B.Tech in
Electronics and Communication Engineering

Faculty of Engineering
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Vision of the Institute

To be a global leader in the delivery of engineering education, transforming individuals to become creative, innovative, and socially responsible contributors in their professions.

Mission of the Institute:

• To provide best-in-class infrastructure and resources to achieve excellence in technical education,

• To promote knowledge development in thematic research areas that have a positive impact on society, both nationally and globally,

• To design and maintain the highest quality education through active engagement with all stakeholders—students, faculty, industry, alumni and reputed academic institutions,

• To contribute to the quality enhancement of the local and global education ecosystem,

• To promote a culture of collaboration that allows creativity, innovation, and entrepreneurship to flourish, and

• To practice and promote high standards of professional ethics, transparency, and accountability
Vision of the Department:

To provide a value-based learning environment for producing engineers with a blend of technical skills, moral values and leadership qualities in the field of Electronics, Communication and Computing channelized towards technological advancement to cater to the needs of the industry and the society.

Mission of the Department:

**M1:** Achieving excellence in teaching and learning with an emphasis on fundamental knowledge and hands-on exposure to match the state-of-the-art in technology.

**M2:** Providing an environment for core competency development and enhancing quality research in emerging areas.

**M3:** Facilitating professional growth to the students for higher education and career in industry and academia.

**M4:** Imbibing the essence of human values, ethics and professional skills to sustain socio-economic development.
Program Educational Objectives (PEOs)

PEO1: To integrate fundamental knowledge of basic science, mathematics and engineering to work on complex problems in the field of electronics and communication engineering.

PEO2: To promote independent research and continuous learning by providing hands-on exposure in electronics, signal processing and communication domains.

PEO3: To provide a platform to explore and pursue interests in diversified fields for a successful career.

PEO4: To nurture team spirit and leadership qualities with a sense of social responsibility and produce engineers with an ability to integrate engineering and society.

PROGRAM SPECIFIC OUTCOMES (PSO)

- PSO1: Able to design, develop and analyze systems in signal processing, electronics, communication and computing.

- PSO2: Able to demonstrate competency in research and innovations.
Program Outcomes (PO)

Engineering Graduates will be able to:

• PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science and engineering fundamentals to the solution of complex engineering problems in the field of electronics and communication.

• PO2: **Problem analysis**: Identify, formulate, review research literature, and analyze problems in electronics and communication, reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

• PO3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

• PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in the field of electronics and communication. PO5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, modeling and simulation tools applicable to the field of electronics and communication engineering.

• PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

• PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

• PO8: **Ethics**: Apply ethical principles and commit to professional ethics, responsibilities and norms pertaining to the field of electronics and communication.

• PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
• PO10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

• PO11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and a leader in a team, to manage projects and in multidisciplinary environments.

• PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
### SEMESTER I

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Total 16

* A maximum of One Elective course can be chosen from the Electives prescribed for other Branches or from under Science Electives.

** Live-in-Lab -This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester or sixth semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth or seventh semester. The objectives and projected outcome of the project should be reviewed and approved by the Dept. chairperson and a faculty assigned as the project guide. On completion of the project, the student shall submit a detailed project report. The report shall be evaluated and the students shall appear for a viva-voce test on the project.

Students undertaking and registering for a Live-in-Lab project, can be exempted from registering for an Elective course in the higher semester.
ELECTIVES

15ECE367 Hardware Security and Trust
15ECE356 Satellite Communication
15ECE344 Antenna Systems and Design
15ECE339 Application of Linear Integrated Circuits
15ECE345 Cellular and mobile communication system
15ECE359 Wireless communication
15MEC333 Financial management
15ECE331 Pattern recognition techniques and algorithms
15ECE366 Embedded systems
15ECE368 Introduction to soft computing
15ECE380 Telecommunication Management
15MEC411 Operation Research
15ECE347 Introduction to Radar Systems
15ECE371 VLSI Fabrication Technology
15ECE374 Automotive Embedded Systems
15ECE369 Principles of VLSI Testing

SCIENCE ELECTIVES (3003)

15CHY231 Advanced Polymer Chemistry
15CHY232 Biomaterials Science
15CHY233 Catalytic Chemistry
15CHY234 Chemistry of Advanced Materials
15CHY235 Chemistry of Engineering Materials
15CHY236 Chemistry of Nanomaterials
15CHY237 Chemistry of Toxicology
15CHY238 Colloidal and Interfacial Chemistry
15CHY239 Computational Chemistry and Molecular Modelling
15CHY241 Electrochemical Energy Systems and Processes
15CHY242 Environmental Chemistry
15CHY243 Fuels and Combustion
15CHY244 Green Chemistry and Technology
15CHY245 Instrumental Methods of Analysis
15CHY246 Medicinal Organic Chemistry
15CHY247 Modern Polymer Composites
15CHY248 Organic Reaction Mechanisms
15CHY249 Organic Synthesis and Stereochemistry
15CHY250 Polymer Materials and Properties
15CHY251 Polymers for Electronics
15CHY252 Solid State Chemistry
15CHY331 Batteries and Fuel Cells
15CHY332 Corrosion Science
15PHY230 Advanced Classical Dynamics
15PHY233 Biophysics and Biomaterials
15PHY234 Introduction to Computational Physics
15PHY238 Electrical Engineering Materials
15PHY239 Electromagnetic Fields and Waves
15PHY240 Electronic Material Sciences
15PHY241 Lasers in Material Processing
15PHY243 Microelectronic Fabrication
15PHY245 Nuclear Energy – Principles and Applications
15PHY247 Photovoltaics
15PHY248 Physics of Lasers and Applications
15PHY250 Quantum Physics and Applications
15PHY251 Thin Film Physics
15PHY331 Astronomy
15PHY333 Concepts of Nanophysics and Nanotechnology
15PHY335 Medical Physics
15PHY338 Physics of Semiconductor Devices
15PHY532 Astrophysics
15PHY535 Earth's Atmosphere
15PHY536 Earth's Structure and Evolution
15PHY540 Nonlinear Dynamics
15PHY542 Optoelectronic Devices
HUMANITIES ELECTIVES

15CUL230  Achieving Excellence in Life - An Indian Perspective  2002
15CUL231  Excellence in Daily Life  2002
15CUL232  Exploring Science and Technology in Ancient India  2002
15CUL233  Yoga Psychology  2002
15ENG230  Business Communication  1022
15ENG231  Indian Thought through English  1022
15ENG232  Insights into Life through English Literature  1022
15ENG233  Technical Communication  1022
15ENG234  Indian Short Stories in English  1022
15FRE230  Proficiency in French Language (Lower)  1022
15FRE231  Proficiency in French Language (Higher)  1022
15GER230  German for Beginners I  1022
15GER231  German for Beginners II  1022
15GER232  Proficiency in German Language (Lower)  1022
15GER233  Proficiency in German Language (Higher)  1022
15HIN101  Hindi I  1022
15HIN111  Hindi II  1022
15HUM230  Emotional Intelligence  2002
15HUM231  Glimpses into the Indian Mind - the Growth of Modern India  2002
15HUM232  Glimpses of Eternal India  2002
15HUM233  Glimpses of Indian Economy and Polity  2002
15HUM234  Health and Lifestyle  1022
15HUM235  Indian Classics for the Twenty-first Century  2002
15HUM236  Introduction to India Studies  2002
15HUM237  Introduction to Sanskrit Language and Literature  2002
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<td>Workplace Mental Health</td>
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**Evaluation Pattern**

**50:50 (Internal: External) (All Theory Courses)**

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**80:20 (Internal: External) (Lab courses and Lab based Courses having 1 Theory hour)**

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**70:30 (Internal: External) (Lab based courses having 2 Theory hours/ Theory and Tutorial)**

**Theory- 60 Marks; Lab- 40 Marks**

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**65:35 (Internal: External) (Lab based courses having 3 Theory hours/ Theory and Tutorial)**

**Theory- 70 Marks; Lab- 30 Marks**
Grades O to P indicate successful completion of the course

\[ CGPA = \frac{\sum (C_i \times Gr_i)}{\sum C_i} \]

Where

- \( C_i \) = Credit for the \( i^{th} \) course in any semester
- \( Gr_i \) = Grade point for the \( i^{th} \) course
- \( Cr. \) = Credits for the Course
- \( Gr. \) = Grade Obtained

*CA – Can be Quizzes, Assignment, Projects, and Reports.

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**Semester 7**

| 60 | 15ECE 401 | Information Theory and Coding Techniques | 4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | 2 |
| 61 | 15ECE 402 | Radio Frequency Engineering | 4 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | 2 | |
| 62 | 15ENV 300 | Environmental Science and Sustainability | 3 | 1 | 1 | 1 | 1 | - | 2 | 3 | 3 | 1 | 2 | - | 1 | - | - | |
| 63 | 15ECE 345 | E II - Cellular and mobile communication system (Elective) | 3 | 3 | 2 | 2 | - | 2 | 3 | - | - | 3 | 3 | 3 | 2 | 3 | - | |
| 64 | 15ECE 359 | E II - Wireless communication | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | 3 | |
| 65 | 15MEC 333 | E II - Financial management | 3 | - | - | - | - | 2 | - | 2 | - | 3 | 2 | 2 | - | - | |
| 66 | 15ECE 331 | E III - Pattern recognition techniques and algorithms (Elective) | 3 | 3 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | 3 | 3 | 2 | |
| 67 | 15ECE 366 | E III - Embedded systems | 3 | 3 | 2 | 2 | 2 | 2 | 2 | - | - | 3 | 2 | - | - | 3 | 3 | |
| 68 | 15ECE 368 | E III - Introduction to soft computing | 3 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 | 3 | |
| 69 | 15ECE 481 | Microwave Engineering Lab. | 1 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | 2 | - | 2 | 3 | - | |
| 70 | 15ECE 495 | Project Phase I | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | |
| 71 | 15LIL4 90 | [Live-in –Lab]** | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | | |

**Semester 8**

<p>| 72 | 15ECE 380 | E IV - Telecommunication Management | 3 | 3 | 2 | - | 2 | 3 | - | - | - | 2 | 2 | 2 | - | 2 | - | |
| 73 | 15ECE 347 | E IV - Introduction to Radar Systems | 3 | 3 | 3 | - | 2 | - | - | - | - | - | 2 | - | 2 | 3 | 3 | |
| 74 | 15MEC 411 | E IV - Operation Research | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 3 | 3 | 1 | |
| 75 | 15ECE 369 | E V - Principles of VLSI Testing | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | - | |
| 76 | 15ECE 371 | E V - VLSI Fabrication | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | 3 | |</p>
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OBJECTIVES:

To make the students communicate their thoughts, opinions, and ideas freely and naturally; to make them understand the different styles in communication; to make the students understand the aesthetics of reading and writing; to bring in a spirit of enquiry; to motivate critical thinking and analysis; to help them ruminate on human values.

Unit 1

Reading: Different styles of communication – Reading Comprehension - critical thinking and analysis – Note-making – Any two pieces from the text.

Unit 2

Writing: Prewriting techniques - Kinds of paragraphs - basics of continuous writing.

Grammar & Usage: Parts of Speech, Tenses, Concord, Phrasal Verbs, Modal Auxiliaries, Modifiers (Workbook) - Any two pieces from the text.

Unit 3

Practical sessions (Listening & Speaking): Introduction to English pronunciation including minimal pairs and word stress – differences between British and American English – Listening comprehension and Note-taking - Any two pieces from the text.

Activities: Short speeches, seminars, quizzes, language games, debates, and discussions, Book Reviews, etc.

Text: Language through Reading: Compilation by Amrita University for internal circulation

Poems:

i. The Poplar Field by William Cowper
ii. Telephone Conversation by Wole Soyinka

Prose:

i. Higher Mathematics by R. K. Narayan
ii. Wings of Fire by Abdul Kalam (Part III.11)
Short Stories:

i. Best Investment I Ever Made by A. J. Cronin
ii. Death of an Indian by Krishna Charan Das

Language through Practice: Compilation by Amrita University for internal circulation

Outcomes:

CO 1: Demonstrate competency in all the four linguistic skills viz, listening, speaking, reading and writing.

CO 2: Apply different styles of communication in professional context.

CO 3: Take part in different planned & extempore communicative activities.

CO 4: Interpret and Discuss facts and information in a given context.

CO 5: Develop an appreciation for human values.

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15MAT111 CALCULUS AND MATRIX ALGEBRA 2103

Unit 1

Calculus
Limit and Continuity: Limit (One-Sided and Two-Sided) of Functions. Continuous Functions,
Discontinuities, Monotonic Functions, Infinite Limits and Limit at Infinity.

Unit 2

Unit 3
Matrix Algebra
Review: System of linear Equations, linear independence

Outcomes:
CO1: Understand the basic concepts of functions, limits, continuity, derivatives and analyze them.

CO2: Apply the concept of differentiability to find the extreme values of the given function and analyze the derivatives to sketch the graph of the given function.

CO3: Recall the terms, facts and basic concepts of definite integrals and the techniques of obtaining antiderivatives.

CO4: Understand the notion of eigenvalues and eigenvectors, analyze the possibility of diagonalization and hence compute a diagonal matrix, if possible.

CO5: Apply the knowledge of diagonalization to transform the given quadratic form into the principal axes form and analyze the given conic section.

CO6: Understand the advantages of the iterative techniques and apply it to solve the system of equations and finding eigenvectors.

CO –PO Mapping:
15CSE100 COMPUTATIONAL THINKING AND PROBLEM SOLVING

Unit 1

Unit 2

Unit 3
Problem Solving Techniques: Factoring and Recursion Techniques, Search and Sort techniques, Text processing and Pattern matching.

Outcomes:

CO1: Apply computational thinking principles and algorithmic building blocks to understand, define, and solve problems
CO2: Design algorithms and implement solutions for problems
CO3: Represent, organize, manipulate and interpret data
CO4: Trace computational states and analyse techniques/strategies for given solutions

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TEXTBOOKS:
1. *David Riley and Kenny Hunt, Computational Thinking for Modern Solver, Chapman & Hall / CRC, 2014*
2. *R. G. Dromey, “How to solve it by Computer”, PHI, 2008*

15CHY100 CHEMISTRY 3 0 0 3

Unit 1
Chemical Bonding
Review of orbital concept and electronic configuration, electrovalency and ionic bond formation, ionic compounds and their properties, lattice energy, solvation enthalpy and solubility of ionic compounds, covalent bond, covalency, orbital theory of covalency - sigma and pi bonds - formation of covalent compounds and their properties. Hybridization and geometry of covalent molecules - VSEPR theory - polar and non-polar covalent bonds, polarization of covalent bond - polarizing
power, polarisability of ions and Fajan’s rule, dipole moment, percentage ionic character from dipole moment, dipole moment and structure of molecules - co-ordinate covalent compounds and their characteristics, molecular orbital theory for H2, N2, O2 and CO, metallic bond - free electron, valence bond and band theories, weak chemical bonds – inter and intra molecular hydrogen bond - van der Waals forces.

**Unit 2**

Thermodynamic Parameters

Stoichiometry - mole concept, significance of balanced chemical equation - simple calculations  
- Conditions for occurrence of chemical reactions - enthalpy, entropy and free changes - spontaneity  
- Thermochemistry - heats of reactions - (formation, combustion, neutralization) - specific heats - variation of enthalpy change with temperature - Kirchhoff’s relation (integrated form) - bond enthalpy and bond order - Problems based on the above.

Kinetics

Review of molecularity and order of a reaction, rate law expression and rate constant - first, second, third and zero order reactions, pseudo-first order reactions (pseudo-unimolecular reactions) - complex reactions - equilibrium and steady state approximations - mechanism of these reactions - effect of temperature on reaction rates - Arrhenius equation and its significance, Michaelis Menden kinetics- enzyme catalysis.

**Unit 3**

Electrochemistry

Electrolytes - strong and weak, dilution law, Debye-Huckel theory, faraday’s laws, origin of potential, single electrode potential, electrochemical series, electrochemical cells, Nernst equation and its application, reference electrodes - SHE, Ag/AgCl, Calomel.

