OE | Open Elective (OE2) | 3 | 0 | 0 | 3 |
| 6 | LC | Process Control Lab | 0 | 0 | 3 | 1.5 |
| 7 | LC | VLSI Design Lab | 0 | 0 | 3 | 1.5 |
| 8 | LC | Advanced Instrumentation Lab | **1** | **0** | **2** | **2** |
| 9 | | Machine learning using Scikit | 2 | 0 | 0 | 0 |
| 10 | MC | Research Methodology | 0 | 0 | 0 | 1.5 |
| | | **Total Credits** | | | | **21.5** |
| 11 | | **Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)** | 4 | 0 | 0 | **4** |
| **Industrial/Research Internship (Mandatory) 2 Months during summer vacation** | | | | | | |

| **PE2:** | **HONOR COURSES** | **MINOR COURSES** |
|---|---|---|
| 1.Robotics and Automation<br>2.Computer Architecture and Organization<br>3.Soft computing techniques<br>4.MEMS and Micro Systems | 1.Machine Learning for Image Processing<br>2.Digital Control Systems<br>3.Data Converters<br>4.Biomedical Instrumentation | 1.Principles of Nano Sensors<br>2.Biomedical Engineering<br>3.Digital logic and Microcontrollers<br>4.Telemetry and Telemedicine |

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**IV B.Tech I Semester**

| S. No. | Category | Subjects | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PE | Professional Elective courses(PE3) | 3 | 0 | 0 | 3 |
| 2 | PE | Professional Elective courses(PE4) | 3 | 0 | 0 | 3 |
| 3 | PE | Professional Elective courses(PE5) | 3 | 0 | 0 | 3 |
| 4 | OE | Open Elective (OE3) | 3 | 0 | 0 | 3 |
| 5 | OE | Open Elective (OE4) | 3 | 0 | 0 | 3 |
| 6 | MC | Universal Human Values 2: Understanding Harmony | 3 | 0 | 0 | 3 |
| 7 | | Introduction to Data Analytics /2.Interfacing with Arduino | 1 | 0 | 2 | 2 |
| 8 | | Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester | 0 | 0 | 0 | 3 |
| | | **Total Credits** | | | | **23** |
| 9 | | **Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)** | 4 | 0 | 0 | **4** |

*There is a provision for the Universities/Institutions to implement AICTE mandatory course "Universal Human Values 2: Understanding Harmony" under Humanities and social science Elective in seventh semester for 3 credits.

| | | |
|---|---|---|
| PE3:<br>1. Embedded Systems<br>2.Bio Signal Processing<br>3.Virtual Instrumentation<br>4.Nano Science | HONOR COURSES<br>1.Computer Control of Processes<br>2. Power Plant Instrumentation<br>3.Optimal Control Systems<br>4.CMOS Digital IC Design | Minor Courses<br>1.Digital Signal Processing<br>2. Machine learning<br>3.Fundamentals of Embedded Systems<br>4.Filter Design |
| PE4:<br>1.Non-Linear and Robust Control<br>2.Artificial Intelligence<br>3. Automotive Sensors<br>4.Artificial Neural Networks and Fuzzy Logic | | |
| PE5:<br>1.DSP processors & Architectures<br>2.Instrumentation in Petro Chemical Industries<br>3. Digital Control Systems<br>4.Adaptive Control Systems | | |

**IV B.Tech II Semester**

| S.No. | Category | Code | Course Title | Hours per week | | | Credits |
|---|---|---|---|---|---|---|---|
| 1 | Major Project | PROJ | Project<br>Project work, seminar and internship in industry | - | - | - | 12 |
| | **INTERNSHIP (6 MONTHS)** | | | | | | |
| | | | | | | **Total credits** | **12** |

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **MATHEMATICS-I** | | | | | |

**Course Objectives:**

- This course will illuminate the students in the concepts of calculus.
- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

**Course Outcomes:**

At the end of the course, the student will be able to:

- utilize mean value theorems to real life problems (L3)
- solve the differential equations related to various engineering fields (L3)
- familiarize with functions of several variables which is useful in optimization (L3)
- Apply double integration techniques in evaluating areas bounded by region (L3)
- students will also learn important tools of calculus in higher dimensions. Students will becomefamiliar with 2- dimensional and 3-dimensional coordinate systems (L5)

**UNIT-I: Sequences, Series and Mean value theorems: (10 hrs)**

Sequences and Series: Convergences and divergence – Ratio test – Comparison tests – Integral test –Cauchy's root test – Alternate series – Leibnitz's rule.

Mean Value Theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy'smean value theorem – Taylor's and Maclaurin's theorems with remainders.

**UNIT-II: Differential equations of first order and first degree: (10 hrs)**

Linear differential equations – Bernoulli's equations – Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.

**UNIT III: Linear differential equations of higher order: (10 hrs.)**

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term ofthe type $e^{ax}$, sin ax, cos ax, polynomials in $x^n$, $e^{ax}$ V(x) and $x^n$V(x) – Method of Variation of parameters. Applications: LCR circuit, Simple Harmonic motion.

**UNIT IV: Partial differentiation: (10 hrs.)**

Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

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**UNIT V: Multiple integrals:** **(8 hrs.)**
Double and Triple integrals – Change of order of integration – Change of variables.
Applications: Finding Areas and Volumes.

**Text Books:**

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference Books:**

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Joel Hass, Christopher Heil and Maurice D. Weir,** Thomas calculus, 14th Edition, Pearson.
3. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press, 2013.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

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| I Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **APPLIED CHEMISTRY** | | | | | |

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.**Learning Objectives:**

- Importance of usage of plastics in household appliances and composites (FRP) in aerospace andautomotive industries.
- Outline the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
- Express the increase in demand as wide variety of advanced materials are introduced; which haveexcellent engineering properties.
- Explain the crystal structures, and the preparation of semiconductors. Magnetic properties arealso studied.
- Recall the increase in demand for power and hence alternative sources of power are studied dueto depleting sources of fossil fuels. Advanced instrumental techniques are introduced.

**UNIT I POLYMER TECHNOLOGY**

**Polymerization:** -Introduction-methods of polymerization (emulsion and suspension)-physical and mechanical properties.

**Plastics:** Compounding-fabrication (compression, injection, blown film, extrusion) - preparation, properties and applications of PVC, polycarbonates and Bakelite-mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

**Elastomers: -** Natural rubber-drawbacks-vulcanization-preparation, properties and applications of synthetic rubbers (Buna S, Thiokol and polyurethanes).

**Composite materials:** Fiber reinforced plastics-conducting polymers-biodegradable polymers-biopolymers-biomedical polymers.

**Outcomes: At the end of this unit, the students will be able to**

Analyze the different types of composite plastic materials and interpret the mechanism of conduction in conducting polymers

**UNIT II: ELECTROCHEMICAL CELLS AND CORROSION**

Single electrode potential-Electrochemical series and uses of series-standard hydrogen electrode, calomel electrode-concentration cell-construction of glass electrode-Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li ion battery, zinc air cells–Fuel cells: $H_2$-$O_2$, $CH_3OH$-$O_2$, phosphoric acid, moltencarbonate.

**Corrosion:** -Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, waterline corrosion-passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control (proper designing, cathodic protection)-Protective coatings: Surface preparation, cathodic and anodic coatings, electroplating, electroless plating (nickel). Paints (constituents, functions, special paints).

**Course Outcomes:** ***At the end of this unit, the students will be able to***

- ***Utilize*** the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and c***ategorize*** the reasons for corrosion and study methods to control corrosion.

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**UNIT III: MATERIAL CHEMISTRY**

**Part I: Non-elemental semiconducting materials**: - Stoichiometric, controlled valency & chalcogen photo/semiconductors-preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling, epitaxy, diffusion, ion implantation) - Semiconductor devices (p-n junction diode as rectifier, junction transistor).

**Insulators &magnetic materials:** electrical insulators-ferro and ferri magnetism-Hall effect and its applications.

**Part II:**

**Nano materials: -** Introduction-sol-gel method- characterization by BET, SEM and TEM methods-applicationsof graphene-carbon nanotubes and fullerenes: Types, preparation and applications

**Liquid crystals: -** Introduction-types-applications.

**Super conductors: -**Type –I, Type II-characteristics and applications

**Course Outcomes:** ***At the end of this unit, the students will be able to***

- ***Synthesize*** nanomaterials for modern advances of engineering technology.
- ***Summarize the*** preparation of semiconductors; analyze the applications of liquid crystals and superconductors.

**UNIT IV: SPECTROSCOPIC TECHNIQUES & NON-CONVENTIONAL ENERGY SOURCES**

**10 hrs**

**Part A**: **SPECTROSCOPIC TECHNIQUES**

Electromagnetic spectrum-UV (laws of absorption, instrumentation, theory of electronic spectroscopy, Frank-condon principle, chromophores and auxochromes, intensity shifts, applications), FT-IR [instrumentation and differentiation of sp, $sp^2$, $sp^3$ and IR stretching of functional groups (alcohols, carbonyls, amines) applications], magnetic resonance imaging and CT scan (procedure & applications).

**Part B*:* NON-CONVENTIONAL ENERGY SOURCES**

Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, hydropower,geothermal power, tidal and wave power, ocean thermal energy conversion.

**Course Outcomes:** ***At the end of this unit, the students will be able to***

- ***Analyze*** the principles of different analytical instruments and their applications.
- ***Design*** models for energy by different natural sources.

**UNIT V: ADVANCED CONCEPTS/TOPICS IN CHEMISTRY** **8 hrs**

***Computational chemistry***: Introduction to computational chemistry, molecular modelling and docking studies ***Molecular switches*****:** characteristics of molecular motors and machines, Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, a molecular elevator, an autonomous light-powered molecular motor

**Course Outcomes:** ***At the end of this unit, the students will be able to***

- ***Obtain*** the knowledge of computational chemistry and molecular machines

**Standard Books:**

1. P.C. Jain and M. Jain "**Engineering Chemistry**", 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).
2. Shikha Agarwal, "**Engineering Chemistry**", Cambridge University Press, New Delhi, (2019).
3. S.S. Dara, "**A Textbook of Engineering Chemistry**", S.Chand & Co, (2010).
4. Shashi Chawla, "Engineering Chemistry", Dhanpat Rai Publicating Co. (Latest edition).

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Reference:**


1. K. Sesha Maheshwaramma and Mridula Chugh, "**Engineering Chemistry**", Pearson India Edn.
2. O.G. Palana, "**Engineering Chemistry**", Tata McGraw Hill Education Private Limited, (2009).
3. CNR Rao and JM Honig (Eds) "**Preparation and characterization of materials**" Academic press, NewYork (latest edition)
4. B. S. Murthy, P. Shankar and others, "**Textbook of Nanoscience and Nanotechnology**", University press(latest edition)

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| I Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **COMMUNICATIVE ENGLISH** | | | | | |

**Introduction**

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improvesthe learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearlyin speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

**Course Objectives**

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken bynative speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

**Learning Outcomes**

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specificinformation
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

**Unit 1:**

**Lesson-1: A Drawer full of happiness** from "**Infotech English**", Maruthi Publications

**Lesson-2: Deliverance by Premchand** from "**The Individual Society",** Pearson Publications. (Non-detailed)

**Listening:** Listening to short audio texts and identifying the topic. Listening to prose, prose and conversation.
**Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests. Self introductions and introducing others.
**Reading:** Skimming text to get the main idea. Scanning to look for specific pieces of information.
**Reading for Writing:** Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign postsand transition signals; mechanics of writing - punctuation, capital letters.
**Vocabulary:** Technical vocabulary from across technical branches (20) GRE Vocabulary (20) (Antonyms and Synonyms, Word applications) Verbal reasoning and sequencing of words.
**Grammar:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural basic sentence structures; simple question form - wh-questions;word order in sentences.
**Pronunciation**: Vowels, Consonants, Plural markers and their realizations

**Unit 2:**

**Lesson-1: Nehru's letter to his daughter Indira on her birthday** from "**Infotech English**", Maruthi Publications

**Lesson-2: Bosom Friend by Hira Bansode** from "**The Individual Society",** Pearson Publications.(Non-detailed)

**Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts,both in speaking and writing.

**Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings.**Reading**: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

**Reading for Writing**: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

**Vocabulary**: Technical vocabulary from across technical branches (20 words). GRE Vocabulary Analogies (20 words) (Antonyms and Synonyms, Word applications)

**Grammar**: Use of articles and zero article; prepositions.

**Pronunciation**: Past tense markers, word stress-di-syllabic words

**Unit 3:**

**Lesson-1: Stephen Hawking-Positivity 'Benchmark'** from "**Infotech English**", Maruthi Publications

**Lesson-2: Shakespeare's Sister by Virginia Woolf** from "**The Individual Society",** Pearson Publications.(Non-detailed**)**

**Listening:** Listening for global comprehension and summarizing what is listened to, both in speaking andwriting.
**Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed.FunctionalEnglish: Complaining and Apologizing.
**Reading**: Reading a text in detail by making basic inferences - recognizing and interpreting specific contextclues; strategies to use text clues for comprehension. Critical reading.

**Reading for Writing**: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing-mail etiquette, Writing CV's.

**Vocabulary**: Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Association, sequencing of words

**Grammar**: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academicpurposes.

**Pronunciation**: word stress-poly-syllabic words.

**Unit 4:**

**Lesson-1: Liking a Tree, Unbowed: Wangari Maathai-biography** from "**Infotech English**", Maruthi Publications

**Lesson-2: Telephone Conversation-Wole Soyinka** from "**The Individual Society",** Pearson Publications**.** (Non-detailed)

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video (onlyaudio); listening to audio-visual texts.

**Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - askingfor and giving information/directions. Functional English: Permissions, Requesting, Inviting.

**Reading**: Studying the use of graphic elements in texts to convey information, revealtrends/patterns/relationships, communicative process or display complicated data.
**Reading for Writing**: Information transfer; describe, compare, contrast, identify significance/trends based oninformation provided in figures/charts/graphs/tables. Writing SOP, writing for media.
**Vocabulary**: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters.
**Grammar**: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees ofcomparison; use of antonyms

**Pronunciation**: Contrastive Stress

**Unit 5:**

**Lesson-1: Stay Hungry-Stay foolish** from "**Infotech English**", Maruthi Publications

**Lesson-2: Still I Rise by Maya Angelou** from "**The Individual Society",** Pearson Publications.(Non-detailed)

**Listening:** Identifying key terms, understanding concepts and interpreting the concepts both in speaking andwriting.

**Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides.Functional English: Suggesting/Opinion giving.
**Reading**: Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Reading for Writing**: Writing academic proposals- writing research articles: format and style.
**Vocabulary**: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions.

**Grammar**: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

**Pronunciation**: Stress in compound words
**Prescribed text books for theory for Semester-I:**

**1.** "**Infotech English**", Maruthi Publications. (Detailed)

**2.**"**The Individual Society",** Pearson Publications. (Non-detailed)

**Prescribed text book for Laboratory for Semesters-I & II:**

1. "**Infotech English**", Maruthi Publications. (With Compact Disc)

**Reference Books:**


- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2ndEdition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - I Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **PROGRAMMING FOR PROBLEM SOLVING USING C** | | | | | |

**COURSE OBJECTIVES:**
**The objectives of Programming for Problem Solving Using C are**

- To learn about the computer systems, computing environments, developing of a computerprogram and Structure of a C Program
- To gain knowledge of the operators, selection, control statements and repetition in C
- To learn about the design concepts of arrays, strings, enumerated structure and union types. Tolearn about their usage.
- To assimilate about pointers, dynamic memory allocation and know the significance ofPreprocessor.
- To assimilate about File I/O and significance of functions

**UNIT-I**
**Introduction to Computers:** Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers
**Introduction to the C Language:** Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.
**Structure of a C Program:** Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.

**UNIT-II**
**Bitwise Operators:** Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.
**Selection & Making Decisions:** Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions
**Repetition:** Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples

**UNIT-III**
**Arrays:** Concepts, Using Array in C, Array Application, Two Dimensional Arrays, MultidimensionalArrays, Programming Example – Calculate Averages
**Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code
**Enumerated, Structure, and Union:** The Type Definition (Type def), Enumerated Types, Structure,Unions, and Programming Application

**UNIT-IV**
**Pointers:** Introduction, Pointers to pointers, Compatibility, L value and R value
**Pointer Applications:** Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application
**Processor Commands**: Processor Commands

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**UNIT-V**

**Functions:** Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion

**Text Input / Output:** Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions

**Binary Input / Output:** Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

**TEXT BOOKS:**

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F. Gilberg, CENGAGE
2. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, 2nd edition , Pearson

**REFERENCES:**

1. Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill
2. Programming in C, Ashok N. Kamthane, AmitKamthane, Pearson
3. Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD

**COURSE OUTCOMES:**

Upon the completion of the course the student will learn

- To write algorithms and to draw flowcharts for solving problems
- To convert flowcharts/algorithms to C Programs, compile and debug programs
- To use different operators, data types and write programs that use two-way/ multi-way selection
- To select the best loop construct for a given problem
- To design and implement programs to analyze the different pointer applications
- To decompose a problem into functions and to develop modular reusable code
- To apply File I/O operations

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - I Semester | | L | T | P | C |
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| | | 2 | 0 | 2 | 3 |
| **ENGINEERING DRAWING** | | | | | |

**Course Objective:** Engineering drawing being the principal method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

**Unit-I**
**Objective:** To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.
**Polygons:** Constructing regular polygons by general methods, inscribing and describing polygons oncircles.
**Curves:** Parabola, Ellipse and Hyperbola by general and special methods, cycloids, involutes, tangents &normals for the curves.
**Scales:** Plain scales, diagonal scales and Vernier scales

**Unit-II**
**Objective:** To introduce the students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.
**Orthographic Projections:** Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.
Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

**Unit -III**
**Objective:** The objective is to make the students draw the projections of the plane inclined to both the planes.
Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

**Unit-IV**
**Objective:** The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.
Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to both theplanes.

**Unit-V**
**Objective:** The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.
Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.
Computer Aided Design, drawing practice using Auto CAD, creating 2D&3D drawings of objects using Auto CAD

**Note:** In the End Examination there will be no question from CAD.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**TEXT BOOKS:**

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

**REFERENCE BOOKS:**

1. Engineering Drawing by K.L. Narayana& P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGraw-Hill Publishers
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age

**Course Outcome:** The student will learn how to visualize 2D & 3D objects.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - I Semester | | L | T | P | C |
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| | | 0 | 0 | 3 | 1.5 |
| **ENGLISH COMMUNICATION SKILLS LABORATORY** | | | | | |

## TOPICS

**UNIT I:**
Vowels, Consonants, Pronunciation, Phonetic Transcription, Common Errors in Pronunciation,

**UNIT II:**
Word stress-di-syllabic words, poly-syllabic words, weak and strong forms, contrastive stress (Homographs)

**UNIT III:**
Stress in compound words, rhythm, intonation, accent neutralisation.

**UNIT IV:**
Listening to short audio texts and identifying the context and specific pieces of information to answer a series ofquestions in speaking.

**UNIT V:**
Newspapers reading; Understanding and identifying key terms and structures useful for writing reports.

**Prescribed text boo**k: "**Infotech English**", Maruthi Publications.

**References:**
1. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
2. English Pronunciation in use- Mark Hancock, Cambridge University Press.
3. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
4. English Pronunciation in use- Mark Hewings, Cambridge University Press.
5. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
6. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - I Semester | | L | T | P | C |
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| | | 0 | 0 | 3 | 1.5 |
| **APPLIED CHEMISTRY LAB** | | | | | |

Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis

1. Determination of HCl using standard $Na_2CO_3$ solution.
2. Determination of alkalinity of a sample containing $Na_2CO_3$ and NaOH.
3. Determination of $Mn^{+2}$ using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of $Cu^{+2}$ using standard hypo solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of $Fe^{+3}$ by a colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).
9. Determination of iso-electric point of amino acids using pH-metry method/conductometric method.
10. Determination of the concentration of strong acid vs strong base (by conductometric method).
11. Determination of strong acid vs strong base (by potentiometric method).
12. Determination of $Mg^{+2}$ present in an antacid.
13. Determination of $CaCO_3$ present in an egg shell.
14. Estimation of Vitamin C.
15. Determination of phosphoric content in soft drinks.
16. Adsorption of acetic acid by charcoal.
17. Preparation of nylon-6, 6 and Bakelite (demonstration only).

Of the above experiments at-least 10 assessment experiments should be completed in a semester.

**Outcomes**: The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus, at the end ofthe lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

**Reference Books**

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - I Semester | | L | T | P | C |
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| | | 0 | 0 | 3 | 1.5 |
| **PROGRAMMING FOR PROBLEM SOLVING USING C LAB** | | | | | |

**Course Objectives:**

- Apply the principles of C language in problem solving.
- To design flowcharts, algorithms and knowing how to debug programs.
- To design & develop of C programs using arrays, strings pointers & functions.
- To review the file operations, preprocessor commands.

**Exercise 1:**

1. Write a C program to print a block F using hash (#), where the F has a height of sixcharacters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inchesand width of 5 inches.
3. Write a C program to display multiple variables.

**Exercise 2:**

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positiveand p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

**Exercise 3:**

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the variousgeometrical shape.
3. Write a C program to calculate the factorial of a given number.

**Exercise 4:**

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum.1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

**Exercise 5:**

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

**Exercise 6:**

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

**Exercise 7:**

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

**Exercise 8:**

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Exercise 9:**

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

**Exercise 10:**

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

**Exercise 11:**

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

**Exercise 12:**

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

**Exercise 13:**

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.

**Exercise 14:**

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

**Exercise 15:**

1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to get the largest element of an array using the function.

**Exercise 16:**

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to remove a file from the disk.

**Course Outcomes:**

**By the end of the Lab, the student**

- Gains Knowledge on various concepts of a C language.
- Able to draw flowcharts and write algorithms.
- Able design and development of C problem solving skills.
- Able to design and develop modular programming skills.
- Able to trace and debug a program

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - II Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **MATHEMATICS - II** | | | | | |

**Course Objectives:**

- To instruct the concept of Matrices in solving linear algebraic equations
- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real- world problems and their applications.

**Course Outcomes:** At the end of the course, the student will be able to

- develop the use of matrix algebra techniques that is needed by engineersfor practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan,Gauss Seidel (L3)
- evaluate approximating the roots of polynomial and transcendental equations bydifferent algorithms (L5)
- apply Newton's forward & backward interpolation and Lagrange's formulae forequal and unequal intervals (L3)
- apply different algorithms for approximating the solutions of ordinary differentialequations to its analytical computations (L3)

**Unit I: Solving systems of linear equations, Eigen values and Eigen vectors: (10hrs)**

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss Elimination method – Eigen values and Eigen vectors and properties (article-2.14 in text book-1).

**Unit-II: Cayley-Hamilton theorem and Quadratic forms: (10hrs)**

Cayley-Hamilton theorem (without proof) – Finding inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation.
Singular values of a matrix, singular value decomposition (text book-3).

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**UNIT III: Iterative methods: (8 hrs)**

Introduction – Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations) – Jacobi and Gauss-Seidel methods for solving system of equations numerically.

**UNIT IV: Interpolation: (10 hrs)**

Introduction – Errors in polynomial interpolation – Finite differences – Forward differences – Backward differences – Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange'sinterpolation formula – Newton's divide difference formula.

**UNIT – V: Numerical differentiation and integration, Solution of ordinary differential equations with initial conditions: (10 hrs)**

Numerical differentiation using interpolating polynomial – Trapezoidal rule– Simpson's $1/3^{rd}$ and $3/8^{th}$ rule– Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method – Runge-Kutta method (second and fourth order).

**Text Books:**

1. **B. S. Grewal,** Higher Engineering Mathematics, $44^{th}$ Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw HillEducation.
3. **David Poole,** Linear Algebra- A modern introduction, $4^{th}$ Edition, Cengage.

**Reference Books:**

1. **Steven C. Chapra,** Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
2. **M. K. Jain, S.R.K. Iyengar and R.K. Jain,** Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
3. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - II Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **APPLIED PHYSICS** | | | | | |

**Unit-I: Wave Optics** **12hrs**

**Interference:** Principle of superposition –Interference of light - Interference in thin films(Reflection Geometry) & applications - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index.

**Diffraction:** Introduction - Fresnel and Fraunhofer diffraction - Fraunhofer diffraction due tosingle slit, double slit - N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

**Polarization:** Introduction-Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

**Unit Outcomes:**

**The students will be able to**

- **Explain** the need of coherent sources and the conditions for sustained interference (L2)
- **Identify** engineering applications of interference (L3)
- **Analyze** the differences between interference and diffraction with applications (L4)
- **Illustrate** the concept of polarization of light and its applications (L2)
- **Classify** ordinary polarized light and extraordinary polarized light (L2)

**Unit-II: Lasers and Fiber optics** **8hrs**

**Lasers:** Introduction – Characteristics of laser – Spontaneous and Stimulated emissions ofradiation – Einstein's coefficients – Population inversion – Lasing action - Pumping mechanisms – Ruby laser – He-Ne laser - Applications of lasers.

**Fiber optics:** Introduction –Principle of optical fiber- Acceptance Angle - Numerical Aperture - Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers - Applications.

**Unit Outcomes:**

**The students will be able to**

- **Understand** the basic concepts of LASER light Sources (L2)
- **Apply** the concepts to learn the types of lasers (L3)
- **Identifies** the Engineering applications of lasers (L2)
- **Explain** the working principle of optical fibers (L2)
- **Classify** optical fibers based on refractive index profile and mode of propagation (L2)
- **Identify** the applications of optical fibers in various fields (L2)

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Unit III: Quantum Mechanics, Free Electron Theory and Band theory 10hrs**

**Quantum Mechanics:** Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependentwave equations– Particle in a one-dimensional infinite potential well.

**Free Electron Theory:** Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory– Equation for electrical conductivity based on quantum free electron theory- Fermi-Dirac distribution- Density of states (3D) - Fermi energy.

**Band theory of Solids**: Bloch's Theorem (Qualitative) - Kronig - Penney model (Qualitative)- E vs K diagram - v vs K diagram - effective mass of electron – Classificationof crystalline solids–concept of hole.

**Unit Outcomes:**

**The students will be able to**

- **Explain** the concept of dual nature of matter (L2)
- **Understand** the significance of wave function (L2)
- **Interpret** the concepts of classical and quantum free electron theories (L2)
- **Explain** the importance of K-P model
- **Classify** the materials based on band theory (L2)
- **Apply** the concept of effective mass of electron (L3)

**Unit-IV: Dielectric and Magnetic Materials 8hrs**

**Dielectric Materials:** Introduction - Dielectric polarization - Dielectric polarizability,Susceptibility and Dielectric constant - Types of polarizations- Electronic (Quantitative),Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field- Clausius- Mossotti equation- Piezoelectricity.

**Magnetic Materials:** Introduction - Magnetic dipole moment - Magnetization- Magnetic susceptibility and permeability - Origin of permanent magnetic moment - Classification of magnetic materials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain conceptfor Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials- Eddy currents- Engineering applications.

