M.S. Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme: B.Tech.in Electronics and Communication Engineering

Programme Code: 004

Programme Outcome (PO)

Programme Specific Outcome (PSO)

Program Educational Objectives (PEO)

Course Outcomes (CO)

Registrar
M.S. Ramaiah University of Applied Sciences
Bangalore-560 054

Approved in 23rd ACM (Resolution 23.05) held on 15th July 2021

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Faculty of Engineering and Technology
M.S. Ramaiah University of Applied Sciences
Bangalore-560058

Faculty of Engineering and Technology (FET)

Programme Name: B.Tech. (Electronics and Communication Engineering)

Programme Outcomes (POs)

B. Tech. graduates will be able to:

PO-1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO-2. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO-3. 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

PO-4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information toprovide valid conclusions

PO-5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

PO-6. 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

PO-7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO-8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO-9. Function effectively as an individual, and as a member or leader in diverse teams,and in multidisciplinary settings

PO-10. 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 giveand receive clear instructions

PO-11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, tomanage projects and in multidisciplinary environments

PO-12. Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

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Programme Specific Outcomes (PSOs)

At the end of the B. Tech. (Electronics and Communication Engineering) program, the graduate will be able to:

PSO-1. Apply the knowledge of Electronics Circuits, Communication Systems, Digital Signal Processing, Embedded Systems, Semiconductor Technologies, RF and Microwave Engineering to develop innovative and safe solutions for the real-world problems in Electronics and Communication Engineering.

PSO-2. Design, simulate, analyze and implement electronics and communication systems /subsystems by using modern programming languages, simulation packages, EDA tools and solvers to address industry and societal requirements.

PSO-3. Demonstrate ethics, leadership qualities, communication, project management, entrepreneurial skills and involvement in lifelong learning for the betterment of organization, environment and society.

Program Educational Objectives (PEOs)

The objectives of the B. Tech. (Electronics and Communication Engineering) Programme are to:

PEO-1. Provide students with a strong foundation in mathematics, science and engineering to enable them to devise and deliver efficient solutions to challenging problems in Electronics, Communications and allied disciplines

PEO-2. Impart analytic and cognitive skills required to develop innovative solutions for R&D,Industry, and societal requirements

PEO-3. Provide sound theoretical and practical knowledge of Electronics and Communication Engineering, managerial and entrepreneurial skills to enable students to contribute to the well-being and welfare of the society

PEO-4. Inculcate strong human values and social, interpersonal and leadership skills required for professional success in evolving global professional environments

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 1 (MTB101A)

After the successful completion of this course, the student will be able to:

CO-1. State and discuss basic concepts related to single, two variable calculus and matrix algebra

CO-2. Perform basic operations of matrix algebra and apply them to solve systems of linear equations

CO-3. Solve simple mathematical problems associated with linear algebra, single and two variable calculus

CO-4. Demonstrate competence with the basic ideas of linear systems, independence, bases and dimension, linear transformations, eigenvalues, eigenvectors and diagonalization

CO-5. Solve complex real-world problems associated with linear algebra, single and two variable calculus

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Course Outcomes (COs)

Course Title & Code: Engineering Physics and Laboratory (PYB102A)

After the successful completion of this course, the student will be able to:

- **CO-1.** State, explain the concepts of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics
- **CO-2.** Derive standard relationships in mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser & fiber optics, and interpret them
- **CO-3.** Discuss the applications of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics
- **CO-4.** Solve problems in mechanics, electrical conductivity, quantum mechanics, crystal structure, material science, laser and fiber optics
- **CO-5.** Plan the experimental set-up, conduct experiments, calculate and plot the graphs to obtain the results and write a laboratory report as per the prescribed format.

Course Outcomes (COs)

Course Title & Code: Engineering Mechanics (CEF101A)

After the successful completion of this course, the student will be able to:

- **CO-1.** State and describe the laws of Statics, Friction and Dynamics and their contexts of application.
- **CO-2.** Interpret standard mathematical relationships and apply for solving simple static and dynamic problems in engineering mechanics
- **CO-3.** Calculate moment of inertia, determine centroid, centre of gravity for the structuralmembers
- **CO-4.** Apply the laws of statics and dynamics for the equilibrium analysis of rigid bodies withand without friction
- **CO-5.** Apply energy methods in analyzing of static and dynamic aspects of engineeringstructures made of rigid bodies

Course Outcomes (COs)

Course Title & Code: Elements of Electronics Engineering and Laboratory (ECF102A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain working principles of PN junction diode, Zener diode, transistors, amplifier configurations, Op-Amps, power supply, logic gates and electronic displays
- **CO-2.** Derive mathematical relationships for electronic devices and circuits
- **CO-3.** Solve simple numerical and design problems related to analog / digital circuits as wellas devices
- **CO-4.** Design and analyse operation of standard analog / digital circuits for a given application
- **CO-5.** Conduct experiments as per the standard procedures and tabulate/calculate/plotthe measured values