Photochemistry

Photochemistry, laws of photochemistry - Stark-Einstein law, Beer-Lamberts law, quantum efficiency-determination, photochemical processes - Jablonsky diagram, internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo sensitization, photo polymerization.

**Outcomes:**

CO 1: Understand the fundamental concepts of chemistry to predict the structure and properties of engineering materials
CO 2: Develop analytical skills to evaluate the cause, feasibility and course of chemical reactions
CO 3: Design and apply the idea of cutting edge area of chemistry to solve engineering related problems

CO –PO Mapping:
REFERENCE BOOKS

Physical chemistry, Puri and Sharma
Inorganic chemistry, Puri and Sharma

15PHY100 PHYSICS 3 0 0 3

Unit 1


Unit 2

Atomic Structure and Quantum Mechanics


Quantum Mechanics: Introduction - wave equation - Schrodinger’s equation (time dependent and
independent) - expectation values, operators, Eigen value (momentum and energy) – 1D potential box (finite and infinite) - tunnel effect - harmonic oscillator.

Unit 3

Statistical Mechanics and Solid State Physics


Outcomes:

CO1: Understand, Comprehend and acquaint with concepts of Modern Physics
CO2: Analyze and solve (idealized and quasi practical) physics problems pertaining to various concepts of Modern Physics
CO3: Apply concepts of Modern Physics to solve engineering problems that needs ideas from Modern Physics

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15CHY181 CHEMISTRY LAB. 0021

1. Acid base titration (double titration)
2. Complexometric titration (double titration)
3. Redox (permanganometry) titration (double titration)
4. Conductometric titration
5. Potentiometric titration
6. Ester hydrolysis

Outcomes:

CO1: Develop analytical skills for the determination of water quality parameter

CO2: Understand the electrochemical principles of conductance and electrode potentials and its application in analytical science

CO3: Develop analytical skills in the determination of rates of chemical reactions and its application

CO4: Learn the basics of redox reaction and applying it for quantitative determination.

CO5: Create skills to convert basic chemical reactions to analytical application.

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Young’s Modulus – Non Uniform Bending Newton’s Rings
Laser - Determination of Wavelength and Particle Size Determination Spectrometer Carey Foster’s Bridge

Rigidity Modulus - Tensional Pendulum Viscosity of Liquid by Stokes’s method Ultrasonic Interferometer
Hysteresis – B H curve

Outcomes:

CO1: Prepare for the lab experiment and perform individually a wide spectrum of experiments.
CO2: Present experimental data in various appropriate forms like tabulation, and plots.
CO3: Analyze, Interpret and Summarize experimental results.
CO4: Communicate clearly understanding of various experimental principles, instruments/setup, and procedure.

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32
1. Product Detailing Workshop
Disassemble the product of sub assembly - Measure various dimensions using measuring instruments - Free hand rough sketch of the assembly and components - Name of the components and indicate the various materials used - Study the functioning of the assembly and parts - Study the assembly and components design for compactness, processing, ease of assembly and disassembly - Assemble the product or subassembly.

2. Pneumatics and PLC Workshop

3. Sheet Metal Workshop
Study of tools and equipments - Draw development drawing of simple objects on sheet metal (cone, cylinder, pyramid, prism, tray etc.) Fabrication of components using small shearing and bending machines - Riveting and painting practice.

4. (a) Welding Workshop
Study of tools and equipments - Study of various welding methods - Arc welding practice and demonstration of gas welding and cutting.

(b) Demo and practice Workshop
Fitting: Study of tools, practice in chipping, filing and making joints. Carpentry: Study of tools, planning practice and making joints

Outcomes:

CO1: Dismantle and assemble various products.

CO2: Design and simulate pneumatic and electro-pneumatic circuits.

CO3: Fabricate sheet metal objects.

CO4: Perform arc welding and soldering.

CO-PO Mapping:
REFERENCE:

Concerned Workshop Manual

15EEE180  WORKSHOP B  0 0 2 1

Part A - Electronics
Identification of electronic components (Passive and Active)
Study of measuring instruments (Voltmeter, Ammeter and Multimeter) Measurement and theoretical Verification of series and parallel combination of resistors and capacitors Calibration of CRO and measurements of signal parameters (RMS, maximum value, peak value, time and frequency) Calibration of function generator using CRO Soldering practice

Part B – Electrical

1. Study on power supply and protective devices
2. Study on tools and electrical accessories
3. Study on sources of light
4. Study on energy efficiency
5. Study on water pump
6. Study on house hold appliances:
   a. Iron box
   b. Fan
c. Refrigerator

7. House wiring I – Glow an incandescent lamp using SPST switch
8. House wiring II – Glow a fluorescent lamp using SPST switch
9. House wiring III – Operate a fan and an incandescent lamp using two independent SPST switch
10. House wiring IV – Operate a fluorescent lamp and a 3 pin socket using two independent SPST switch
11. House wiring V – Staircase wiring
12. House wiring VI – Godown wiring

**Outcomes:**

CO1: Understand electrical safety measures and identify electrical tools, electronic components and their symbols.

CO2: Understand electric laws using simulation studies and detect failures in electrical and electronic circuits.

CO3: Build/Solder and test, residential wiring/Electronic circuits and measure electrical parameters.

CO4: Estimate the materials required for wiring a building.

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Objectives:

1. To develop drawings using Bureau of Indian Standards (BIS)
2. To communicate effectively through drawings
3. To enhance visualization skills, which will facilitate the understanding of engineering systems.

Keywords:

Coordinate system, Orthographic projections, Isometric projections

Contents:


Outcomes:

CO1: Understand the fundamental principles of first angle and third angle projections.

CO2: Dimension and label the drawings as per standards.

CO3: Construct the drawings by choosing appropriate line type.

CO4: Visualize and construct projections of line and lamina when inclined to one reference plane and
both reference planes.

CO5: Visualize and construct solid entities in its simple position and when inclined to one reference plane.

CO6: Construct the drawings using computer aided design and drafting software package

**CO –PO Mapping:**

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**TEXTBOOK:**


**REFERENCES:**

Unit 1

Introduction to Indian Culture; Introduction to Amma’s Life and Teachings; Symbols of Indian Culture.

Unit 2

Science and Technology in ancient India; Education in Ancient India; Goals of Life - Purusharthas; Introduction to Vendanta and Bhagavat Gita.

Unit 3

Introduction to Yoga; Nature and Indian Culture; Values from Indian History; Life and work of Great Seers of India.

Outcomes:

CO1: Be introduced to the foundational concepts of Indian culture and heritage, will be able to understand the cultural ethos of Amrita Vishwa Vidyapeetham, and Amma’s life a

CO2: Understand the foundational concepts of Indian civilization like purusharthas, law of karma, etc, which contributes towards personality growth.

CO3: Gain a positive appreciation of Indian culture, traditions, customs and practices

CO4: Imbibe spirit of living in harmony with nature, and principles and practices of Yoga

CO5: Get guidelines for healthy and happy living from the great spiritual masters

CO-PO Mapping:
### TEXTBOOKS:

1. *The Glory of India* (in–house publication)
2. *The Mother of Sweet Bliss* (Amma’s Life & Teachings)

### 15MAT121 VECTOR CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS

#### Unit 1

Vector Integration: Line Integral, Line Integrals Independent of Path. Green’s Theorem in the Plane (Sections: 10.1, 10.2, 10.3, 10.4).

#### Unit 2
Surface Integral: Surfaces for Surface Integrals, Surface Integrals, Triple Integrals – Gauss Divergence Theorem, Stoke’s Theorem. (Sections: 10.5, 10.6, 10.7, 10.9)
First Order Differential Equations: First Order ODE, Exact Differential Equations and Integrating Factors (Sections 1.1 and 1.4).

**Unit 3**
Second Order Differential Equations: Homogeneous and non-homogeneous linear differential equations of second order (Review), Modelling: Free Oscillations, Euler-Cauchy Equations, Solution by Undetermined Coefficients, Solution by the Method of Variation of Parameters (Sections 2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 2.10).


**Outcomes:**

CO 1: Able to understand, and interpret the concepts.

CO 2: Able to apply the concept and understand them

CO 3: Able to understand and implement the concepts in application oriented problems.

CO 4: Able to understand and analyze the and apply the knowledge of diagonalization of matrices to transform the given quadratic form.

CO 5: Able to understand the basic concepts and apply them in modeling the first order ODEs.

CO 6: Able to understand and apply methods of undetermined coefficients and variation of parameters to solve second order ODEs.

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**TEXTBOOK:**

REFERENCE BOOKS:

15CSE102 Computer Programming 3003

Objectives:

- The course intends to familiarize the students with the structured programming paradigm.

- The course aims to provide necessary skills to students to apply the structured programming principles to solve problems

Keywords:

Contents:

Introduction to C language: Structure of a C program, comments, Data types, variables, constants, data input and output statements, input assertions; expressions and evaluation. Functions: inter function communication, standard functions, scope. Selection: two way selection, multi-way selection. Repetition: concept of loop, loop invariant, pretest and posttest loops, initialization and updating, event and counter controlled loops. Recursion: recursive definition, recurivse solution, designing recursive functions, limitations of recursion.

Files and streams, file input output, Arrays –1D numeric, searching and sorting, 2D numeric arrays, problems with matrices. Pointers: introduction, compatibility, arrays and pointers, Dynamic memory allocation, arrays of pointers, pointer arithmetic.

Strings: fixed length and variable length strings, strings and characters, string input, output, array of strings, string manipulation functions, sorting of strings. Enumerated types, Structres: structure vs array comparison, complex structures, structures and functions, Union, binary input output, command line arguments.

Outcomes:

CO1: Understand the structured programming constructs: data types (primitive and compound), control and recursion thereby to understand a given program
CO2: Understand and analyze a given program by tracing, identify coding errors and debug them

CO3: Apply structural programming constructs appropriately for given problem scenarios

CO4: Develop computer programs that implement suitable algorithms for problem scenarios and applications

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**TEXTBOOK/ REFERENCES:**


Objectives:

- To enable understanding and application of physics that govern semiconductors
- To provide fundamental knowledge on electron transport and working principles of PN junctions
- To prepare the students towards higher learning of solid state electronic devices

Keywords:

Semiconductor materials, Charge carriers, Diffusion, Diode, MOSFET

Contents:


Direct and indirect recombination - excess carrier lifetime - Steady State Carrier generation - Quasi Fermi levels - Continuity Equation - Haynes Shockley experiment - Equilibrium PN junctions - Band diagram - built in potential and electric field in space charge region - depletion width - Forward and Reverse Biased PN junction - Ideal Diode equation - Reverse bias breakdown - PN Junction diodes - MOSFET Physics - Threshold voltage - Fundamentals of BJT physics.

Outcomes:

CO1: Able to understand the fundamentals of solid state physics and quantum mechanics
CO2: Able to understand the basics and the nature of semiconducting materials
CO3: Able to apply the physics to comprehend the manifestation of charge carriers in a semiconductor
CO4: Able to describe the flow of charge in p-type and n-type semiconductors

CO5: Able to acquire and analyze the knowledge on the working principles of PN Junction-based devices

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**TEXT BOOKS/REFERENCES:**


**15ECE112 FUNDAMENTALS OF ELECTRICAL TECHNOLOGY 3104**

**Objectives:**

- To enable review of fundamental laws of electricity
• To introduce basic laws of circuit theory to do DC, transient and AC analysis
• To impart knowledge about the working of machines and instruments

Keywords:

Mesh analysis, nodal analysis, network, phase, magnetic induction

Contents:


Reactance and Impedance - Response in RLC circuits to sinusoidal voltage - Real and Reactive Power - Power factor - Complex Power and Power Triangle: Introduction to Three Phase Systems - Balanced 3-Phase STAR and DELTA connections of Load - Three phase power.


Outcomes:

CO1: Able to formulate equations of circuit and its components based on fundamental laws

CO2: Able to understand the circuit parameters in steady state and transient conditions

CO3: Able to analyse the behaviour and evaluate the circuit parameters in single-phase and three phase systems

CO4: Able to comprehend three-phase induction motor and transformer

CO5: Able to analyse the characteristics of measuring instruments
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TEXTBOOK/ REFERENCES:


15CSE180 Computer Programming Laboratory 0 0 2 1

Objectives:
• The laboratory intends to provide hands-on experience on the structured programming paradigm.
• This laboratory facilitates students to apply the structured programming principles to solve problems

Keywords:

Contents:

Solving simple problems with operators, programs on conditional control constructs, programs on loops (while, do-while and for), programs using user-defined functions and library functions, programs on files, arrays (single and multi-dimensional), programs using DMA, programs on strings, structures.

Outcomes:

CO1: Develop solutions for problems systematically using structured logic approach.

CO2: Develop computer programs for a given problem scenario.

CO3: Make use of the programming constructs effectively while developing computer programs.

CO4: Develop modular solutions for a given scenario.

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TEXT BOOKS/REFERENCES:
Behrouz A. ForouzanComputerand ScienceRichardAStructured ProgrammingF.Filberg,
Objectives:

The students will be able to deepen their understanding and further their knowledge about the different aspects of Indian culture and heritage.

Keywords:

Education, Personality, Oneness, Bhagavadgita

Contents:

Unit 1
1. Relevance of Sri Rama and Sri Krishna in this Scientific Age
2. Lessons from the Epics of India
3. Ramayana & Mahabharata

Unit 2
4. Who is a Wise Man?
5. A Ruler’s Dharma
6. The Story of King Shibi

Unit 3
7. Introduction to the Bhagavad Gita
8. Bhagavad Gita – Action without Desire

Unit 4
9. Role and Position of Women in India
10. The Awakening of Universal Motherhood

Unit 5

Patanjali’s Astanga Yoga System for Personality Refinement
11. Examples of Heroism and Patriotism in Modern India

Outcomes:

CO1: Get an overview of India and her contribution to the world in the field of science and literature

CO2: Understand the foundational concepts of ancient Indian education system and practices associated with them

CO3: Learn the important concepts of Vedas, Bhagavad-Gita and Yogasutras and their relevance to daily life

CO4: Familiarize themselves with the inspirational characters and anecdotes from the epics and Indian history

CO5: Gain a rational understanding of the underlying principles of Indian spirituality

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TEXT BOOKS/REFERENCES:

1. The Vedas - Sri ChandrasekharendraSaraswati

2. A Concise history of Science in India - D. M. Bose, S. N. Sen. B. V. Subbarayappa
Objectives:

- To enable understanding of the electromagnetic phenomena, and its relevance to electronics and communication engineering

- To introduce the concepts of electric current and fields
- To inculcate knowledge on mathematical models involved in field description and analysis
- To emphasize the role of electromagnetics in evolution of present day technology.

Keywords:

Electric field, Magnetic Field, Charge, Current, Medium, Plane Electromagnetic Wave

Contents:


Electromagnetic Fields:-Maxwell”sFaraday”s-DifferentialequationsandwIntegralof FormsInduction-Boundary Conditions for electromagnetic fields - Wave equation - Time harmonic electromagnetic fields.

Outcomes:

CO1: Able to understand basic mathematical tools required for describing and analyzing Field Effect.

CO2: Able to describe the relation between circuit parameters, field parameters, and laws governing them, in both static and time varying conditions.
CO3: Able to understand Plane Wave model and Wave –Medium Interaction.

CO4: Able to construct Plane Wave propagation Model for a medium.

CO5: Ability to analyze wave-medium interaction and interpret its relevance for that particular electrical engineering application.

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**TEXT**

**BOOKS/REFERENCES:**


**15ECE202 Digital Circuits And Systems 3 1 0 4**

**Objectives:**

- To introduce the fundamentals of Boolean Logic and the building blocks of digital circuits
• To enable understanding of abstraction of simple practical problems into Boolean Logic and their efficient implementation

• To impart fundamental knowledge of design with combinational and sequential subsystems

Keywords:

Boolean Logic, Boolean Minimization, Combinational and Sequential Circuits

Contents:


Outcomes:

CO1: Able to understand the basics of Boolean logic and the number system and codes for representing Boolean variables.