**Unit Outcomes:**

**The students will be able to**

- **Explain** the concept of dielectric constant and polarization in dielectric materials (L2)
- **Summarize** various types of polarization of dielectrics (L2)
- **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics(L2)
- **Classify** the magnetic materials based on susceptibility and their temperaturedependence (L2)
- **Explain** the applications of dielectric and magnetic materials (L2)
- **Apply** the concept of magnetism to magnetic data storage devices (L3)

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Unit – V: Semiconductors and Superconductors** **10hrs**

**Semiconductors:** Introduction- Intrinsic semiconductors – Density of charge carriers – Electrical conductivity – Fermi level – extrinsic semiconductors – density of charge carriers – dependence of Fermienergy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation- Hall effect – Hall coefficient –Applications of Hall effect.
**Superconductors**: Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory (Qualitative) – Josephson effects (AC and DC) – SQUIDs – High $T_c$ superconductors – Applications of superconductors.

**Unit Outcomes:**

**The students will be able to**

- **Classify** the energy bands of semiconductors (L2)
- **Interpret** the direct and indirect band gap semiconductors (L2)
- **Identify** the type of semiconductor using Hall effect (L2)
- **Identify** applications of semiconductors in electronic devices (L2)
- **Classify** superconductors based on Meissner's effect (L2)
- **Explain** Meissner's effect, BCS theory & Josephson effect in superconductors (L2)

**Text books:**

1. M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy" A Text book of EngineeringPhysics"- S.Chand Publications, 11th Edition 2019.
2. Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).
3. Applied Physics by P.K.Palanisamy SciTech publications.

**Reference Books:**

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
2. Engineering Physics by M.R.Srinivasan, New Age international publishers (2009).
3. Shatendra Sharma, Jyotsna Sharma, " Engineering Physics", Pearson Education, 2018
4. Engineering Physics - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
5. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill
6. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year- II Semester | | L | T | P | C |
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| | | 2 | 0 | 2 | 3 |
| **OBJECT ORIENTED PROGRAMMING THROUGH JAVA** | | | | | |

**Course Objectives:**
This subject will help to improve

- the analytical skills of object oriented programming
- Overall development of problem solving and critical analysis.
- Formal introduction to Java programming language

**Course Outcomes:**
On successful completion of this course, the student should be able to:

- Show competence in the use of the Java programming language in the development of small tomedium- sized application programs that demonstrate professionally acceptable coding and performance standard
- Illustrate the basic principles of the object-oriented programming
- Demonstrate an introductory understanding ofgraphical user interfaces, multithreadedprogramming, and event-driven programming.

**Unit I**
**Introduction to Java:** Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.
Objects and Classes: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference.

**Unit II**
**Inheritance and Polymorphism:** Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

**Unit III**

**Event and GUI programming:** Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing, Creating a swing applet, swing controls and components.

**Unit IV**
**I/O programming:** Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. Event driven model, handling events

**Unit V**
**Multithreading in java:** Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.

**Text Books:**

1) Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.
2) Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.

**Reference Books:**

1) Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.
2) Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell,Pearson Education.
3) The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH.Java Programming, D. S. Malik, Cengage Learning.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year- II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **NETWORK ANALYSIS** | | | | | |

**UNIT – I**

**Introduction to Electrical Circuits**: Network elements classification, Electric charge and current, Electric energy and potential, Resistance parameter – series and parallel combination, Inductance parameter – series and parallel combination, Capacitance parameter – series and parallel combination. Energy sources: Ideal, Non-ideal, Independent and dependent sources, Source transformation, Kirchoff's laws, Mesh analysis and Nodal analysis problem solving with resistances only including dependent sources also. (Text Books: 1,2,3, Reference Books: 3)

**A.C Fundamentals and Network Topology**: Definitions of terms associated with periodic functions: Time period, Angular velocity and frequency, RMS value, Average value, Form factor and peak factor-problem solving, Phase angle, Phasor representation, Addition and subtraction of phasors, mathematical representation of sinusoidal quantities, explanation with relevant theory, problem solving. Principal of Duality with examples.

**Network Topology:** Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basictie set schedule, basic cut set schedule. (Text Books: 2,3, Reference Books: 3)

**UNIT – II**

**Transients:** First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots. Solutions using Laplace transform method. (Text Books: 1,2,3, Reference Books: 1,3)

**UNIT – III**

**Steady State Analysis of A.C Circuits:** Impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving. (Text Books: 1,2, Reference Books: 3)

**Coupled Circuits:** Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

**UNIT – IV**

**Resonance:** Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, Condition for maximum impedance, current in anti-resonance, Bandwidth of parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies. (Text Books:2,3, Reference Books: 3)

**Network Theorems:** Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens- problem solving using dependent sources also. (Text Books: 1,2,3, Reference Books: 2)

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**UNIT – V**

**Two-port Networks**: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Inverse h-parameters, Inverse Transmission line parameters, Relationship between parameter sets, Parallel connection of two port networks, cascading of two port networks, series connection of two port networks, problem solving including dependent sources also. (Text Books: 1,2, Reference Books: 1,3)

**TEXT BOOKS:**

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, 3rd Edition, 2000.
2. Network Analysis by K.Satya Prasad and S Sivanagaraju, Cengage Learning
3. Electric Circuit Analysis by Hayt and Kimmarle, TMH

**REFERENCES:**

1. Network lines and Fields by John. D. Ryder 2nd edition, Asia publishing house.
2. Basic Circuit Analysis by DR Cunninghan, Jaico Publishers.
3.Network Analysis and Filter Design by Chadha, Umesh Publications.

**COURSE OBJECTIVES:**

- To understand the basic concepts on RLC circuits.
- To know the behavior of the steady states and transients states in RLC circuits.
- To know the basic Laplace transforms techniques in periods' waveforms.
- To understand the two port network parameters.
- To understand the properties of LC networks and filters.

**COUSE OUTCOME:**

- gain the knowledge on basic network elements.
- will analyze the RLC circuits behavior in detailed.
- analyze the performance of periodic waveforms.
- gain the knowledge in characteristics of two port network parameters (Z, Y, ABCD, h & g).
- analyze the filter design concepts in real world applications.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **BASIC ELECTRICAL ENGINEERING (ES1211)** | | | | | |

**Preamble:**
This course covers various topics related to principle of operation and performance of various electrical machines.

**Course Educational Objectives:**

- To understand the principle of operation, constructional details and operational characteristics ofDC generators.
- To understand the principle of operation, characteristics of DC motor. Methods of starting andspeed control methods of DC motors.
- To learn the constructional details, principle of operation and performance of transformers.
- To study the principle of operation, construction and details of synchronous machines.
- To learn the principle of operation, constructional details, performance, torque – slipcharacteristics and starting methods of 3-phase induction motors.

**Unit-I**
**DC Machines**
Principle of operation of DC generator – emf equation – types of DC machines – torque equation of DC motor – applications – three-point starter - losses and efficiency - Swinburne's test - speed control methods – OCC of DC generator- Brake test on DC Shunt motor-numerical problems

**Unit-II**
**Transformers**
Principle of operation of single-phase transformer constructional features – EMF equation – Losses and efficiency of transformer- regulation of transformer – OC & SC tests predetermination of efficiency and regulations – Sumpner's test-Numerical Problems.

**Unit-III**
**Synchronous Generators**
Principle of operation and construction of alternators – types of alternators Regulation of alternator by synchronous impedance method-EMF equation of three phase alternator

**Synchronous Motors**
Construction of three phase synchronous motor - operating principle –equivalent circuit of synchronous motor.

**Unit-IV**
**Induction Machine:** Principle of operation and construction of three-phase induction motors –slip ring and squirrel cage motors – slip-torque characteristics – efficiency calculation – starting methods-Braketest on 3-Phase Induction Motor.

**Unit-V**

**Special Machines:** Principle of operation and construction - single phase induction motor - shaded polemotors – capacitor motors and AC servomotor.

**Course Outcomes:**

- Able to explain the operation of DC generator and analyze the characteristics of DC generator.
- Able to explain the principle of operation of DC motor and analyze their characteristics. Acquirethe skills to analyze the starting and speed control methods of DC motors.
- Ability to analyze the performance and speed – torque characteristics of a 3-phase inductionmotor and understand starting methods of 3-phase induction motor.
- Able to explain the operation of Synchronous Machines
- Capability to understand the operation of various special machines.

**TEXT BOOKS**:

1. Principles of Electrical Machines by V.K. Mehta & Rohit Mehta, S.Chand publications
2. Theory & performance of Electrical Machines by J.B.Guptha, S.K.Kataria& Sons

**REFERENCES**:

1. Basic Electrical Engineering by M.S. Naidu and S. Kamakshiah,TMH, TMH Publications
2. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications,2nd edition
3. Basic Electrical Engineering by Nagsarkar,Sukhija, Oxford Publications,2nd edition

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year- II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |
| **ELECTRONIC COMPONENTS & MEASURING INSTRUMENTS WORKSHOP** | | | | | |

I. Identification of components
II. Laboratory equipment
III. Soldering practice
IV. PCB Layout
V. Testing of Components
VI. CRO
VII. fiber optical kit
VIII. various types of Transducers

**I. Identification of components:**

- Resistors:- Types of Resistors, Value of Resistance using color code, DRBS.
- Capacitors:- Types of capacitors, value of capacitance using color code, DCBS.
- Inductors:- Types of Inductors, DLB
- Rheostats:- Types of Rheostats, Types of potentiometers, Relays.
- Switches:- Types of Switches.
- Cables: Types of Cables.
- Types of Instruments used.

**Identification of active elements.**
(Two Terminal, Three Terminal Devices)
- (SC diode, Zener diode, D.AC)
- Three Terminal Devices: BJT, UJT, SCR, FET, MOSFET, TRIAC.
- Digital and Analog ICs. (TO and Flat packages) IC regulators types.
- Testing of above components using Multi metros.

**II. Laboratory Equipment:**

A) Meters:-
- Types of Voltmeters, Types of Ammeters both Analog and Digital.
- Types of Multi meters (Analog & Digital)
- AVO Meters.
- FET input Voltmeter.

B) Laboratory Function Generators and Audio Oscillators.
C) Power Supplies.
D) RF generators.
E) Different Types of Transformers. (Power, AF,RF, etc..)

**III. Soldering practice**

Tools kit including soldering iron Tools Kit:

- Insulated nose player
- Insulated cutting player
- Screw driver kit
- Electrical tester
- Soldering iron, Lead, Flex

**IV. PCB layout and Design.**

Materials required, centimeter graph sheets, marker.

**V. Testing of Components.**

Active and Passive Components

**VI. CRO**

Acquaintance with CRO

Measurementson CRO

**VII Acquaintance of fiber optical kit-Transmitter & receiver**

**VIII Acquaintance with various types of Transducers**

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year- II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |
| **BASIC ELECTRICAL ENGINEERING LAB** | | | | | |

**Learning Objectives:**

- To plot the magnetizing characteristics of DC shunt generator and understand the mechanism of self-excitation.
- To control the speed of DC motors.
- To determine and predetermine the performance of DC machines.
- To predetermine the efficiency and regulation of transformers and assess their performance.
- To analyze performance of three phase induction motor.
- To understand the significance of regulation of an alternator using synchronous impedance method.

**Any ten of the following experiments are to be conducted**

1. Magnetization characteristics of D.C. Shunt generator.
2. Speed control of D.C. shunt motor.
3. Brake test on DC shunt motor.
4. Swinburne's test on DC machine
5. Load test on DC shunt generator
6. Load test on DC series generator.
7. Separation of losses in DC Shunt motor
8. OC & SC tests on single-phase transformer
9. Sumpner's test on single phase transformer
10. Brake test on 3-phase Induction motor.
11. Regulation of alternator by synchronous impedance method.

**Learning Outcomes:**

The student should be able to:

- Determine and predetermine the performance of DC machines and transformers.
- Control the DC shunt machines.
- Compute the performance of 1-phase transformer.
- Perform tests on 3-phase induction motor and alternator to determine their performancecharacteristics.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - II Semester | | L | T | P | C |
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| | | 0 | 0 | 3 | 1.5 |
| **APPLIED PHYSICS LAB** | | | | | |

**LIST OF EXPERIMENTS:**

(Any 10 of the following listed experiments)

**List of Applied Physics Experiments**

1. Determination of thickness of thin object by wedge method.
2. Determination of radius of curvature of a given plano convex lens by Newton's rings.
3. Determination of wavelengths of different spectral lines in mercury spectrumusingdiffraction grating in normal incidence configuration.
4. Determination of dispersive power of the prism.
5. Determination of dielectric constant using charging and discharging method.
6. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
7. Determination of numerical aperture and acceptance angle of an optical fiber.
8. Determination of wavelength of Laser light using diffraction grating.
9. Estimation of Planck's constant using photoelectric effect.
10. Determination of the resistivity of semiconductor by four probe method.
11. To determine the energy gap of a semiconductor using p-n junction diode.
12. Magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method
13. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect .
14. Measurement of resistance of a semiconductor with varying temperature.
15. Resistivity of a Superconductor using four probe method & Meissner effect.

**References**:

S. Balasubramanian, M.N. Srinivasan "A Text Book of Practical Physics"- S Chand Publishers, 2017.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| I Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 |
| **ENVIRONMENTAL SCIENCE** | | | | | |

**Course Objective:**

Engineering drawing being the principal method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

**Unit I**

**Objective:** To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.
**Polygons:** Constructing regular polygons by general methods, inscribing and describing polygons on circles. **Curves:** Parabola, Ellipse and Hyperbola by general and special methods, cycloids, involutes, tangents&normals for the curves.
**Scales:** Plain scales, diagonal scales and vernier scales

**Unit II**

**Objective:** To introduce the students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.
**Orthographic Projections:** Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.
Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

**Unit III**

**Objective:** The objective is to make the students draw the projections of the plane inclined toboth the planes. Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

**Unit IV**

**Objective:** The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.
Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to both the planes.

**Unit V**

**Objective:** The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views. Computer Aided Design, drawing practice using Auto CAD, creating 2D&3D drawings of objects usingAuto CAD

**Note:** In the End Examination there will be no question from CAD.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**TEXT BOOKS:**

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

**REFERENCE BOOKS:**

1. Engineering Drawing by K.L. Narayana& P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGraw Hill Publishers
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age

**Course Outcome:** The student will learn how to visualize 2D & 3D objects.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year - I Semester | | L | T | P | C |
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| | | 3 | 1 | 0 | 3 |
| **ELECTRONIC DEVICES AND CIRCUITS** | | | | | |

**OBJECTIVES:**

**The main objectives of this course are**

- To learn and understand the basic concepts of semiconductor physics.
- Study the physical phenomena such as conduction, transport mechanism and electricalcharacteristics of different diodes.
- To learn and understand the application of diodes as rectifiers with their operation andcharacteristics with and without filters are discussed.
- Acquire knowledge about the principle of working and operation of Bipolar Junction Transistorand Field Effect Transistor and their characteristics.
- To learn and understand the purpose of transistor biasing and its significance.
- Small signal equivalent circuit analysis of BJT and FET transistor amplifiers and comparesdifferent configurations.

**UNIT-I:**

**Review of Semi-Conductor Physics:** Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors.

**Junction Diode Characteristics:** energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.

**UNIT-II:**

**Special Semiconductor Devices**: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PN-PN Diode, SCR. Construction, operation and V-I characteristics.

**Rectifiers and Filters:** Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter (Series inductor), Capacitor filter (Stunt inductor), π-Filter, comparison of various filter circuits in terms of ripple factors.

**UNIT- III:**

**Transistor Characteristics:**

**BJT:** Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

**FET:** FET types, construction, operation, characteristicsμ, $g_m$, $r_d$, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

**UNIT- IV:**

**Transistor Biasing and Thermal Stabilization:** Need for biasing, operating point, load line analysis biasing- methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in $V_{BE}$, Ic, and β, Stability factors, ($S, S', S''$), Bias compensation, Thermal runaway, Thermal stability, FET Biasing- methods and stabilization.

**UNIT- V:**

**Small Signal Low Frequency Transistor Amplifier Models:**

**BJT:** Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

**FET:** Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

**TEXT BOOKS:**

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, SecondEdition,2007
2. Electronic Devices and Integrated Circuits – B.P. Singh, Rekha, Pearson publications,2006
3. Electronics devices & circuit theory- Robert L. Boylestad and LouiNashelsky,Pearson/PrenticeHall, tenth edition,2009

**REFERENCES:**

1 Integrated Electronics- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition, 2009
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016.
3. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill,4th Edition,2008.

**OUTCOMES:**

**At the end of this course the student will be able to:**

- Apply the basic concepts of semiconductor physics.
- Understand the formation of p-n junction and how it can be used as a p-n junction as diode indifferent modes of operation.
- Know the construction, working principle of rectifiers with and without filters with relevantexpressions and necessary comparisons.
- Understand the construction, principle of operation of transistors, BJT and FET with their V-Icharacteristics in different configurations.
- Know the need of transistor biasing, various biasing techniques for BJT and FET andstabilization concepts with necessary expressions.
- Perform the analysis of small signal low frequency transistor amplifier circuits using BJT andFET in different configurations.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year - I Semester | | L | T | P | C |
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| | | 3 | 1 | 0 | 3 |
| **SIGNALS and SYSTEMS** | | | | | |

**OBJECTIVES:**

**The main objectives of this course are given below:**

- To study about signals and systems.
- To analyze the spectral characteristics of signal using Fourier series and Fourier transforms.
- To understand the characteristics of systems.
- To introduce the concept of sampling process
- To know various transform techniques to analyze the signals and systems.

**UNIT- I:**

**INTRODUCTION:** Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions. Related Problems.

**UNIT–II:**

**FOURIER SERIES AND FOURIERTRANSFORM:** Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform. Related Problems.

**UNIT-III:**

**ANALYSIS OF LINEAR SYSTEMS:** Introduction**,** Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and risetime.

**UNIT –IV:**

**CORRELATION:** Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

**SAMPLING THEOREM:** Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling, Related problems.

**UNIT –V:**

**LAPLACE TRANSFORMS:** Introduction**,** Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.Ts, Inverse Laplace transform, Relation between L.Ts, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.

**Z–TRANSFORMS:** Concept of Z- Transform of a discrete sequence. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms. Distinction between Laplace, Fourier and Z transforms.

**TEXT BOOKS:**

1. Signals, Systems & Communications - B.P. Lathi, BS Publications,2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI,2ndEdn,1997
3. Signals & Systems - Simon Haykin and Van Veen, Wiley,2ndEdition,2007

**REFERENCES:**

1. Principles of Linear Systems and Signals – BP Lathi, Oxford UniversityPress,2015
2. Signals and Systems – T K Rawat, Oxford Universitypress,2011

**OUTCOMES:**

**At the end of this course the student will able to:**

- Differentiate the various classifications of signals and systems.
- Analyze the frequency domain representation of signals using Fourier concepts.
- Classify the systems based on their properties and determine the response ofLTI Systems.
- Know the sampling process and various types of sampling techniques.
- Apply Laplace and z-transforms to analyze signals and Systems (continuous &discrete).

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year - I Semester | | L | T | P | C |
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| | | 3 | 1 | 0 | 3 |
| **SWITCHING THEORY and LOGIC DESIGN** | | | | | |

**OBJECTIVES:**

**Course Objectives:**

- To solve a typical number base conversion and analyze new error coding techniques.
- Theorems and functions of Boolean algebra and behavior of logic gates.
- To optimize logic gates for digital circuits using various techniques.
- Boolean function simplification using Karnaugh maps and Quine-McCluskey methods.
- To understand concepts of combinational circuits.
- To develop advanced sequential circuits.

**UNIT – I**

**REVIEW OF NUMBER SYSTEMS & CODES:**

Representation of numbers of different radix, conversation from one radix to another radix, r- 1's compliments and r's compliments of signed members. Gray code ,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc. Error detection & correction codes: parity checking, even parity, odd parity, Hamming code.

**BOOLEAN THEOREMS AND LOGIC OPERATIONS:**

Boolean theorems, principle of complementation & duality, De-morgan theorems. Logic operations; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX- NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations, Realization of three level logic circuits. Study the pin diagram and obtain truth table for the following relevant ICs 7400,7402,7404,7408,7432,7486.

**UNIT – II**

**MINIMIZATION TECHNIQUES:**

Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables) and tabular method (Quine-McCluskey method) with only four variables and single function.

**COMBINATIONAL LOGIC CIRCUITS DESIGN:**

Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a-head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams.

**UNIT – III**

**COMBINATIONAL LOGIC CIRCUITS DESIGN USING MSI &LSI:**

Design of encoder, decoder, multiplexer and de-multiplexers, Implementation of higher order circuits using lower order circuits. Realization of Boolean functions using decoders and multiplexers. Design of Priority encoder, 4-bit digital comparator and seven segment decoder. . Study the relevant ICs pin diagrams and their functions 7442,7447,7485,74154.

**INTRODUCTION OF PLD's:**

PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions, Programming table.

**UNIT – IV**

**SEQUENTIAL CIRCUITS I:**

Classification of sequential circuits (synchronous and asynchronous), operation of NAND& NOR latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip- flop. Design of 5ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift, register.

Study the following relevant ICs and their relevant functions 7474,7475,7476,7490,7493,74121.

**UNIT – V**

**SEQUENTIAL CIRCUITS II:**

Finite state machine; state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa. Realization of sequence generator, Design of Clocked Sequential Circuit to detect the given sequence (with overlapping or without overlapping).

**TEXT BOOKS:**

1. Switching and finite automata theory Zvi.KOHAVI,Niraj.K.Jha3rdEdition,Cambridge UniversityPress,2009
2. Digital Design by M.MorrisMano,Michael D Ciletti,4th editionPHIpublication,2008
3. Switching theory and logic design by Hill and Peterson**,** Mc-Graw Hill TMHedition, 2012.

**REFERENCES:**

1. Fundamentals of Logic Design by Charles H. Roth Jr,JaicoPublishers,2006
2. Digital electronics by R S Sedha.S.Chand&companylimited,2010
3. Switching Theory and Logic Design by A. AnandKumar,PHI Learningpvtltd,2016.
4. Digital logic applications and design by John M Yarbough, Cengagelearning,2006.
5. TTL 74-Seriesdatabook.

**Course Outcomes:**

- Classify different number systems and apply to generate various codes.
- Use the concept of Boolean algebra in minimization of switching functions
- Design different types of combinational logic circuits.
- Apply knowledge of flip-flops in designing of Registers and counters
- The operation and design methodology for synchronous sequentialcircuits and algorithmic state machines.
- Produce innovative designs by modifying the traditional design techniques.

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year - I Semester | | L | T | P | C |
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| | | 3 | 1 | 0 | 3 |
| **ELECTRONIC MEASUREMENTS AND INSTRUMENTATION** | | | | | |

**OBJECTIVES:**
**The main objectives of this course are:**

- Learn and understand functioning of various measuring system and metrics for performanceanalysis.
- Acquire knowledge of principle of operation, working of different electronic Instruments viz.signal generators, signal analyzers, recorders and measuring equipment.
- To Compare various measuring bridges and their balancing conditions.
- Learn and understand the use of various measuring techniques for measurement of differentphysical parameters using different classes of transducers.

**UNIT-I:**
**PERFORMANCE CHARACTERISTICS OF INSTRUMENTS,**
**STATICCHARACTERISTICS:** Accuracy, Resolution, Precision, expected value, Error, Sensitivity.Dynamic Characteristics; speed of response, Fidelity, Lag and Dynamic error. Types of errors in measurements and their analysis. Design of multi-range AC, DC meters (voltmeter &ammeter) and ohmmeter (series &shunt type) using D'arsonval movement. True rms meter.

**UNIT-II:**
**SPECIFICATIONS AND DESIGNING ASPECTSOF SIGNALGENERATORS**-
AF sine and square wave signal generators, Function Generators, Random noise generators, Arbitrary waveform generators. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers.

**UNIT-III:**
**OSCILLOSCOPES**- general purpose CROs; block diagram, functions and implementation of various blocks, specifications, various controls and their functions, types of probes used in CROs. Measurementof frequency and phase difference using Lissajous patterns.
Special purpose CROs; sampling oscilloscope, analog storage oscilloscope, digital storage oscilloscope.

**UNIT-IV:**
Bridge circuits, Wheat stone bridge, measurement of very low resistance, Measurement of inductance-Maxwell's bridge, Anderson Bridge. Measurement of capacitance - Schering Bridge. Wien Bridge, Errors and precautions in using bridges.
Q-meter; principle of operation, measurement methods and sources of errors.
Counters: principle of operation -modes of operation- totalizing mode, frequency mode and time period mode- sources of errors.

**UNIT-V:**
Transducers- active & passive transducers: Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers.
Measurement of physical parameters temperature, force, pressure, velocity, acceleration and displacement.

**TEXTBOOKS:**

1. Electronic instrumentation, second edition - H. S. Kalsi, Tata McGrawHill,2004.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D.Cooper, PHI, 5th Edition,2002.

**REFERENCES:**

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, Edition.
2. Electrical and Electronic Measurement and Instrumentation A.K. Sawhney. Dhanpat Rai &Co.

**OUTCOMES:**

**At the end of this course the student can able to:**

- Select the instrument to be used based on the requirements.
- Understand and analyze different signal generators and analyzers.
- Understand the design of oscilloscopes for different applications.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year – I Semester | | L | T | P | C |
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| **MATHEMATICS - III (BS1203)**<br>**(Common to all Branch for I Year B. Tech)** | | | | | |

**OBJECTIVES:**
**The main objectives of this course are:**

- To familiarize the techniques in partial differential equations
- To furnish the learners with basic concepts and techniques at plus two level to lead them intoadvanced level by handling various real-world applications.

**Unit – I: Vector calculus: (10hrs)**
Vector Differentiation: Gradient – Directional derivative – Divergence – Curl – Scalar Potential. Vector Integration: Line integral – Work done – Area – Surface and volume integrals – Vectorintegral theorems: Greens, Stokes and Gauss Divergence theorems (without proof).

**Unit –II: Laplace Transforms: (10hrs)**
Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function – Inverse Laplace transforms – Convolution theorem (without proof).
**Applications:** Solving ordinary differential equations (initial value problems) using Laplace transforms.

**Unit –III: Fourier series and Fourier Transforms: (10hrs.)**
Fourier Series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet'sconditions – Even and odd functions – Change of interval – Half-range sine and cosine series.
**Fourier Transforms:** Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms – Properties – inverse transforms – Finite Fourier transforms.

**Unit –IV: PDE of first order**: **(8hrs.)**
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types)equations.

**UNIT V: Second order PDE and Applications: (10hrs.)**
Second order PDE: Solutions of linear partial differential equations with constant coefficients – RHS

term of the type $e^{ax+by}$,sin( $ax+by$), cos($ax+by$), $x^m y^n$ .

**Applications of PDE:** Method of separation of Variables – Solution of One-dimensional Wave,Heat and two-dimensional Laplace equation.

**Text Books:**

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference:**

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10thEdition, Wiley-India.
2. **Dean. G. Duffy,** Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRCPress.
3. **Peter O' Neil,** Advanced Engineering Mathematics, Cengage.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford UniversityPress.

**OUTCOMES:**

**At the end of the course, the student will be able to**

- Interpret the physical meaning of different operators such as gradient, curl and divergence(L5)
- Estimate the work done against a field, circulation and flux using vector calculus(L5)
- Apply the Laplace transform for solving differential equations(L3)
- Find or compute the Fourier series of periodic signals (L3)
- Know and be able to apply integral expressions for the forwards and inverse Fourier transform toa range of non-periodic waveforms(L3)
- Identify solution methods for partial differential equations that model physical processes(L3)

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year - I Semester | | L | T | P | C |
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| **ELECTRONIC DEVICES AND CIRCUITS LAB** | | | | | |

**Note:** The students are required to perform the experiment to obtain the V-I characteristics and todetermine the relevant parameters from the obtained graphs.

**Electronic Workshop Practice:**

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers,Coils, Gang Condensers, Relays, Breadboards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs,SCR,UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and DigitalMultimeter, Function Generator, Regulated Power Supply and CRO.

**List of Experiments: (Minimum of Ten Experiments has to be performed)**

1. P-N Junction Diode Characteristics
   Part A: Germanium Diode (Forward bias& Reverse bias)Part B: Silicon Diode (Forward Bias only)
2. Zener Diode CharacteristicsPart A:
   V-I Characteristics
   Part B: Zener Diode as Voltage Regulator
3. Rectifiers (without and with c-filter)Part A:Half-waveRectifier
   Part B: Full-wave Rectifier
4. BJT Characteristics (CE Configuration)Part A:
   InputCharacteristics
   Part B: Output Characteristics
5. FET Characteristics(CS Configuration)
6. Part A: Drain Characteristics Part B:
   Transfer Characteristics
7. SCR Characteristics
8. UJT Characteristics
9. Transistor Biasing
10. CRO Operation and its Measurements
11. BJT-CE Amplifier
12. Emitter Follower-CC Amplifier
13. FET-CS Amplifier

**Equipment required:**

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multi-meters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year – I Semester | | L | T | P | C |
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| | | 0 | 0 | 3 | 1.5 |
| **ELECTRONIC MEASUREMENTS AND INSTRUMENTATION LAB** | | | | | |

(Minimum 10 experiments should be conducted)

1. RTD –characteristics
2. Thermocouple –characteristics
3. LVDT –characteristics.
4. Displacement measurement using inductive pickup/ capacitive pickup.
5. Inductive and capacitive transducers.
6. RPM indicator using Strobotron/Gyroscope
7. Acceleration transducer.
8. Pressure measurement using Bourdon tube
9. Piezoelectric transducer.
10. Measurement of R, L and C using bridge circuits.
11. Measurement of Level using Capacitance Transducer.
12. Measurement of Humidity.
13. Measurement of strain using strain gauge

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year – I Semester | | L | T | P | C |
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| **DIGITAL SYSTEM DESIGN LAB** | | | | | |

**List of Experiments:** (Minimum of Twelve Experiments has to be performed)

1. Verification of truth tables of Logic gates
Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR
2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify thetruth table using Digital Trainer Kit
3. Verification of functional table of 3 to 8 line Decoder /De-multiplexer
4. 4 variable logic function verification using 8 to 1multiplexer.
5. Design full adder circuit and verify its functional table.
6. Verification of functional tables of
   (i) J K Edge triggered Flip –Flop
   (ii) J K Master Slave Flip –
   Flop(iii)D Flip -Flop
7. Design a four bit ring counter using D Flip – Flops / JK Flip Flop and verify output
8. Design a four bit Johnson's counter using D Flip-Flops / JK Flip Flops and verify output
9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.
10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip- Flops and Test itwith a low frequency clock and sketch the output waveforms.
11. Design MOD – 8 synchronous counter using T Flip-Flop and verify the result and sketch the outputwaveforms.
12. (a) Draw the circuit diagram of a single bit comparator and test the output
    (b) Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.

**ADD on Experiments:**

1. Design BCD Adder Circuit and Test the Same using Relevant IC
2. Design Excess-3 to 9-Complement convertor using only four Full Adders and test the Circuit.
3. Design an Experimental model to demonstrate the operation of74154 De-Multiplexer using LEDs for outputs.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year – I Semester | | L | T | P | C |
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| **Skill Oriented Course* (Computational Techniques using MATLAB &Lab VIEW)** | | | | | |

**Unit I Introduction to MATLAB**

Brief Introduction-Installation of MATLAB – History-Use of MATLAB- Key features-MATLAB window-Command window – Workspace-Basic Commands-Assigning variables - Operations with variables

**Unit II MATLAB Software**

Data files and Data types - Character and string-Arrays and vectors, Arithmetic Operations-Logical Operators-Solving arithmetic equations-Matrix operations-M files Working with script tools - Writing Script file – Executing script files - The MATLAB Editor - Saving m files – Plots, Plot labelling, curve labelling and editing - Figure Windows - Displaying Multiple Plots in One Figure – Subplots - Introduction of Graphical User Interface

**Unit III MATLAB Programming**

Automating commands with scripts - Writing programs with logic and flow control - Writing functions - Control statement Programming-Conditional Statement Programming, Examples-Control Flow Conditional Control if,else, switch- Loop Control for, while, continue, break- Program Termination return- Functions - Writing user defined functions- Built in Function, Function calling- Return Value - Types of Functions-Global Variables

**UNIT IV Virtual Instrumentation: An introduction**

Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, Active X programming.

**UNIT V Virtual Instrumentation (VI)programming techniques:**

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

**Text Books:**

1. MATLAB Programming for Engineers by Stephen J. Chapman, 6th edition- Cengage Learning, 2020.
2. MATLAB for Engineers by Holly Moore, Third Edition – Pearson Publications.
3. LabVIEW Graphical Programming by Gary Johnson**,** Second edition, McGraw Hill, Newyork, 1997.

**Reference:**

1. Matrices and MATLAB: A Tutorial by Marvin Marcus, First Edition, Prentice Hall, 2010.
2. LabVIEW for everyone by Lisa K. wells & Jeffrey Travis, Third edition Prentice Hall, 2006.
3. MATLAB getting started guide by Math works.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year - II Semester | | L | T | P | C |
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| | | 3 | 1 | 0 | 3 |
| **ELECTRONIC CIRCUITS ANALYSIS** | | | | | |

**OBJECTIVES:**
**The main objectives of this course are:**

- To learn hybrid-pi parameters at high frequency and compare with low frequency parameters.
- Learn and understand the purpose of cascading of single stage amplifiers and derive the overallvoltage gain.
- Analyze the effect of negative feedback on amplifier characteristics and derive thecharacteristics.
- Learn and understand the basic principle of oscillator circuits and perform the analysis ofdifferent oscillator circuits.
- Compare and analyze different Power amplifiers like Class A, Class B, Class C, Class AB andother types of amplifiers.
- Analyze different types of tuned amplifier circuits.

**UNIT-I:**

**Small Signal High Frequency Transistor Amplifier models:**

**BJT:** Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid π conductance's, Hybrid π capacitances, validity of hybrid π model, determination of high-frequency parameters in terms of low-frequency parameters, CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product.
**FET:** Analysis of common Source and common drain Amplifier circuits at high frequencies.

**UNIT-II:**

**Multistage Amplifiers:** Classification of amplifiers, methods of coupling**, c**ascaded transistor amplifier and its analysis, analysis of two stage RC coupled amplifier, high input resistance transistor amplifier circuits and their analysis-Darlington pair amplifier, Cascode amplifier, Boot-strap emitter follower, Differential amplifier using BJT.

**UNIT -III:**

**Feedback Amplifiers:** Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of feedback amplifiers.

**UNIT-IV:**

**Oscillators:** Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wien bridge oscillators with BJT and FET and their analysis, generalized analysis of LC Oscillators, Hartley and Colpitts's oscillators using BJT, Frequency and amplitude stability of oscillators.

**UNIT-V:**

**Power Amplifiers:** Classification of amplifiers (A to H), Class A power Amplifiers, Class B Push- pull amplifiers, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Thermal stability and Heat sinks.

**Tuned Amplifiers**: Introduction, Q-Factor, small signal tuned amplifier, capacitance single tunedamplifier, double tuned amplifiers, staggered tuned amplifiers

**TEXT BOOKS:**

1. Integrated Electronics- J. Millman and C.C. Halkias, Tata McGraw-Hill,1972.
2. Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky,Pearson/Prentice Hall, Tenth Edition,2009.
3. Electronic Devices and Integrated Circuits – B.P. Singh, Rekha, Pearson publications,2006

**REFERENCES:**

1. Electronic Circuit Analysis and Design – Donald A. Neaman, McGraw-Hill,2010.
2. Microelectronic Circuits-Sedra A.S. and K.C. Smith, Oxford University Press, SixthEdition, 2011.
3. Electronic Circuit Analysis-B.V. Rao, K.R.Rajeswari, P.C.R. Pantulu, K.B.R.Murthy,Pearson Publications.

**OUTCOMES:**

**At the end of this course the student can able to**

- Design and analysis of small signal high frequency transistor amplifier using BJT and FET.
- Design and analysis of multistage amplifiers using BJT and FET and Differential amplifierusing BJT.
- Derive the expressions for frequency of oscillation and condition for oscillation of RCand LC oscillators and their amplitude and frequency stability concept.
- Know the classification of the power and tuned amplifiers and their analysis withperformance comparison.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year - II Semester | | L | T | P | C |
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| | | 3 | 1 | 0 | 3 |
| **LINEAR CONTROL SYSTEMS** | | | | | |

**OBJECTIVES:**

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

- To introduce the concepts of open loop and closed loop systems, mathematical models ofmechanical and electrical systems, and concepts of feedback.
- To study the characteristics of the given system in terms of the transfer function and introducingvarious approaches to reduce the overall system for necessary analysis.
- To develop the acquaintance in analyzing the system response in time-domain and frequencydomain in terms of various performance indices.
- To analyze the system in terms of absolute stability and relative stability by different approaches.
- To design different control systems for different applications as per given specifications.
- To introduce the concepts of state variable analysis, design and also the concepts ofcontrollability and observability.

**UNIT-I**

**INTRODUCTION:** Concepts of System, Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems.

**UNIT-II**

**TRANSFER FUNCTION REPRESENTATION:** Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra– Representation by Signal flow graph - Reduction using mason's gain formula.

**TIME RESPONSE ANALYSIS:** Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.

**UNIT-III**

**STABILITY ANALYSIS IN S-DOMAIN:** The concept of stability – Routh's stability criterion –qualitative stability and conditional stability – limitations of Routh's stability 100

**ROOT LOCUS TECHNIQUE:** The root locus concept - construction of root loci-effects of addingpoles and zeros to G(s)H(s) on the root loci.

**UNIT-IV**

**FREQUENCY RESPONSE ANALYSIS:** Introduction, Correlation between time and frequencyresponse, Polar Plots, Bode Plots, Nyquist Stability Criterion.

**UNIT-V**

**CLASSICAL CONTROL DESIGN TECHNIQUES:** Compensation techniques -Lag, Lead, Lead-Lag Controllers design infrequency Domain, PID Controllers. State Space Analysis of Continuous Systems Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and its Properties – Concepts of Controllability and Observability.

**TEXTBOOKS:**

1. Automatic Control Systems 8th edition– by B. C. Kuo 2003–John Wiley andson's.
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New AgeInternational(P)Limited, Publishers, 2ndedition.

**REFERENCES:**

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition,1998.
2. Control Systems by A. Nagoor kani, RBA publications,3 Edition.
3. Control Systems by A. Anand Kumar, PHI, 2Edition.

**OUTCOMES:**

**At the end of this course the student can able to:**

- This course introduces the concepts of feedback and its advantages to various control systems.
- The performance metrics to design the control system in time-domain and frequency domain areintroduced.
- Control systems for various applications can be designed using time-domain and frequencydomain analysis.
- In addition to the conventional approach, the state space approach for the analysis of controlsystems is also introduced.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year- II Semester | | L | T | P | C |
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| | | 3 | 1 | 0 | 3 |
| **MICROPROCESSOR AND MICROCONTROLLERS** | | | | | |

**OBJECTIVES:**
**The main objectives of this course are**

- To acquire knowledge on microprocessors and microcontrollers.
- To select processors based on requirements.
- To acquire the knowledge on interfacing various peripherals, configure and develop programs tointerface peripherals/sensors.
- To develop programs efficiently on ARM Cortex processors and debug.

**UNIT–I**
**Introduction:** Basic Microprocessor architecture, Harvard and Von Neumann architectures with examples, Microprocessor Unit versus Microcontroller Unit, CISC and RISC architectures.
**8086 Architecture:** Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

**UNIT–II**
**8086 Programming:** Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

**UNIT-III**
**8086 Interfacing:** Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

**UNIT-IV**
**Intel 8051 MICROCONTROLLER**
Architecture, Hardware concepts, Input/output ports and circuits, external memory, counters/timers,serial data input/output, interrupts.
Assembly language programming: Instructions, addressing modes, simple programs.
Interfacing to 8051: A/D and D/A Convertors, Stepper motor interface, keyboard, LCD Interfacing,Traffic light control.

**UNIT–V**
**ARM Architectures and Processors**: ARM Architecture, ARM Processors Families, ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional Description, functions and interfaces.
Programmers Model – Modes of operation and execution, Instruction set summary, System address map, write buffer, bit-banding, processor core register summary, exceptions.
ARM Cortext-M3 programming – Software delay, Programming techniques, Loops, Stack and Stack pointer, subroutines and parameter passing, parallel I/O, Nested Vectored Interrupt Controller – functional description and NVIC programmers' model.

**TEXTBOOKS:**

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao,Tata McGraw Hill Education Private Limited,3rd Edition.
2. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad AliMazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; Pearson 20112-Edition.
3. The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Joseph You

**REFERENCES:**

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A PracticalApproach in English, by Dr.Alexander G. Dean, Published by Arm Education Media.
2. Cortex -M3 Technical Reference Manual

**OUTCOMES:**

**At the end of this course the student will be able to:**

- Understand the architecture of microprocessor/ microcontroller and their operation.
- Demonstrate programming skills in assembly language for processors and Controllers.
- Analyze various interfacing techniques and apply them for the design of processor/Controllerbased systems.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year- II Semester | | L | T | P | C |
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| **INTEGRATED CIRCUITS AND APPLICATIONS** | | | | | |

**OBJECTIVES:**
**The main objectives of this course are given below:**

- To understand the basic operation &performance parameters of differential amplifiers.
- To understand & learn the measuring techniques of performance parameters of Op-Amp
- To learn the linear and non-linear applications of operational amplifiers.
- To understand the analysis & design of different types of active filters using op-amps
- To learn the internal structure, operation and applications of different analog ICs
- To Acquire skills required for designing and testing integrated circuits

**UNIT-I:**
**Introduction:** Internal Block Diagram of various stages of Op-Amp and Roll of each Stage. Differential Amplifier using BJTs and With $R_E$ DC and AC Analysis, Basic Current Mirror Circuit, Improved Version of current mirror circuit, current repeated circuit, Wilson current source. OP-Amp Block Diagram (Symbolic Representation), Characteristics of Op-Amp, Ideal and Practical Op- Amp specifications, DC and AC Characteristics, Definitions of Input and Output Off-set voltage and currents slow rate, CMRR, PSRR.etc., Measurements of Op-Amp Parameters.
Three-Terminal Voltage Regulators 78xx& 79xx Series, current Booster, adjustable voltage, Dual Power Supply with 78xx &79xx.

**UNIT-II:**
**LINEAR and NON-LINEAR APPLICATIONS OF OP-AMPS:** Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters, Buffers. Non- Linear function generation, Comparators, Multivibrators, Triangular and Square wave generators, Log and Anti log Amplifiers, Precision rectifiers.

**UNIT-III:**
**ACTIVE FILTERS, ANALOG MULTIPLIERS AND MODULATORS:** Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters.
Four Quadrant Multiplier, IC 1496, Sample & Hold circuits.

**UNIT-IV:**
**TIMERS & PHASE LOCKED LOOPS**: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger; PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566).

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**UNIT-V:**

**DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS:** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADC Specifications, Specifications AD 574 (12-bitADC).

**TEXT BOOKS:**

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p)Ltd, 2nd Edition,2003.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1987.
3. Linear Integrated Circuits by Salivahan-3rd-Edition, McGrawHill,2018

**REFERENCES:**

1. Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma; SK Kataria& Sons;2nd Edition,2010
2. Operational Amplifiers & Linear Integrated Circuits–R.F. Coughlin&Fredrick Driscoll,PHI, 6th Edition,2000.
3. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition,2011.
4. Linear Integrated Circuits, by Ganesh Babu T.R and Suseela B. Scitech, 5th Edition,2014.

**OUTCOMES:**

**At the end of this course the student will be able to:**

- Design circuits using operational amplifiers for various applications.
- Analyze and design amplifiers and active filters using Op-amp.
- Diagnose and trouble-shoot linear electronic circuits.
- Understand the gain-bandwidth concept and frequency response of the amplifier configurations.
- Understand thoroughly the operational amplifiers with linear integrated circuits.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year - I Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS** | | | | | |

**OBJECTIVES:**
**The main objectives of this course are:**

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

**UNIT-I**
**Introduction to Managerial Economics and demand Analysis:**
Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

**UNIT – II:**
**Theories of Production and Cost Analyses:**
Theories of Production function- Law of Variable Proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs – Cost – Volume-Profit Analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

**UNIT – III:**
**Introduction to Markets, Theories of the Firm & Pricing Policies:**
Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles: Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

**UNIT – IV:**
**Introduction to Accounting & Financing Analysis:**
Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accountswith adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

**UNIT -V:**

**Capital and Capital Budgeting:** Capital Budgeting: Meaning of Capital-Capitalization-Meaning ofCapital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (payback period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index).

**REFERENCES:**

1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & CompanyLtd.
2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition.
3. N.P Srinivasan and M. Sakthivel Murugan, Accounting for Management, S. Chand &Company Ltd.
4. Maheswari S.N, An Introduction to Accountancy, Vikas Publishing House PvtLtd.
5. I.M Pandey, Financial Management, Vikas Publishing House PvtLtd.
6. V. Maheswari, Managerial Economics, S. Chand & Company Ltd.

**OUTCOMES:**

**At the end of the course the student will be able to:**

- The Learner is equipped with the knowledge of estimating the Demand and demand elasticitiesfor a product.
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of theleast cost combination of inputs.
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
- The Learner is able to prepare Financial Statements and the usage of various accounting toolsfor Analysis.
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year - II Semester | | L | T | P | C |
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| **ELECTRONIC CIRCUIT ANALYSIS LAB** | | | | | |

**Note:** The students are required to design the circuit and perform the simulation using Multisim/ Equivalent Industrial Standard Licensed simulation software tool**.** Further they are required to verifythe result using necessary hardware equipment.

**List of Experiments :( Minimum of Ten Experiments has to be performed)**

1. Determination of fT of a given transistor.
2. Voltage-Series Feedback Amplifier
3. Current-Shunt Feedback Amplifier
4. RC Phase Shift/Wien Bridge Oscillator
5. Hartley/Colpitts Oscillator
6. Two Stage RC Coupled Amplifier
7. Darlington Pair Amplifier
8. Bootstrapped Emitter Follower
9. Class A Series-fed Power Amplifier
10. Transformer-coupled Class A Power Amplifier
11. Class B Push-Pull Power Amplifier
12. Complementary Symmetry Class B Push-Pull Power Amplifier
13. Single Tuned Voltage Amplifier
14. Double Tuned Voltage Amplifier

**Equipment required:**

**Software:**

**i.** Multisim/ Equivalent Industrial Standard Licensed simulation software tool.

**ii.** Computer Systems with required specifications

**Hardware Required:**

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Mustimeters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year- II Semester | | L | T | P | C |
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| **MICROPROCESSOR AND MICROCONTROLLERS LAB** | | | | | |

LIST OF EXPERIMENTS:

**PART- A: (Minimum of 5 Experiments has to be performed)**

**8086 Assembly Language Programming and Interfacing**

1. Programs for 16 -bit arithmetic operations (using Various Addressing Modes).
   a. Addition of n-BCD numbers.
   b. Multiplication and Division operations.
2. Program for sorting an array.
3. Program for Factorial of given-numbers.
4. Interfacing ADC to8086
5. Interfacing DAC to8086.
6. Interfacing stepper motor to8086.

**PART-B (Minimum of 5 Experiments has to be performed)8051 Assembly Language Programming and Interfacing**

7. Finding number of 1's and number of 0's in a given8-bitnumber
8. Average of numbers.
9. Program and verify Timer/ Counter in 8051.
10. Interfacing Traffic Light Controller to8051
11. UART operation in8051
12. Interfacing LCD to8051.

**PART-C (Minimum of 2 Experiments has to be performed)**

**Conduct the following experiments using ARM CORTEX M3 PROCESSOR USING KEIL MDKARM**

13. Write an assembly program to multiply of 2 16-bit binary numbers.
14. Write an assembly program to find the sum of first 10 integer numbers.
15. Write a program to toggle LED every second using timer interrupt.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year- II Semester | | L | T | P | C |
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| **INTEGRATED CIRCUITS AND APPLICATIONS LAB** | | | | | |

**PART A: Digital IC Applications:**

1. Verification of truth tables of Logic gates
   Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR.
2. Design a simple combinational circuit with four variables and obtain minimal SOPexpression and verify the truth table using Digital Trainer Kit
3. Verification of functional table of 3 to 8line Decoder /De-multiplexer
4. Verification of functional tables of
   (i) J K Edge triggered Flip –Flop
   (ii) J K Master Slave Flip –
   Flop(iii)D Flip –Flop
5. Design a four-bit ring counter using D Flip – Flops / JK Flip Flop and verify Output.
6. Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.

**PART-B: Linear IC Applications**

1. OP AMP Applications – Adder, Subtractor, Comparator Circuits
2. Integrator and Differentiator Circuits.
3. Waveform Generator using single OP-AMP with variable duty cycle
4. IC 555 Timer – Monostable Operation Circuit, A stable Operation Circuit
5. IC 566 – VCO Applications.
6. Design of Dual Power Supply using 78XX and 79XX (use full wave BridgeRectifier with shunt capacitance filters).

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| II Year - II Semester | | L | T | P | C |
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| | | 1 | 0 | 2 | 2 |
| **SKILL COURSE (PYTHON PROGRAMMING)** | | | | | |

**OBJECTIVES:**

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

- To develop a basic understanding of programming and Python programming language.
- Learn to apply the programming concepts to fundamental problems.
- To get exposure to various problems solving approaches.
- To acquire knowledge about Scripting Language.
- To expose students to application development and prototyping using Python.

**UNIT-I:**

**INTRODUCTION:** History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Types - Integers, Strings, Booleans.

**UNIT-II:**

**OPERATORS AND EXPRESSIONS:** Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations

Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.

**UNIT-III:**

**CONTROL FLOW:** - if, if-elseif-else, for, while, break, continue, pass.

Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

**UNIT-IV:**

**MODULES:** Creating modules, import statement, from import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions, Object Oriented Programming OOP in Python: Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data Hiding,

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**UNIT-V:**

**BRIEF TOUR OF THE STANDARD LIBRARY**: Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multi-Threading, GUI Programming, Turtle Graphics

**TESTING:** Why testing is required? Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

**TEXT BOOKS:**

1. Python Programming: A Modern Approach, VamsiKurama, Pearson.
2. Learning Python, Mark Lutz, Orielly.

**REFERENCES:**

2. Think Python, Allen Downey, Green Tea Press
3. Core Python Programming, W. Chun, Pearson.
4. Introduction to Python, Kenneth A. Lambert, Cengage

**OUTCOMES:**

**At the end of this course the student can able to:**

- Analyze the programming concepts with an interpreted Language.
- Build software applications for real needs.
- Acquire knowledge for prior Introduction to testing software
- Making Software easily right out of the box.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **DIGITAL SIGNAL PROCESSING** | | | | | |

**Course Objectives:**

1. Analyze the Discrete Time Signals and Systems
2. Know the importance of FFT algorithm for computation of Discrete Fourier Transform
3. Understand the various implementations of digital filter structures
4. Learn the FIR and IIR Filter design procedures
5. Know the need of Multirate Processing
6. Learn the concepts of DSP Processors

**UNIT – 1**

**INTRODUCTION:** Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems , stability of LTI systems, Invertability, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms, solution of difference equations using Z-transforms, System function.

**UNIT – 2**

**DISCRETE FOURIER SERIES &FOURIER TRANSFORMS:** Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT,Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

**UNIT – 3**

**DESIGN OF IIR DIGITAL FILTERS& REALIZATIONS:** Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.

**UNIT – 4**

**DESIGN OF FIR DIGITAL FILTERS & REALIZATIONS:**

Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters.Basic structures of FIR systems, Lattice structures, Lattice-ladder structures

**UNIT – 5**

**INTRODUCTION TO DSP PROCESSORS:** Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs ,Multiple Access Memory, Multiported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals.

**Architecture of TMS320C5X:** Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals

**TEXT BOOKS:**

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, DimitrisG.Manolakis,Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI.
3. Digital Signal Processors – Architecture, Programming and Applications,, B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002

**Reference Books:**

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.
3. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.

**CourseOutcomes:**

Aftergoingthroughthis coursethestudentwill be ableto

1. Applythedifference equationsconceptin theanayziationofDiscretetimesystems
2. UsetheFFTalgorithmforsolvingtheDFTof a givensignal
3. Design aDigitalfilter(FIR&IIR)fromthegivenspecifications
4. RealizetheFIRand IIRstructuresfromthedesigneddigitalfilter.
5. UsetheMultirateProcessingconceptsinvarious applications(eg:Designofphaseshifters,Interfacingofdigitalsystems
6. Applythe signal processingconcepts on DSPProcessor.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **TRANSDUCERS AND SENSORS** | | | | | |

**Course Objectives:**

1. To prepare students for successful career in industry, research and development.
2. To provide sound knowledge about various transducers used for the measurement of different industrial parameters.
3. To make error analysis for various measuring instruments.
4. To observe the characteristics of various transducers.

**UNIT – 1**

**Introduction to transducers & sensors,** classification of transducers, selection of transducer.

**Static characteristics of Transducers and sensors:** Introduction, static characteristics: accuracy, precision, resolution, static sensitivity, Linearity, Threshold, Hysteresis, Dead Zone, span, Range Loading effect.

**Dynamic characteristics:** Generalized Mathematical model of measurementsystem, operational & sinusoidal transfer functions zero, first and second order instruments & their response to step, ramp, and impulse inputs

**UNIT – 2**

**Introduction:** Definition of Transducer, Classification of transducers.

**Resistive Transducers:** Potentiometers, Strain gauges & their types, RTD-2-wire,3-wire,4-wire RTDs, Thermistors, Hotwire anemometers.

**UNIT – 3**

**Inductive Transducers:** Principles of Inductive transducers: Change in self inductance, Change in mutual inductance, Production of eddy currents, Variable reluctance transducer, Linear Variable differential transformer (LVDT), Rotary Variable differential transformer (RVDT), Magneto strictive transducer.