CO2: Able to frame Boolean equations and truth tables for formalizing real-life phenomena

CO3: Able to apply the basics of Boolean logic and the number system and codes for representing Boolean variables.
CO4: Able to comprehend the design and working of basic combinational and sequential subsystems
CO5: Able to analyze and design sequential systems with minimal functionality

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**REFERENCES:**


**15ECE 203 NETWORK THEORY 3 0 0 3**

Pre Requisite(s): Nil

Objectives:

- To enable review of the concepts of mesh and nodal analysis
• To introduce the different network theorems for DC and AC analysis
• To introduce transient analysis of first order and second order circuits
• To impart knowledge on basic concepts of filters and filter design

Keywords:
Mesh analysis, nodal analysis, network theorems, network parameters.

Contents:

Transient Analysis:


Outcomes:
CO1: Able to understand the basic concepts of DC and AC networks.
CO2: Able to formulate and analyze the network equations.
CO3: Able to analyze electrical networks under steady state and transient conditions.
CO4: Able to design and analyze passive filter circuits.
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### 15ECE204 SIGNAL PROCESSING I 3 1 0 4

**Objectives:**

- To introduce signal characterization in time domain
- To give exposure to frequency domain analysis of signals
- To provide insight to analysis of systems in time and frequency domains

Keywords:

Signal classification, System characterization, Transform analysis

Contents:

Introduction: Integrated approach for continuous-, discrete-time cases.

Signals: Classification of signals, continuous –discrete time; even/odd signals, periodic/nonperiodic signals, deterministic/random signals, energy/power signals: Basic operations on signals: Basic (continuous/discrete) signals –unit step, unit impulse, sinusoidal and complex exponential signals etc. Systems (continuous/discrete): Representation, classification –linear/nonlinear, causal/ noncausal, time invariant/time variant, with/without memory - BIBO stability, feedback systems. LTI system response of LTI system - convolution, properties (continuous/ discrete) - LTI systems –differential/difference equation representation.


Outcomes:

CO1: To understand time-domain characteristics of signals

CO2: To apply transform techniques to analyze signals

CO3: To apply time and frequency domain techniques for determining system response
CO4: To analyze behaviour of linear time invariant systems

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REFERENCES:


15MAT202 Linear Algebra 2 1 0 3
(Pre-Requisite: Nil)

Objectives:

- Understand real vector spaces and subspaces and apply their properties.
- Understand linear independence and dependence.
- Find the basis and dimension of a vector space, and understand the change of basis.
• Find a basis for the row space, column space and null space of a matrix and find the rank and nullity of a matrix.
• Compute linear transformations, kernel and range, and inverse linear transformations, and find matrices of general linear transformations.
• Find the dimension of spaces such as those associated with matrices and linear transformations.
• Find eigenvalues and eigenvectors and use them in applications.
• Diagonalize, and orthogonally diagonalize symmetric matrices
• Evaluate the dot product, norm, the angle between vectors, and orthogonality of two vectors in $\mathbb{R}^n$.

• Compute inner products on a real vector space and compute angle and orthogonality in inner product spaces.
• Create orthogonal and orthonormal bases: Gram-Schmidt process and use bases and orthonormal bases to solve application problems.

Keywords:
Vector space, sub-space, linear independence, linear dependence, orthogonality.

Contents:


Linear Transformations: Positive definite matrices - Matrix norm and condition number - QR-Decomposition - Linear transformation - Relation between matrices and linear transformations - Kernel and range of a linear transformation - Change of basis - Nilpotent transformations - Similarity of linear transformations - Diagonalisation and its applications - Jordan form and rational canonical form.

Outcomes:

CO1: Understand the basic concepts of vector spaces, subspaces, linear independence, span, basis and dimension and analyze such properties on the given set.

CO2: Understand the concept of inner products and apply it to define the notion of length, distance, angle, orthogonality, orthogonal complement, orthogonal projection, orthonormalization and apply these ideas to obtain least square solution.
CO3: Understand the concept of linear transformations, the relation between matrices and linear transformations, kernel, range and apply it to change the basis, to get the QR decomposition, and to transform the given matrix to diagonal/Jordan canonical form.

CO4: Understand the concept of positive definiteness, matrix norm and condition number for a given square matrix.

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15ECE281 Digital Circuits and Systems Lab 0 0 2 1

**Objectives:**

- To introduce digital components and ICs used as building blocks for realizing larger systems
• To introduce realization and troubleshooting of simple digital circuits using logic gate ICs on the breadboard and verify their truth tables

• To impart knowledge on the use of off-the-shelf components by appropriately configuring them with the help of datasheets for realizing circuits to solve engineering problems

Keywords:

Digital Logic ICs, Boolean Logic Implementation, Digital Circuit Implementation with MSI ICs

Contents:

• Study of Logic Gate ICs
• Realization of Boolean functions using logic gate ICs
• Truth table based design and implementation of simple real-life problems
• Implementation of digital systems using MSI building blocks such as adders, multiplexers and decoders
• Breadboard realization of synchronous sequential circuits
• Digital system design and implementation for a real-life problem

Outcomes:

CO 1: Able to identify, configure and use off the shelf digital components

CO 2: Able to realize and troubleshoot combinational and sequential digital circuits

CO 3: Able to employ MSI ICs of appropriate configuration for realizing a digital system

CO 4: Able to design and implement small digital system for a real-life problem

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Objectives:

- To introduce time and frequency domain analysis of signals and systems
- To inculcate concepts for characterizing systems
- To develop skill set towards visualization of signal processing

Contents:

1. Representation of Sinusoidal Signals and Spectrum.
2. Basic operations on signal.
3. LTI systems – convolutions.
4. Fourier Series Representation of Periodic signals.
5. Continuous time Fourier Transforms
6. Discrete time Fourier Transforms
8. Sampling.
9. Term Project.

Outcomes:

CO1: Able to understand the time and frequency domain representation of signals

CO2: Able to apply various transforms for analyzing signals

CO3: Able to analyze linear time invariant systems

CO4: Able to visualize signal processing for basic applications
Amrita University's Amrita Values Programme (AVP) is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Students shall have to register for any two of the following courses, one each in the third and fourth semesters, which may be offered by the respective school during the concerned semester.

**Courses offered under the framework of Amrita Values Programmes I and II**

**Message from Amma’s Life for the Modern World**

Amma’s messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma’s guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

**Lessons from the Ramayana**

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana
outside India – Relevance of Ramayana for modern times.

**Lessons from the Mahabharata**

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

**Lessons from the Upanishads**

Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, Satyakama Jabala, Aruni, Shvetaketu.

**Message of the Bhagavad Gita**


**Life and Message of Swami Vivekananda**

Brief Sketch of Swami Vivekananda’s Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji’s life.

**Life and Teachings of Spiritual Masters India**

Sri Rama, Sri Krishna, Sri Buddha, Adi Shankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri Ramana Maharshi, Mata Amritanandamayi Devi.

**Insights into Indian Arts and Literature**

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

**Yoga and Meditation**

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali’s Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.
**Kerala Mural Art and Painting**

Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

**Course on Organic Farming and Sustainability**

Organic farming is emerging as an important segment of human sustainability and healthy life. Haritamritam’ is an attempt to empower the youth with basic skills in tradition of organic farming and to revive the culture of growing vegetables that one consumes, without using chemicals and pesticides. Growth of Agriculture through such positive initiatives will go a long way in nation development. In Amma’s words “it is a big step in restoring the lost harmony of nature“.

**Benefits of Indian Medicinal Systems**

Indian medicinal systems are one of the most ancient in the world. Even today society continues to derive enormous benefits from the wealth of knowledge in Ayurveda of which is recognised as a viable and sustainable medicinal tradition. This course will expose students to the fundamental principles and philosophy of Ayurveda and other Indian medicinal traditions.

**Traditional Fine Arts of India**

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is ‘Unity in Diversity” and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

**Science of Worship in India**

Indian mode of worship is unique among the world civilisations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realisation of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of
civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

Outcomes:

CO1: Appreciate the significance of *Rāmāyaṇa* as an *īṭhāṣa*, and important aspects of *Bālakāṇḍa*.

CO2: Understand the family values and ideal human relationships portrayed in the *Ayodhyakāṇḍa* and *Aranyakāṇḍa* of *Rāmāyaṇa*.

CO3: Understand *dharma* and its nuances, emphasizing its applicability in an individual’s life through *Kishkindhakāṇḍa* and *Sundarakāṇḍa* of Ramayana.

CO4: Appreciate the triumph of *dharma* over *adharma* through *Yuddhakāṇḍa* of *Rāmāyaṇa*.

CO5: Appreciate the spiritual values from *Rāmāyaṇa* in resolving personal and social conflicts through varied effective presentations of important episodes of the *Rāmāyaṇa*.

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15ECE211 Electronic Circuits 3 1 0 4

(Pre-Requisite: 15ECE111 Solid State Devices)

Objectives:
To be able to use a pn junction diode in simple applications • To be able to operate a BJT in different configurations • To be able to understand the operation of a MOSFET

Keywords:
Semiconductor Diodes, Bipolar junction transistors, Field effect transistors.

Contents:

Bipolar junction transistors: Introduction - Operation of BJT - I-V characteristics of BJT. BJT Applications: BJT biasing techniques - Analysis of BJT as a switch and as an amplifier - Small signal analysis - Single stage BJT amplifiers (CE, CB, CC) - BJT high frequency models and amplifier frequency analysis.

Field effect transistors: Introduction - Device structure and operation of JFET (Junction Field Effect Transistor) and MOSFETs - I-V characteristics of JFET and MOSFET - MOSFET applications - MOSFET biasing techniques - Analysis of MOS as a switch and as an amplifier - Small signal analysis - Single stage MOS amplifiers (CS, CD, CG) MOS capacitances - MOS high frequency and model and amplifier frequency analysis.

Outcomes:

CO1: To understand the structure of a pn junction diode, its characteristics and modelling

CO2: Ability to use diodes and analyse their small signal operation

CO3: To understand the characteristics of a BJT and its operation

CO4: Understanding the biasing of a BJT and simple applications

CO5: Understanding of the structure and operation of MOSFETs

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**15ECE212 Signal Processing II**

3 1 0 4

(Pre Requisite(s):15ECE204 Signal Processing 1)

**Objectives:**

- To introduce digital filter design concepts
- To provide knowledge in efficient transforms for signal analysis
- To impart the fundamental concepts on structures for realizing filters

**Contents:**


Outcomes:

CO1: Able to understand algorithms for efficient computation of transforms

CO2: Able to design digital filters with desired characteristics

CO3: Able to comprehend structures for filter realization

CO4: Able to characterize and analyze digital systems

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REFERENCES:

15ECE213  TRANSMISSION LINES AND WAVEGUIDES  3 0 0 3

(Pre requisite: 15ECE201 Applied Electromagnetics)

Objectives:

- To enable understanding of electrical energy propagation and appreciate existence of two forms including wave and current
- To introduce mathematical models related to study of electrical energy transfer mechanism
- To enable knowledge development on parametric analysis of different energy transfer structures.

Keywords:

Poynting vector, Propagation Mode, Cut off frequency, Transmission Line, Wave guide,

Contents:

Plane Wave Theory: Plane waves in lossless and lossy media – Types of media – Skin effect – Poynting vector and group velocity – Normal incidence at conducting and dielectric boundary – Brief review of oblique incidence.


Outcomes:

CO1: Able to understand concept of Electrical Energy transfer in both Current and Field form.
CO2: Able to understand Transmission Line Model of Energy transfer

CO3: Able to understand Guided Wave model

CO4: Able to interpret the parameters and analyze the performance of a electrical energy transmission system

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**TEXTBOOK:**

**REFERENCES:**

15MAT213 Probability and Random Processes 3 1 0 4
(Pre-Requisite: Nil)

**Objectives:**

- To understand the basic concepts of probability, types of random variables and their
distribution functions.

- To study some of the standard discrete and continuous distributions and their properties.

- To study joint variation of random variables and how they depend on each other.

- To study random process, its different interpretations, classification, relation between member functions, stationarity of different levels.

- To understand meaning of ergodicity, power spectral density, relation between autocorrelation and PSD

- To study Markov chain its properties and its applications to real problems

**Keywords:**


**Contents:**

Review of probability concepts - conditional probability- Bayes theorem.

Random Variable and Distributions: Introduction to random variable –discrete and continuous random variables and its distribution functions- mathematical expectations –moment generating function and characteristic function - Binomial, Poisson, Geometric, Uniform, Exponential, Normal distribution functions (moment generating function, mean, variance and simple problems) –Chebyshev’s theorem.

Random processes: General concepts and definitions - stationarity in random processes - strict sense and wide sense stationary processes - autocorrelation and properties- special processes –Poisson points, Poisson and Gaussian processes and properties.


**Outcomes:**

CO1: Understand the basic concepts of probability and probability modeling.
CO2: Gain knowledge about statistical distributions and their properties

CO3: Know the importance of two dimensional random variables and correlation studies

CO4: Understand the basic concepts of random processes and the stationarity.

CO5: Understand the purpose of some special distributions

CO6: Gain knowledge about spectrum estimation and spectral density function

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Objectives:

- To provide exposure and knowledge on efficient transforms for signal analysis
- To enable design of digital filters using mathematical approaches
- To develop skill set for higher learning in signal processing techniques

Keywords:


Contents:

- Familiarization of Simulink
- Effects of Sampling and Aliasing
- Discrete Fourier Transform
- Properties of DFT
- Effective FFT Algorithm
- Linear Filtering using overlap add/save method
- Design of FIR Filter
- Design of IIR Filter
- Term Work

Outcomes:

CO1: Able to analyze the time domain aspects of the signals

CO2: Able to compute frequency domain transforms efficiently

CO3: Able to apply efficient techniques for digital filtering

CO4: Able to demonstrate implementation of signal processing techniques
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15ECE286 ELECTRONIC CIRCUITS LAB. 0 0 2 1

Objectives:

- To be able to efficiently use laboratory equipment
- To be able to understand the use of simple electronic devices and circuits
- To be able to prototype and troubleshoot simple electronic circuits

Keywords:

Diode, voltage regulators, amplifiers

Contents:

P-N junction Diode and Zener Diode Characterization.

Rectifier with and without filters

Clippers / Clampers
Shunt regulator

BJT Characterization

Single stage CE amplifier

**Outcomes:**

CO1: Ability to use lab equipment, datasheets and handle circuit simulation

CO2: Ability to design, analyse and implement simple diode circuits

CO3: Ability to design, analyse and implement simple BJT circuits

CO4: Ability to implement and troubleshoot simple electronic circuits

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<td>1.</td>
<td>Soft Skills: At the end of the course, the students would have developed self-confidence and positive attitude necessary to compete and challenge themselves. They would also be able to analyse and manage their emotions to face real life situations. In this context, CO#1 corresponds to PO8, PO9, PO10, PO12.</td>
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<td>2.</td>
<td>Soft Skills: At the end of the course, the students would hone their presentation skills by understanding the nuances of content creation, effective delivery, use of appropriate body language and the art of overcoming nervousness to create an impact in the minds of a target audience. In this context, CO#2 corresponds to PO9, PO10, PO12.</td>
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<td>3.</td>
<td>Aptitude: At the end of the course, the student will have acquired the ability to analyze, understand and classify questions under arithmetic, algebra and logical reasoning and solve them employing the most suitable methods. They will be able to analyze, compare and arrive at conclusions for data analysis questions. In this context, CO#3 corresponds to PO2, PO4.</td>
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<td>4.</td>
<td>Verbal: At the end of the course, the students will have the ability to dissect polysyllabic words, infer the meaning, inspect, classify, contextualise and use them effectively. In this context, CO#4 corresponds to PO10, PO12.</td>
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<td>Verbal: At the end of the course, the students will have the ability to understand the nuances of English grammar and apply them effectively. In this context, CO#5 corresponds to PO10, PO12.</td>
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<td>6.</td>
<td>Verbal: At the end of the course, the students will have the ability to identify, analyse and interpret relationship between words and use the process of elimination to arrive at the answer. They will also have the ability to judge, evaluate, summarise, criticise, present and defend their perceptions convincingly. In this context, CO#6 corresponds to PO9, PO10, PO12.</td>
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**CO-PO Mapping:**

- CO#1: PO8, PO9, PO10, PO12
- CO#2: PO9, PO10, PO12
- CO#3: PO2, PO4
- CO#4: PO10, PO12
- CO#5: PO10, PO12
- CO#6: PO9, PO10, PO12
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Soft skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. Need for change. Fears, stress and competition in the professional world.
Importance of positive attitude, self motivation and continuous knowledge upgradation.