**UNIT – 4**

**Capacitive Transducers:** Variable dielectric, Variable gap, Variable area typeCapacitive devices, Differential type.Capacitive microphone

**Piezo-electric Transducers:** Piezo-electric effect, Piezo-electric Materials, Piezoelectric transducer & its characteristics

**UNIT – 5**

**Developments in Sensor Technology:** Introduction, Smart sensors, Micro Sensors, IR radiation Sensors, Ultrasonic Sensors, Fiber optic sensors, Chemical sensors and Bio Sensors.

**Text Books:**

[1] A.K.Ghosh, “Introduction to Measurements & Instrumentation”, IIIrded, PHI, 2009. (UNIT I)

[2] A.K.Sawhney&PuneetSawhney, “A Course in MechnanicalMeasuremnets& Instrumentation”, XIIthed, DhanapatRai& Co., 2012. (UNIT II & III, IV)

[3] D.V.S.Murty, “Transducers & Instrumentation”, IIed, PHI. (UNIT V)

**Reference Books:**

[1] Raman Pallas-Arney& John G.Webster, “Sensors & Signal Conditioning”, II nd ed., J. Wiley,2012.

[2] D.Patranabis, “Sensors and Transducers” II nd ed., PHI, 2013.

[3] BC Nakra, KK Chaudhry “Instrumentation, Measurement and Analysis”, IIed TMH.

**Course Outcomes:**

At the end of this course, students will be able to

1. Know the basic principle and operation of various transducers
2. Select transducers based on application
3. Select proper transducer based on application in various fields.
4. Know basics on MEMS, Fiber -optic and Smart Sensors.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **INDUSTRIAL INSTRUMENTATION** | | | | | |

**Course Objectives:**

1. To prepare students for successful career in industry, research and development.
2. To understand the purpose of instrumentation in Industrial processes.
3. To provide sound knowledge about various techniques used for the measurement of different industrial parameters

**UNIT – 1**

**Measurement of Pressure:** Manometers— U-tube manometer, inclined tube manometer, Bourdon gauge, Diaphragm gauges, Bellows gauges, Electrical type based on inductive and capacitive type, vacuum gauges- McLeod gauge, pirani gauge, thermocouple gauge, Differential pressure transmitter, Calibration of pressure gauges. High pressure measurement — Bridgeman gauge.

**UNIT – 2**

**Measurement of Temperature:** Temperature scale, Temperature standard, Bimetallic thermometer, filled-in thermometers, vapour pressure thermometers, resistance thermometers —3-lead and 4-lead arrangement, thermistors, thermocouples –laws of thermocouples, types and characteristics, cold-junction compensation, Pyrometers – radiation pyrometer, optical pyrometer.

**UNIT – 3**

**Measurement of Flow:** Variable head flow meters —orifice plate, venturi tube, dall tube, flow nozzle, pitot tube, Variable area Rota meter, mass flow meter, positive displacement meter, turbine flow meter, electromagnetic flow meter, ultrasonic flow meter, Doppler flow meter, Vertex flow meter

**UNIT – 4**

**Measurement of Level:** Sight glass, float gauge, displacer, torque tube, Hydrostatic type –bubbler tube, diaphragm box type, electrical methods – resistance type, capacitance type level gauging, ultrasonic level gauging, nuclear radiation method

**UNIT – 5**

**Miscellaneous Measurements:** Measurement of speed–AC and DC-Tacho-generators, Measurement of force-load cell-strain gauge load cell, Pneumatic load cell, hydraulic load cell. Density measurement –for liquids and gases. Humidity, dew point, psychomotor, hygrometers, moisture measurement in paper, kilns, viscosity –say bolt viscometer, Rota meter type viscometer. Torque measurements using strain gauges and magnetic pickup.

**Text Books:**

1. Principles of Industrial Instrumentation, D. Patranabis, Tata McGraw Hill Publishing co., 2000.
2. A course in mechanical measurements and instrumentation, A. K. Sawhney&PuneetSawhney, DhanpatRai& Co., 2001.

**References**:

1. Measurement systems: Application and Design, E. O. Doeblin, TMH Publishing co., 2004.
2. Instrument Engineers handbook, edited by B. G. Liptak., Chilton Book Co., 1974.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**
**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

At the end of this course, students will be able to

1. Know the basic principle and operation of various instruments
2. Identify the role of various instruments in the process of Measurement and instrumentation.
3. Understand how instruments are used for process control.
4. Select instruments based on application in various fields.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
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| **PRINCIPLES OF COMMUNICATION ENGINEERING (PE-1)** | | | | | |

**Course Objectives**

1. Introduction to different analog modulation schemes.
2. To learn about angle modulation schemes and its advantages and its disadvantages .
3. To know about modulation techniques.
4. To deliver knowledge of Digital Modulation Techniques.
5. To learn about Telemetry and Telecontrol.

**UNIT – 1**

**AMPLITUDE MODULATION :** Introduction and overview of basic communication system, Need for Modulation, Amplitude Modulation, Modulation Index, Spectrum of AM Signal, Power Calculations in AM Systems, Modulators and Demodulators (Diode detector),DSB-SC Signal, SSB Signal, Comparison of AM Techniques.

**UNIT – 2**

**ANGLE MODULATION:** Angle Modulation, Narrow Band and Wideband FM, Spectrum of an FM Signal. Indirect method of Frequency Modulation (Armstrong Method), FM Demodulation: Balanced Slope Detector, Ratio Detector, Pre – emphasis and De – emphasis, Comparison of FM and AM.

**UNIT – 3**

**PULSE ANALOG MODULATION**: Time Division Multiplexing, Types of Pulse modulation, PAM (Single polarity, double polarity), Generation & demodulation of PWM, Generation and demodulation of PPM, Comparison of PAM, PWM and PPM systems.

**UNIT – 4**

**PULSE DIGITAL MODULATION**: Elements of Digital Communication System, Comparison of Digital and Analog Communication Systems. Pulse Code Modulation (PCM): Quantization and Encoding, Differential Pulse Code Modulation, Delta Modulation.

**UNIT – 5**

**DIGITAL MODULATION TECHNIQUES:** Introduction, Amplitude Shift Keying, Binary Frequency Shift Keying, Binary Phase Shift Keying, Differential PSK (DPSK), Quadrature Phase Shift keying (QPSK), Comparison of Digital Modulation Techniques.

**TEXT BOOKS:**

1. Simon Haykins, "Communication Systems", 2nd Edition, Reprint, John Wiley and Sons, 2008.
2. H. Taub and D. L. Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 3rd print, 2008.

**REFERENCES:**

1. R.P. Singh and S. Sapre, "Communication Systems: Analog and Digital", 3rd edition, Tata McGraw-Hill, 2017.
2. Digital Communication, Bernard Sklar, 2nd Edn. Pearson Education.

**Course Outcomes:**

A student who successfully completes Principles of Communication Systems will

1. Understand the basic concept of information.
2. Understand how information is put into electronic for storage and delivery.
3. Have detailed understanding of amplitude and frequency modulation and demodulation methods including synchronous demodulation, nonlinear demodulation and phase-locked loops.
4. Have an understanding of design considerations for multiple access/use spectrum and multiplexing.
5. Have detailed understanding of digital communication basics including matched filters, signal space methods and optimal receiver design.
6. Understand basic principles of Gaussian noise processes and their use/utility in communication system design.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
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| **PLCs AND SCADA(PE-1)** | | | | | |

**Course Objectives:**

1. The main objective is that the student will be able to know about the basic concepts of PLC which is present in every Industry.
2. By learning the concepts, the student can be able to design ladder logics which are very useful in control of a particular process of an Industry.
3. SCADA deals with the overview of a plant and the student can be able to estimate the parameter values with the current running of the plant.
4. The animations in SCADA gives an idea to the student regarding the flow of different parameters and how to control them.

**UNIT – 1**
**Programmable Logic Controllers :** Introduction, Basic Operation, Architecture, Programming Languages, Basic components of Ladder Logic, Fundamentals of Ladder Diagrams, Boolean Logic and Relay Logic.

**UNIT – 2**
**File Structure and Addressing Formats:**
Input and Output Data Files, Bit data file, Timer data file, Control data file, Integer data file, Timer and Counter instructions, Comparison and Sequencer instructions

**UNIT – 3**
**PLC Applications:**
Switching ON-OFF light, Liquid Level control, Process control, Vehicle Parking Control, Bottling Plant and Traffic Light control.

**UNIT – 4**
**SCADA:** Introduction, Types of Animations- Animation Dialog box, Visibility & Text animations, Fill, Horizontal Position, Vertical Position, Width and Height. Numeric Display and Numeric Input.

**UNIT – 5**
**Alarm and Data Logging & SCADA Development:** SCADA Software Installation, SCADA Project Development. Alarm configuration, Alarm setup, Alarm Startup and Display, Data Logging

**Text Books:**
1. Rajesh Mehra, Vikrant Vij, "PLCs &SCADA :Theory and Practice", Laxmi Publications,2011,edition 1.
2. Gordon Clarke, Deon Reynders, "Practical Modern SCADA Protocols", Newnes,2004,edition illustrated.
3. W.Bolton, "Programmable Logic Controllers", Newnes,2004,edition 5.

**Reference:**
1. Stuart A. Boyer, "SCADA: Supervisory Control and Data Acquisition", International Society of Automation, 2010, Edition 4.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

1. After completion of the course the student will be able to design even complex ladder logics for any type of process.
2. The student will be able to do Projects at the Final year of his Graduation by taking any one of the PLC applications.
3. The SCADA will be used whenever a student wants to replicate the industry environment in his Project.
4. The student will be able to learn both the software techniques of PLC and SCADA from this course.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **IOT SENSOR TECHNOLOGY(PE-1)** | | | | | |

**Course Objectives:**

1. The main objective is that the student will be able to know about the basic concepts of IOT.
2. Learn about elements of IOT.
3. Understand various applications of IOT.
4. Study about Industrial automation.

**UNIT – 1 Introduction to IoT:** Introduction to IoT, Architectural Overview, Design principles and needed capabilities, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

**UNIT – 2 Elements of IoT:** Hardware Components- Computing- Arduino, Raspberry Pi, ARM Cortex-A class processor, Embedded Devices – ARM Cortex-M class processor, Arm Cortex-M0 Processor Architecture, Block Diagram, Cortex-M0 Processor Instruction Set, ARM and Thumb Instruction Set.

**UNIT – 3 Introduction and Applications**: smart transportation, smart cities, smart living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints, hardware, Data representation and visualization, Interaction and remote control.

**UNIT – 4 IOT Physical Devices & Endpoints**: What is an IOT Device, Exemplary Device Board, Linux on Raspberry , Interface and Programming & IOT Device. Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases

**UNIT – 5** Industrial Automation-Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation-Introduction, Case study: phase one-commercial building automation today, Case study: phase two commercial building automation in the future. Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT.

**Text Books:**

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.
2. The Definitive Guide to the ARM Cortex-M0 by JosephYiu,2011
3. Vijay Madisetti, ArshdeepBahga, Internet of Things, "A Hands on Approach", University Press,2015.
4. Mandler, B., Barja, J., MitreCampista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publication
5. Internet of Things: A Hands-On Approach Paperback – 2015, byArsheepBahga (Author), Vijay Madisetti (Author)
6. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017 ,by Hanes David (Author), Salgueiro Gonzalo (Author), Grossetete Patrick (Author), Barton Rob (Author).

**References:**

1. Cypress Semiconductor/PSoC4 BLE (Bluetooth Low Energy) Product TrainingModules.
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: EnablingTechnologies, Platforms, and Use Cases", CRC Press,2017.

**Course Outcomes:**

After completion of the course the student will be able to

1. Define and classify IOT.
2. Apply IOT Architecture.
3. Learn various applications of IOT.
4. Define routing and other technologies.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **ELECTROMAGNETIC INTERFERENCE & COMPATIBILITY (PE-1)** | | | | | |

**Course Objectives:**

1. StudentshallbeabletounderstandtherootcausesforElectromagneticNoise(EMI),itssources.
2. ShallbeabletounderstandtheeffectsofEMIandtherequiredprecautionstobetaken/tobediscussedwithhi speergroup.
3. ShallbeabletounderstandthedifferentmeasurementtechniquesofEMI(forconductedandnormal) andtheirinfluencesin detail.
4. Shallbeabletounderstanddifferentcompatibilitytechniques(EMC)toreduce/suppressEMI.
5. Shallbeabletounderstanddifferentstandardsbeingfollowedacrosstheworldinthefieldsof EMI/EMC.

**UNIT – 1**

**Natural and Nuclear sources of EMI / EMC**: Introduction, Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI/ EMC, Natural and Nuclear sources of EMI

**UNIT – 2**

**EMI from apparatus, circuits and open area test sites**: Electromagnetic emissions, noise from relays and switches, non-linearity in circuits, passive inter-modulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

**UNIT – 3**

**Radiated and conducted interference measurements**: Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements.

**UNIT – 4**

**ESD, Grounding, shielding, bonding and EMI filters**: Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design. ESD, Electrical fast transients / bursts, electrical surges.

**UNIT – 5**

**Cables, connectors, components**: Introduction, EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, Transient and Surge Suppression Devices.
**EMC standards- National / International**: Introduction, Standards for EMI and EMC, MIL-Standards, IEEE/ANSI standards, CISPR/IEC standards, FCC regulations, Euro norms, British Standards, EMI/EMC standards in JAPAN, Conclusions.

**Text Books:**

1. Engineering Electromagnetic Compatibility by Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.

**References:**

1. Introduction to Electromagnetic Compatibility, NY, John Wiley, 1992, by C.R. Pal.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi.

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**KAKINADA – 533 003, Andhra Pradesh, India**
**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

## Course Outcomes

At the end of this Course,

1. Students shall be able to distinguish effects of EMI and counter measures by MC-techniques.
2. Students shall apply the knowledge gained in selecting proper gadget/device/appliance/system, as per EMC- norms specified by regulating authorities.
3. Students shall choose career in the fields of EMI /EMC asan Engineer / Researcher / Entrepreneur in India / abroad

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |
| **TRANSDUCERS & SENSORS LABORATORY** | | | | | |

**List of Experiments:**

**PART-A**

1. To determine the variation of Percent error of potentiometer using MATLAB.
2. To find the step response, Impulse response, Frequency response of First order and second order Instruments using MATLAB.
3. To find the variation of Gauge factor of a strain gauge with Poisson's Ratio using MATLAB.
4. Simulation of PID Controller using Simulink.
5. Simulation of a digital control system using Simulink.

**PART-B**

1. LVDT Characteristics
2. Measurement of weight using Load cell
3. Measurement of Pressure using Strain Gauge
4. Characteristics of Thermistor,
5. Characteristics of Thermocouple
6. Characteristics of RTD.
7. Level measurement using capacitive level transducer
8. Study the performance of a biosensor (Pulse sensor)

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |
| **DIGITAL SIGNAL PROCESSINGLABORATORY** | | | | | |

**List of Experiments:**

1. Linear convolution between two sequences.
2. Circular convolution between two sequences.
3. Linear convolution using circular convolution.
4. Program to perform N-point DFT. Also to perform the IDFT on the result obtained to verify the result.
5. To perform circular correlation using a) direct method b) circular convolution using rotation method.
6. To perform circular convolution and correlation using DFT.
7. To perform linear convolution using (a) overlap save method (b) overlap add method.
8. To perform FFT on a sequence using the following methods.
   (a) Decimation in time (b) Decimation in frequency.
9. To perform IDFT on a transformed sequence using DFT.
10. Design an FIR filter using windowing techniques.
11. Design an IIR filter using impulse invariant method.
12. Design an IIR filter using bilinear transformation method.
13. Program to compute power density spectrum of a sequence.
14. Filter Design and Analysis.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 2 | 2 |
| **SCILAB (SKILL ADVANCED COURSES/SOFT SKILL COURSES)** | | | | | |

**Course Objectives**

1. To study about variables in SCILAB
2. To draw a plot
3. To come across Various loops
4. To study various data structures
5. To write a function

**UNIT – 1**

**MATRICES AND ARRAYS IN SCILAB:**About SCILAB, SCILAB System, How to start SCILAB, Entering Matrices sum and transpose, subscripts, Colon Operator, magic Function, Variables and constants: Definition, naming (identifiers or labels for different entities, initialization and accessing of variables. Constants and their representation.

**UNIT – 2**

**WORKING WITH MATRICES:** Generating Matrices, The load Function, Concatenation, Deleting Rows and Columns, Linear Algebra, Arrays Multivariate Data, Scalar Expansion, Logical Subscripting, find Function. Variables Numbers, Operators Functions, Expressions.

**UNIT – 3**

**GRAPHICS & COMMAND WINDOW:**The format Function, Suppressing Output, Entering Long Statements, Command Line Editing. Plotting Process, Editing Process, Preparing Graphs, Basic Plotting Functions, Mesh & Surface Plot, and Image Reading &Writing, Printing graphics, Simple programs.

**UNIT – 4**

**DATA STRUCTURE & FLOW CONTROL:** If, else and elseif , switch and case, for, while, continue, break, try-catch, return. Multidimensional Arrays, Cell Arrays, Characters and Text, Structures, Simple programs.

**UNIT – 5**

**SCRIPTS &FUNCTIONS:**Scripts, Functions, Global Variables, Passing String, Arguments to Functions, eval Function, Function Handles, Vectorization, Preallocation, Simple programs.

**TEXT BOOKS**

1. Introduction to SCILAB by RachnaVerma and ArvindVerma

**REFERENCE BOOKS**

1. SCILAB - A Beginner‟s Approach by Anil Kumar Verma

**Course outcomes**

After completion of the course student is able to

1. Write a program using scilab
2. Uses variables
3. Draws a plot
4. Writes a function

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **PROCESS CONTROL INSTRUMENTATION** | | | | | |

**Course Objectives:**

1. To learn about process and types of processes
2. To describe the purpose and importance of process control systems
3. To describe the components and operation of process control loops
4. To know about different controller characteristics and their applications
5. To learn various controller tuning methods

**UNIT – 1**

**Process Control Basics** Introduction: History, Control Objectives, Benefits, Levels of Process Control-Block Diagram of process control – Elements and Process variables-degrees of freedom, Process Dynamics, Process Characteristics of liquid system, gas system, thermal system -Mathematical model of liquid process, gas process, flow process, thermal process.

**UNIT – 2**

**Control Modes**: Basic control actions: Characteristics of on-off, proportional, single–speed floating Control, integral and derivative modes - composite control modes - PI, PD and PID control modes -Response of controllers for different types of test inputs – Pneumatic and electronic controllers to realize various control actions.

**UNIT – 3**

**Tuning PID Controllers** – Introduction – Process Reaction Curve Method - Ziegler-Nichols Method – 1/4th Decay Ratio – Damped Oscillation Method – Auto tuning , Comparison of Tuning methods, Process Flow Diagrams, Piping and Instrumentation Drawings

**UNIT – 4**

**Final Control Elements:** Actuators – Introduction – Pneumatic – Hydraulic – Electric Actuators, I/P – P/I Converters, Control Valves – Control Valve Characteristics – Types of Control Valves -Control Valve Sizing - Control Valve selection - Cavitation and Flashing in Control Valves

**UNIT – 5**

**Advanced Control schemes**: Introduction – Feed Forward Control, Cascade Control, Ratio Control. Computed Variable control, Override control, Nonlinear and adaptive control, Optimizing control, Control System design concepts.

**Text Books:**

1. Peter Harriot" Process Control",TMH, , 2008.
2. SK Singh "Process Control : Dynamics Concepts and Applications" –, PHI 2009
3. Michael L. Luyben, William L. Luyben, " Essentials of Process Control, McGraw Hill, 1997.

**Reference Books:**

1. Eckman, D.P "Automatic Process Control". Wiley Eastern Limited, 2nd edition ,1997
2. Curtis Johnson "Process Control Instrumentation Technology", PHI, 8thedition , 2006.
3. D Patrnabis "Principles of Process Control", TMH, 2nd edition, 1996.

4. B.G. Liptak, "Instrument Engineers' Handbook: Process Control "Volume 2 CRC press, Florida 2006.

**Course Outcomes:**

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

1. Understand about various components in process control loop and their functions
2. Explain how to control process variables
3. Select suitable controller for a particular applications
4. Understand advanced controller for industrial applications
5. Design a process control system.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
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| | | 3 | 1 | 0 | 3 |
| **VLSI DESIGN** | | | | | |

**Course Objectives:-**

1. To learn the various IC fabrication steps required for NMOS, CMOS, BICMOS
2. To learn about basic electrical properties of MOSFET.
3. To study the concepts of stick diagrams and layouts with the knowledge of MOS layers through design rules.
4. To study gate level design of subsystem, integrated circuit
5. To study CMOS testing, Design Strategies for Testing.

**UNIT – 1**

**Introduction :**Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, IC production process, MOS and CMOS Fabrication processes, BiCMOS Technology, Comparison between CMOS and Bipolar technologies.

**Basic Electrical Properties Of MOS and Bi-CMOS Circuits:** $I_{ds}$ versus $V_{ds}$Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. The Pass transistor, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter. Alternative forms of pull-up, The CMOS Inverter, MOS transistor circuit model, Bi-CMOS Inverter, Latch-up in CMOS circuits and BiCMOS Latch-up Susceptibility.

**UNIT – 2**

**MOS and Bi-CMOS Circuit Design Processes:** MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2µm Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2µm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams-Translation to Mask Form.

**UNIT – 3**

**Basic Circuit Concepts:** Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Choice of layers, Transistor switches, Realization of gates using NMOS, PMOS and CMOS technologies.

**Scaling Of MOS Circuits:** Scaling models, Scaling factors for device parameters, Limits due to sub threshold currents, current density limits on logic levels and supply voltage due to noise.

**UNIT – 4**

**Subsystem Design:** Architectural issues, switch logic, Gate logic, examples of structured design, clocked sequential circuits, system considerations, general considerations of subsystem design processes, an illustration of design processes.

**UNIT – 5**

**VLSI Design Issues:** VLSI Design issues and design trends, design process, design for testability, technology options, power calculations, package selection, clock mechanisms, mixed signal design, ASIC design flow, FPGA design flow, introduction to SoC design. Basic CPLD architecture, typical CPLD design flow

**FPGA Design:** Basic FPGA architecture, , FPGA configuration, configuration modes, FPGA design process-FPGA design flow, FPGA families, FPGA design examples-stack, queue and shift register implementation using VHDL, step-by-step approach of FPGA design process on Xilinx environment.

**Text Books:**

1. Essentials of VLSI Circuits and Systems By Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited,2005 Edition.

**References:**

1. VLSI Design By A.Albert Raj &T.Latha,PHI Learning Private Limited,2010.
2. VLSI Design-A.Shanthi and A.Kavita, New Age International Private Limited, 2006 First Edition.

**Course Outcomes**

**After going through this course the student will be able to**

1. Learn IC Fabrication process steps required for PMOS, NMOS, CMOS, BiCMOS.
2. Understand VLSI Design flow for fabrication of a chip, layout design rules, stick diagrams and scaling of MOS transistor.
3. Learn about scaling of MOS transistor.
4. Learn the time delays, driving large capacitive loads, Wiring capacitance, choice of layers.
5. Understand the process of subsystem design.
6. Understand CMOS testing, Design Strategies for Testing.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **ANALYTICAL INSTRUMENTATION** | | | | | |

**Course Objectives:**

1. To study the principles of Instrument Analysis.
2. To understand different specific instrumentation topics that are fundamental to different types of instrument systems.
3. To acquaint with the performance characteristics of Analytical Instruments.
4. To know the various instrumental techniques such as Chromatography, Spectroscopy etc. as required to support an understanding of the performance characteristics.
5. To familiarize with different pollution monitoring instruments and their application in engineering.

**UNIT – 1**

**Ultraviolet And Visible Spectroscopic Instruments:** Radiation sources – Monochromators – filters, prism, grating types – detectors – Recording type of instruments– UV & VIS absorption methods – emission methods – various types of instruments –application in Industry.

**UNIT – 2**

**Infrared Spectroscopic Instruments**: Fundamentals of Infrared spectrometers – Sources of Infrared – detecting units – different types of Instruments.
**Flame Spectrophotometry:** Essential parts of flame photometers – different types of flame photometers..

**UNIT – 3**

**Nuclear Magnetic Resonance Spectroscopy:** Principle of NMR, Measurement of NMR spectrum, Broad band NMR spectrometer – FT NMR spectrometer – application.
**Electron Spin Resonance Spectroscopy:** Principle of ESR, ESR spectrometer – application.
**Mass Spectrometry:** Principle of operation – Magnetic deflection Mass Analyzer – Time of flight mass analyzer

**UNIT – 4**

**Nuclear Radiation Measurements:** Nuclear Radiation detectors – Ionization chamber, GM Counter, proportional counter, scintillation counter, solid state detector.
**X-Ray Spectroscopy:** Introduction, Instrumentation for X-ray spectroscopy, X-ray absorption meter, X-ray diffractometer, X-ray fluorescence spectrometer – application

**UNIT – 5**

**Gas and Liquid Chromatography:** Chromatography – types- Basic principles of gas chromatography, liquid chromatography (HPLC) - different types of columns, detectors, recorders and associated equipment for Gas and Liquid Chromatography and their applications, Interpretation and Analysis

**Text Books:**

1. Willard H.H., Merrit L.L. , Dean J.A., Scattle F.I., Instrumental methods of Analysis, 7th Edn., CBS, 1986.
2. R.S.Khandpur , Handbook of Analytical Instruments, TMH 1989.
3. Skoog D.A., Principles of Instrumental Analysis, Holt Soundes publications, 4th Edn.1982.

**Reference Books:**

1. Mann C.K., Vicker T.J. &Gullick W.H., Instrumental Analysis , Harper and Row Publishers

**Course Outcomes:**

1. The student will be able to know the operating principles of various gas and liquid analysers used in industries.
2. Understand the basic operation of each class of instrument and the chemical or physical property they measure.
3. To acquire knowledge about the limitations of methods and instruments.
4. To analyse various Spectroscopic techniques.
5. The student will be able to suggest suitable instrumental methods for selected analytical problems.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year-II Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **ROBOTICS AND AUTOMATION (PE-2)** | | | | | |

**Course Objectives:**

1. To be familiar with the automation and brief history of robot and applications.
2. To give knowledge about robot end effectors and their design.
3. To give knowledge about robot different drive systems, actuators and their control.
4. To give the student familiarities with the kinematics of robots.
5. To give knowledge about various Sensors and their applications in robots

**UNIT – 1**

Fundamentals of Robots:Definition –Historical background- Robot Anatomy : Polar, Cylindrical, Cartesian coordinate, Joint-arm configuration–Work volume– Robot Drive System : Hydraulic, Electric, Pneumatic – Control System: Limited sequence, Play back with point to point and Continuous path control Intelligent RobotsDynamic performance: Speed of response and Stability - Precision of movement: Spatial Resolution, Accuracy, Repeatability and Compliance – Introduction to End effectors, Robotic Sensors, Robot Programming and work cell control

**UNIT – 2**

Robot End Effectors, Sensors, End Effectors: Types-Mechanical grippers-Magnetic grippers, Vacuum cups, Adhesive gripper, Hooks and Scoops- Tools as end effectors - Robot/ End-effectors, interface-Consideration in Gripper selection and Design.

**UNIT – 3**

Sensors: Transducers and Sensors – Sensors in Robotics: Tactile, Proximity, and Range Sensors, Miscellaneous sensors and sensor based systems- Machine Vision System.

**UNIT – 4**

Programming and Control of Robots :Robot Programming: Methods of Programming-: Lead through Methods, Robot program as a path in space- Motion interpolation, WAIT, SIGNAL and DELAY Commands, Branching, Capabilities and limitations of Lead through MethodsTextual Robot Programming- structure, Motion, End effectors and Sensor commands, Program control communication, Monitor mode commands Robot Control: Open and Closed loop control- control Problem- Linear control SchemesDesign of Partitioned PD, PID and Adaptive Controllers for Linear Second order SISO Model of robot and their Block schematic representation- Control of Industrial Robots Using PLCs

**UNIT – 5**

Automation :Factory Automation: Fixed Automation, Flexible Automation and Programmable Automation.Intelligent Industrial Automation, Industrial Networking, Bus Standards Automatic Feeders, Automatic Storage and Retrieval Systems (AS/RS), Transfer Lines, Automatic Inspection Systems Applications of Robots, Factors influencing the selection of Robots – Robots for Welding, Painting, Assembly, Nuclear, Thermal and Chemical Plants.Introduction to Mobile Robots, Legged Robots and Remote Controlled Robots,Automated Guided Robots, Micro Robots – Control and Safety Issues

**Text Books:**

1. Groover, M.P., Weiss, M., Nagel, R.N., Odrey, N.G., Industrial Robots: Technology, Programming and Applications, McGraw-Hill Book Company, 2012.
2. Mittal R K, Nagrath I J, “Robotics and control”, Tata McGraw Hill, 2010.

**Reference Books:**

1. Groover, M.P., Automation, Production Systems, and Computer-Integrated Manufacturing, Prentice-Hall of India Private Limited, New Delhi, 2007
2. S.R.Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill, 1994
3. Yoran Koren, Robotics for Engineers, McGraw Hill, 1980.
4. Saeed B. Niku, An Introduction to Robotics- Analysis, Systems, Applications, Second Edition, John Wiley & Sons Inc., 2010.
5. Wesley, E. Sryda, "Industrial Robots: Computer interfacing and Control" PHI, 1985

**Course Outcomes:**

1. Students will be equipped with the automation and brief history of robot and applications.
2. Students will have good knowledge about robot end effectors and their design concepts.
3. Students will have good knowledge about robot drive systems ,actuators and their control.
4. Students will be familiarized with the kinematic motions of robot.
5. Students will be equipped with the principles of various Sensors and their applications in robot

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year-II Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **COMPUTER ARCHITECTURE and ORGANIZATION (PE-2)** | | | | | |

**Course Objectives:**

1. Understand the fundamentals of different instruction set architectures and their relationship to the CPU design.
2. Understand the principles and the implementation of computer arithmetic and ALU.
3. Understand the memory system, I/O organization.
4. Understand the operation of modern CPUs including interfacing, pipelining, memory systems and busses.
5. Understand the principles of operation of multiprocessor systems.

**UNIT – 1**

**Introduction**:Organization and Architecture, Structure and function, computer components, computer function, interconnection structures, Bus interconnection

**UNIT – 2**

**Memory & I/O Cache Memory:** Computer memory system overview, cache memory principles, elements of cache design.ARM Cache organization

**Internal Memory Technology:** semiconductor main memory, error correction Advanced DRAM Organization.

**External Memory:** Magnetic Disk, RAID, Optical Memory, Magnetic Tape

**UNIT – 3**

**Input / Output:** External Devices, I/O modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Processors

**UNIT – 4**

**Computer Arithmetic:** The Arithmetic and Logic Unit (ALU), Integer Representation, Integer Arithmetic, Floating-Point Representation, Floating-Point Arithmetic

**Instruction Sets:** Machine Instruction Characteristics, Types of operands, Types of operations, Addressing, Instruction Formats

**Processor Structure and Function:** Processor Organization, Register Organization, The Instruction cycle, Instruction Pipelining. Reduced Instruction Set Computers

**UNIT – 5**

**Micro programmed Control:** Basic Concepts, Microinstruction Sequencing, Microinstruction Execution.

**Parallel Processing:** The use of Multiple Processors, Symmetric Multiprocessors

**Text Books**

1. William Stallings, "Computer Organization and Architecture", Pearson Publishers, Eighth Edition.
2. M.Morris Mano," **Computer System Architecture**," Pearson Publishers, Third Edition

**Reference Books**

1. John P Hayes, "**Computer Architecture and Organization,"**Mc-Graw Hill Publishers, Third Edition
2. Carl Hamacher, "**Computer Organization**," Tata Mc-Graw Hill Publishers, Fifth Edition.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**
**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

1. Students can understand the architecture of modern computer.
2. They can analyze the Performance of a computer using performance equation
3. Understanding of different instruction types.
4. Students can calculate the effective address of an operand by addressing modes
5. They can understand how computer stores positive and negative numbers.
6. Understand the concepts of I/O Organization and Memory systems.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year-II Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **SOFT COMPUTING TECHNIQUES (PE-2)** | | | | | |

## Course Objectives:

1. Teach an example of scripting and interpretative language and compare it with classical compiled programming languages
2. Introduce the student to Python programming fundamentals
3. Expose students to application development and prototyping using Python
4. Learn to apply fundamental problem solving technique
5. Introduce the student to soft computing and genetic algorithms with relevant applications

**UNIT – 1**

**Introduction**: Artificial Intelligence, Artificial Neural Networks, Fuzzy systems, Genetic Algorithm and Evolutionary programming, Swarm Intelligent systems

**UNIT – 2**

**Artificial Neural Networks: I**ntroduction to Artificial Neural Networks, Classification of ANNS, First generation neural networks, Perceptron network, Adaline, Madaline, Second generation neural networks, Back propagation neural networks

**UNIT – 3**

**Fuzzy Logic System**:Introduction to fuzzy logic, classical sets and fuzzy sets, fuzzy set operations, fuzzy relations, fuzzy composition, fuzzy inference system

**UNIT – 4**

**Genetic Algorithm:**Introduction to Genetic algorithms, Genetic algorithms, procedures of Gas, working of Gas, Travelling sales man problem

**UNIT – 5**

**Swarm Intelligent system:**Introduction to swarm intelligence, back ground, Ant colony system, working of ant colony optimization, Particle swarm intelligent systems, Artificial bee colony system, cuckoo search algorithm..

**TEXT BOOKS:**


1. 1.Soft computing with MATLAB programming—N.P.Padhy, S.P.Simon, Oxford university press,2015
2. Neural Networks and Fuzzy Systems - Kosko, B., Prentice-Hall of India Pvt. Ltd., 1994.
3. Introduction to Artificial Neural Systems-Jacek.M.Zurada, Jaico Publishing House,1999


**REFERENCE BOOKS:**


1. Fuzzy Sets, Uncertainty and Information - Klir G.J. &Folger T.A., Prentice-Hall of India Pvt. Ltd., 1993.
2. Fuzzy Set Theory and Its Applications - Zimmerman H.J. Kluwer Academic Publishers,1994.
3. Introduction to Fuzzy Control - Driankov, Hellendroon, Narosa Publishers.
4. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
5. Elements of Artificial Neural Networks - KishanMehrotra, Chelkuri K. Mohan,SanjayRanka, Penram International.
6. Artificial Neural Network –Simon Haykin, 2nd Ed., Pearson Education.
7. Introduction Neural Networks Using MATLAB 6.0 - S.N. Shivanandam, S. Sumati, S. N.Deepa,1/e, TMH, New Delhi.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

## Course Outcomes:

1. Understand and comprehend the basics of python programming.
2. Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
3. Explain the use of the built-in data structures list, sets, tuples and dictionary.
4. Make use of functions and its applications.
5. Identify real-world applications using oops, files and exception handling provided by python.
6. Formulate and implement a program to solve a real-world problem using GUI and Turtle graphics.
7. Understand soft computing applications

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **MEMS AND MICRO SYSTEMS (PE-2)** | | | | | |

**Course Objectives:**

1. To understand the operation principles of MEMS Devices,
2. To understand the various micromachining techniques used to fabricate MEMS devices
3. To become familiar with a wide variety of MEMS application areas such as MEMS sensors, RF MEMS, Optical MEMS, and Fluidic MEMS.
4. To provide basic educational foundation in micro-systems engineering emphasizing Biomedical micro-devices. This would also include some basic biological/ biochemical concepts and techniques which are necessary for understanding of diagnostics and therapeutics.
5. To provide education and training in fundamental micro-fabrication/microelectronic processing technologies,
6. To provide experience in micro-system design issues and various characterization schemes / biomedical/ chemical testing practices and procedures.

**UNIT – 1**

Introduction: Microsystems versus MEMS, Micro fabrication, Smart Materials, Structures and Systems, Integrated Microsystems, Applications of Smart Materials and Microsystems

**UNIT – 2**

Micro Sensors, Actuators, Systems and Smart Materials, Silicon Capacitive Accelerometer, Piezo resistive Pressure Sensor , Conductometric Gas Sensor, An Electrostatic Comb-Drive, A Magnetic Micro relay, Portable Blood Analyzer , Piezoelectric Inkjet Print Head, Micromirror Array for Video Projection, Smart Materials and Systems

**UNIT – 3**

Micro Fabrication Technique, Silicon as a Material for Micromachining, Thin-Film Deposition, Lithography, Etching, Silicon Micromachining Specialized Materials for Microsystems, Advanced Processes for Micro fabrication

**UNIT – 4**

Modelling of Solids in Microsystems, The Simplest Deformable Element: A Bar, Transversely Deformable Element: A beam, Energy Methods for Elastic Bodies, Heterogeneous Layered Beams, Bimorph Effect, Residual Stresses and Stress Gradients, Poisson Effect and the Anticlastic Curvature of Beams, Torsion of Beams and Shear Stresses, Dealing with Large Displacements, In-Plane Stresses

**UNIT – 5**

Finite Element Method: Need for Numerical Methods for Solution of Equations, Variational Principles, Finite Element Model for Structures with Piezoelectric Sensors and Actuators, Analysis of a Piezoelectric Bimorph Cantilever Beam, Modelling of Coupled Electromechanical Systems, Electrostatics, Coupled Electromechanics: Statics and Stability and Pull-In Phenomenon, Dynamics, Squeezed Film Effects in Electromechanics

**Text Book**

1. G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, V.K. Aatre, “Micro And Smart Systems” Wiley, India (2010)

**References**

1. Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan "Smart Material Systems and MEMS: Design and Development Methodologies", John Wiley & Sons Ltd,
2. Mohamed Gad-el-Hak "The MEMS Handbook", University of NotreDame, CRC Press LLC

**Course Outcomes:**

1. The student will be able to realize the sensors and micro scale.
2. The student will be learning the fabrication procedures at micro scale
3. The students can design systems at micro scale level.
4. FEM Analysis
5. Microsystem design and characterization

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |
| **PROCESS CONTROL LABORATORY** | | | | | |

**List of Experiments:**

**PART-A**

*Using Quanser DC Motor control hardware / Heating Ventilation & Airconditioning hardware andLabVIEW*

1. Mathematical Modeling and simulation
2. Qualitative PD Control
3. PD Control to Specifications
4. Qualitative PI Control
5. PI Control to Specifications
6. PID Controller Design
7. Stability analysis
8. Time domain analysis
9. Frequency domain analysis
10. Fuzzy controller design
11. Special control design

**PART-B**

1. Study of Process Control Training Plant and Compact Flow Control Unit
2. Characteristics of Pneumatically Actuated Control Valve
3. Level Control and Pressure Control in Process Control Training Plant
4. Design of ON/OFF Controller for the Temperature Process
5. PID Implementation Issues
6. Tuning of PID Controller for mathematically described processes
7. PID Enhancements ( Cascade and Feed-forward Control Schemes)
8. Design and Implementation of Multi-loop PI Controller on the Three-tank system
9. Analysis of Multi-input Multi-output system (Four-tank System)
10. Auto-tuning of PID Controller
11. Study of PID Controller Characteristics using **Temperature Process Controller**
12. Study of PID Controller Characteristics using **Level Process Controller**
13. Study of PID Controller Characteristics using **Pressure Process Controller**

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |
| **VLSI DESIGNLABORATORY** | | | | | |

**List of Experiments**

**PART (A):**
The students need to develop Verilog /VHDLSource code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary Synthesizer.
Note 2: All the experiments need to be implemented on the latest FPGA/CPLD Hardware in the Laboratory

1. Realization of Logic gates

**Design and Implementation of the following:**

2. 4-bit ripple carry and carry look ahead adder using behavioural, dataflow and structural modeling
3. a) 16:1 mux through 4:1 mux
   b) 3:8 decoder realization through 2:4 decoder
4. 8:3 encoder
5. 8-bit parity generator and checker
6. Flip-Flops
7. 8-bit synchronous up-down counter
8. 4-bit sequence detector through Mealy and Moore state machines.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |
| **ADVANCED INSTRUMENTATON LABORATORY** | | | | | |

**LIST OF EXPERIMENTS:**

1. Temperature control using Programmable logic controllers (PLC)
2. Level control using PLC
3. Pressure control using PLC
4. Motor Speed control using PLC
5. Digital PID controller.
6. Implementation of logic gates, timer and counter using PLC
7. Process control simulator
8. Flame photo meter
9. UV spectrometers
10. IR spectrometers

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 2 | 2 |
| **MACHINE LEARNING WITH SCIKIT (SKILL ADVANCED COURSES/SOFT SKILL COURSES)** | | | | | |

**Course Objectives**

1. To study about Machine learning
2. To learn SCIKIT
3. To study about PCA
4. To learn about Kernel

**UNIT – 1**

The Fundamentals of Machine Learning,Learning from experience,Machine learning tasks,Training data and test data,Performance measures, bias, and variance,An introduction to scikit-learn,Installing scikit-learn, **Installing scikit-learn on Windows,Installing scikit-learn on Linux ,Installing scikit-learn on OS X,Verifying the installation,**Installing pandas and matplotlibLinear Regression:Simple linear regression,**Evaluating the fitness of a model with a cost function ,Solving ordinary least squares for simple linear regression,**Evaluating the model,Multiple linear regression, Polynomial regression, Regularization, Applying linear regression, **Exploring the data, Fitting and evaluating the model,**Fitting models with gradient descent

**UNIT – 2**

Extracting features from categorical variables,Extracting features from text,The bag-of-words representation,Stop-word filtering, Stemming and lemmatization, Extending bag-of-words with TF-IDF weights,Space-efficient feature vectorizing with the hashing trick,Extracting features from images,Extracting features from pixel intensities,Extracting points of interest as features ,SIFT and SURF,Data standardization .Binary classification with logistic regression,Spam filtering,Binary classification performance metrics,Accuracy,Precision and recall ,Calculating the F1 measure,ROC AUC,Tuning models with grid search,Multi-class classification,Multi-class classification performance metrics,Multi-label classification and problem transformation**,**Multi-label classification performance metrics

**UNIT – 3**

Decision trees ,Training decision trees,Selecting the questions,Information gain,Gini impurity, Decision trees with scikit-learn, Tree ensembles,The advantages and disadvantages of decision trees Clustering with the K-Means algorithm, Local optima,The elbow method, Evaluating clusters, Image quantization, Clustering to learn features

**UNIT – 4**

An overview of PCA ,Performing Principal Component Analysis, Variance, Covariance, and Covariance Matrices, Eigenvectors and eigenvalues, Dimensionality reduction with Principal Component Analysis, Using PCA to visualize high-dimensional data,Face recognition with PCA

**UNIT – 5**

Kernels and the kernel trick, Maximum margin classification and support vectors, Classifying characters in scikit-learn, Classifying handwritten digits, Classifying characters in natural images Nonlinear decision boundaries, Feedforward and feedback artificial neural networks, Multilayer perceptrons, Minimizing the cost function, Forward propagation, Backpropagation,Approximating XOR with Multilayer perceptrons,Classifying handwritten digits

## TEXT BOOKS

1. Mastering Machine Learning with scikit-learn, Gavin Hackeling,Packt Publishing

## REFERENCE BOOKS

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow, AurélienGéron

## Course Outcomes

After completion of the course the student is able to

1. Learn about SCIKIT
2. Come across PCA
3. Learn about kernels

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **EMBEDDED SYSTEMS (PE-5)** | | | | | |

**Course Objectives:**

1. Understand the general embedded system concepts , design of embedded hardware and software development tools
2. Learn the basics of real time operating and embedded systems
3. Describe key issues such as CPU scheduling, memory management, task synchronization, and file system in the context of real-time embedded systems

**UNIT – 1**

**Introduction:** Embedded System-Definition, History, Classification, application areas and purpose of embedded systems, The typical embedded system-Core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, PCB and passive components. Characteristics, Quality attributes of an Embedded systems, Application-specific and Domain-Specific examples of an embedded system, Main processing elements of embedded system, hardware and software partitions.

**UNIT – 2**

**Embedded Hardware Design:** Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

**UNIT – 3**

**Embedded Firmware Design:** Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

**UNIT – 4**

**Real Time Operating System:** Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Threads, Processes and Scheduling, Task Scheduling, Communication, Synchronization, Device Drivers, How to choose an RTOS. Electronics and Communication Engineering **Hardware Software Co-Design:** Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware, ICE.

**UNIT – 5**

**Embedded System Development:** The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools.

**Embedded System Implementation And Testing:** The main software utility tool, CAD and the hardware, Translation tools-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools. Test and evolution of an embedded systems(Build in self testetc).**Case study-** typical embedded system design flow with an example.

**Text Books:**

1. Embedded Systems Architecture By Tammy Noergaard, Elsevier Publications, 2005
2. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications.

**References:**

1. Embedding system building blocks By Labrosse, CMP publishers.

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**KAKINADA – 533 003, Andhra Pradesh, India**
**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

1. Understand and design embedded systems and real-time systems
2. Define the unique design problems and challenges of real-time systems
3. Program an embedded system
4. Identify the unique characteristics of real-time operating systems and evaluate the need for real-time operating system
5. Explain the general structure of a real-time system
6. Understand and use RTOS to build an embedded real-time system
7. Gain knowledge and skills necessary to design and develop embedded applications based on real-time operating systems.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **BIO SIGNAL PROCESSING(PE-3)** | | | | | |

**Course Objectives:**

1. To study about the Nature of Biomedical Signals-ECG, EEG, EMG, PCG
2. To study about the Discrete-Time signals, systems and their medical applications
3. To gain the knowledge about various noises in recording of ECG and noise elimination with Time-Frequency domain filters
4. To learn about Optimal and Adaptive filtering techniques
5. To study the Event detection techniques in ECG and Spikes & Wave detection in EEG

**UNIT – 1**

**Random Processes**: Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth and noise figure of systems.

**UNIT – 2**

**Data Compression Techniques**: Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Huffman coding, vector quantization, DICOM Standards

**UNIT – 3**

**Cardiological Signal Processing**: Pre-processing, QRS Detection Methods, Rhythm analysis, Arrhythmia Detection Algorithms, Automated ECG Analysis, ECG Pattern Recognition. 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 – 4**

**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 – 5**

**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

**TEXT BOOKS**

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.

**REFERENCE BOOKS**

1. Digital Bio Dignal Processing - Weitkunat R, 1991, Elsevier.
2. Biomedical Signal Processing - AkayM , IEEE Press.
3. Biomedical Signal Processing -Vol. I Time & Frequency Analysis - Cohen.A, 1986, CRC Press

**Course Outcomes:**

At the end of this course, students will be able to

1. Gain the Knowledge on Nature of Biomedical Signals-ECG, EEG, EMG, PCG
2. Know the Application of various transformation techniques for noise elimination and segmentation
3. Get complete knowledge on various noises in recording of ECG and noise elimination techniques
4. Learn about ECG & EEG signal analysis and diagnosis of patient health based on PQRST peak detection

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **VIRTUAL INSTRUMENTATION(PE-3)** | | | | | |

**Course Objectives:**

1. To understand what is Virtual instrumentation.
2. To familiarize with the VI softwares and Lab VIEW programming.
3. To study various signal conditioning boards and data acquisition boards
4. To acquire knowledge various interfacing buses.
5. To understand various analysis tools and develop programs for Process control and signal processing.

**UNIT – 1**

**Introduction:** Virtual Instrumentation–Definition, flexibility–Block diagram and Architecture of Virtual Instruments–Virtual Instruments versus Traditional Instruments Data flow techniques-graphical programming in data flow–Review of Popular softwares in virtual Instrumentation.

**UNIT – 2**

**VI Programming Techniques**: VI- sub VI- Loops-structures-charts- arrays- clusters–graphs-formulanode-math script-local and global variable-strings- file I/O-execution control- Instrument drivers.

**UNIT – 3**

**DataAcquisitioninVI:**Introductiontodataacquisition-signalconditioning- classes of signal conditioning-field wiring and signal measurement-ground loops-A/D,D/Aconverters,plug-inDAQboards-Analog input/output cards – Digital Input/output cards-counter and timer I/o boards-Isolation-techniques- Opt isolation -Data acquisition MODULEs with serial communication

**UNIT – 4**

**Communication networked Units:** Introduction to PCB uses–Localbus: ISA – PCI – RS232 – RS422 – RS485 – Interface Bus – USB, PCMCIA, VXI, SCXI, and PXI. Instrumentation buses: Mod bus–GPIB-Networked bus–ISO/OSI Reference model, Ethernet and VISA

**UNIT – 5**

**Real time control and Applications**: Design of ON/OFF controller- PID controller -electronic prototyping and testing with ELVIS- real-time data acquisition-transducer analysis-signal processing with DSP unit-real-time embedded control with CRIO.

**Textbooks:**

1. Lab VIEW based advanced Instrumentation System, P.Sumathi, Springer science Elsievier 2007.
2. Practical Data Acquisition for Instrumentation and Control Systems, John Park and Steve Mackay, Elsevier Publications.

**Reference Books:**

1. Lab viewGraphicalprogramming,GaryJhonson,McGrawHill, Newyork,1997.
2. Lab viewforeveryone,LisaK.WellsandJeffreyTravis,PrenticeHall,NewJersey,1997.

**Course Outcomes:**

1. Students will be able design Virtual Instruments based on required application.
2. Students acquire skill for practical implementation of interfacing the PC and Stand- alone instruments with real world signals.
3. After completion of this course students will be able to carry out their project in this field.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **NANO SCIENCE(PE-3)** | | | | | |

**Course Objectives:**

1. The main objectives of course are to introduce the basic scientific concepts underlyNanoscience,
2. understand the properties of materials at the atomic/molecular level and the scaling laws governing these properties and to understand the working principle of equipment used in nanostructures.
3. In this course, students will gain knowledge of introduction to nanomaterials and their properties like magnetic, electrical, thermal and mechanical properties and a range of laboratory methods, specifically the fabrication and characterization tools used in nanotechnology such as various microscopies.

**UNIT – 1: Introduction:** Definition of Nano-Science and Nano Technology, Applications of NanoTechnology. Introduction to Physics of Solid State: Structure: Size dependence of properties;crystal structures, face centered cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations. Energy Bands: Insulators, semiconductor and conductors;Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces. Localized Particles: Acceptors and deep taps; mobility; Excitons.

**UNIT – 2: Quantum Theory For Nano Science:** Time dependent and time independent Schrodinger wave equations. Particle in a box, Potential step: Reflection and tunneling (Quantum leak). Penetration of Barrier, Potential box(Trapped particle in 3D:Nanodot), Electron trapped in 2D plane (Nano sheet), Quantum confinement effect in nano materials. Quantum Wells, Wires and Dots Preparation of Quantum Nanostructure; Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Excitons; Single electron Tunneling, Infrared electors; Quantum dot laser Super conductivity. Properties of Individual Nano particles Metal Nano clusters: Magic Numbers; Theoretical Modelling of Nano particles; geometric structure; electronic structure; Reactivity; Fluctuations Magnetic Clusters; Bulle to Nano structure. Semi conducting Nano particles: Optical Properties; Photo fragmentation; Columbic explosion. Rare Gas & Molecular Clusters: Inert gas clusters; Super fluid clusters molecular clusters

**UNIT – 3: Growth Techniques of Nano materials:** Lithographic and Non lithographic techniques, Sputtering and film deposition in glow discharge, DC sputtering technique (p-CuAlO2 deposition). Thermal evaporation technique, E-beam evaporation, Chemical Vapour deposition(CVD), Synthesis of carbon nano-fibres and multi-walled carbon nano tubes, Pulsed Laser Deposition, Molecular beam Epitoxy, Sol-Gel Technique (No chemistry required), Synthesis of nano wires/rods, Electro deposition, Chemical bath deposition, Ion beam deposition system, Vapor-Liquid –Solid (VLS) method of nano wires.

**UNIT – 4: Methods of Measuring Properties:** Structure: Crystallography, particle size determination, surface structure, Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy (TEM) Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibration Spectroscopy, Luminescence.

**UNIT – 5:**

**Buckeye Ball:** Nano structures of carbon(fullerene): Carbon nano-tubes: Fabrication ,structure. Electrical, mechanical, and vibration properties and applications. Nano diamond, Boron Nitride Nano-tubes, single elecTron transistors, Molecular machine, Nano-Biometrics,Nano Robots

## TEXT BOOKS

1. C.P.PooleJr F.J. Owens, "Introduction to Nanotechnology".
2. "Introduction to S.S. Physics" - (7th Edn.) Wiley 1996.
3. S. Sugano & H. Koizuoni, "Microcluster Physics" –Springor 1998

## REFERENCE BOOKS

1. "Handbook of Nano structured Materials & Nanotechnology" vol.-5. Academic Press 2000
2. A.K.Bandyopadhyay, "Nano Materials" New Age International

**Outcomes:**

A student undertaking this course will be able to understand

1. have a sound grounding and expert knowledge in multidisciplinary areas of Nanoscience
2. Understand basic interdisciplinary nature of nanotechnology; (physics, chemistry, electronic and mechanical properties)
3. Understand some of the basic research tools and techniques involved in nanotechnology research and manufacturing
4. fabrication methods in nanotechnology (top down & bottom up) characterization methods in nanotechnology (optical, electrical, AFM, SEM, TEM, and nanoindentation)
5. have enough of an introduction to see how student interests are connected to nanotechnology and how students can get involved in nanotechnology research
6. Understand societal impact and managing possible risks of nanotechnology: present and future

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **NONLINEAR AND ROBUST CONTROL (PE-4)** | | | | | |

**Course Objectives:**

1. To provide a basic knowledge of the theoretical foundations of optimal control.
2. To develop the skill needed to design controllers using available optimal control Theory and software.
3. To introduce to current research in optimization methods for robust control.
4. To understand the physical interpretation of H∞ norm.