Self-confidence: Characteristics of the person perceived, characteristics of the situation, characteristics of the perceiver. Attitude, values, motivation, emotion management, steps to like yourself, positive mental attitude, assertiveness.

Presentations: Preparations, outlining, hints for efficient practice, last minute tasks, means of effective presentation, language, gestures, posture, facial expressions, professional attire.

Vocabulary building: A brief introduction into the methods and practices of learning vocabulary. Learning how to face questions on antonyms, synonyms, spelling error, analogy, etc. Faulty comparison, wrong form of words and confused words like understanding the nuances of spelling changes and wrong use of words.

Listening skills: The importance of listening in communication and how to listen actively.

Prepositions, articles and punctuation: A experiential method of learning the uses of articles and prepositions in sentences is provided.

Problem solving level I: Number system; LCM &HCF; Divisibility test; Surds and indices; Logarithms; Ratio, proportions and variations; Partnership;

Problem solving level II: Time speed and distance; work time problems;

Data interpretation: Numerical data tables; Line graphs; Bar charts and Pie charts; Caselet forms; Mix diagrams; Geometrical diagrams and other forms of data representation.
Logical reasoning: Family tree; Deductions; Logical connectives; Binary logic; Linear arrangements; Circular and complex arrangement; Conditionalities and grouping; Sequencing and scheduling; Selections; Networks; Codes; Cubes; Venn diagram in logical reasoning; Quant based reasoning; Flaw detection; Puzzles; Cryptogrithms.

**TEXTBOOKS:**

4. The Hard Truth about Soft Skills, by Amazon Publication.
5. Quantitative Aptitude by R. S. Aggarwal, S. Chand
6. Quantitative Aptitude – Abijith Guha, TMH.
7. Quantitative Aptitude for Cat - Arun Sharma. TMH.

**REFERENCES:**

3. The BBC and British Council online resources
4. Owl Purdue University online teaching resources www.the grammarbook.com - online teaching resources
www.englishpage.com- online teaching resources and other useful websites.

**15ECE301 Communication Theory 3 1 0 4**

**Objectives:**

- To introduce the concepts of amplitude modulations and their spectral characteristics
- To provide the concepts of angle modulations and their spectral characteristics
- To enable comprehension of the effect of noise on communication systems

**Keywords:**
Amplitude modulation, Angle modulation, Spectral characteristics, Noise analysis.

**Contents:**

Introduction to analog communication system - Amplitude Modulation (AM) - Double Sideband Suppressed Carrier (DSB-SC) –Single Sideband (SSB) - Quadrature AM (QAM) - Vestigial Sideband (VSB) –Generation and demodulation of AM signal

Frequency Modulation (FM) - Phase Modulation (PM) - Bandwidth of FM signals - Generation and demodulation of FM signals –Frequency Division Multiplexing (FDM) –Super-heterodyne receiver.

Complex low pass representation of narrow band signals - Introduction to random processes - Characterization of noise - Noise analysis of analog modulation systems - Sampling theorem - Time division multiplexing.

**Outcomes:**

CO1: Able to understand the fundamental principles of signal modulation and demodulation.

CO2: Able to analyze the time domain and frequency domain representations of amplitude and angle modulated signals.

CO3: Able to analyze the effect of noise and other disturbances on analog communication systems.

CO4: Able to apply the concepts of modulation and demodulation for the design of communication systems.

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TEXT BOOKS/REFERENCES:


15ECE302 Control Systems Engineering 3 1 0 4
(Pre-Requisite: 15ECE204 Signal Processing I)

Objectives:

- To introduce the concepts in model-based design process.
- To impart knowledge on system's behavior in time and frequency domain characteristics
- To equip with the concepts of compensation for desired system characteristics.

Keywords:

Feedback, stability, closed loop, transient response.

Contents:


Design via frequency response - Transient response design via gain adjustment - Lag compensation - Lead compensation - The general state - Space representation - Applying the state-space representation - Converting a transfer function to state-space - Converting from state-space to a transfer function.

Outcomes:
CO1: Able to understand the concepts of control engineering.

CO2: Able to determine mathematical models of simple engineering systems.

CO3: Able to evaluate the performance specifications for typical control problem.

CO4: Able to design controllers from performance specifications of control systems.

CO5: Able to design a control system using CAD tools and prepare a report.

CO –PO Mapping:

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REFERENCES:

15ECE303  LINEAR INTEGRATED CIRCUITS  3 0 0 3
(Pre-requisite: 15ECE211 Electronic Circuits)

Objectives

- To be able to design and analyse BJT amplifiers, with and without feedback
- To be able to use operational amplifiers as a building block for circuit design
- To be able to design and analyse both linear and non-linear circuits, using operational amplifiers

Keywords:

Operation amplifier, negative feedback, linear circuits, nonlinear circuits, timers, signal generators

Contents:


Outcomes:
CO1: Ability to determine the frequency response of amplifiers

CO2: Ability to understand negative feedback and its impact on amplifier performance

CO3: Ability to understand and interpret opamp characteristics

CO4: Ability to design and analyse linear and non-linear circuits, using opamps

CO5: Ability to use simulation tools to analyse and understand electronic circuits

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TEXTBOOK:


REFERENCES:

4. Application Notes and Data Sheets of ICs from various manufacturers.
15ECE304 Microprocessor and Microcontroller 3104
(Pre-requisite: 15ECE202 Digital Circuits and Systems)

Objectives:

- To introduce basics of Microprocessors
- To provide an overview of functioning of a Microprocessor
- To introduce RISC processor(s) family and their operation
- To introduce pipelining and its impact on performance

Keywords:

8085 Microprocessor, Instructions, ARM, Pipelining.

Contents:


Outcomes:

CO 1: Able to identify the importance of a Microprocessor/Microcontroller
CO 2: Able to understand processor architectures

CO 3: Able to analyse Peripherals and their programming aspects.

CO 4: Able to design and develop embedded systems using microcontroller.

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**TEXTBOOKS:**


**REFERENCES:**

Objectives:

- To understand modeling of Optimization Problems
- To learn non-linear Optimization methods
- To understand the Optimality criteria for functions in several variables
- To learn to apply OT methods like Undirectional search and Direct search methods.
- To learn constrained optimization techniques

Keywords:

Optimization algorithms, Constrained Optimization, unidirectional search methods, Unconstrained Optimization

Contents:

Optimization - optimal problem formulation, engineering optimization problems, optimization algorithms, numerical search for optimal solution.

Optimality criteria, bracketing methods - exhaustive search method, bounding phase method- region elimination methods - interval halving, Fibonacci search, golden section search, point estimation method- successive quadratic search, gradient based methods.

Optimality criteria, unconstrained optimization - solution by direct substitution, unidirectional search – direct search methods evolutionary search method, simplex search method, Hook-Jeeves pattern search method,


Outcomes:

CO1: Understand different types of Optimization Techniques in engineering problems. Learn Optimization methods such as Bracketing methods, Region elimination methods, Point estimation methods

CO2: Learn gradient based Optimizations Techniques in single variables as well as
multivariables (non-linear).

CO3: Understand the Optimality criteria for functions in several variables and learn to apply OT methods like Undirectional search and Direct search methods.

CO4: Learn constrained optimization techniques. Learn to verify Kuhn-Tucker conditions and Lagrangian Method.

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TEXT BOOKS/REFERENCES:


Objectives:

- To familiarize with the usage of electronic instruments.
• To introduce the characteristics of transistors and operational amplifiers.
• To familiarize the design concepts for linear and non-linear circuits.

Keywords:

Negative feedback, Op-amp, Amplitude modulation, Frequency modulation.

Contents:

Electronic circuits

• Current mirror
• Amplifier using current biasing
• Op-Amp characterization
• Inverting and Non-inverting Amplifier
• Integrator, Differentiators
• Schmitt trigger
• Astable multivibrator using 555 Timer Communication
• Standard Amplitude Modulation and Demodulation
• Generation of Double Side Band –Suppressed Carrier using Balanced Ring Modulator
• Synchronous Detector
• Generation of Single Side Band wave
• Transistor Mixer
• Intermediate Frequency Amplifier
• Frequency Modulation
• Pre-emphasis and De-emphasis

Outcomes:

CO1: Able to design transistor-based amplifier circuits.

CO2: Able to design circuits with operational amplifiers.

CO3: Able to design and analyze electronic circuits for analog communication systems.

CO4: Able to design and analyze circuits for modulation techniques.

CO –PO Mapping:
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**TEXTBOOKS/REFERENCES:**


3. Neamen D A, “*Electronic circuit analysis and design*”, McGraw-Hill,


**15ECE382 MICROCONTROLLER LAB 0021**

**Objectives:**

- To familiarize with microprocessor simulator

- To learn keil C simulator to implement arithmetic and logical operations and by interfacing peripherals

**Keywords:**
Arithmetic and logical operations, interfacing, indirect addressing

Contents:

• ARM Assembly program for Arithmetic and Logical Operations
• ARM Assembly program for Multi-Byte Operations
• ARM Assembly program for Control Manipulation
• ARM Assembly program for String Manipulation
• ARM Assembly program for Thumb Instructions
• Embedded C Programming using Keil Simulator
  
a. Simple C Programs  
b. Port Programming  
c. Peripheral Interfacing – Keypad, Motor, LED etc.

Outcomes:

CO1: Able to implement arithmetic and logical functions in assembly language using microprocessor simulator

CO2: Able to implement array operations using microprocessor simulator

CO3: Able to familiarize with Keil C software to program RISC processor

CO4: Able to perform peripheral interfacing

CO – PO Mapping:

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<td>1.</td>
<td>Soft Skills: At the end of the course, the students will have the ability to communicate convincingly and negotiate diplomatically while working in a team to arrive at a win-win situation. They would further develop their inter-personal and leadership skills.</td>
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<td>Soft Skills: At the end of the course, the students shall learn to examine the context of a Group Discussion topic and develop new perspectives and ideas through brainstorming and arrive at a consensus.</td>
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<td>Aptitude: At the end of the course, students will be able to identify, recall and arrive at appropriate strategies to solve questions on geometry. They will be able to investigate, interpret and select suitable methods to solve questions on arithmetic, probability and combinatorics.</td>
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<td>Verbal: At the end of the course, the students will have the ability to relate, choose, conclude and determine the usage of right vocabulary.</td>
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<td>Verbal: At the end of the course, the students will have the ability to utilise prior knowledge of grammar to recognise structural instabilities and modify them.</td>
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<td>6.</td>
<td>Verbal: At the end of the course, the students will have the ability to comprehend, interpret, deduce and logically categorise words, phrases and sentences. They will also have the ability to theorise, discuss, elaborate, criticise and defend their ideas.</td>
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Group discussions: Advantages of group discussions, structured GD – roles, negative roles to be avoided, personality traits to do well in a GD, initiation techniques, how to perform in a group discussion, summarization techniques.

Listening comprehension advanced: Exercise on improving listening skills, grammar basics: Topics like clauses, punctuation, capitalization, number agreement, pronouns, tenses etc.

Reading comprehension advanced: A course on how to approach middle level reading comprehension passages.

Problem solving level III: Money related problems; Mixtures; Symbol based problems; Clocks and calendars; Simple, linear, quadratic and polynomial equations; special equations; Inequalities; Functions and graphs; Sequence and series; Set theory; Permutations and combinations; Probability; Statistics.

Data sufficiency: Concepts and problem solving.

Non-verbal reasoning and simple engineering aptitude: Mirror image; Water image; Paper folding; Paper cutting; Grouping of figures; Figure formation and analysis; Completion of incomplete pattern; Figure matrix; Miscellaneous.
Spacial aptitude: Cloth, leather, 2D and 3D objects, coin, match sticks, stubs, chalk, chess board, land and geodesic problems etc., related problems.

**TEXTBOOKS:**

5. Quick Maths – Tyra.
6. Quicker Arithmetic – Ashish Aggarwal
7. Test of reasoning for competitive examinations by Thorpe.E. TMH
8. Non-verbal reasoning by R. S. Aggarwal, S. Chand

**REFERENCES:**

3. The BBC and British Council online resources
4. Owl Purdue University online teaching resources

www.the grammarbook.com - online teaching resources  www.englishpage.com- online teaching resources and other useful websites.

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**15LIV390**

**LIVE-IN-LABS® I**

**3 0 0 3**

**Objectives:**

- Understand the principles of Human Centered Design, Participatory Rural Appraisal, Sustainable Change Agents, Ethnographic Action Research and User Need Assessment.

- Learn the various tools, techniques and templates used in the mentioned concepts to identify the challenges in the villages.
• Design a sustainable technological intervention for the identified challenge.

Contents:

Participatory Rural Appraisal (PRA)

Concept, Principles and Philosophy of PRA. Scope and Dimensions of PRA. Important Tools for PRA. Application of PRA.

Human Centered Design I (HCD)


Sustainable Social Change

Case Study. Introduction. Understanding and identifying the Community Communication Channels

Outcomes:

CO1: Using Human Centered Design Concepts to document observations and user experiences

CO2: Identify and Analyze various Challenge Indicators in the village using Participatory Rural Appraisal

CO3: Selection of one Challenge that needs to be solved

CO4: Preparing Field Journal to document the observations, interviews, measurements etc.

CO5: Recording ideas, personal thoughts and experiences as well as reflections and insights through Reflective Journal

CO6: Identify and Analyze the Social Structure, Social Change Agents, etc., to implement Sustainable Social Change Models

CO7: Collating and Analyzing Current Government Policies applicable for the rural India

CO8: Quantitative and Qualitative Data Collection, Representation and Analysis for problem identification

CO9: User Needs Assessment and Prioritization

CO10: Design a Technical Solution using Human Centered Design Concepts
CO11: Report Generation

CO12: Research Paper Submission

CO13: Poster Presentation

**CO-PO Mapping:**

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1 – Substantial; 2 – Moderate; 3 – Strong
TEXT BOOKS/ REFERENCES:

There are no required textbooks for this course; all articles, reports and research papers assigned as required reading will be shared with the students by Live-in-Labs® faculties.


15ECE311 Data Communication and Networks 3 0 0 3

Objectives:

• Provide in-depth understanding of the fundamental networking principles and implementation issues
encountered in designing practical network protocols at Internet scale.

- Teach the techniques for analyzing the performance of network protocols and system architectural design choices.

- Connect networking principles with the actual implementation details as found in networking standards currently used in practice.
- Provide hands-on experience by simulating the network protocols.

**Keywords:**

Topologies, layering, protocols, services, switching, routing.

**Contents:**


**Outcomes:**

CO1: Able to understand the fundamental networking principles and protocol concepts.

CO2: Able to apply networking principles behind practical network protocols used in the Internet.

CO3: Able to analyze the performance of network protocols and system architectural design choices.

CO4: Able to simulate and monitor the performance of standard networking protocols.

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TEXTBOOKS/REFERENCES:


15ECE312 Digital Communication 3 1 0 4

(Prerequisite: 15ECE301 Communication Theory)

Objectives:
- Introduce the fundamental principles of digital modulation and demodulation methods.
- To make understand the importance of quantifying the impact of noise and channel impairments on digitally modulated signals.
- Provide the importance of optimum transmitter and receiver design.

Keywords:
Waveform coding, Binary modulation, M-ary modulation, Baseband modulation, Carrier modulation.

Contents:


Digital Transmission through band limited channels – Signal design for band limited channels – Probability of error for detection of digital PAM – System design in the presence of channel distortion.