**UNIT – 1**

**Introduction:** Why nonlinear control?, Nonlinear system behavior **Phase Plane Analysis** :Concepts of phase plane analysis, constructing phase portraits, determining time from phase portraits, phase plane analysis of nonlinear systems, existence of limit cycles

**UNIT – 2**

**Fundamentals of Lyapunov Theory** : Nonlinear systems and equilibrium points, concepts of stability, linearization and local stability, Lyapunov's direct method, system analysis based on Lyapunov's direct method, control design based on Lyapunov's direct method

**UNIT – 3**

**Advanced stability theory** : concepts of stability for non-autonomous systems, Lyapunov analysis of non-autonomous systems, instability theorms, existence of Lyapunov functions, Lyapunov like analysis using Barbalat's Lemma, positive linear systems, the passivity formalism, absolute stability, establishing boundedness of signals, existence and unicity of solutions.

**Describing function analysis** : Describing function fundamentals, common nonlinearities in control systems, Describing functions of common nonlinearities, Describing function analysis of common non linear systems.

**UNIT – 4**

**Feedback Linearization** : Intuitive concepts, mathematical tools, input state linearization of SISO systems, input-ouput linearization of SISO systems, multi input systems.

**Sliding Control** : Sliding surfaces, continuous approximations of switching control laws, the modelling/performance trade-offs, multi-input systems.

**UNIT – 5**

**Adaptive Control** : Basic concepts in adaptive control, adaptive control of first order systems, adaptive control of linear systems with full state feedback, adaptive control of linear systems with output feedback, adaptive control of nonlinear systems, robustness of adaptive control systems, on-line parameter estimation

**Text Books:**

1. Jean-Jacques E.Slotine, Weiping LI : Applied nonlinear control, Prentice Hall
2. Hassan K Khalil : Nonlinear systems, Prentice Hall

**Reference Books:**

1. Alberto Isidori : Nonlinear control systems, springer
2. M Vidyasagar : Nonlinear system analysis, Prentice Hall
3. Wassim M.Haddad, Vijaysekhar Chellaboina: Nonlinear dynamic system and control, Princeton University press
4. Mourad Boufadene : Nonlinear control systems using MATLAB , CRC press

**Course Outcomes:**

At the end of the course the student should be able to

1. Design and implement system identification experiments.
2. Use input-output experimental data for identification of mathematical dynamical models.
3. Use singular value techniques to analyze the robustness of control systems.
4. Incorporate frequency-domain-based robustness specifications into multivariable control System designs.
5. Use H-infinity methods to design robust controllers.
6. Explain the advantages and disadvantages of robust control relative to other control approaches.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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| **ARTIFICIAL INTELLIGENCE(PE-4)** | | | | | |

**Course Objectives:**

1. To provide a basic knowledge of AI.
2. To develop the skill needed to represent knowledge
3. To introduce to current research in Game playing.
4. To understand the Fuzzy logic.

**UNIT – 1**

What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System, Characteristics And Issues In The Design Of Search Programs, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

**UNIT – 2**

Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

**UNIT – 3**

Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory

**UNIT – 4**

Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC

**UNIT – 5**

Game Playing: Overview, And Example Domain: Overview, Mini Max, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction
Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI

**References:**

1. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

**Course Outcomes:**

At the end of the course the student should be able to

1. implement AI techniques.
2. Learn about natural language processing.
3. Use singular value techniques to analyze the robustness of control systems.
4. Study about game playing.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **AUTOMOTIVE SENSORS(PE-4)** | | | | | |

**Course Objectives:**

1. To provide a basic knowledge of Chassis.
2. To develop the skill needed to represent sensors for transportation
3. To introduce to sensors for security.
4. To understand the actuators
5. To learn about MEMS based sensors

**UNIT 1**

**CHASSIS (STEERING, SUSPENSION, BRAKING AND STABILITY):** Vehicle construction – Chassis and body – Specifications – construction Steering and Suspension: Principle of steering – steering geometry and wheel alignment –steering linkages, front axle – power steering. Active Suspension System (ASS)Brakes: Need – types – mechanical, hydraulic and pneumatic, power brake. Suspension system - independent coil and leaf spring and air suspensions, torsion bar, shock absorbers.

**UNIT – 2**

**SENSORS FOR TRANSPORTATION:** Vehicle Body:- Sensors Flap air flow sensors, Ranging radar (ACC) Power Train:- Fuel level sensors, Lambda Oxygen sensor, Hotwire air mass meter Chassis:- Steering wheel angle sensor, Vibration and acceleration sensors.

**UNIT – 3**

**SENSORS FOR AUTOMOTIVE VEHICLE CONVENIENCE AND**

**SECURITY SYSTEMS:** Tyre pressure monitoring systems, Two wheeler and Four wheeler security systems, parking guide systems, anti lock braking system. Vehicle diagnostics and health monitoring, Traction Control, Vehicle Dynamics Control, accelerators and tilt sensors for sensing skidding and anti collision - anti collision techniques using ultrasonic Doppler sensors.

**UNIT – 4**

**ACTUATORS:** Automotive Actuator Technologies-Operation and application of DC brushless motors and switched reluctance motors, Magneto-rheological Actuators-Suspension semi active actuators, Mangeto-strictive anti vibration actuators, Piezo Actuators, Micro positioning.

**UNIT – 5**

**MEMS BASED AUTOMOTIVE SENSORS:**Micro systems in Automobiles- an Overview, different types of MEMS based Sensors for Drive train Control, Safety Systems and Comfort Systems. NOX sensors

**TEXT BOOKS**


1. R. B. Gupta, ―Automobile Engineering‖, SatyaPrakasam Publishers, New Delhi 1993.
2. ROBERT BOSCH, ―Automotive Electrics, Automotive Electronics: Systems & Components, 4th Ed.,. 2005


**REFERENCES**


1. Joseph Heitner, ―Automotive Mechanics‖, Affiliated East West Pvt. LTD.
2. Robert Bosch , ―Automotive Sensors‖, BOSCH. 2002
3. Ronald K. Jurgen, ―Sensors and Transducers, 2nd Edition, SAE, 2003.
4. Tai-Ran Hsu, ―MEMS & Microsystem, Design and Manufacture‖, McGraw Hill, 2002.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Objectives:**

1. To provide a basic knowledge of chassis.
2. To develop the design of sensors for various applications
3. To study about MEMS based sensors
4. To understand the automotive sensors

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year -I Semester | | L | T | P | C |
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| **ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC(PE-4)** | | | | | |

**Course Objectives:**

1. To know the Difference between artificial neuron and human brain
2. To study the different terminologies in the artificial neural network
3. To solve the logical function with artificial neural network
4. To study the supervised and unsupervised learning methods
5. To solve the travelling salesman problem using artificial neural network
6. To know the difference between classical sets and fuzzy sets.
7. To understand the classical and fuzzy logic decision making

**UNIT – 1**

Introduction to Artificial Neural Networks: Artificial neural networks and their biological motivation – Terminology – Models of neuron –Topology – characteristics of artificial neural networks – types of activation functions. Learning Laws: Learning methods – error correction learning – Hebbian learning – Perceptron – XOR Problem –Perceptron learning rule convergence theorem – Adaline

**UNIT – 2**

Feed forward networks: Multilayer Perceptron – Back Propagation learning algorithm – Universal function approximation – Associative memory: auto association, heteroassociation, recall and cross talk. Recurrent neural networks: Linear auto associator – Bi-directional associative memory – Hopfield neural network – Traveling Salesman Problem

**UNIT – 3**

Unsupervised Learning: Competitive learning neural networks – Max net – Mexican Hat – Hamming net.Self Organizing networks:Kohonen Self organizing Feature Map – Counter propagation – Learning Vector Quantization Adaptive Resonance Theory.Applications of neural networks in image processing, signal Processing, modeling and control.

**UNIT – 4**

**Fuzzy Sets and Fuzzy Relations:** Introduction –classical sets and fuzzy sets – classical relations and fuzzy relations –membership functions –fuzzy to crisp conversion,fuzzy arithmetic, numbers, vectors, and extension principle

**UNIT – 5**

Fuzzy Decision Making: Classical logic and fuzzy logic –fuzzy rule based systems –fuzzy nonlinear simulation –fuzzy decision making –fuzzy control systems –fuzzy optimization –one-dimensional optimization. Neuro Fuzzy: Mathematical formulation of adaptive neuro-fuzzy inference systems.

**Text Books:**

1. Laurence Fausett, Fundamentals of Neural Networks-Architectures, algorithms and applications, Pearson Education Inc., 2004.
2. Timothy J. Ross, Fuzzy Logic with Engg. Applications, John Wiley and sons, 2004

**References**:

1. S.Haykin,“Neural Networks, A Comprehensive Foundation”, Pearson Edu. 2004.
2. Jacek.M.Zurada,“Introduction to Artificial Neural Systems”,Jaico Publishing House, 2001.
3. J.S.R. Jang, C.T. Sun, E. Mizutani,, “Neuro Fuzzy and Soft Computing - A computational
4. Approach to Learning and Machine Intelligence”, Pearson Education Inc., 2002.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

At the end of the course the student should be able to

1. Write the differences in artificial neuron and human brain
2. Solve the logical problems using artificial neural network
3. Apply the back propagation algorithm in real time problems
4. Write the differences of classical, fuzzy sets and relations
5. Application of fuzzy logic optimization in the real time applications

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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## DSP PROCESSORS AND ARCHITECTURES (PE-5)

**Course Objectives:**

1. To recall the various techniques of digital signal processing.
2. To introduce the architectural features of programmable DSP Processors of Texas Instruments and Analog devices.
3. To understanding the practical examples of DSP Processor architectures.
4. To develop programming knowledge by using Instruction set of DSP Processors.
5. To know the interfacing techniques to I/O devices and memory.

**UNIT – 1**

**Introduction to Digital Signal Processing:** Introduction, a Digital signal-processing system, the sampling process, discrete time sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation. **Computational Accuracy in DSP Implementations:** Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter

**UNIT – 2**

**Architectures for Programmable DSP Devices** Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing

**UNIT – 3**

**Programmable Digital Signal Processors:** Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX Instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54XX Processors.

**UNIT – 4**

**Analog Devices Family of DSP Devices:** Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor. Introduction to Black fin Processor – The Black fin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory.

**UNIT – 5**

**Interfacing Memory and I/O Peripherals to Programmable DSP Devices:**Memory -space organization, interface External bus interfacing signals, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access

**TEXT BOOKS:**

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. A Practical Approach To Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009
3. Embedded Signal Processing with the Micro Signal Architecture: Woon-SengGan, SenM.Kuo, Wiley-IEEE Press, 2007

## REFERENCE BOOKS:

1. Digital Signal Processors, Architecture, Prog and Applications-B. Venkataramani and M. Bhaskar, 2002, TMH.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
3. Digital Signal Processing App Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI

**Course Outcomes:**

1. Upon the completion of course, studen t able to
2. Understand the basic concepts of Digital Signal Processing.
3. To differentiate the architectural features of General purpose processors and DSP processors.
4. Understand the architectures of TMS320C54xx devices and ADSP 2100DSP devices.
5. Write the simple assembly language programs by using instruction set of TMS320C54xx.
6. To interface the various devices to DSP Processors.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **INSTRUMENTATION IN PETRO CHEMICAL INDUSTRIES (PE-5)** | | | | | |

**Course Objectives:**

1. To understand the fundamentals and principles of Process Control and field instrumentation.
2. To understand the construction, working, performance characteristics and applications of various instruments.
3. To understand the recent trends in Petroleum Field Instrumentation & Control.
4. To understand various quality control norms and specifications related to refining and petrochemical industry

**UNIT – 1**

**PETROLEUM EXPLORATION:** Introduction: Petroleum Exploration, production and Refining, Refining Capacity in India, Consumption of Petroleum products in India, Constituents of Crude Oil, P & I diagram of petroleum refinery.

**UNIT – 2**

**CRUDE OIL DISTILLATION:** Atmospheric Distillation of Crude oil - Vacuum Distillation process - Thermal Conversion process - Control of Distillation Column - Temperature Control - Pressure control - Feed control - Reflux Control - Reboiler Control.

**UNIT – 3**

**CHEMICAL REACTORS AND DRYERS:** Introduction of Chemical reactors, Temperature and Pressure Control of Chemical reactors, Control of Dryers, Batch Dryers, Continuous Dryers, control of Dryers-Cascade Control, Feed forward Control.

**UNIT – 4**

**HEAT EXCHANGERS:** Variables and Degrees of freedom, Liquid to Liquid Heat Exchangers, Steam Heaters,Condensers, Reboiler and Vaporizers.

**UNIT – 5**

**CONTROLS FOR EVAPORATORS AND PUMPS:** Types of Evaporators. - Evaporators in Petroleum refinery- Cascade Control - Feed forward Control. Centrifugal pump: On-Off level control - Pressure control - Flow control – Throttling control. Rotary pumps: On-Off pressure control.-Reciprocating Pumps: On-Off control and Throttling control.

**TEXT BOOK**

1. Dr. Ram Prasad, ―Petroleum Refining Technology‖, Khanna Publisher, 1st Edition, 2000
2. B.G. Liptak, ―Instrumentation in Process Industries‖, Chilton Book Company, 1973

**REFERENCES**

1. M. Considine and S.D. Ross, ―Handbook of Applied Instrumentation‖, McGraw Hill, 1962.
2. B.G. Liptak, ―Instrument Engineers Handbook‖, Chilton Book Company, Volume II, 1989

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**KAKINADA – 533 003, Andhra Pradesh, India**
**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

At the end of this course, students will be able to

1. Gain knowledge on principals of process control and field instrumentation.
2. Understanding Clearly of construction, working, performance characteristics and application of various instruments
3. Gets the Sound knowledge on recent trends in petroleum field instrumentation and control
4. Get Knowledge on quality control norms and specifications related to refining and petrochemical industries

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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| **DIGITAL CONTROL SYSTEMS (PE-3)** | | | | | |

**Course Objectives:**

1. To study the Z-Transform, Properties& Inverse Z-transform.
2. To understand the difference between continuous and discrete time control systems.
3. To Find out the Pulse transfer function of Discrete time Closed loop control systems.
4. To design the digital control system using different techniques.
5. To find the stability of the control systems using different techniques.
6. To analyse the digital control systems in the state variable model.
7. To design the state feedback controller through the pole placement.

**UNIT – 1**

**Introduction to Digital Control:** The structure of a digital control system, examples of digital control systems.

**Discrete time systems** : Analog systems with piecewise constant inputs, difference equations, the Z-transform, computer aided design, Z-transform solution of difference equations, the time response of a discrete time system, the modified Ztransform, frequency response of discrete time systems, the sampling theorem

**UNIT – 2**

**Modeling of Digital control systems**: ADC model, DAC model, the transfer function of the ZOH, effect of the sampler on the transfer function of a cascade, DAC, analog subsystem, and ADC combination transfer function, systems with transport lag, the closed loop transfer function, analog disturbances in a digital system, steady-state error and error constants, MATLAB commands.

**UNIT – 3**

**Stability of Digital Control systems:** Definitions of stability, stable Z-domain pole locations, stability conditions, stability determination, Jury test, Nyquist criterion

**Digital control system Design**: z-domain root locus, z-domain digital control system design, digital implementation of analog controller design, direct z-domain digital controller design, frequency response design, direct control design, finite settling time design..

**UNIT – 4**

**State space representation of Digital control system**: State variables, state-space representation, linearization of nonlinear state equations, the solution of linear state space equations, the transfer function matrix, discrete time state-space equations, solution of discrete time state-space equations, z-transfer function from state space equations, similarity transformation.

**Properties of discrete state-space models**: Stability of state space realizations, controllability and stabilizability, observability and detectability, poles and zeros of multivariable systems, state space realizations, duality, Hankel realization

**UNIT – 5**

**State feedback control**: State and output feedback, pole placement, servo problem, invariance of system zeros, state estimation, observer state feedback, pole assignment using transfer functions.

**Optimal control:** Optimization, optimal control, the linear quadratic regulator, steady state quadratic regulator, Hamiltonian system

**Text Books:**

1. M Sami Fadali, Antonio Visioli: Digital Control Engineering: Analysis and design, third edition, Elsevier, Academic press, 2020
2. Hemachandra Madhusudhan Shertukde: Digital control applications illustrated with MATLAB, CRC press

**Reference Books:**

1. Benjamin C Kuo: Digital control systems, second edition, Oxford University press Katsuhiko Ogata: Discrete time control systems , Prentice Hall

**Course Outcomes:**

At the end of the course the student should be able to

1. Write difference between continuous and digital control systems
2. Find out the pulse transfer function of different configurations of digital control systems
3. Find out the stability of control system using different techniques
4. Design the control systems using deadbeat response.
5. Write the Digital control system in the state space model
6. Design the state feedback observer using different techniques.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |
| **ADAPTIVE CONTROL SYSTEMS (PE-5)** | | | | | |

**Course Objectives:**

1. To study the definition of adaptive control.
2. To understand the MRAS.
3. To Find out the MRAS for first order system.
4. To design the self-tuning regulators.
5. To study about gain scheduling

**UNIT – 1**

Introduction: Definitions, History of adaptive Control, Essential aspects of adaptive control, Classification of adaptive control system: Feedback adaptive controllers, Feed forward adaptive controllers, Why adaptive control?

**UNIT – 2**

Model Reference Adaptive System: Different configuration of model reference adaptive systems; classification of MRAS, Mathematical description, and Equivalent representation as a nonlinear time-varying system, direct and indirect MRAS.

**UNIT – 3**

Analysis and Design of Model Reference Adaptive Systems: Model reference control with local parametric optimization (Gradient method), MIT rule, MRAS for a first order system, MRAS based on Lyapunov stability theory, Design of a first order MRAS based on stability theory, Hyperstability approach, Monopoli's augmented error approach.

**UNIT – 4**

Self Tuning Regulators: Introduction: The basic idea; process models, disturbance models, General linear difference equation models, model simplification, Different approaches to self-tuning, Recursive Parameter Estimation Methods: The RLS method, extended Least squares, Recursive instrumental variable method; U-D factorization, Covariance resulting, variable data forgetting. Estimation accuracy, Direct and Indirect Self-tuning regulators, Clarke and Gawthrop's Self tuning Controller, Pole Placement approach to self tuning control; Connection between MRAS and STR.

**UNIT – 5**

Gain Scheduling: Introduction, The Principal, Design of Gain Scheduling Regulators, Nonlinear transformations, Applications of gain scheduling. Alternatives to Adaptive Control: Why not Adaptive Control? Robust High gain feedback control, Variable Structure schemes, Practical aspects, application and Perspectives on adaptive control.

**TEXT BOOKS**

1. B Landau, Adaptive Control - The Model Reference Approach, New York; Marcel Dekker, 1979.
2. K. J. Astrom and B. Wittenmark, Adaptive Control, Addison Wesley Publication Company, 1989.

**REFERENCE BOOKS**

1. B. Roffel, P. J. Vermeer, P. A. Chin, Simulation and Implementation of self Tuning Controllers, Prentice-Hall, Englewood cliffs, NJ, 1989.
2. R. Isermann, K. Lashmann and D. Marko, Adaptive Control Systems, Printice-Hall International (UK) Ltd. 1992.
3. K. S. Narendra and A. M. Annaswamy, Stable Adaptive Systems

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

At the end of the course the student should be able to

1. Write difference between ordinary and adaptive control systems
2. Find out the transfer function of MRAS
3. Find out the stability of control system using different techniques
4. Design the control systems using adaptive techniques.
5. Write the regulatory system in the state space model

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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**INTRODUCTION TO DATA ANALYTICS**
**(SKILL ADVANCED COURSES)**

**Course Objectives:**
1. To study the definition of data analytics.
2. To understand the concept of big data.
3. To Find out the various data visualization techniques.
4. To study about machine learning.
5. To study about various ethics

**UNIT – 1**
**INTRODUCTION:** Data Analytics - Types – Phases - Quality and Quantity of data – Measurement - Exploratory data analysis - Business Intelligence

**UNIT – 2**
**BIG DATA:** Big Data and Cloud technologies - Introduction to HADOOP: Big Data, Apache Hadoop, Map Reduce - Data Serialization - Data Extraction - Stacking Data - Dealing with data.

**UNIT – 3**
**DATA VISUALIZATION:** Introduction to data visualization – Data visualization options – Filters – Dashboard development tools – Creating an interactive dashboard with dc.js - summary.

**UNIT – 4**
**ANALYTICS AND MACHINE LEARNING** Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms.

**UNIT – 5**
**ETHICS AND RECENT TRENDS :** Data Science Ethics – Doing good data science – Owners of the data - Valuing different aspects of privacy - Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.

**TEXT BOOKS**

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Introducing Data Science, Manning Publications Co., 1st edition, 2016.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 1st edition, 2013.
3. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley.
4. D J Patil, Hilary Mason, Mike Loukides, Ethics and Data Science, O' Reilly, 1st edition, 2018


**REFERENCE BOOKS**

1. Dr Anil Maheshwari, Data Analytics Made Accessible, Publisher: Amazon.com Services LLC.
2. Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly, 1st edition, 2015.
3. Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from the Frontline, O' Reilly, 1st edition, 2013.
4. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2nd edition, 2014.
5. Eric Siegel, Predictive Analytics The Power to Predict Who Will Click, Buy, Lie, or Die, 2 nd Ed., Wiley

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

At the end of the course the student should be able to

1. Know about HADOOP
2. Find out the definition of big data
3. Find out various data visualization techniques
4. Learn about machine learning techniques.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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| | | 1 | 0 | 2 | 2 |
| **INTERFACING WITH ARDUINO (SKILL ADVANCED COURSES)** | | | | | |

**Course Objectives:**

1. To learn and understand elements of IoT system.
2. Acquire knowledge about various protocols of IoT.
3. To learn and understand design principles and capabilities of IoT.

**UNIT – 1**

Introduction to IoT: The impact of IoT in industry and daily life, Understanding the IoT ecosystem: devices, platforms, and applications. Overview of IoT Components -Analog sensors, Digital sensors

**UNIT – 2**

Programming an ArduinoIoT Device, Preparing the development environment (Arduino IDE), Exploring the Arduino language (C/C++) syntax, Coding, compiling, and uploading to the microcontroller

**UNIT – 3**

Working with Arduino Communication Modules, Bluetooth Modules, WiFi Modules, RFID Modules, I2C and SPI

**UNIT – 4**

Interfacing Arduino and Blynk via USB, LED Blinking, Controlling a Servomotor. ESP8266 WiFi Serial Module - Overview, Setting up the Hardware, Interfacing with Arduino

**UNIT – 5**

Creating an IoT Temperature and Humidity Sensor System - Overview of DHT-22 Sensor, Interfacing the Hardware: Arduino, ESP8266 WiFi Module, and DHT-22 Sensor, Checking Your Data via ThingSpeak, Connecting Your Arduino Set-up to Blynk via WiFi, Running your ArduinoIoT Sensor System, Troubleshooting

**TEXT BOOKS**

1. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-onApproach)”, 1st Edition, VPT, 2014

**REFERENCE BOOKS**

1. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
2. CunoPfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1-4493-9357-1

**Course Outcomes:**

The student will be able to:

1. Understand internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication modules.
3. Remotely monitor data and control devices.
4. Design real time IoT based applications

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

# MINOR COURSES

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
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| | | 4 | 0 | 0 | 4 |
| **SIGNALS AND SYSTEMS** | | | | | |

**Course Objectives:**

The main objectives of this course are given below:

1. To study about signals andsystems.
2. To analyze the spectral characteristics of signal using Fourier series and Fourier Transforms.
3. To understand the characteristics of systems.
4. To introduce the concept of sampling process
5. To know various transform techniques to analyze the signals andsystems.

**UNIT – 1**

**INTRODUCTION:** Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions. Related Problems.

**UNIT – 2**

**FOURIER SERIES AND FOURIERTRANSFORM:** Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform.Related Problems.

**UNIT – 3**

**ANALYSIS OF LINEAR SYSTEMS:** Introduction**,** Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and risetime

**UNIT – 4**

**CORRELATION:** Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

**SAMPLING THEOREM :** Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Passsampling, Related problems.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**UNIT – 5**

**LAPLACE TRANSFORMS:** Introduction**,** Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveformsynthesis.**Z–TRANSFORMS:** Concept of Z- Transform of a discrete sequence. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms. Distinction between Laplace, Fourier and Z transforms.

**TEXT BOOKS:**

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2ndEdn,1997
3. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2ndEdition,2007

**REFERENCE BOOKS:**

1. Principles of Linear Systems and Signals – BP Lathi, Oxford University Press,2015
2. Signals and Systems – T K Rawat , Oxford University press,2011

**Course Outcomes:** At the end of this course the student will able to:

1. Differentiate the various classifications of signals and systems
2. Analyze the frequency domain representation of signals using Fourier concepts
3. Classify the systems based on their properties and determine the response of LTI Systems.
4. Know the sampling process and various types of sampling techniques.
5. Apply Laplace and z-transforms to analyze signals andSystems (continuous & discrete).

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| **III Year-I Semester** | | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **4** | **0** | **0** | **4** |
| **ANALOG AND DIGITAL COMMUNICATIONS** | | | | | |

**Course Objectives:**

Students undergoing this course are expected to

1. Familiarize with the fundamentals of analog communicationsystems.
2. Familiarize with various techniques for analog modulation and demodulation ofsignals.
3. Distinguish the figure of merits of various analog modulationmethods.
4. Develop the ability to classify and understand various functional blocks of radio transmitters andreceivers.
5. Familiarize with basic techniques for generating and demodulating various pulse modulatedsignals.

**UNIT – 1**

Introduction to communications systems: communications, Communications SYSTEMS,Infonnation,Transmitter,ChannelNoise,Receiver,modulation,Description,Need formodulation, bandwidth requirements, Sine wave and Fourier series review, Frequency spectra of non sinusoidal waves

**UNIT – 2**

Amplitude modulation ,amplitude modulation theory, generation of am (chapter 3, georgekennedy) Single-sideband techniques , suppression of unwanted sideband, extensions of ssb

**UNIT – 3**

Frequency modulation , theory of frequency and phase modulation,noise and frequency modulation, generation of frequency modulation

**UNIT – 4**

**PULSE DIGITAL MODULATION:** Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Differential PCM systems(DPCM). Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, Time division multiplexing, Frequency division multiplexing

**UNIT – 5**

**DIGITAL MODULATION TECHNIQUES:** Introduction, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-ary PSK, ASK, FSK, similarity of BFSK and BPSK.

**TEXT BOOKS:**

1. Principles of Communication Systems – H Taub& D. Schilling, GautamSahe, TMH, 3rdEdition, 2007.
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004
3. Digital communications - Simon Haykin, John Wiley, 2005

**REFERENCES:**

1. Principles of Communication Systems - Simon Haykin, John Wiley, 2nd Edition, 2007
2. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH, 2007.
3. Electronic Communication systems – Tomasi, Pearson, fourth Edition, 2007.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

After undergoing the course, students will be able to

1. Differentiate various Analog modulation and demodulation schemes and their spectral characteristics
2. Analyze noise characteristics of various analog modulation methods
3. Analyze various functional blocks of radio transmitters and receivers
4. Design simple analog systems for various modulation techniques

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **PRINCIPLES OF ELECTRONICS** | | | | | |

**Course Objectives:**

The main objectives of this course are

1. To learn and understand the basic concepts of semiconductor physics.
2. Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes.
3. To learn and understand the application of diodes as rectifiers with their operation and characteristics with and without filters are discussed.
4. Acquire knowledge about the principle of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics.
5. To learn and understand the purpose of transistor biasing and its significance.
6. Small signal equivalent circuit analysis of BJT and FET transistor amplifiers and compare different configurations.

**UNIT – 1**

Junction Diode Characteristics : Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.

**UNIT – 2**

**Special Semiconductor Devices**: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR. Construction, operation and V-I characteristics

**UNIT – 3**

**Rectifiers and Filters:** Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter(Series inductor), Capacitor filter(Stunt inductor), π-Filter, comparison of various filter circuits in terms of ripple factors.

**UNIT – 4**

**Transistor Characteristics: BJT:** Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values

**UNIT – 5**

**FET:** FET types, construction, operation, characteristicsμ, $g_m$, $r_d$parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET, CMOS.

**Text Books:**

1. Integrated Electronics-J. Millman, C. Halkias,TataMc-Graw Hill, Second Edition,2009
2. Electronic Devices and Circuits by David A. Bell, Oxford University Press
3. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, tenth edition, 2009

**References:**

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, SecondEdition,2007
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016.
3. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, 4th Edition,2008.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

At the end of this course the student will be able to

1. Apply the basic concepts of semiconductor physics.
2. Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.
3. Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.
4. Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.
5. Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.
6. Perform the analysis of small signal low frequency transistor amplifier circuits using BJT and FET in different configurations.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **PRINCIPLES OF INSTRUMENTATION** | | | | | |

**Course Objectives:**

1. To get the basic idea on instruments and the errors associated with measuring instruments
2. Understand principle, working and operation of various Electrical and electronic instruments.
3. Learn techniques for measuring electrical parameters .
4. Applications of electrical and electronic instruments.
5. To learn different types CROs and various parameters measurement by CRO.

**UNIT – 1**

Generalised Instrumentation system – Units and standards- Calibration methods- Standards of measurement- Classification, Introduction to mechanical, electrical and electronic instruments

**UNIT – 2**

Cathode ray oscilloscope: Block diagram vertical and horizontal amplifiers, sweep circuits, delay line, electrostatic focusing and electrostatic deflection. Special purpose oscilloscopes- sampling oscilloscopes, analog storage and digital storage oscilloscopes, dual beam and dual trace oscilloscopes.

**UNIT – 3**

Instruments for generating and analyzing wave forms, square wave, pulse, standard-signal, random noise and function generators, wave analysers, spectrum analysers, Q-meters, vector – voltmeters, vector impedance meters.

**UNIT – 4**

Electronic analog meters: Electronic voltmeters VTVM, TVM, FETVM Voltmeters, electronic – multimeters differential voltmeters. DC voltmeters- Loading- Transfer volt meter- Chopper type– Differential voltmeter – Peak responding voltmeter – True RMS voltmeter – Calibration of DC instruments

**UNIT – 5**

Digital Instruments: – Digital multimeters – Digital frequency meter – Digital Measurement of time – Universal counter – Electronic counter – Digital Tachometer- Digital voltmeter– Ramp Type DVM – Dual slope Ramp DVM- Integrating type DVM – Successive approximations type DVM – Resolution and sensitivity of digital meters – General specifications of a DVM, Data acquisition system.

**TEXT BOOKS:**

1. Modern electronic instrumentation measurements techniques by Helfrick and cooper.
2. A course in electrical and electronic measurement and instrumentation by A.K.Shawney.

**REFERENCES:**

1. Electronic Instrumentation by H.S.Kalsi

**Course Outcomes:**

1. Students can understood about different instruments that are used for measurement purpose.
2. Students can calculate various errors related to measurements.
3. Students can find the unknown values of resistance, capacitance and inductance using different bridge techniques.
4. Able to perform accurate measurements.
5. Students can able measure/find phase and frequency using Lissajous Pattern.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **PRINCIPLES OF NANOSENSORS** | | | | | |

**Course objectives:**

1. Make them to understand the technology of MEMS and NEMS.
2. Expose them about fabrication processes for development of MEMS/NEMS devices and systems.
3. Educate about the potential applications of NEMS.

**UNIT – 1**

NANOSENSORS I Micro and nano-sensors, Fundamentals of sensors, biosensor, micro fluids, Packaging and characterization of sensors, Method of packaging at zero level, dye level and first level. Sensors for aerospace and defense: Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, nano-cutting tools, Integration of sensor with actuators and electronic circuitry,

**UNIT – 2**

NANOSENSORS II Sensor for bio-medical applications: Cardiology, Neurology and as diagnostic tool, For other civil applications: metrology, bridges etc. Biosensors. Clinical Diagnostics, generation of biosensors, immobilization, characteristics, applications, conducting Polymer based sensor, DNA Biosensors, optical sensors.

**UNIT – 3**

Biochips. Metal Insulator Semiconductor devices, molecular electronics, information storage, molecular switching, Schottky devices,

**UNIT – 4**

NEMS Inertial sensors – accelerometer – gyroscope - micromechanical pressure sensors – pizoresistive – capacitive - microrobotics – micro channel heat sinks – optical MEMS – visual display – precision optical platform – optical data switching – RF MEMS – MEMS variable capacitors – MEMS switches – Resonators.

**UNIT – 5**

NANOLITHOGRAPHY Basics of lithography, optical, micro, ion beam lithography, lithographic tools, nanoimprint lithography – polymeric nanofiber templates – focused ion beam doping wet chemical etching – stencil lithography and sacrificial etching – large scale integration – future challenges - applications

**Text Books:**

1. K. Goser, P. Glosekotter and J. Dienstuhl, “Nanoelectronics and Nanosystems-From Transistors to Molecular Quantum Devices” , Springer, 2004.
2. W.R.Fahrner, “Nanotechnology and Nanoelectronics – Materials, Devices and Measurement Techniques” Springer, 2006.
3. Sensors: Micro &Nanosensors, Sensor Market trends (Part 1&2) by H. Meixner.
4. Nanoscience& Technology: Novel structure and phenomea by Ping Sheng (Editor).

**References:**

1. Nano Engineering in Science &Technology : An introduction to the world of nano design by Michael Rieth.
2. Tai –Ran Hsu, “MEMS & Microsystems Design and Manufacture”, Tata McGraw-Hill publication, 2001.
3. P. Rai-Choudhury, “MEMS and MOEMS technology and applications”, PHI learning private Ltd, 2009.
4. Mohamed Gad-el-Hak, “The MEMS Handbook”, CRC Press, 2002

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**
**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes**

At the end of course students will be able to

1. Acquire the knowledge of mechanisms in NEMS
2. Understand various engineering mechanics of microsystems
4. Gain the concept in finite element analysis of microsystems
5. Obtain the knowledge of NEMS fabrication
5. Acquire knowledge of quantum effects in NEMS
6. Apply the knowledge of system integration in NEMS
7. Design and simulate micro/nano sensors and actuators.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year-II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **BIOMEDICAL ENGINEERING** | | | | | |

**Course Objectives:**

1. To study about the major systems of the body and different potentials associated with each system
2. To study about various Electrodes and Transducers used for acquisition of biopotential
3. To know the physiological effects of electricity on humans and preventive methods
4. To study about various patient monitoring systems and need of pacemaker and defibrillator.
5. To get acquainted with medical imaging systems used in biomedical field

**UNIT – 1**

Sources of Bioelectric potentials and Electrodes: Resisting and Action Potentials, Propagation of Action Potentials, The Bioelectric Potentials. Electrodes: Electrode theory, Bio Potential Electrodes, Biochemical Transducers, introduction to bio-medical signals

**UNIT – 2**

The Cardiovascular System: The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristics of Blood Flow, Heart Sounds, Cardio Vascular Measurements, Electrocardiography, Measurement of Blood Pressure, Measurement of Blood Flow and Cardiac output, Plethysmography, Measurement of Heart Sounds, Event detection, PQRS & T-Waves in ECG, the first & second Heart beats, ECG rhythm analysis, the di-crotic notch in the carotid pulse detection of events and waves, analysis of exercise ECG, analysis of event related potentials, correlation analysis of EEG channels, correlation of muscular contraction

**UNIT – 3**

Patient Care & Monitory and Measurements in Respiratory System: The elements of Intensive Care Monitory, Diagnosis, Calibration and reparability of Patient Monitoring equipment, other instrumentation for monitoring patients, pace makers, defibrillators, the physiology of respiratory system, tests and instrumentation for mechanics of breathing ,respiratory theory equipment, analysis of respiration

**UNIT – 4**

Bio telemetry and Instrumentation for the clinical laboratory Introduction to bio telemetry, Physiological parameters adaptable to bio telemetry, the components of bio telemetry system, implantable units, applications of telemetry in patient care – The blood, tests on blood cells, chemical test, automation of chemical tests.

**UNIT 5:**

X-ray and radioisotope instrumentation and electrical safety of medical equipment: Generation of Ionizing radiation, instrumentation for diagnostic X-rays, special techniques, instrumentation for the medical use of radioisotopes, radiation therapy - Physiological effects of electrical current, shock Hazards from electrical Equipment, Methods of accident prevention, Modern Imaging Systems: Tomography, Magnetic resonance, Imaging System, Ultrasonic Imaging System, Medical Thermograph

**TEXT BOOK:**

1. Biomedical Instrumentation and Measurements – C. Cromwell, F.J. Weibell, E.A.Pfeiffer – PHI.
2. Biomedical Instruments Theory and Design-Welkowitz, Elseiver

**Reference:**

1. Biomedical instrumentation systems- ShakthiChattarjee, Aubert Miller Cenage Learning
2. Hand Book of Bio-Medical Instrumentation – R.S. Khandpur, (TMH)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**KAKINADA – 533 003, Andhra Pradesh, India**
**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

At the end of this course, students will be able to

1. Understand about various systems in the body and origin of biopotential.
2. Learn about Electrodes and Transducers used for acquisition of biopotential
3. Analyse various physiological signals and their waveforms
4. Gain knowledge on Patient monitoring systems and working, operation of pacemakers.
5. Study the Principles of different Medical Imaging Systems

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **DIGITAL LOGIC AND MICROCONTROLLERS** | | | | | |

**Course Objectives:**

1. To solve a typical number base conversion and analyze new error coding techniques.
2. Theorems and functions of Boolean algebra and behavior of logic gates.
3. To optimize logic gates for digital circuits using various techniques.
4. Boolean function simplification using Karnaugh maps and Quine-McCluskey methods.
5. To understand concepts of combinational circuits.
6. To develop advanced sequential circuits.

**UNIT – 1**

**REVIEW OF NUMBER SYSTEMS &CODES:** Representation of numbers of different radix, conversation from one radix to another radix, r-1's compliments and r's compliments of signed members. Gray code ,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc.

**BOOLEAN THEOREMS AND LOGIC OPERATIONS:** Boolean theorems, principle of complementation & duality, De-morgan theorems. Logic operations ; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX-NOR operations.

**UNIT – 2**

**MINIMIZATION TECHNIQUES:** Minimization and realization of switching functions using Boolean theorems, K-Map method.

**COMBINATIONAL LOGIC CIRCUITS DESIGN:** Design of Half adder, full adder, half subtractor, full subtractor,

**UNIT – 3**

**SEQUENTIAL CIRCUITS** Classification of sequential circuits (synchronous and asynchronous), operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip-flop.

**UNIT – 4**

Ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift, register. Study the following relevant ICs and their relevant functions 7474,7475,7476,7490,7493,74121.

**UNIT – 5**

**8051 MICROCONTROLLER:** Introduction to microcontrollers, 8051Microcontrollers, 8051pin description, connections, I/O ports and memory organization, MCS51addressing modes and instructions, assembly language programming tools.Introduction to RISC, processor design tradeoffs, Introduction to 16/32 bit processors, ARM architecture and organization, ARM family, Thumb instructions, programming models of ARM 7, Register set, CPSR, SPSR

**TEXT BOOKS:**

1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K.Jha 3rd Edition, Cambridge University Press, 2009
2. Digital Design by M.MorrisMano,Michael D Ciletti,4th edition PHI publication, 2008
3. Switching theory and logic design by Hill and Peterson**,**Mc-Graw Hill TMH edition, 2012.

4. Douglas V Hall, "Microprocessors and Interfacing Programming and Hardware" , New Delhi Tata McGrawHill Publishing Company Limited

**REFERENCES:**

1. Ajay V Deshmukh, "Microcontrollers", TATA McGraw Hill publications,2012.
2. Krishna Kant, "Microprocessors and Microcontrollers", PHI Publications, 2010.
3. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010.
4. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers,2006
5. Digital electronics by R S Sedha.S.Chand& company limited,2010
6. Switching Theory and Logic Design by A. AnandKumar,PHI Learning pvt ltd,2016

**Course Outcomes:**

1. Classify different number systems and apply to generate various codes.
2. Use the concept of Boolean algebra in minimization of switching functions
3. Design different types of combinational logic circuits.
4. Apply knowledge of flip-flops in designing of Registers and counters
5. The operation and design methodology for synchronous sequential circuits and algorithmic state machines.
6. Produce innovative designs by modifying the traditional design techniques.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **TELEMETRY AND TELEMEDICINE** | | | | | |

**Course Objectives:**

1. To study about the basics of telemetry and various methods of Telemetry.
2. To gain knowledge about the various systems used in telemetry with an example.
3. To study about the different transmitting and Receiving techniques employed in telemetry.
4. To get acquainted with optical fibre transmission techniques employed in data transmission.
5. To study about the various filters used in transmission, Satellite telemetry and DAQ system.

**UNIT – 1**

Classification of Telemetry Systems: voltage, current position, frequency, pulse, land-line and radio telemetry. Land-Line Telemetry:voltage telemetering system, current telemetering system, motion balance current telemetering system, position telemetering system using bridge configuration, position telemetering system using synchro's.

**UNIT – 2**

Amplitude Modulation and Demodulation of a Carrier Wave: Expression for an AM- wave, frequency spectrum of an AM-wave, bandwidth, AM-detector, illustration of AM for measuring system, full-wave phase sensitive demodulator, block diagram of carrier amplifier system.

**UNIT – 3**

Frequency Modulation and Demodulation of A Carrier Wave:Expression for an FM-wave, frequency spectrum of an FM-wave, bandwidth, diode FM modulator, phase shift discriminator, ratio detector.

**UNIT – 4**

Introduction to Telemedicine: Historical perspective and evolution of telemedicine, tele health, tele care, components of telemedicine system, global and indian scenario, ethical and legal aspects of telemedicine, safety and regulatory issues, laws governing telemedicine.

**UNIT – 5**

Telemedicine Technology: Principles of multimedia – text, audio, video, data, data communications and networks, PSTN, POTS, ANT, ISDN, internet, air/wireless communications: GSM satellite, and micro wave, modulation techniques, integration and operational issues, communication infrastructure for telemedicine, LAN and WAN technology, satellite communications, mobile hand held devices and mobile communication, internet technology, video and audio conferencing, clinical data - local and centralized

**TEXT BOOKS:**


1. Electrical and electronics measurements and instrumentation, by A.K.Sawhney, DhanpatRai&Sons.
2. Introduction to Telemetry by Alan Andrews, Foulsham-Sams technical books, published by W-Foulsham&Co Ltd., England.
3. Understanding telemetry circuits, by John D.Lenk, Foulsham – Sams technical books, Published by W.Foulsham& Co., England
4. Norris, A.C. "Essentials of Telemedicine and Telecare", Wiley (ISBN 0-471-53151-0), First edition, 2002.
5. O'Carroll, P.W, Yasnoff W.A., Ward E.Ripp, L.H., Martin, E.L., "Public Health Informatics and Information Systems", Springer (ISBN 0-387-95474-0), 1st Edition, 2003.
6. Ferrer-Roca, O., Sosa-Iudicissa, M, "Handbook of Telemedicine", IOS Press (Studies in Health Technology and Informatics, Volume 54). (ISBN 90-5199-413-3), 3rd Edition, 2002.

**Reference Books:**

1. Simpson, W. "Video over IP- A practical guide to technology and applications", Focal Press (Elsevier). ISBN-10: 0-240-80557-7, 2006.
2. Wootton R. Craig, J., Patterson V. "Introduction to Telemedicine", Royal Society of Medicine Press Ltd (ISBN 1853156779), 2nd Edition, 2006.

**Course Outcomes:**

At the end of this course, students will be able to

1. Learn the knowledge on telemetry systems and their design.
2. Gains the Knowledge on systems used in telemetry with real time examples.
3. Learn about Different data transmitting systems employed in bio telemetry.
4. Have the Knowledge on transmission system, receiving system and Advanced data transmission methodologies.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **DIGITAL SIGNAL PROCESSING** | | | | | |

**Course Objectives:**

1. Analyzethe Discrete Time Signals and Systems
2. Know the importance of FFT algorithm for computation of Discrete Fourier Transform
3. Understand the various implementations of digital filter structures
4. Learn the FIR and IIR Filter design procedures
5. Know the need of Multirate Processing
6. Learn the concepts of DSP Processors

**UNIT – 1**

**INTRODUCTION:** Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems , stability of LTI systems,Frequency domain representation of discrete time signals and systems. Review of Z-transforms, solution of difference equations using Z-transforms, System function.

**UNIT – 2**

**DISCRETE FOURIER SERIES &FOURIER TRANSFORMS:** Properties of discrete Fourier series, DFS representation of periodic sequences,

**UNIT – 3**

**Discrete Fourier transforms**: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

**UNIT – 4**

Realization of filters, Definitions of FIR and IIR systems. Delay element, adder, IIR and FIR structures (TYPE-I, TYPE-II, forms only)

**UNIT – 5**

**INTRODUCTION TO DSP PROCESSORS:** Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs ,Multiple Access Memory, Multiported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals.

**TEXT BOOKS:**

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI.
3. Digital Signal Processors – Architecture, Programming and Applications,,B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002.
4. Digital Signal Processing – K Raja Rajeswari, I.K. International Publishing House.

**Reference Books:**

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.
3. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris, Thomson, 2007.
5. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006.

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**KAKINADA – 533 003, Andhra Pradesh, India**
**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

After going through this course the student will be able to

1. Apply the difference equations concept in the anayziation of Discrete time systems
2. Use the FFT algorithm for solving the DFT of a given signal
3. Design a Digital filter (FIR&IIR) from the given specifications
4. Realize the FIR and IIR structures from the designed digital filter.
5. Use the Multirate Processing concepts in various applications (eg: Design of phase shifters, Interfacing of digital systems)
6. Apply the signal processing concepts on DSP Processor.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
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| **MACHINE LEARNING** | | | | | |

**COURSE OBJECTIVES:**

1. To understand pattern classification algorithms to classify multivariate data
2. To understand the Implementation of genetic algorithms
3. To gain knowledge about Q-Learning
4. To create new machine learning techniques

**UNIT – 1**

**Introduction**: Well-posed learning problems, designing a learning system Perspectives and issues in machine Learning Concept learning and the general to specific ordering Introduction, A concept learning task, concept learning as search, Find-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination algorithm, Remarks on Version Spaces and Candidate Elimination, Inductive Bias. Decision Tree Learning Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.

**UNIT – 2**

**Artificial Neural Networks:** Introduction, Neural Network Representation, Appropriate Problems for Neural Network Learning, Perceptions, Multilayer Networks and the Back propagation Algorithm, Discussion on the Back Propagation Algorithm, An illustrative Example: Face Recognition Evaluation Hypotheses Motivation, Estimation Hypothesis Accuracy, Basics of Sampling Theory, A General Approach for Deriving Confidence Intervals, Difference in Error of Two Hypotheses, Comparing Learning Algorithms.

**UNIT – 3**

**Bayesian learning:** Introduction, Bayes Theorem, Bayes Theorem and Concept Learning Maximum Likelihood and Least Squared Error Hypotheses, Maximum Likelihood Hypotheses for Predicting Probabilities, Minimum Description Length Principle , Bayes Optimal Classifier, Gibs Algorithm, Naïve Bayes Classifier, An Example: Learning to Classify Text, Bayesian Belief Networks, EM Algorithm.

Computational Learning Theory Introduction, Probably Learning an Approximately Correct Hypothesis, Sample Complexity for Finite Hypothesis Space, Sample Complexity for Infinite Hypothesis Spaces, The Mistake,Bound Model of Learning. Instance-Based Learning Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

**UNIT – 4**

**Pattern Comparison Techniques:** Temporal patterns, Dynamic Time Warping Methods, Clustering, Codebook Generation, Vector Quantization

Pattern Classification

Introduction to HMMS, Training and Testing of Discrete Hidden Markov Models and Continuous Hidden Markov Models, Viterbi Algorithm, Different Case Studies in Speech recognition and Image Processing

**UNIT – 5**

**Analytical Learning :**Introduction, Learning with Perfect Domain Theories : PROLOG-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operations.

Combining Inductive and Analytical Learning Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis.

**Text Books**

1. Machine Learning – Tom M.Mitchell,-MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.

**References**

1. Machine Learning : An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

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**COURSE OUTCOMES**:

Upon completion of the course, the students will be able to:

1. Develop and apply pattern classification algorithms to classify multivariate data.
2. Develop and apply regression algorithms for finding relationships between data variables.
3. Develop and apply reinforcement learning algorithms for learning to control complex systems.
4. Write scientific reports on computational machine learning methods, results and conclusions.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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| **FUNDAMENTALS OF EMBEDDED SYSTEMS** | | | | | |

**Course Objectives:**

After going through this course the student will be able to

1. Understand the building blocks of typical embedded system and different memory technology and memory types.
2. Learn the characteristics of an embedded system, quality attributes of embedded systems, application specific and domain specific embedded system,
3. Learn about communication devices and basics about VLSI and integrated circuit design and learn concept of firmware design approaches, ISR concept. Interrupt sources, interrupt servicing mechanism, multiple interrupts,
4. Understand the concepts of c versus embedded and compiler versus cross-compiler.
5. Learn about the integrated development environment, software utility tool. Also learn about quality assurance and testing of the design, testing on host machine, simulators.

**UNIT – 1**

**Introduction:** Embedded System-Definition, History, Classification, application areas and purpose of embedded systems, The typical embedded system-Core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, PCB and passive components. Characteristics, Quality attributes of an Embedded systems, Application-specific and Domain-Specific examples of an embedded system, Main processing elements of embedded system, hardware and software partitions.

**UNIT – 2**

**Embedded Hardware Design:** Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

**UNIT – 3**

**Embedded Firmware Design:** Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

**UNIT – 4**

**Real Time Operating System:** Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Threads, Processes and Scheduling, Task Scheduling, Communication, Synchronization, Device Drivers, How to choose an RTOS. Electronics and Communication Engineering **Hardware Software Co-Design:** Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware, ICE.

**UNIT – 5**

**Embedded System Development:** The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools.

**Embedded System Implementation And Testing:** The main software utility tool, CAD and the hardware, Translation tools-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools. Test and evolution of an embedded systems(Build in self testetc).**Case study-** typical embedded system design flow with an example.

**Text Books:**

1. Embedded Systems Architecture By Tammy Noergaard, Elsevier Publications, 2005
2. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications.

**References:**

1. Embedding system building blocks By Labrosse, CMP publishers.

**Course Outcomes:**

After going through this course the student will be able to

1. Know basics of embedded system, classification, memories, different communication interface and what embedded firmware is and its role in embedded system, different system components.
2. Distinguish all communication devices in embedded system, other peripheral device.
3. DistinguishconceptsofCversusembeddedCandcompilerversuscross-compiler.
4. Choose an operating system, and learn how to choose an RTOS

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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| **FILTER DESIGN** | | | | | |

**Course Objectives:**

1. To study about various filters
2. To understand the approximation procedures
3. To Find out Transfer function of the Biquad filters.
4. To design the filters using Trans conductance amplifier.
5. To study about switched capacitors

**UNIT – 1**

**Review of op-amps circuits, Categorization of filters**-Low-pass filter, High-pass filter, band-pass filter, band-reject filter, Gain equalizers, and Delay equalizers.

**UNIT – 2**

**Approximation Theory:** Butterworth approximation, Chebyshev approximation, Inverse Chebyshev approximation, Basic of sensitivity, Frequency Transformations

**UNIT – 3**

Three amplifier Bi quad: Basic low pass and band pass circuit, realization of the general Biquadratic Functions, summing of four Amplifier bi quad, feed forward three amplifier bi quad, Passive Ladder structures, Inductor Substitution using Gyrator, Transformation of elements using the FDNR. Active ladder filters. Active R filters.

**UNIT – 4**

Elementary trans conductor building blocks, resistors, integrators, amplifiers, summers, gyrator, First and second order filters, higher order filters

**UNIT – 5**

Switched capacitor filters: The MOS switch, The switched capacitor, first order building blocks, second order sections, sampled data operation, Switched capacitor first and second order filters, Bilinear transformation based SC filter design

**Text Books:**

1. 1GobindDaryanani, “Principles of active network synthesis and design”,John Wiley & Sons.

**References:**

2. R. Schaumann, M. E. Van Valkenburg, “Design of analog filters”, Oxford University

**Course Outcomes:**

At the end of the course the student should be able to

1. Design Biquad
2. Analyze switched capacitor filter
3. Learn various approximations
4. Differentiate between various approximation methods.
5. Design a filter

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

# HONOUR COURSES

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
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| **COMPUTER NETWORKS** | | | | | |

**Course Objectives:**

1. To introduce the Fundamentals of data communication networks
2. To demonstrate the Functions of various protocols of Data link layer.
3. To demonstrate Functioning of various Routing protocols.
4. To introduce the Functions of various Transport layer protocols.
5. To understand the significance of application layer protocols

**UNIT – 1**

**OVERVIEW OF THE INTERNET:**Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration; Comparison of the OSI and TCP/IP reference model. Physical Layer: Guided transmission media, wireless transmission media. Data Link Layer – design issues, CRC Codes, Elementary Data link Layer protocols,
sliding window protocol

**UNIT – 2**

**MULTIPLE ACCESS PROTOCOLS:**ALOHA, CSMA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer, data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters , hubs, bridges , switches, routers and gateways.

**UNIT – 3**

**NETWORK LAYER:**Network Layer Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Count to Infinity Problem, Hierarchical Routing, Congestion control algorithms, admission control.