Outcomes:

CO1: Able to understand the concepts of waveform coding schemes

CO2: Able to design and analyze various modulation techniques

CO3: Able to design and analyze optimum transmitter and receiver for baseband additive white Gaussian noise channel

CO4: Able to exhibit the competency in the design of digital communication systems

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TEXTBOOKS/REFERENCES:


15ECE313 VLSI Design 3 0 0 3
(Pre-Requisite: 15ECE202 Digital circuits and systems)

Objectives:

• To introduce the physics of MOSFET devices and MOS layouts

• To impart knowledge on static, transient and dynamic responses of basic CMOS gates

• To enable understanding of different MOSFET networks and their characteristics

Keywords:

MOSFETs, Fabrication, Layout, CMOS switching, logic arrays, inverter chain, sizing of chain of logic BiCMOS

Contents:

An Overview of VLSI - Basic Concepts of VLSI, Design, MOSFETs - Basic Physics, I-V Characteristics and models, Threshold voltage, MOSFETs as switches, pass transistors and transmission gates, Fabrication of CMOS Circuits, CMOS Fabrication, NMOS and CMOS Physical layouts and stick diagrams.
Analysis of MOS logic Gates - DC Switching characteristics and transient response of CMOS Inverters, NAND and NOR gates transient response, Unit size transistor, inverter, Scaling of Transistor, inverter, NAND, NOR.

Designing High speed CMOS Logic Networks - Gate delays, Driving Large capacitive load, Logical Effort, BiCMOS drivers, Clocking and data flow control – advanced techniques in CMOS logic circuits: Mirror Circuits, Pseudo- NMOS, Tri state circuits, clocked CMOS, Dynamic CMOS logic circuits, dual-rail logic networks

Outcomes:
CO 1: Able to understand physics of MOSFET devices
CO 2: Able to realize simple MOS networks and their layout
CO 3: Able to analyze static and dynamic behavior of basic MOS gates
CO 4: Able to analyze the impact of area-delay trade-off in design of MOS networks

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TEXT BOOKS/REFERENCES:


15ECE314 Computer System Architecture 3 0 0 3
(Pre-Requisite: 15ECE202 Digital circuits and systems)

Objectives:

- To introduce the basic organization of a computer system.
- To introduce the functioning of data path and control path elements in a processor.
- To impart understanding of the memory organization of a processor system.
- To familiarize the input-output operations in a processor system.

Keywords:

Computer System, Computer Arithmetic, Memory Organization, Input-Output System

Contents:

Introduction to computer system - Brief history of computer systems - Fixed point arithmetic –Addition –Subtraction - Multiplication and division - Booth”s - algorithmNon-restoringdivision algorithm - Floating point arithmetic. Various addressing modes and designing of an Instruction set.

Data path and controller design - Introduction to CPU design - Processor organization - Execution of complete instruction - Design of control unit - Microprogrammed control unit.
Memory and system organization - Concepts of semiconductor memory - CPU-memory interaction - Organization of memory modules - Cache memory and related mapping and replacement policies - Virtual memory. Introduction to input/output processing: Programmed controlled I/O transfer - Interrupt controlled I/O transfer DMA - Secondary storage and type of storage devices - Introduction to buses - Introduction to RISC and CISC paradigm - Design issues of a RISC processor and example of an existing RISC processor - Introduction to pipelining.

Outcomes:
CO 1: Able to comprehend operations and arithmetic of computer systems.

CO 2: Able to identify data-path and control-path operations involved in the execution of an instruction.

CO 3: Able to analyse the CPU, memory and IO architecture of a processor at the system level.

CO 4: Able to analyse the trade-offs involved in the CPU and memory organization of a processor system.

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TEXT BOOKS/REFERENCES:


Objectives:

- Familiarize the concepts of base band and pass band communication techniques.
- Familiarize the concepts of communication techniques through simulation.

Keywords:

Base band Modulation, Pass Band Modulation

Contents

1. Pulse Amplitude Modulation and Demodulation
2. Pulse Position Modulation
3. Pulse Width Modulation
4. Amplitude Shift Keying Modulation and Demodulation
5. Frequency Shift Keying
6. Phase Shift Keying
7. Time Division Multiplexing
8. Sampling and Quantization using Matlab.
9. Gram Schmidt orthogonalization for vectors using Matlab

Outcomes:
CO1: Able to design electronic circuits for communication systems

CO2: Able to design and analyze base band modulation schemes

CO3: Able to design and analyze pass band modulation schemes

CO4: Able to analyze concepts of communication techniques using simulation tools

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**TEXTBOOKS/REFERENCES:**


15ECE386 VLSI Design Lab 0 0 2 1

**Objectives:**
To introduce modelling of digital logic in HDL
To introduce implementation of combinational and sequential circuits in FPGA
To introduce modelling of MOS circuits in Spice

**Keywords:**
Combinational circuits, sequential circuits, VHDL, FPGA, SPICE, netlist, MOS models

**Contents:**
1. Design of Adder – Ripple carry adder in V HDL
2. Design of Hierarchical decoder, multiplexer
3. Design of flip flops
4. Design of counters
5. FPGA implementation of adders
6. FPGA implementation of Counters
7. NMOS, PMOS, Forward and Transfer characteristics
8. Study of W/L ratio on NMOS and PMOS forward and transfer characteristics
9. CMOS inverter in SPICE
10. On time off time variation with W/L for 2, 3 input NAND gate

**Outcomes:**
CO1: Able to model digital circuits using HDL
CO2: Able to realize simple hardware in FPGA
CO3: Able to analyze NMOS and PMOS characteristics in SPICE

CO4: Able to analyze basic digital gates in SPICE

**CO-PO Mapping:**

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**TEXT BOOKS/REFERENCES:**


Objectives:

- To enable hands-on experience in the electronics hardware domain
- To enable development of skill set for designing and realizing prototype electronic systems

Keywords:

Simulation, Hardware, Design.

Outcomes:

CO 1: Able to conduct literature survey to identify an application oriented research problem
CO 2: Able to design and validate the proposed system using simulation
CO 3: Able to prototype the proposed system
CO 4: Able to analyze the obtained results and prepare a technical report

CO –PO Mapping:

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<td>1.</td>
<td>Soft Skills: At the end of the course, the students will have the ability to prepare a suitable resume (including video resume). They would also have acquired the necessary skills, abilities and knowledge to present themselves confidently. They would be sure-footed in introducing themselves and facing interviews.</td>
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<td>Soft Skills: At the end of the course, the students will have the ability to analyse every question asked by the interviewer, compose correct responses and respond in the right manner to justify and convince the interviewer of one”s right ca positive attitude and courteous communication.</td>
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<td>Aptitude: At the end of the course, students will be able to interpret, critically analyze and solve logical reasoning questions. They will have acquired the skills to manage time while applying methods to solve questions on arithmetic, algebra, logical reasoning, and statistics and data analysis and arrive at appropriate conclusions.</td>
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<td>Verbal: At the end of the course, the students will have the ability to understand and use words, idioms and phrases, interpret the meaning of standard expressions and compose sentences using the same.</td>
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<td>Verbal: At the end of the course, the students will have the ability to decide, conclude, identify and choose the right grammatical construction.</td>
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<td>6.</td>
<td>Verbal: At the end of the course, the students will have the ability to examine, interpret and investigate arguments, use inductive and deductive reasoning to support, defend, prove or disprove them. They will also have the ability to create, generate and relate facts / ideas / opinions and share / express the same convincingly to the audience/ recipient using their communication skills in English.</td>
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**CO-PO Mapping:**

1. **CO1**: PO9, PO10, PO12
2. **CO2**: PO8, PO9, PO10, PO12
3. **CO3**: PO2, PO4
4. **CO4**: PO10, PO12
5. **CO5**: PO10, PO12
6. **CO6**: PO9, PO10, PO12
Team work: Value of team work in organisations, definition of a team, why team, elements of leadership, disadvantages of a team, stages of team formation. Group development activities: Orientation, internal problem solving, growth and productivity, evaluation and control. Effective team building: Basics of team building, teamwork parameters, roles, empowerment, communication, effective team working, team effectiveness criteria, common characteristics of effective teams, factors affecting team effectiveness, personal characteristics of members, team structure, team process, team outcomes.

Facing an interview: Foundation in core subject, industry orientation/knowledge about the company professional personality, communication skills, activities before interview, upon entering interview room, during the interview and at the end. Mock interviews.

Advanced grammar: Topics like parallel construction, dangling modifiers, active and passive voices, etc.

Syllogisms, critical reasoning: A course on verbal reasoning. Listening comprehension advanced: An exercise on improving listening skills.

Reading comprehension advanced: A course on how to approach advanced level of reading, comprehension passages. Exercises on competitive exam questions.

Problem solving level IV: Geometry; Trigonometry; Heights and distances; Co-ordinate geometry; Mensuration.

Specific training: Solving campus recruitment papers, national level and state level competitive examination papers; Speed mathematics; Tackling aptitude problems asked in interview; Techniques to remember (In mathematics). Lateral thinking problems. Quick checking of answers techniques; Techniques on elimination of options, estimating and predicting correct answer; Time management in aptitude tests; Test taking
strategies.

TEXTBOOKS:

4. The Hard Truth about Soft Skills, by Amazon Publication.
5. Data Interpretation by R. S. Aggarwal, S. Chand
6. Logical Reasoning and Data Interpretation – Niskit K Sinkha
7. Puzzles – Shakuntala Devi

REFERENCES:

3. The BBC and British Council online resources
4. Owl Purdue University online teaching resources www.the grammarbook.com - online teaching resources www.englishpage.com- online teaching resources and other useful websites.

15ECE401 Information Theory and Coding Techniques 3 1 0 4
(Pre-Requisite: 15ECE301 Communication Theory)

Objectives:

- Introduce fundamentals of information theory and analyze the fundamental limits of communication systems.
• Provide an insight of Galois fields and primitive polynomials.

• Introduce traditional and modern coding theory and analyze the performance of different channel coding algorithm.

**Keywords:**

Entropy, Source coding, Channel model, Linear Block Codes, Convolutional codes, Viterbi decoding

**Contents:**


**Outcomes:**

CO1: Able to understand the fundamentals of Information theory

CO2: Able to analyze the basic types of codes and understand the source coding algorithms

CO3: Able to derive the channel capacity of communication channel models

CO4: Able to understand the encoding and decoding technique for channel coding

CO5: Able to carry out implementation of different source coding and channel coding algorithms

**CO – PO Mapping:**

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**TEXTBOOKS/REFERENCES:**


Objectives:

- To introduce the principle of operation of radio frequency devices and circuits
- To provide knowledge on device performance using scattering parameters
- To introduce the concepts of wireless communication system
- To provide exposure on RF technologies used in application(s)

Keywords:

S-Parameter, Microwave device, Noise, Radio system.

Contents:


Radio Frequency Systems: Noise in RF Systems – Dynamic Range – Noise Equivalent Temperature – Noise Figure – Noise Figure of Cascaded System – Antenna Parameters – Gain – Directivity – Efficiency – Bandwidth


Outcomes:

CO1: Able to understand the significance and analytical approaches to the unique engineering issues at radio frequencies.

CO2: Able to demonstrate the design concept of waveguide-based passive and active devices in terms of their theoretical formulation

CO3: Able to estimate and measure the effects of noise in radio frequency systems

CO4: Able to understand the design specifications and parameters of antennas in RF communication
systems.

**CO-PO Mapping:**

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**TEXTBOOK:**


**REFERENCES:**


15ENV300  ENVIRONMENTAL SCIENCE AND SUSTAINABILITY  3 0 0 3

**Unit 1**

State of Environment and Unsustainability, Need for Sustainable Development, Traditional conservation systems in India, People in Environment, Need for an attitudinal change and ethics, Need for Environmental Education, Overview of International Treaties and Conventions, Overview of Legal and Regulatory Frameworks.
Environment: Abiotic and biotic factors, Segments of the Environment, Biogeochemical Cycles, Ecosystems (associations, community adaptations, ecological succession, Food webs, Food chain, ecological pyramids), Types of Ecosystems – Terrestrial ecosystems, Ecosystem Services, Economic value of ecosystem services, Threats to ecosystems and conservation strategies.

Biodiversity: Species, Genetic & Ecosystem Diversity, Origin of life and significance of biodiversity, Value of Biodiversity, Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation (Hotspots) & Protected Area Network, Community Biodiversity Registers. Threats to Biodiversity, Red Data book, Rare, Endangered and Endemic Species of India. Conservation of Biodiversity. People’s action.

Impacts, causes, effects, control measures, international, legal and regulatory frameworks of: Climate Change, Ozone depletion, Air pollution, Water pollution, Noise pollution, Soil / land degradation / pollution

Unit 2

Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology. Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.

Discuss the interrelation of environmental issues with social issues such as: Population, Illiteracy, Poverty, Gender equality, Class discrimination, Social impacts of development on the poor and tribal communities, Conservation movements: people’s movements and activism, Indigenous knowledge systems and traditions of conservation.

Unit 3


Global and national state of housing and shelter, Urbanization, Effects of unplanned development case studies, Impacts of the building and road construction industry on the environment, Eco-homes / Green buildings, Sustainable communities, Sustainable Cities.

Ethical issues related to resource consumption, Intergenerational ethics, Need for investigation and resolution of the root cause of unsustainability, Traditional value systems of India, Significance of holistic value-based education for true sustainability.
Outcomes:

CO1: Integrate facts and concepts from ecological, physical and social sciences to characterize some common socio-environmental problems.

CO2: Develop simple integrated systems and frameworks for solving common interconnected socio-environmental problems.

CO3: Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

CO4: Identify the ethical underpinnings of socio-environmental issues in general.

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15ECE481  Microwave Engineering Lab  0021

Objectives:

- To provide exposure to the operating characteristics of microwave components.
- To introduce hands-on training on electromagnetic propagation using microwave sources at X band
- To provide a knowledge on design of various microwave circuits using microwave simulator

Keywords:

Klystron oscillator, Slotted line, Circulator, Directional coupler, Magic Tee

Content:

1) Study of characteristics of Klystron calibration

2) Study the Rectangular waveguide and mode characteristics.

3) Measurement of Guided wavelength and impedance of unknown device using slotted line section.

4) Antenna Measurements

5) A. Characterization of Circulator

B. Microwave Characterization of Materials employing circulator

6) Characterization of Directional coupler

7) Characterization of E-plane, H-plane and Magic Tee using HFSS software

Outcomes:

CO1: Able to demonstrate the characteristics of Microwave source

CO2: Able to measure and analyze the characteristics of microwave components

CO3: Able to measure and analyze the radiation pattern and antenna gain
CO4: Able to design and analyze the waveguide characteristics using microwave simulator

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15ECE495 Project Phase 1 0 0 0 2

**Objectives:**

- To introduce research methodologies focused to engineering problems
- To inculcate ethical principles of research
- To enable development of oral and technical writing skills
- To enable advancement of independent thinking and higher learning skills

**Keywords:**

Literature, simulation tools, hardware, research, communication, technical report

**Outcomes:**

CO1: Able to exhibit the research aptitude for identification of contemporary engineering problems

CO2: Able to determine appropriate scientific approaches to the given problem

CO3: Able to perform the experimental / simulation approaches for preliminary results
CO4: Able to demonstrate communication skills via oral presentation and technical report.

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15LIV490 LIVE-IN-LABS® II L-T-P-C: 3-0-0-3

Pre Requisite(s):

1. Students can enrol for Live-in-Labs® II course only if they have successfully completed Live-in-Labs® I course by meeting all the criteria set by the Live-in-Labs® team.

Objectives:

- Understand the principles of
  a. Advanced Human Centered Design
  b. Co-Design
  c. Social Change Management Models
  d. Project Management
  e. Prototyping
  f. Modelling
g. Field Implementation.

- Learn the various tools, techniques and templates used in the mentioned concepts to implement a sustainable intervention in the villages.
- Creating awareness and training the villagers.

Contents:

Co-design


Project Management


Human Centered Design II (HCD)

Design Process. Design evaluation. Design implementation

Outcomes:

CO1: Presenting Proposed Technological Implementation in the respective villages

CO2: Proposal Submission

CO3: Implement the process of Co-design along with the villagers to identify the right design for implementation

CO4: Understanding and Implementing Project Management

CO5: Developing, analysing and testing a Prototype

CO6: Real time Implementation of a feasible, affordable, sustainable and efficient model

CO7: Generating Awareness and Training Users to adopt and use the Intervention
CO8: Practical Application of the theories learnt

CO9: Report Generation

CO10: Research Paper Submission

CO11: Poster Presentation

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1 – Substantial; 2 – Moderate; 3 – Strong
TEXT BOOKS/ REFERENCES:

There are no required textbooks for this course; all articles, reports and research papers assigned as required reading will be shared with the students by Live-in-Labs® faculties.