**UNIT – 4**

**INTERNETWORKING:**Tunneling, Internetwork Routing, Packet fragmentation, IPv4, Ipv6 Protocol, IP addresses, CIDR, IMCP, ARP, RARP, DHCP. Transport Layer: Services provided to the upper layers elements of transport protocol-addressing connection establishment, connection release,Connection Release, Crash Recovery

**UNIT – 5**

**THE INTERNET TRANSPORT PROTOCOLS:**UDP-RPC, Real Time Transport Protocols, The Internet Transport ProtocolsIntroduction to TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Connection Management Modeling, The TCPSliding Window, The TCP Congestion Control, The future of TCP. Application Layer-Introduction ,providing services, Applications layer paradigms, Client server model, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS, SSH

**TEXT BOOKS**

1. Data Communications and Networking – Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education.

## REFERENCE BOOKS

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W.A.Shay, Cengage Learning.
3. Introduction to Computer Networks and Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press.
4. Computer Networks, L.L.Peterson and B.S.Davie,4th edition, ELSEVIER.
5. Computer Networking: A Top-Down Approach Featuring the Internet, James F.Kurose,K.W.Ross,3rd Edition, Pearson Education.

**Course Outcomes:**

Upon completing this course, the student will be able to

1. Know the Categories and functions of various Data communication Networks
2. Design and analyze various error detection techniques.
3. Demonstrate the mechanism of routing the data in network layer
4. Know the significance of various Flow control and Congestion control Mechanisms
5. Know the Functioning of various Application layer Protocols.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
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| **ARTIFICIAL INTELLIGENCE** | | | | | |

**Course Objectives:**

1. Gain a historical perspective of AI and its foundations.
2. Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.
5. Experiment with a machine learning model for simulation and analysis.
6. Explore the current scope, potential, limitations, and implications of intelligent systems.

**UNIT – 1**

What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System, Characteristics And Issues In The Design Of Search Programs, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

**UNIT – 2**

**Knowledge Representation Issues**: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

**UNIT – 3**

**Symbolic Reasoning Under Uncertainty**: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory

**UNIT – 4**

**Fuzzy Logic**. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC

**UNIT – 5**

**Game Playing**: Overview, And Example Domain: Overview, Mini Max, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction
Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI

**TEXT BOOKS:**

1. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

**Course Outcomes:**

Upon successful completion of this course, the student shall be able to:

1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
3. Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
5. Demonstrate proficiency in applying scientific method to models of machine learning.
6. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
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## CMOS ANALOG IC DESIGN

**Course Objectives:**

The student will be introduced to

1. The student will be able to understand the behavior of MOS Devices and Small-Signal & Large-Signal Modeling of MOS Transistor and Analog Sub-Circuits.
2. In this course, students can study CMOS Amplifiers like Differential Amplifiers, Cascode Amplifiers, Output Amplifiers, and Operational Amplifiers.
3. Another main object of this course is to motivate the graduate students to design and to develop the Analog CMOS Circuits for different Analog operations.
4. The concepts of Open-Loop Comparators and Different Types of Oscillators like Ring Oscillator, LCO scillatoretc.

**UNIT – 1**

**MOS Devices and Modeling:** The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

**UNIT – 2**

**Analog CMOS Sub-Circuits:** MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

**UNIT – 3**

**CMOS Amplifiers:** Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

**UNIT – 4**

**CMOS Operational Amplifiers:** Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

**UNIT – 5**

**Comparators:** Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

**Oscillators & Phase-Locked Loops:** General Considerations, Ring Oscillators, LC Oscillators, Voltage Controlled Oscillators. Simple PLL, Charge Pump PLLs, Non-Ideal Effects in PLLs, Delay Locked Loops, Applications.

**Text Books**:

1. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition.
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

**References**:

1. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.
2. Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn, 2013.

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**Course Outcomes:**

After going through this course the student will be able to

1. Understand the concepts of MOS Devices and Modeling.
2. Design and analyze any Analog Circuits in real time applications.
3. Extend the Analog Circuit Design to Different Applications in Real Time.
4. Understand of Open-Loop Comparators and Different Types of Oscillators.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - I Semester | | L | T | P | C |
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| **ADVANCED SENSORS** | | | | | |

**Course Objectives:**

This course enables the students to:

1. Describe the operation of various smart sensors and their application
2. Select an appropriate sensor for a given application
3. Compare analogue and digital transducer.
4. Mathematically model a smart sensor
5. Discuss the latest technology in sensor development

**UNIT – 1**

**Micro mechanical sensing and actuating structures:** SAW micro sensors, Resonant micro sensors, micro accelerometers, Pressure micro sensors, micro actuators and micro motors, semiconductor strain gauges, Piezo resistive elements

**UNIT – 2**

**Temperature and Light Sensitive Microstructures:** Solid state temperature sensors – silicon resistive temperature sensors, Transistor based sensors, Integrated thermocouple, Photo detectors, Pneumatic detectors, Pyro electric detectors, Photo emissive, photo conductive, Schottky, CCDs, Radiation detectors, Fibre optic sensors: Pressure, Temperature and Phase modulated, Gyroscopes

**UNIT – 3**

**Miscellaneous Miniature Sensors:** Magnetic sensors, solid-state, chemical sensors: silicon based, Metal oxide based, Catalyst.

**UNIT – 4**

**Sensor Fusion:** Introduction to sensor fusion and sensor selection. Bayesian theory of sensor fusion and its applications

**UNIT – 5**

**Acceleration, Shock and Vibration Sensors:** Introduction, Technology Fundamentals, Selecting and Specifying Accelerometers, Applicable Standards, Interfacing and Designs.

**Nanotechnology-Enabled Sensors:** Possibilities, Realities, Applications.

**TEXT BOOKS**

1. Khazan Alexander D, " Transducers and their elements – Design and Applications", PTR Prentice Hall, Englewood Cliff, NJ07632 (1994)
2. Middlehoek S and Audet S A, "Silicon Sensors", Academic Press, London (1989)
3. Edmonds T E, "Chemical Sensors", Blackie, London (1988)
4. Jon S. Wilson, "Sensor Technology handbook", Elsevier, Newnes, USA, 2005

**REFERENCE BOOKS**

1. "Sensors and Actuators", No 8, 1985 (pp 227-233); No 10, 1986 (pp 65-82); No 12, (1987), pp 129-144.
2. Sloman Sabrie" sensor and control system in manufacturing "TMH, India (1994)

**Course Outcomes:**

The students will be able to –

1. Explain the various principles employed in transducers.
2. Examine the methods of fabricating a sensor.
3. Apply knowledge in designing smart sensors.
4. Discuss the techniques of fabrication and application of MEMS.
5. Describe the various applications of smart sensors.
6. Discuss advanced sensing technology.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
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| **MACHINE LEARNING FOR IMAGE PROCESSING** | | | | | |

**Course Objectives:**

1. Explain the theoretical background of convolutional neural networks in terms of learning
2. rates and system size.
3. Perform theoretical analyses of network performance
4. Study about deep learning
5. Study about PCA

**UNIT – 1**

**Machine Learning Basics:** Learning Algorithms , Capacity, Overfitting and Underfitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance , Maximum Likelihood Estimation, Bayesian Statistics , Supervised Learning Algorithms , Unsupervised Learning Algorithms, Stochastic Gradient Descent ,Building a Machine Learning Algorithm ,Challenges Motivating Deep Learning .

**UNIT – 2**

**Deep Feed forward Networks:** Example: Learning XOR ,Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms, Historical Notes

**UNIT – 3**

**Regularization for Deep Learning:** Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier

**UNIT – 4**

Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications

**UNIT – 5**

Linear Factor Models**,** Probabilistic PCA and Factor Analysis, Independent Component Analysis (ICA), Slow Feature Analysis, Sparse Coding, Manifold Interpretation of PCA, Under complete Auto encoders, Regularized Auto encoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Auto encoders, Learning Manifolds with Auto encoders, Contractive Auto encoders, Predictive Sparse Decomposition, Applications of Auto encoders

**TEXT BOOKS:**

I. Good fellow, Y. Bengio , Deep Learning, MIT Press, (2016)

**REFERENCES:**

1. R. O. Duda, P. E. Hart , Pattern Classification, WILEY, (2001)

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**Course outcomes**

At the completion of the course, a student will be able to:

1. Apply the definitions of the image classification and analysis problem to common problems in computer vision.
2. Explain the basics of object recognition and image search, object detection techniques, motion estimation, object tracking in video using convolutional filters.
3. Apply convolutional neural networks to image data for object recognition and detection.
4. Select different network architectures for the appropriate image processing problems.
5. Design and execute an implementation of an image processing system using tools such as PyTorch or Tensor Flow.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
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| **DIGITAL CONTROL SYSTEMS** | | | | | |

**Course Objectives:**

1. To study the Z-Transform, Properties& Inverse Z-transform.
2. To understand the difference between continuous and discrete time control systems.
3. To Find out the Pulse transfer function of Discrete time Closed loop control systems.
4. To design the digital control system using different techniques.
5. To find the stability of the control systems using different techniques.
6. To analyse the digital control systems in the state variable model.
7. To design the state feedback controller through the pole placement.

**UNIT – 1**

**INTRODUCTION:** Block Diagram of typical control system- advantages of sampling in control systems – examples of discrete data and digital systems – data conversion and quantization – sample and hold devices – D/A and A/D conversion – sampling theorem – reconstruction of sampled signals –ZOH. Z-transform: Definition and evaluation of Z-transforms – mapping between s-plane and z-plane – inverse z-plane transform – theorems of the Z-transforms –limitations of z-transforms –pulse transfer function – pulse transfer function of ZOH –relation between G(s) and G(z) – signal flow graph method applied to digital systems

**UNIT – 2**

**STATE SPACE ANALYSIS:** State space modelling of digital systems with sample and hold – state transition equation of digital time in variant systems – solution of time in variant discrete state equations by the Z-Transformation – transfer function from the state model – Eigen values – Eigen vector and diagonalisation of the A-matrix – Jordan canonical form. Computation of state transition matrix-Transformation to phase to variable canonical form-The state diagram – decomposition of digital system – Response of sample data system between sampling instants using state approach. Stability: Definition of stability – stability tests – The second method of Liapunov.

**UNIT – 3**

**TIME DOMAIN ANALYSIS:** Comparison of time response of continuous data and digital control systemscorrelation between time response and root locus j the s-plane and z-plane – effect of polezero configuration in the z-plane upon the maximum overshoot and peak time of transient response – Root loci for digital control systems – steady state error analysis of digital control systems – Nyquist plot – Bode plot-G.M and P.M

**UNIT – 4**

**DESIGN:** The digital control design with digital controller with bilinear transformation – Digital PID controller-Design with deadbeat response-Pole placement through state feedback-Design of full order state observer-Discrete Euler Lagrance Equation – Discrete maximum principle

**UNIT – 5**

**DIGITAL STATE OBSERVER**: Design of – Full order and reduced order observers. Design by max. Principle: Discrete Euler language equation-discrete maximum principle.

**TEXT BOOKS**

1. Discrete-Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition.
2. Digital Control and State Variable Methods by M. Gopal, TMH.

## REFERENCE BOOKS

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
2. Digital Control Engineering, M. Gopal
3. Digital Control Engineering Analysis and Design, M. Sami Fadali, AntonioVisioli, Second Edition, Academic Press

## Course Outcomes:

At the end of the course the student should be able to

1. Write difference between continuous and digital control systems
2. Find out the pulse transfer function of different configurations of digital control systems
3. Find out the stability of control system using different techniques
4. Design the control systems using deadbeat response.
5. Write the Digital control system in the state space model
6. Design the state feedback observer using different techniques.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **DATA CONVERTERS** | | | | | |

**Course Objectives**

1. Understand and learn single and multichannelData Acquisition System.
2. Acquire basic skills on capturing experimental data.
3. Understand and learn digital to analog and analog to digital conversion techniques.
4. Understand and learn on-linear data convertor techniques and applications.
5. Understand and learn monolithic data convertors and error budget of Data Acquisition System.

**UNIT – 1**

**INTRODUCTION:** Objective of a DAS, single channel DAS, Multi-channel DAS, Components used in DAS– Converter Characteristics-Resolution-Non-linearity,settling time, Monotonicity

**UNIT – 2**

**ANALOG TO DIGITAL CONVERTERS (ADCS):** Classification of A/D converters. Parallel feedback – Successive approximation – Ramp comparison – Dual slope integration – Voltage to frequency – Voltage to Time – Logarithmic types of ADCS.

**NON-LINEAR DATA CONVERTERS (NDC):** Basic NDC configurations – Some common NDACS and NADCS – Programmable non-linear ADCS – NADC using optimal sized ROM – High speed hybrid NADC – PLS based NADC – Switched capacitor NDCS.

**ADC APPLICATIONS:** Data Acquisition systems – Digital signal processing systems – PCM voice communication systems – Test and measurement instruments – Electronic weighing machines.

**UNIT – 3**

**DIGITAL TO ANALOG CONVERTERS (DACS):** Principles and design of – Parallel R– 2R, Weighted resistor, inverted ladder, D/A decoding – Codes other than ordinary binary.

**DATA CONVERTER APPLICATIONS:** DAC applications – Digitally programmable V/I sources – Arbitrary waveform generators – Digitally programmable gain amplifiers – Analog multipliers/ dividers – Analog delay lines.

**UNIT – 4**

**Monolithic data converters:** typical study of monolithic DACS and ADCS. Interfacing of DACS and ADCS to a μP.

**UNIT – 5**

**Error budget of DACS and ADCS:** Error sources, error reduction and noise reduction techniques in DAS. Error budget analysis of DAS, case study of a DAC and an ADC.

**TEXT BOOKS:**

1. Electronic data converters fundamentals and applications – Dinesh K. Anvekar, B.S. Sonde –Tata McGraw Hill.

**REFERENCES:**

1. Electronic Analog/ Digital conversions – Hermann Schmid – Tata McGraw Hill.
2. E.R. Hanateck, User's Handbook of D/A and A/D converters - Wiley
3. Electronic instrumentation by HS Kalsi- TMH 2 ndEdition, 2004.
4. Data converters by G.B. Clayton

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes**

At the end of this course the student will be able to:

1. Differentiate between single and multichannel Data Acquisition System.
2. Describe the functional blocks of data acquisition system.
3. Operation of different DACs, ADCs and non-linear ADCs.
4. Understands of data convertor and monolithic data convertors and their applications.
5. Gets aware of error budget analysis of Data Acquisition System.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| III Year - II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **BIO-MEDICAL INSTRUMENTATION** | | | | | |

**Course Objectives:**

1. To study about the major systems of the body and different potentials associated with each system
2. To study about various Electrodes and Transducers used for acquisition of bio potential
3. To know the physiological effects of electricity on humans and preventive methods
4. To study about various patient monitoring systems and need of pacemaker and defibrillator.
5. To get acquainted with medical imaging systems used in biomedical field

**UNIT – 1**

**Introduction:** Introduction to Bio-Medical Engineering field, Components of Man Instrument system, problems encountered in measuring a living system

**Physiological systems of the Body:** Basic Features of cardiovascular system, Nervous system, muscular system, respiratory system.

**Resting potential & action potential concepts:** Resting potential concept,characteristics of resting potential, action potential concept, propagation of action potential.

**Bio-electric potentials:** Definition for Bio-electric Potential, Typical Examples of Bio-Electric Potential with important features

**UNIT – 2**

**Bio-Medical Electrodes:** Introduction to Bio-Medical Electrodes, Various types of Bio-Medical Electrodes: surface electrodes, micro electrodes, needle electrodes depth electrodes.

**Electro Cardiograhphy (ECG):** Introduction to electro cardiography, ECG LEADConcept, various types of ECG Lead configurations, typical ECG waveform details, ECG recording, Analysis of Recorded ECG waveform.

**Electro Encephalography (EEG):** Introduction to Electro Encephalography, EEGRecording EEG in diagnostics

**Electro Myography:** Introduction to Electro-Myography, EMG Recording, EMG Applications

**UNIT – 3**

**Cardiovascular Measurements:** Introduction to various cardiovascular parameters: Blood Pressure Blood flow, cardiac output, Heart sounds. Blood Pressure Measurement techniques: Direct methods & In-direct Methods.

**Blood flow measurement techniques:** Electro Magnetic Blood flow meter, ultrasonic Blood flow meter, Thermal convection method. Cardiac output Measurement techniques: Fick's technique, Indicator dillution method, thermal dilution method, Impedance change method. Phonocardiography: Heart sounds Recording

**UNIT – 4**

**Therapeutic Instruments:** Cardiac Pacemakers, Types of pacemakers: External pace makers, Internal Pacemakers, Pacing modes, lead wires & Electrodes for internal pacemakers, power sources for implantable cardiac pacemakers, hem dialysis. Cardiac defibrillators, defibrillator electrodes, Introduction to diathermy. Various diathermy apparatus: surgical, shortwave, microwave

**UNIT – 5**

**Instruments for clinical laboratory:** Introduction to Bio-Chemical electrodes, Types of Bio-Chemical electrodes for measurement of various Blood gas parameters such as Blood $P_H$, $P_{O2}P_{CO2}$ Blood gas analyzer, Blood cell counters.

**Modern technologies in Bio-Medical field:** Use of X-Rays in medicine, CT scan, ultrasound applications in medicine, MRI scan.

**Text Books:**

1. Leslie Cromwell, Fred J. Weibell and Erich A,Pleiffer, " Biomedicalinstrumentation and Measurements", IInded, Prentice Hall of India,2004
2. R.S Kandpur. " Handbook of Biomedical Instrumentation, IInded, Tata McGrawHill, 2011

**Reference Books:**

1. Webster, Medical Instrumentation Application&Design, John Wiley& sons
2. Jog: Electronics in Medicine and Biomedical Instrumentation, Prentice Hall ofIndia,2006
3. Dr. M.Armugam,"Biomedical Instrumentation" IInded, AnuradhaPublications,2009

**Course Outcomes:**

At the end of this course, students will be able to

1. Understand about various systems in the body and origin of biopotential.
2. Learn about Electrodes and Transducers used for acquisition of biopotential
3. Analyse various physiological signals and their waveforms
4. Gain knowledge on Patient monitoring systems and working, operation of pacemakers.
5. Study the Principles of different Medical Imaging Systems

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **COMPUTER CONTROL OF PROCESSES** | | | | | |

**Course Objectives:**

1. The main objective is that the student will be able to know about the basic concepts of different processes and associated controls which is present in every Industry.
2. By learning the concepts the student can be able to design control algorithms for PID which are very useful in control of a particular process of an Industry.
3. Industrial Buses deals with the overview of a plant connections and the student can be able to know about the advantages of different buses based on the plant requirement.
4. With the knowledge of Advanced controllers students will be aware of complex control actions present in an industry.
5. The student will be able implement Ladder logics in PLC

**UNIT – 1**

Basics of Computer Aided Process Control and Industrial Buses: Current trends in computer control of process plants. Fundamentals of automatic process control, Computer aided process control architecture. Industrial Buses-CAN, Profi bus, Interface cables-RS 232,422,485.

**UNIT – 2**

Digital Control: Digital PID control- Position and velocity form, DDC Structure, Microcomputer based DDC structure.Hold circuits- ZOH,FOH.Mapping between Laplace and Z planes.

**UNIT – 3**

Distributed Control Systems: Distributed vs Centralized control - Advantages-Functional requirements of distributed process control system - System Architecture-Distributed Control System (DCS)-Sub-systems-Local field station-Presentation and monitoring device-Communication options in DCS - configuration. Some popular distributed control systems. Display systems-Display parameters-Display in process control environment-Computer graphics.

**UNIT – 4**

Programmable Logic Controllers: Evolution of PLC's – Components of PLC – Advantages over relay logic - PLC programming languages – Ladder diagram – Programming timers and counters – Design of PLC. Industrial Applications.

**UNIT – 5**

Advanced Strategies for Computer Process Control: Model Predictive Control, Robust Adaptive Control, Algorithms for Processes with Dead time and Delay, Optimal Controllers

**Text Books**

1. Krishna Kant, "Computer-based Industrial Control", PHI Publishers, 2003, edition 2.
2. S.K.Singh, "Computer Aided Process Control", PHI learning, 2005, edition 4.

**References**

1. Bela G.Liptak, "Instrumentation Engineers Hand book", CRC Press,1995, edition 3.

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**KAKINADA – 533 003, Andhra Pradesh, India**
**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**Course Outcomes:**

1. After completion of the course the student will be able to differentiate among different sequential processes.
2. The student will be able to do Projects at the Final year of his Graduation by taking any one of the PLC applications as well as the topics concerned with Distributed Controls.
3. The PLC will be used whenever a student want to replicate the industry environment in his Project and develop a prototype.
4. The student will be able to learn about the optimal selection of a controller based on the output requirements and include modifications w.r.t. MRAC and MPC controllers.
5. Design advanced process control systems

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| IV Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **POWER PLANT INSTRUMENTATION** | | | | | |

**Course Objectives:**

1. The student will gain knowledge about the different general procedures and practices involved in the operation of power plants and their different set up available for power plants
2. The student will gain knowledge about the different energy conversion process in power generation.
3. The student can identify the different practices involved in the generation of energy.
4. The student will learn about the different emergency measures to be taken in a plant and also learns about the alarm analysis
5. The student will gain knowledge about the thermal power plant instrumentation concepts and the different procedures and practices involved in the operation of the power plant.

**UNIT – 1**
Overview of power generation: Introduction, various sources of electrical energy, non-conventional energy sources, conventional energy sources, Importance of instrumentation and control in power generation, piping and instrumentation diagrams, cogeneration of power, control rooms.

**UNIT – 2**
Instrumentation and control in water and air-fuel circuit: Boiler circuit, boiler feed water circulation, measurements of water circuits, controls in water circuits, impurities in water and steam, Air-fuel circuit, measurements in air-fuel circuit, controls in air-fuel circuits, analytical measurements.

**UNIT – 3**
Power Plant management: Introduction, master control, combustion process, boiler efficiency, maintenance of measuring instruments, intrinsic and electrical safety, interlocks for boiler operations, computer based control and data logging systems, distributed control systems.

**UNIT – 4**
Turbine monitoring and control: Introduction, turbine steam inlet system, turbine measurements, turbine control systems, lubrication for turbo alternator, turbo-alternator cooling system.

**UNIT – 5**
Nuclear power plant instrumentation: Introduction, instrumentation and control for nuclear power plant, important components of I & C systems, evolution of I & C in NPP, Sensors and measurement systems, reactor control, digital architectures in NPP, Radiation protection and monitoring, nuclear reactor safety, surveillance, diagnostics and prognostics.

**TEXT BOOKS:**
1. Jervis M.J, Power Station Instrumentation, Butterworth Heinemann, Oxford, 1993.
2. Krishnaswamy, PonniBala, Power Plant Instrumenation, PHI , 2013

**REFRENCE BOOKS:**
1. David Lindsley, Boiler Control Systems, McGraw Hill, New York, 1991.
2. Modern Power Station Practice, Vol.6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.
3. Sam G Dukelow, The Control of Boilers, 2nd Edition, ISA Press, New York, 1991
4. Gill A B, Power Plant Performance, Butterworth, London, 1984.

5. P C Martin and I W Hannah, Modern Power Station Practice, British Electricity International Vols. 1 & VI, Pergamon Press, London, 1992.

**Course Outcomes:**

1. The student will learn about the instrumentation in a power plant and the different devices used in the process.
2. The student will be able to operate the devices and analyse the process in thermal, nuclear and hydro power plants.
3. The student will be able to work in a industry by the knowledge gained in the power plant instrumentation.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |
| **OPTIMAL CONTROL SYSTEMS** | | | | | |

**Course Objectives:**

1. To provide a basic knowledge of the theoretical foundations of optimal control.
2. To develop the skill needed to design controllers using available optimal control Theory and software.
3. To introduce to current research in optimization methods for robust control.
4. To understand the physical interpretation of H∞ norm.

**UNIT – 1**

Historical development of optimal control. Variational approach to optimal control Concept of functional, variational problems and performance indices. Euler-Lagrange equation to find the extremal of a functional. Transversality condition. Application of variation approach to control problems.

**UNIT – 2**

Statement of Linear quadratic regulator (LQR) problem and establish a mathematical framework to solve this problem. Optimal solution of LQR problem. Different techniques for solution of algebraic Riccati equation. Frequency domain interpretation of LQR problem. Stability and robustness properties of LQR design. Optimal saturating controllers.

**UNIT – 3**

Systematic formulation of robust control problem, Uncertainty and robustness, Effect on system stability and performance, Performance limitations, Introduction to linear matrix inequalities

**UNIT – 4**

Review of measures of signals and systems, H2 and H∞ norm computations. Linear fractional transformations, Parameterization of stabilizing controllers, spectral factorizations, positive real functions, inner-outer and normalized coprime factorization

**UNIT – 5**

Riccati and LMI based solutions to general H2 and H∞ control problems, H∞ loop shaping, singular control, output feedback and fixed structure control formulations, passivity based design, Variable structure control

**Text Books:**

1. Optimal control: An introduction --- Arturo Locatelli ---BirkhauserVerlag , 2001.
2. K. Zhou, J.C. Doyle and K. Glover, “Robust & Optimal Control”, Prentice Hall Inc. NY 1998.

**References**:

1. Optimal control systems --- D.S. Naidu, CRC Press, 2003.Jacek.
2. Petros A. Joannou and Jing Sun, ìRobust Adaptive Controlî, Prentice Hall Inc,1996
3. Anderson B. D. O. and J. B. Moore, ìLinear Optimal Controlî, Prentice Hall, Englewood Cliff, N. J., 1971.

**Course Outcomes:**

At the end of the course the student should be able to

1. Design and implement system identification experiments.
2. Use input-output experimental data for identification of mathematical dynamical models.
3. Use singular value techniques to analyze the robustness of control systems.
4. Incorporate frequency-domain-based robustness specifications into multivariable control System designs.
5. Use H-infinity methods to design robust controllers.
6. Explain the advantages and disadvantages of robust control relative to other control approaches.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

| IV Year - I Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |

## CMOS DIGITAL IC DESIGN

**Course Objectives:**

1. The student will be able to understand the MOS Design.
2. In this course, students can study Combinational MOS Logic Circuits and Sequential MOS Logic Circuits.
3. Another main object of this course is to motivate the graduate students to design and to develop the Digital Integreated Circuits for different Applications.
4. The concepts of Semiconductor Memories, Flash Memory, RAM array organization.

**UNIT – 1**

**MOS Design:** Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

**UNIT – 2**

**Combinational MOS Logic Circuits**: MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates , AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

**UNIT – 3**

**Sequential MOS Logic Circuits:** Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

**UNIT – 4**

**Dynamic Logic Circuits:** Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits

**UNIT – 5**

**Interconnect:** Capacitive Parasitics, Resistive Parasitics, Inductive Parasitics, Advanced Interconncet Techniques.

**Semiconductor Memories:** MemoryTypes, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory- NOR flash and NAND flash.

**TEXT BOOKS:**

1. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, AnanthaChandrakasan, BorivojeNikolic, 2nd Ed., PHI.
2. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.

**REFERENCE BOOKS:**

1. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.
2. CMOS VLSI Design – Neil H.E Weste, David harris, Ayan Banerjee 3rd Edition, Pearson

**Course Outcomes:**

After going through this course the student will be able to

1. Understand the concepts of MOS Design.
2. Design and analysis of Combinational and Sequential MOS Circuits.
3. Extend the Digital IC Design to Different Applications.
4. Understand the Concepts of Semi conductor Memories, Flash Memory, RAM array organization.