15ECE499 PROJECT PHASE II 10cr

Objectives:

• To introduce research methodologies focused to engineering problems
• To inculcate ethical principles of research
• To enable development of oral and technical writing skills
• To enable advancement of independent thinking and higher learning skills

**Keywords:**

Literature, simulation tools, hardware, research, communication, technical report

**Outcomes:**

CO1: Able to identify and adopt complementary research methods

CO2: Able to implement the experimental / simulation approaches

CO3: Able to perform data acquisition, interpretation and analysis

CO4: Able to demonstrate communication skills via oral presentation and technical report.

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**15ECE367 Hardware Security and Trust 3 0 0 3**

(Pre-Requisite: 15ECE202 Digital circuits and systems)

**Objectives:**

To introduce Hardware Trojan architectures
To impart knowledge of Trojan insertion methods and detection approaches at various level of abstraction
To introduce VLSI design flow incorporating trust at different levels

**Keywords:**

Hardware Security, Trusted Design, Hardware Trojans

**Contents:**

Review of VLSI Design Flow - Hardware Trojan –Trojan taxonomy - Case study - Trojan detection – Classification of Trojan detection - Challenges in Trojan detection.

Design for hardware trust –Delay based methods –Shadow registers –Ring oscillators - Dummy scan Flip-Flop insertion - Trojan activation time analysis - Trojan detection and isolation flow –Architectural approaches

Security and testing –Scan-based testing –Scan-based attacks and counter measures - System-on-chip test infrastructure - Emerging areas of test security. Trojan prevention: Built-in self authentication - BISA structure and insertion flow - Analyzing BISA structure - Trusted design in FPGAs.

**Outcomes:**

CO 1: Able to describe and identify typical hardware security vulnerabilities at various phases of VLSI Design flow

CO 2: Able to understand fundamental approaches used in Trojan insertion,

CO 3: Able to understand different approaches for Trojan and Piracy detection and analysis

CO 4: Able to identify ways in which trust can be incorporated in VLSI Design flow

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TEXTBOOK:


REFERENCE:


15ECE356 Satellite Communication 3 0 0 3
(Pre-requisite:15ECE301 Communication Theory)

Objectives:

• To introduce the concepts of orbital mechanics for satellite communication.

• To familiarize different satellite system parameters and preparation of the link budget.

• To provide an acquaintance of different subsystems in communication satellites.

• To familiarize different applications of satellite communication.

Keywords:

Orbital mechanics, link budget, subsystems, multiple access.

Contents:

Review of Microwave Communications - Overview of satellite communications - Satellite orbits - Orbital mechanics and effects - Kepler’s-Configurationslawsof various orbits - Orbital elements - Elevation and azimuth angles - Doppler effect - Effect of the sun and moon - Sun transit outage. Satellite link models and design - Satellite system parameters - Link budget design.
Satellite subsystems – AOCS - TTC&M - Power and communication subsystems - Computations and controlling by processors - Satellite multiple access schemes –FDMA - TDMA and CDMA - Spread spectrum concepts - Comparison of multiple access schemes.


**Outcomes:**

CO1: Able to understand the orbital mechanics and analyze its effects on satellite communication.

CO2: Able to analyze different satellite system parameters and design of link budget.

CO3: Able to understand the various subsystems in communication satellites.

CO4: Able to understand and compare various multiple access techniques used in satellite communication.

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**TEXTBOOK:**


**REFERENCE:**

Objectives:

- To introduce the concept of radiation mechanism of the antenna and its fundamental parameters.
- To provide knowledge on different types of antennas and their working mechanism.
- To introduce the concept of antenna array and its types.
- To enable antenna design using microwave simulator.

Keywords:
Radiation pattern, antenna parameters, dipole antenna, array.

Contents:


Array of two sources – Pattern multiplication – Linear arrays – Broadside array – End fire array – Planar arrays.

Outcomes:

CO 1: Able to comprehend the radiating and non-radiating elements and to compute the antenna parameters.

CO 2: Able to design and analyze various types of antennas using analytical models.

CO 3: Able to understand antenna array concept based on the application.
CO 4: Able to implement design and analyze the antenna parameters using microwave simulator

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**TEXTBOOK:**

**REFERENCES:**

2. C. A. Balanis, “Antenna Theory – Analysis and Design”, Wiley India, 2000

**15ECE339 Applications of Linear Integrated Circuits 3 0 0 3**
(Pre-Requisite: 15ECE303 Linear Integrated Circuits)

**Objectives:**

- To be able to choose the appropriate components for a particular circuit
- To be able to design circuit for various operations, to given specifications
- To be able to understand and compensate for different non-idealities in an electronic circuit

**Keywords:**

Operational Amplifiers; Operational Transconductance amplifiers; Isolation Amplifiers; Analog to Digital
Converters

Contents:

Op-amp Basics; µA741 –Internal Schematic; Parameters; Frequency Compensation of voltage and current feedback amplifiers; OP07

Instrumentation Amplifiers; Current Sources using opamps; Isolation Amplifiers; Operational Transconductance Amplifiers (OTA); Log and Anti-Log amplifiers; Multipliers; Voltage to Frequency and Frequency to Voltage Converters; Phase Sensitive Detectors (PSD); Phase Locked Loops (PLL)

Voltage References; Low Noise Current Differencing and Low power operational amplifiers; Voltage regulators; IC Protection Circuits; Analog to Digital Converters - Σ-ΔADC.

Outcomes:

CO1: Ability to understand the operation of various high level circuits, using ICs

CO2: Ability to design fairly complex circuits, using ICs.

CO3: Ability to understand and use circuits and techniques to compensate for the effects of temperature and other fluctuations in an electronic circuit

CO4: Ability to effectively use simulation tools for a better understanding of electronic circuits

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Textbooks:

REFERENCES:
4. Relevant Datasheets from Texas Instruments, Maxim and Harris Semiconductors.

15ECE345  Cellular and Mobile Communication System  3 0 0 3

Objectives:

• To introduce the concepts of cellular communication and analyze cell capacity.

• To familiarize the modeling of multipath channel and fading effects and multiple access techniques.

• To enable comprehension of the architectures of modern cellular standards.

Keywords:
Cellular radio, Interference, Wireless channel model, CDMA, LTE

Contents:

Introduction to cellular mobile systems - Basic Cellular System - Cellular communication infrastructure: Cells – Clusters - Cell Splitting - Frequency reuse concept and reuse distance calculation - Cellular system components - Operations of cellular systems –Handoff / Handover - Channel assignment - Fixed and dynamic - Cellular interferences: Co-Channel and adjacent channel and sectorization.

Channel Models: Properties of mobile radio channels –Inter-symbol interference - Multipath and fading effects - Interleaving and diversity -Multiple access schemes (TDMA, FDMA, CDMA, SDMA) – Inter-user interference - Traffic issues and cell capacity - Power control strategies - Channel assignment - Handoff.
Introduction to modern cellular standards - 2G Architecture such as GSM and CDMA based - 2.5G- GPRS: GPRS and its features - GPRS network architecture - GPRS protocol architecture - GPRS backbone network - 3G standard details such as UMTS - Introduction to LTE.

Outcomes:

CO1: Able to understand the technological evolution of mobile radio communication systems.

CO2: Able to apply the cellular concepts and analyze the associated performance measures.

CO3: Able to understand various wireless channel propagation models and signal processing techniques.

CO4: Able to compare the architectures of modern cellular standards.

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TEXTBOOKS/REFERENCES:

Wireless Communication 3 0 0 3
(Pre-requisite: 15ECE312 Digital Communication)

Objectives:

- To introduce the concepts of cellular communication.
- To familiarize the modeling of multipath channel and fading effects.
- To provide the knowledge on computing the capacity of the fading channel.

Keywords:
Free space path loss, Fading channels, Equalizer, Channel capacity

Contents:

Introduction to wireless communications –Large scale path loss –Free space propagation model –Two ray model –Practical link budget design –Outdoor and indoor propagation models. Small scale multipath propagation –Impulse response model of a multipath channel –Parameters of mobile multipath channels –Types of small-scale fading


Outcomes:

CO1: Able to understand and analyze the cellular concept and propagation models.

CO2: Able to understand the impulse response model of multipath channel.

CO3: Able to analyze the small-scale fading and mobile multipath channels.
CO4: Able to analyze the capacity in AWGN and fading channels.

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TEXTBOOKS/REFERENCES:


15MEC333 Financial Management 3 0 0 3
(Pre-Requisite: Nil)

Objectives:

- To understand financial system and concept of time value of money
- 
• To analyze the financing options and decide which is the best decision.

• To apply the appropriate capital budgeting technique and decide the investment options.

• Understand the concept of risk in decision making and use this for investment option selection.

• To create awareness on financial performance analysis, ratios, working capital management, financing and cash and liquidity management.

**Keywords:**

Financial markets, financial statements, cash flow analysis, financial ratios

**Contents:**

Introduction to financial management – Objectives, Functions, Scope, Evolution, Interface of financial management with other areas, Environment of corporate finance

Time value of money – Future value of single cash flow, Multiple cash flow, Annuity, Sinking fund factor, Present value of single cash flow, Annuity, Perpetuity, Comparison of interest rates, Sources of working capital – Equity finance, Preference shares, Debt finance, Term loans, Stock and debentures, Bank and institutional debt, Leasing and hire-purchase

Understanding financial statements, Balance sheet, Profit and loss account and cash flow statements

Financial statement analysis – Ratio analysis, Du Point analysis, Common size analysis, Trend analysis, Industry averages, Comparison with competitors, Cash flow and fund flow analysis, Short term financial management – Managing corporate liquidity, Managing current assets, Managing financial structure, Using the yield curve to make financial decisions

Financial ratios as perceived by commercial banks, corporate controllers, Forecasting financial failures, Financial statements and ratio analysis in different corporate sectors

**Outcomes:**

CO01 Able to understand financial system and concept of time value of money

Able to analyze the financing options and decide which is the best decision.

CO02 To apply the appropriate capital budgeting technique and decide the
investment options
CO04  Able to know the risk in decision making and use this for investment option selection
CO05  To be aware of financial performance analysis, ratios, working capital management, financing and cash and liquidity management.

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TEXT BOOKS/REFERENCES:


Objectives:

- To introduce various pattern recognition algorithms
- To impart advanced concepts in pattern recognition algorithms for multivariate data
- To develop the skill set towards implementation of pattern recognition techniques

Keywords:

Statistical Decision Making, Supervised Learning, Unsupervised Learning, Neural Network.

Contents:

Statistical decision making techniques: Multiple features - Bayes’ theorem - Independent features - Decision boundaries - Unequal costs of error - Estimation of error rates - Leaving one out technique - Characteristic curves.


Outcomes:

CO1: To demonstrate the mathematical knowledge in pattern recognition domain

CO2: To determine suitable pattern recognition concepts for a given engineering problem

CO3: To apply various algorithms for pattern recognition

CO4: To implement the chosen algorithm using simulation tool(s)
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**TEXTBOOK:**

**REFERENCES:**
Objectives:

- To provide an overview of various Embedded Systems Architectures.
- To enable understanding of Real Time Operating Systems and its operations.
- To impart design concepts of Embedded Systems using RISC Microcontrollers.

Keywords:

ARM7TDMI, ARM Cortex M3, LPC2148.

Contents:


ARM cortex M3 processor: ARM processor - ARM cortex M3 architecture - NXP LPC214x On chip Peripherals: A/D converters, PWM, Timer/Counter, UART and its Interfacing- Application development using Keil IDE.

Outcomes:

CO1: Able to understand architecture of RISC Processor.

CO2: Able to analyze peripherals and its programming aspects.

CO3: Able to understand basic concepts of Real Time Operating Systems.

CO4: Able to analyze various embedded systems developed using Embedded C.
CO5: Able to design and develop embedded systems using RISC Microcontrollers

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TEXTBOOKS:

REFERENCES:
Introduction to Soft computing

(Pre-Requisite: Nil)

Objectives:
- To introduce the concepts of bio-inspired algorithms
- To provide knowledge on search and optimization methods
- To enable development of higher learning skill set towards engineering problems

Keywords:
Bio-inspired algorithms, Artificial Neural Networks, Genetic Algorithms, Particle Swarm Optimization.

Contents:
Overview of Artificial Neural Networks (ANN) - Models of a neuron - Network architectures - Bayes theorem - Naïve Bayes classifier - Rosenblatt’s-PerceptronPerceptronconvergencetheorem - Multilayer Perceptrons - Back propagation - Application of ANN in Classification and Regression - Classifier performance measures - Validation techniques.


Outcomes:
CO 1: To understand supervised / unsupervised learning methods
CO 2: To apply the basic principles of evolutionary algorithms
CO 3: To exemplify the use of computing methods to solve engineering problems
CO 4: To analyze the computational efficiency of search and optimization methods
CO–PO Mapping:

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TEXTBOOKS:


REFERENCES:


15ECE380 TELECOMMUNICATION MANAGEMENT 3 0 0 3

Objectives

- To introduce the concepts of management aspects in Telecommunication Engineering
- To impart knowledge about the state of art performance of the Satellite communication
- To enhance the students knowledge in the area of standards of telecommunication regulatory bodies and performance criteria
To enable the student to understand the importance of the investigation of frequency management, business on bandwidth and network modeling.

**Keywords:**

Satellite communication, TCP/IP Protocols, TRAI, Bandwidth, networks modeling

**Contents:**


Telecommunication project management: Telecommunication design and implementation –Network analysis and design –Sources of projects –Methodology for designing, developing and implementing telecommunication capabilities –Network modeling –Phases of project management.

**Outcomes:**

CO1: To acquire knowledge of the application of wireless communication Protocols, TCP/IP, Satellite communication

CO2: To analyze the regulation and standards of telecommunication regulatory bodies. Performance criteria

CO3: To apply cost computation for electronic commerce such as mobile, Wi-Fi and DTH operators

CO4: To Investigate Frequency Management and Business on Bandwidth
CO5: To learn how to design the networks modeling and system evaluation

**CO-PO Mapping:**

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**TEXTBOOK:**

**REFERENCES:**


**15MEC411 Operations Research 3 0 0 3**

**Objectives:**

- To possess the ability to compute, identify, formulate and solve mathematical problems for decision making.
To allocate or use enterprise resource optimally

**Keywords:**

Resource optimization, project management, decision making

**Contents:**


Sequencing model –2 machines „n” jobs,–n 2 machines, „m” machines „n” jobs

Inventory models: deterministic & probabilistic models. Queuing models: Poisson arrival and exponential service times. Single server, multi-server

Simulation –Monte Carlo simulation: simple problems.

**Outcomes:**

**CO01:** Formulate operations research models to optimize resources and maximize profit.

**CO02:** Formulate transportation and assignment problems and solve and infer solutions.

**CO03:** Explain the scope of project planning and apply appropriate technique to analyze a project with an objective to manage resources and minimize cost.

**CO04:** Solve operational problems applying different decision making methods.

**CO05:** Classify queuing models, sequencing models and determine their performance.

**CO06:** Choose the appropriate inventory models to optimize inventory.

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**TEXTBOOK:**


**REFERENCES:**


15ECE371 VLSI Fabrication Technology 3 0 0 3
(Pre-Requisite: Nil)

**Objectives:**

- To understand the effects of technology scaling in device fabrication.
• To learn the fabrication techniques of BJT and MOSFETs.

• To investigate the effects of process parameters in device fabrication.

Keywords:

VLSI, Oxidation, Lithography, Diffusion, Ion Implantation.

Contents:

Brief History of Semiconductor technology, Scaling Trends and Scaling Methodologies, Scaling Challenges, ITRS Roadmap; Starting material, silicon structure and properties, Czochralski and Float Zone crystal growth, GaAs growth; Silicon oxidation methods and properties, Deal Grove Model, Photolithography –masks, pattern transfer techniques, minimum resolvable feature sizes, UV sources, photoresists.

Diffusion and ion implantation, Types of diffusion, implantation profile, variations to predicted distribution, implantation damage and annealing; Deposition requirements and techniques –Physical and Chemical Vapor deposition, Epitaxial growth techniques; Wet and dry etching techniques, Etch requirements, Chemical Mechanical Polishing.

Interconnect Technology –Copper and Aluminum interconnects, Silicides, Isolation, CMOS and BJT Process flow; CMOS process for sub-100nm era - dielectrics and gate electrodes, Low K Dielectrics with Cu, Strained silicon, Silicon Germanium, Process Techniques to overcome Short Channel Effects, Nanolithography techniques, SOI Technology, Ultra Shallow Junction, Multiple Gate MOSFETs.

Outcomes:

CO 1: Understand the effects of technology scaling and various crystal growth methods.

CO 2: Understand the fabrication flow of BJTs and MOSFETs.

CO 3: Apply the different process models to investigate the effects of varying process parameters on device characteristics.

CO4: Understand the recent developments in IC fabrication and its application in device modeling.

CO –PO Mapping:
TEXT BOOKS/REFERENCES:


15ECE474 Automotive Embedded Systems 3 0 0 3

Objectives:

- To introduce the basics of Electronic and Mechanical systems with Automotive
- To impart knowledge on vehicular networks
To equip with the concepts of model-based design using Simulink
To introduce the state-of-art technologies and systems available with the Industry

Keywords:
Automotive Sensors/ Actuators, Automotive graded controllers, Vehicular networks, ADAS applications

Overview of Automotive industry - Tools and Processes - Introduction to modern automotive systems - Spark and Compression Ignition Engines - Automotive Transmissions - Vehicle braking fundamentals - Steering Control - Overview of Hybrid Vehicles - Analog and Digital Systems - Basic measurements systems - Sensors: Characteristics, response and modeling - Actuators - Microcontroller and Digital Signal Processors used for Automotive applications: Renesas, Quorivva, Infineon - Tool chain for different processors - Control algorithm for different Automotive subsystems - Look-up tables and maps - Engine calibration - Torque table - Dynamometer testing

Overview of Automotive communication protocols: CAN, LIN, Flex ray, MOST, Ethernet, D2B, DSI, TCP/IP - Wireless LANs standards such as Bluetooth, IEE802.11x communication protocols - Telematics in Automotive domain: Global Positioning Systems (GPS) and General Packet Radio Service (GPRS) - Automotive Control Systems: Analog and Digital methods, modeling of linear systems and responses - Model based Development: Introduction to MATLAB: Simulink and SIMSCAPE tool boxes - Model based Design for an automotive system


Outcomes:

CO1: Able to understand the fundamentals of various mechanical systems along with Sensors, Controller and Actuators

CO2: Able to analyze various systems used in vehicle domains

CO3: Able to Understand the communication and diagnostic protocols

CO4: Able to design/Prototype an Automotive Embedded System based Matlab/Simulink.

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**TEXT BOOKS/ REFERENCES:**

2. James D Halderman: “Automotive Electricity and Electronics”, PHI Publication

**SCIENCE ELECTIVES**

**15CHY239**

**COMPUTATIONAL CHEMISTRY AND MOLECULAR MODELLING**

**Unit 1**

Introduction: Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born - Haber cycle – Energetic – kinetics - Principles of spectra.

Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.

Introduction to Quantum mechanics - Schrodinger equation - Position and momentu - MO formation - Operators and the Hamiltonian operator - The quantum oscillator - Oscillator Eigen value problems - Quantum numbers - labeling of atomic electrons.

Unit 2
Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.

Huckel’s MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel’s theory and the LCAO approximation - Homogeneous simultaneous equations - Secular matrix - Jacobi method - Eigen vectors: Matrix as operator - Huckel’s coefficient matrix - Wheeler’s method - Hoffmann’s EHT method - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

Unit 3
Self consistent fields: Elements of secular matrix - Variational calculations - Semi empirical methods - PPP self consistent field calculation - Slater determinants - Hartree equation - Fock equation – Roothaan - Hall equation - Semi empirical models and approximations.

Ab-initio calculations: Gaussian implementations – Gamess - Thermodynamic functions - Koopman’s theorem - Isodesmic reactions, DFT for larger molecules - Computer aided assignments/mini projects with softwares - Introduction to HPC in Chemical calculations.

Molecular modelling software engineering - Modeling of molecules and processes - Signals and signal processing in Chemistry - QSAR studies and generation of molecular descriptors - Applications of chemical data mining - Familiarization with open source softwares useful for molecular modeling - Introduction to molecular simulation - M.D. simulation.

Course Outcome

CO01: Get to understand the structure of molecules using symmetry.

CO02: Understanding Quantum mechanical approach to calculate the energy of a system.

CO03: Applying mathematical knowledge and quantum mechanical approach in finding out the characteristics- reactivity, stability, etc., of the molecule.
CO04: To get a brief idea about molecular mechanics based chemical calculations. CO05: To get an idea about general methodology of molecular modeling.

TEXTBOOKS:


REFERENCES:


15CHY241 ELECTROCHEMICAL ENERGY SYSTEMS AND PROCESSES

Unit 1

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.
Unit 2
Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc- carbon (Leclanche type), zinc alkaline (Duracell), zinc/air, zinc-silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: ARM (alkaline rechargeable manganese) cells, Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultra thin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Electrochemical Processes: Principle, process description, operating conditions, process sequence and applications of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electroless plating of nickel, copper and gold; Electropolishing of metals; Anodizing of aluminium; Electrochemical machining of metals and alloys.

Course Outcomes

CO01: Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics

CO02: Learn the application of the electrochemical principles for the functioning and fabrication of industrial batteries and fuel cells

CO03: Acquire knowledge in solving numerical problems on applied electrochemistry

CO04: Analysis and practical problem solving in fabrication of batteries and fuel cells
CO05: Application of concepts and principle in industrial electrochemical processes

CO06: Evaluation of comprehensive knowledge through problem solving

TEXTBOOKS:

REFERENCES:

15CHY243 FUELS AND COMBUSTION 3 0 0 3

Course Objectives: To provide the basic knowledge about fuels, rocket propellants and explosives.
propellants and explosives
Unit 1
Fuels - Solid fuels - Classification, preparation, cleaning, analysis, ranking and properties - action of heat, oxidation, hydrogenation, carbonization, liquefaction and gasification.

Liquid fuels – Petroleum - origin, production, composition, classification, petroleum processing, properties, testing - flow test, smoke points, storage and handling.


Unit 2
Gaseous fuels - Types, natural gas, methane from coal mine, water gas, carrier gas, producer gas, flue gas, blast furnace gas, biomass gas, refinery gas, LPG - manufacture, cleaning, purification and analysis. Fuels for spark ignition engines, knocking and octane number, anti knock additives, fuels for compression, engines, octane number, fuels for jet engines and rockets.

Flue gas analysis by chromatography and sensor techniques.

Unit 3

Rocket propellants and Explosives - classification, brief methods of preparation, characteristics; storage and handling.

Course Outcomes

CO01: Understand the types of fuels and variation in their properties

CO02: Able to analyze the fuel content

CO03: Obtain knowledge in identifying a proper fuel as per the requirement

CO04: Ability to know the preparation and working of
15CHY244 GREEN CHEMISTRY AND TECHNOLOGY 3 0 0 3

Objectives
1. Understand the principles of green chemistry and its contribution to the development of sustainable products
2. Possess knowledge of the migration from a hydrocarbon-based economy to carbohydrate-based economy
3. Evaluate the deficiencies of traditional process and acknowledge the invent of new processes
4. Distinctly map the culmination of academic research to industrial chemistry

Unit 1
Our environment and its protection, chemical pollution and environmental regulations, environmental chemistry, pollution prevention strategies, challenges to the sustainability of chemical industry, Pollution Prevention Act 1990, USA, Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.

Unit 2
Greener strategies of the synthesis of ibuprofen synthesis, teriphthalic acid etc. phase behaviour and solvent attributes of supercritical CO2, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents,
superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and CO2 fixation, green plastics, green oxidations, etc.

Unit 3
Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.

Course Outcomes
CO01: Understand the evolving concept of Green Chemistry and its application to the manufacture of sustainable products

CO02: Appreciate the need for Renewable energy and Feed stock along with carbon sequestration through the fundamentals of Green Chemistry Techniques

CO03: Develop a coherence to evaluate systematic deficiencies in traditional Chemical science process and products

CO04: Undertake a purposeful Journey through the microscopic domain of academic research to the macroscopic domain of Industrial chemistry

REFERENCES:
3. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

15CHY245 INSTRUMENTAL METHODS OF ANALYSIS

Unit 1
Separation Techniques: Brief outline of column, paper and thin layer chromatography - Ion exchange methods - principle and application – HPLC.

Unit 2
Gas chromatography - principle and applications – gel chromatography.


Unit 3

Thermal and Diffraction techniques: Principles and applications of DTG - DTA - DSC - X-ray - Electron Diffraction Studies - SEM, TEM.

Course Outcome

CO01: To develop an understanding of principle and working of the range of instrumental methods in analytical chemistry

CO02: To provide an understanding and skills in contemporary methods of separation and appropriate selection of instruments for the successful analysis of chemical compounds

CO03: To impart skills in the scientific method of planning, conducting, reviewing, reporting experiments and problem solving in chemical analysis.

TEXTBOOKS:

REFERENCES:


15CHY331 BATTERIES AND FUEL CELLS

Course Objective: To provide sound knowledge on the application of electrochemistry in energy storage systems.

Unit 1
Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2
Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc- carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells - liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3
Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

Membranes for fuel cells: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.


**Course Outcome**

**CO01:** Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics

**CO02:** Learn the application of the electrochemical principles for the functioning and fabrication industrial batteries and fuel cells

**CO03:** Analysis of practical problem solving in fabricating batteries and fuel cells

**CO04:** Evaluation of comprehensive knowledge through problem solving

**TEXTBOOKS:**


**REFERENCES:**

15CHY332 CORROSION SCIENCE

Unit 1
Basic principles: Free energy concept of corrosion - different forms of corrosion
- Thermodynamic & Kinetic aspects of corrosion: The free energy criterion of corrosion possibility - Mechanism of Electrochemical corrosion - Galvanic and Electrochemical series and their significance.

Corrosion Control: Materials selection - metals and alloys - metal purification - non metallic - changing medium.

Unit 2
Anodic and cathodic protection methods - Coatings - metallic and other inorganic coatings - organic coatings - stray current corrosion - cost of corrosion control methods.

Corrosion protection by surface treatment: CVD and PVD processes - Arc spray - Plasma spray - Flame spray.

Corrosion Inhibitors: Passivators - Vapour phase inhibitor.

Unit 3
Stress and fatigue corrosion at the design and in service condition - control of bacterial corrosion. Corrosion protection: Automobile bodies – engines – building construction.

Course Outcome:

CO01: Development of skill in identifying the nature and type of corrosion

CO02: Understanding the mechanism of various types of corrosion

CO03: Analysing the problem and find out a solution to combat corrosion in any sort of environment.
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**TEXTBOOKS:**


**REFERENCES:**


15PHY230 ADVANCED CLASSICAL DYNAMICS 3 0 0 3

**Unit 1**

Introduction to Lagrangian dynamics

Survey of principles, mechanics of particles, mechanics of system of particles, constraints, D'Alembert's principle and Lagrange's equation, simple applications of the Lagrangian formulation, variational principles and Lagrange's equations, Hamilton's principles, derivation of Lagrange's equations from Hamilton's principle, conservation theorems and symmetry properties.

**Unit 2**
Central field problem

Two body central force problem, reduction to the equivalent one body problem, Kepler problem, inverse square law of force, motion in time in Kepler’s problem, scattering in central force field, transformation of the scattering to laboratory system, Rutherford scattering, the three body problem.

Rotational kinematics and dynamics

Kinematics of rigid body motion, orthogonal transformation, Euler’s theorem on the motion of a rigid body.

Unit 3
Angular momentum and kinetic energy of motion about a point, Euler equations of motion, force free motion of rigid body.

Practical rigid body problems

Heavy symmetrical spinning top, satellite dynamics, torque-free motion, stability of torque-free motion - dual-spin spacecraft, satellite manoeuvering and attitude control - coning maneuver - Yo-yo despin mechanism - gyroscopic attitude control, gravity-gradient stabilization.

Course Outcomes

CO1 - Able to use the Lagrangian formalism to solve simple dynamical system
CO2- Able to understand Hamiltonian formalism and apply this in solving dynamical systems
CO3- Able to apply Lagrangian formalism in bound and scattered states with specific reference to Kepler’s laws and Scattering states
CO4- Able to solve problems in the Centre of Mass frame and connect it to Laboratory Frame of Reference
CO5- Understand and solve problems in rigid body rotations applying of Euler’s equations.

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**TEXTBOOKS:**


**REFERENCE BOOKS:**


15PHY238 ELECTRICAL ENGINEERING MATERIALS 3 0 0 3

Unit 1
Conducting materials: The nature of chemical bond, crystal structure Ohm’s law and the relaxation time, collision time, electron scattering and resistivity of metals, heat developed in a current carrying conductor, thermal conductivity of metals, superconductivity.

Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and its consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

Unit 2

Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti ferromagnetic materials, ferrites and its applications.

Unit 3

Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

PN junction: Drift currents and diffusion currents, continuity equation for minority carriers, quantitative treatment of the p-n junction rectifier, the n-p-n transistor.

Course Outcomes

CO1: To understand the nature of interaction between atoms in crystalline solid materials that determines their dielectric, magnetic and electrical properties.

CO2: Analyze the relation between the macroscopic dielectric constant and the atomic structure of an insulator.

CO3: Fundamental concepts of magnetic fields required to illustrate the magnetic dipoles. This forms the basis to understand the magnetic properties of dia, para, ferro, antiferro and ferri magnetic materials.

CO4: Fundamentals concerned with conduction mechanism in metals and superconductors.

CO5: Understand the basics for classification of materials based on its conductivity, nature of chemical bonds in Si and Ge, carrier density, energy band structure and conduction mechanism in intrinsic and extrinsic semiconductors.
CO-PO Mapping

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TEXTBOOK:


REFERENCES:


15PHY248 PHYSICS OF LASERS AND APPLICATIONS 3 0 0 3

Unit 1

Review of some basic concepts and principle of laser.


Unit 2

Properties of LASERS

Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of FWHM natural emission line width as deduced by quantum mechanics - additional broadening process: collision broadening, broadening due to dephasing collision, amorphous crystal broadening, Doppler broadening in laser and broadening in gases due to isotope shifts. Saturation intensity of laser, condition to attain saturation intensity.

Properties – coherency, intensity, directionality, monochromaticity and focussibility. LASER transition – role of electrons in LASER transition, levels of LASER action: 2 level, 3 level and 4 level laser system.

Unit 3

Types of LASERS


Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homo-junction and hetero-junction LASERS, high power semiconductor diode LASERS.

Applications in Communication field:

LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication.

Applications of LASERS in other fields:

Holography: Principle, types, intensity distribution, applications. laser induced fusion.

Course Outcomes

CO 1- Understand, Comprehend and acquaint with concepts of NanoPhysics
CO2- To familiarize the material’s property changes with respect to the dimensional confinements.
CO3- Acquire knowledge on the modern preparation process and analysis involved in the nanomaterial’s research
CO4- To learn about the technological advancements of the nano-structural materials and devices in the engineering applications

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REFERENCES:

Unit 1


Practical astronomy - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.

Celestial mechanics - Kepler’s laws - and derivations from Newton’s laws.

Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

Unit 2

Stellar astronomy: H-R diagram, color-magnitude diagram - main sequence - stellar evolution

- red giants, white dwarfs, neutron stars, black holes - accretion disc - Schwartzchild radius
- stellar masses Saha–Boltzman equation - derivation and interpretation.

Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds - Nebulae.

Unit 3

Galactic astronomy: Distance measurement - red shifts and Hubble’s law – age of the universe, galaxies – morphology - Hubble’s classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.


Cosmology: Comic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - plank length and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.
COURSE OUTCOMES (CO):

After completion of the course students should be able to

CO1: Get a broad knowledge of scientific and technical methods in astronomy and astrophysics.

CO2: Apply mathematical methods to solve problems in astrophysics.

CO3: Develop critical/logical thinking, scientific reasoning and skills in the area of modern astrophysics.

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REFERENCES:

5. ‘Stellar Astronomy’ by K. D Abhayankar.
HUMANITIES ELECTIVES

15ENG230 BUSINESS COMMUNICATION 1022

Course Objectives

To introduce business vocabulary
To introduce business style in writing and speaking
To expose students to the cross-cultural aspects in a globalised world
To introduce the students to the art of persuasion and negotiation in business contexts

Course Outcomes

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<td>CO1</td>
<td>Familiarize and use appropriate business vocabulary and etiquettes in verbal communication in the professional context</td>
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<td>CO2</td>
<td>Understand organizational structures, pay structures and performance assessments</td>
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<td>CO3</td>
<td>Apply language skills in drafting various business documents and other necessary communications in the business context</td>
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<td>Understand and address cross-cultural differences in the corporate environment</td>
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<td>Participate in planned and extempore enactments of various business situations</td>
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CO-PO Mapping

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Syllabus

Unit 1:
Business Vocabulary - Writing: Drafting Notices, Agenda, and Minutes - Reading: Business
news, Business articles

Unit 2:

**Writing:** Style and vocabulary - Business Memorandum, letters, Press Releases, reports – proposals – **Speaking:** Conversational practice, telephonic conversations, addressing a gathering, conducting meetings

Unit 3:

**Active Listening:** Pronunciation – information gathering and reporting - **Speaking:** Cross-Cultural Issues, Group Dynamics, negotiation & persuasion techniques

**Activities**

Case studies & role-plays

**Books recommended:**


**15ENG233 TECHNICAL COMMUNICATION 1 0 2 2**

**Course Objectives:**

To introduce the students to the elements of technical style To introduce the basic elements of formal correspondence To introduce technical paper writing skills and methods of documentation To improve oral presentation skills in formal contexts
Course Outcomes: After the completion of the course the student will be able to:

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<th>Understand and use the basic elements of formal correspondence and methods of documentation</th>
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<td>Learn to edit technical content for grammatical accuracy and appropriate tone and style</td>
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<td>CO3</td>
<td>Use the library and internet resources for research purposes</td>
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<td>CO4</td>
<td>Demonstrate the ability to communicate effectively through group mock-technical presentations and other activities</td>
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Mapping of course outcomes with program outcomes:

| PO/PSO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
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Syllabus:

Unit 1

Unit 2
Different kinds of written documents: Definitions - descriptions- instructions-recommendations- manuals - reports – proposals; Formal Correspondence: Letter Writing including job applications with Resume

Unit 3
Technical paper writing: Library research skills- documentation style - document editing – proof reading - formatting
Practice in oral communication: Practice in Oral communication and Technical presentations
References


15HIN101 HINDI I 1 0 2 2

To teach Hindi for effective communication in different spheres of life:- Social context , Education, Research & Media.

Syllabus Unit-1

Introduction to Hindi Language, -National Language, Official Language, link Language etc.. S Introduction to Hindi language , Devanagari script and Hindi alphabet.
Shabda Bhed , Roopanhtar ki Drishti se- Bhasha – Paribhasha aur Bhed - Sangya - Paribhasha Aur Bhed- Sangya ke Roopanhtar- kriya.

Unit-2

Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender& number - General vocabulary for conversations in given context –understanding proper pronunciation – Conversations, Interviews, Short speeches.
Unit -3

Poems – Kabir Ist 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada

Unit- 4
Letter writing – personal and Formal –Translation from English to Hindi

Unit- 5
Kahani –Premchand : Kafan , Abhilasha, Vidroh, Poos ki rath, Juloos

Course Outcomes:

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

CO1 Gain knowledge about the nature and culture of Hindi language

CO2 Understand the structural aspects of Hindi language

CO3 Apply the knowledge of the grammatical structures to communicate in Hindi

CO4 Analyse the social significance of modern literature.

CO5 Develop the ability to translate a given text to Hindi

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Text Books :
1. Prem Chand Ki Srvashrestha Kahaniyam: Prem Chand ; Diamond Pub Ltd. New Delhi
2. Vyavaharik Hindi Vyakaran ,Anuvad thaha Rachana : Dr. H. Parameswaran, Radhakrishna publishing House,New Delhi

15HIN111

HINDI II

1022

Appreciation and assimilation of Hindi Literature - both *drishya* and *shravya* - using the best specimens provided as anthology.

Syllabus:

Unit -1

Kavya Tarang;-Dhumil ke Anthim Kavitha[Poet-Dhumil],Dhabba[Poet-Kedarnath Singh],Proxy[Poet- Venugopal],Vakth[Poet-Arun Kamal],Maachis[Poet-Suneeta Jain].

Unit -2

Communicative Hindi - Moukhik Abhivyakthi

Unit -3

Audio- Visual –Media in Hindi – Movies like Tare Zameen par , Paa, Black etc., appreciation and evaluation . News reading and presentations in Radio and TV channels in Hindi .

Unit -4

Gadya Manjusha – Budhapa , Kheesa, Sadachar ka Thavis

Unit -5

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

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Mapping of course outcomes with program outcomes:

Text Books:

2. Gadya Manjusha: Editor: Govind, Jawahar Pustakalay, Mathura
3. Prem Chand Ki Srvashrestha Kahaniyam: Prem Chand; Diamond Pub Ltd. New Delhi

15HUM239 PSYCHOLOGY FOR EFFECTIVE LIVING 2002

Course Objectives
1. To help students acquire the basic knowledge of behavior and effective living
2. To create an awareness of the hazards of health compromising behaviours
3. To develop and strengthen the tools required to handle the adversities of life

Syllabus
Unit 1

SELF AWARENESS & SELF MOTIVATION

Unit 2

THE NATURE AND COPING OF STRESS
Definition of stress, stressors, eustress, distress-PTSD-stress among college students- stress assessment-coping with stress-progressive muscle relaxation-RET-guided imagery-bio feedback- religious and spiritual way of coping with stress

Unit 3

APPLICATION OF HEALTH PSYCHOLOGY
Health compromising behaviors-smoking and alcoholism-biological and psychological effects of addiction-deaddiction-behavior modifications-CBT in handling problem behavior-cancer risks- AIDS.

Course Outcome

CO 1: Understand the basic concepts of Behavioral Psychology
CO 2: Demonstrate self reflective skills through activities
CO 3: Apply the knowledge of psychology to relieve stress
CO 4: Analyse the adverse effects of health compromising behaviours.
CO 5: Evaluate and use guided techniques to overcome and cope with stress related problems.

CO-PO Mapping
Text Book(s)
V.D.Swaminathan & K.V.Kaliappan. Psychology for Effective living-An introduction to Health

Reference(s)

15HUM240 PSYCHOLOGY FOR ENGINEERS 2002

Course Objectives

1. To strengthen the fundamental knowledge of human behavior
2. To strengthen the ability to understand the basic nature and behavior of humans in organizations as a whole
3. To connect the concepts of psychology to personal and professional life

Syllabus
Unit 1
PSYCHOLOGY OF ADOLESCENTS
Psychology-definition-scope-adolescence-characteristics-developmental tasks-physical and psychological changes-interests-family relationships-emotions-peer pressure-positive and Negative effects of peer pressure-types of friends-choice of friends

Unit 2
LEARNING, MEMORY AND STUDY SKILLS
Definitions—Classical conditioning—Operant conditioning—Insight learning—reinforcement—its principles and its effects—role of reward and punishment in learning—forgetting—causes—techniques for improving study skills—Mnemonics—Intelligence—Emotional and social intelligence

Unit 3

ATTENTION & PERCEPTION
Definition—types of attention—span of attention—division of attention—factors determining attention—perception—difference between sensation and perception—laws of perception—errors in perception—illusion and hallucination

Course Outcome
CO 1: Understand the fundamental processes underlying human behavior such as learning, motivation, individual differences, intelligence and personality.
CO 2: Apply the principles of psychology in day-to-day life for a better understanding of oneself and others.
CO 3: Apply the knowledge of Psychology to improve study skills and learning methods
CO 4: Apply the concepts of defense mechanisms to safeguard against abusive relationships and to nurture healthy relationships.

CO-PO Mapping

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Text Book(s)

Reference(s)

1. Elizabeth B. Hurlock, Developmental Psychology - A Life span approach, 6th edition
Course Objectives:

- To introduce the significance of food, nutrients, locally available food resources, synergic food combinations, good cooking methods and importance of diversity in foods
- To understand nutritional imbalances and chronic diseases associated with the quality of food.
- To gain awareness about the quality of food - Organic food, genetically modified food, adulterated food, allergic food, food poisoning and food safety.
- To understand food preservation processing, packaging and the use of additives.


UNIT III: INTRODUCTION TO FOOD BIOTECHNOLOGY: Future foods- Organic foods and genetically modified foods, Fortification of foods, bio fortification of foods, value addition of foods, functional foods, nutraceuticals, weaning foods/supplementary. Processing and preservation of foods, applications of food technology in daily life, and your prospects associated with food industry – Nanoparticles, biosensors, advanced research.

Course Outcome:
CO1: Acquire knowledge about the various food and food groups
CO2: Understand nutritional imbalances and chronic diseases prevailing among different age groups.
CO3: Understand the significance of safe food and apply the food safety standards
CO4: Demonstrate skills of food processing, preservation and packaging methods with or without additives
CO5: Evaluate the quality of food based on the theoretical knowledge of Food and Nutrition

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Reference Books:


15MAL101 MALAYALAM I 1 0 2 2

Course Objectives:

To teach Malayalam for effective communication in different spheres of life:- Social context, Education, Research & Media
Unit 1
Ancient poet trio: Adhyatmaramayanam, LakshmanaSwanthanam (Lines: valsasoumitre... mungikidakayal), Ezuthachan - Medieval period classics – Inanappana (Lines: kalaminnu... vilasangalingane), Poonthanam.

Unit 2

Unit 3
Short stories from period 1/2/3: Poovanpazham - VaikaomMuhammedBasheer - Literary & Cultural figures of Kerala and about their literary contributions.

Unit 4
Literary Criticism: BharathaParyadanam-VyasanteChiri – Ithihasa studies - KuttikrishnaMararu - Outline of literary Criticism in Malayalam Literature - Introduction to KuttikrishnaMararu & his outlook towards literature & life.

Unit 5

Course Outcome:

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

| CO1 | Understand and inculcate philosophical thoughts and practices |
| CO2 | Understand and appreciate the post modern trends of literature. |
| CO3 | Analyse the literary texts and comprehend the cultural diversity of Kerala |
| CO4 | Distinguish the different genres in Malayalam literature |
| CO5 | Demonstrate the ability to effectively communicate in Malayalam |

CO-PO Mapping Mapping of course outcomes with program outcomes:
REFERENCES:


15MAL111  MALAYALAM II  1 0 2 2

Course Objectives

➢ To appreciate the aesthetics and understand the cultural implications in Malayalam Literature
➢ To enhance creative thinking in Malayalam
➢ To equip the students to read and write effectively in Malayalam
➢ To acquire pronunciation skills

Course Outcome:

After the completion of the course the student will be able to:
CO1 Understand the different cultural influences in linguistic translation
CO2 Identify and appreciate the Romantic elements of modern literature
CO3 Analyze the genre of autobiographical writing
CO4 Critically evaluate the significance of historical, political and socio cultural aspects in literature
CO5 Demonstrate good writing skills in Malayalam

CO-PO Mapping Mapping of course outcomes with program outcomes:

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Unit 1

Unit 2

Unit 3

Unit 4
Part of an autobiography/travelogue: Kannerum Kinavum, Chapter: Valarnnuvarunnoratmavu, V.T.Bhattathirippadu-Socio-cultural literature-historical importance.

Unit 5
Error-free Malayalam- 1.Language; 2.Clarity of expression; 3.Punctuation-Thettillatha Malayalam- Writing-a. Expansion of ideas; b. Précis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script/Feature/Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:


15TAM101 TAMIL I 2002

Course Objectives

- To introduce the students to different literature- Sangam literature, Epics, Bhakthi literature and modern literature.
- To improve their ability to communicate with creative concepts, and also to introduce them to the usefulness of basic grammatical components in Tamil.

Syllabus

Unit 1
The history of Tamil literature: Nāṭṭupuṟapp pāṭalkaḷ, kataikkal, paḷamoliṅkal - ciṟukataṅkal tōṟramum vaḷarciyyum, ciṟilakkiankaḷ: Kaliṅkattup pariṇi (pörpāṭiyatu) - mukkūṭar paḷḷu 35.
Kāppiyaṅkaḷ: Cilappatikāram – maṇimēkalai naṭaiiyiyal āyyu māṟṟum aimpanum – aṅṅciṟūṅ kāppiyaṅkaḷ toṭarpāṅa ceytiṅkal.

Unit 2

tiṅai ilakkiyamum nītiyilakkiyamum - patiṅņekkāṅkanakkku nūlkal toṭarpāṅa piṟa ceytiṅkal - tirukkuṟāḷ (āṟpu, paṅpu, kalvi, oḷukkm, naṭpu, vāymai, kēḷvi, ceynaṟi, periyāraitunakkōṭal, vilippuṇarvu pēṅra atikārattilulḷa ceytiṅkal.
Aṅṅulkal: Ulakanīti (1-5) – ēḷāti (1,3,6). - Cittarkaḷ: Kaṭuveḷi cittar pāṭalkaḷ (āṅgantak kalippu –1, 4, 6, 7, 8), māṟṟum akappēy cittar pāṭalkaḷ (1-5).

Unit 3
tamiḻ ilakkaṅam: Vākkiya vakaṅkaḷ – tāṇviṅai piṟaviṅai – nērkkūṟu ayarkūṟu

Unit 4

Unit 5

Course Outcomes

CO 1: To understand the Sangam literature
CO 2: To understand the creative literature
CO 3: To understand the literary work on religious scriptures
CO 4: To improve the communication and memory skills
CO 5: To understand the basic grammar components of Tamil language and their usage and applications.
CO 6: Understand creative writing aspects and apply them.

CO-PO Mapping

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Textbooks:

- http://Www.tunathamizh.tom/2013/07/blog0post_24.html
- Mu.Varatarācaṇ “tamiḻ ilakkiyavaralāru” cāhitya akatemi papālikēṣaṇaṇ, 2012
- poṇ maṇimāraṇ “atōṅ tamiḷ ilakkaṇam “atōṅ papliṣiṅ kurūp, vaṇciyūr,

15TAM111 TAMIL II 2002

Course Objectives

- To learn the history of Tamil literature.
- To analyze different styles of Tamil Language.
- To strengthen the creativity in communication, Tamil basic grammar and use of computer on Tamil Language.

Syllabus
Unit 1

Unit 2
tiṉai ilakkiyamum nītiyilakkiyamum - patiṅkenkilḵkanakku nūlkal toṭarpāṇa pira ceytkal - tirukkuṟal (aṟṟu, paṉṟu, kalvi, oḻukkam, naṭṭu, vāymai, kēḷvi, ceynaṅri, periyārittunakkoṭal, vilppunarvu pēṇṟa atikārattil uḷḷa ceytkal. Aṟanūlkal: Ulakanīti (1-5) – ēḷāti (1,3,6). - Cittarkal: Kaṭuveḷi cittar pāṭalkal (āṅgantak kalippu –1, 4, 6, 7, 8), marṟum akappēy cittar pāṭalkal (1-5).

Unit 3
tamil ilakkaṇam: Vākkiya vakaiṅkal – taṇṉaṅi piraviṅai – nērkkūru ayarkūru

Unit 4

Unit 5


Course Outcomes

CO 1: Understand the history of Tamil literature.
CO 2: Apply practical and comparative analyses on literature.
CO 3: Understand thinai literature, literature on justice, Pathinenkeelkanaku literature.
CO 4: Understand the tamil scholars’ service to Tamil language and society.
CO 5: Understand components of Tamil grammar and its usage
CO 6: Understand creative writing aspects and apply them
CO-PO Mapping

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