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CO-6. Interpret and compare with standard results, and draw conclusions and Write reportas per the prescribed format

Course Outcomes (COs)

Course Title & Code: Engineering Drawing (MEF103A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the conventions used in projections of geometric entities and interpret thesame
CO-2. Draw orthographic projections for the geometric entities in specified positions
CO-3. Develop lateral surfaces of un-sectioned and sectioned regular solids
CO-4. Develop orthographic projections for given applications
CO-5. Draw isometric projections for the solids and their combinations
CO-6. Demonstrate competency in using CAD tool for drawing projections of geometric entities

Course Outcomes (COs)

Course Title & Code: Constitution, Human Rights and Law (LAN101A)

After the successful completion of this course, the student will be able to:

CO-1. Explain the key principles of the Indian Constitution
CO-2. Explain Indian legal system and judicial structure that govern the citizens
CO-3. Discuss UN Declaration of Human Rights
CO-4. Discuss the scope and application of Human Rights Principles and Law
CO-5. Suggest strategies for protection of human rights and resolving legal issues in compliance with applicable laws

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics – 2 (MTB102A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the fundamentals of ordinary differential equations and Laplace transform
CO-2. Solve standard forms of ordinary differential equations
CO-3. Solve simple problems in ordinary differential equations and Laplace transform
CO-4. Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations using Laplace transform
CO-5. Apply Laplace transform in solving complex real world engineering problems

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Course Outcomes (COs)

Course Title & Code: Engineering Chemistry and Laboratory (CYB104A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the basic concepts of electrochemistry, conversion of chemical energy into electrical energy, theory of corrosion and principles of metal finishing
- **CO-2.** Differentiate renewable - nonrenewable fuels, primary - secondary electrodes & primary - secondary batteries, batteries - fuel cells, electroplating – electroless plating, thermosetting – thermoplastic polymers and dry corrosion - wet corrosion
- **CO-3.** Discuss the reaction chemistry and stoichiometry of combustion of fuels, remedial measures to control oxides of nitrogen, sulphur and carbon, polymerization – methods, mechanism, preparation, properties and applications of some polymers, concepts of nano science and nanotechnology
- **CO-4.** Identify the types of corrosion and methods to prevent corrosion, suitable polymers and nanocomposite materials for engineering applications
- **CO-5.** Derive kinetic rate equations for various chemical systems and equation for electromotive force
- **CO-6.** Analyze the suitability of polymers & composites for various applications and solve problems related to storage devices, chemical kinetics, electro chemistry, corrosion and metal finishing
- **CO-7.** Plan the experimental set up, conduct experiments, calculate and plot the graphs to obtain results, and write a laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Elements of Mechanical Engineering and Workshop Practice (MEF104A)

After the successful completion of this course, the student will be able to:

- **CO-1.** conversion systems, mechanical power transmission systems, machine tools and processes
- **CO-2.** Describe various energy conversion systems, mechanical power transmission systems and machine tools
- **CO-3.** Explain the working principle of refrigeration systems, biomass conversion technologies and machining operations
- **CO-4.** Solve numerical problems on IC engines and mechanical power transmission systems
- **CO-5.** Apply principles of energy conversion systems, power transmission systems, machining processes and mechanical joints to practical applications

Course Outcomes (COs)

Course Title & Code: Elements of Electrical Engineering and Laboratory (EEF105A)

After the successful completion of this course, the student will be able to:

- **CO-1.** State and explain various laws of electric circuits, magnetic circuits and their significance, phasor diagrams for electrical elements
- **CO-2.** Explain construction, principle of operation, working and characteristics of DC machines, transformers, AC rotating machines and their applications

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CO-3. Derive equations for electrical circuits, magnetic circuits and performance of various AC and DC machines

CO-4. Solve problems on electric circuits, magnetic circuits, DC machines, transformers and AC rotating machines

CO-5. Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values

CO-6. Interpret and compare with standard results, and draw conclusions and Write report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Elements of Computer Science and Engineering and Laboratory (CSF106A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the elements and methodology of Computer Science and Engineering

CO-2. Explain the basic principles and techniques of algorithms and programming

CO-3. Select appropriate approach to solve a computational problem

CO-4. Design an algorithmic solution and draw a flow chart of the solution

CO-5. Develop computer programs for moderately complex problems

CO-6. Test and validate developed computer programs

Course Outcomes (COs)

Course Title & Code: Professional Communication (TSN101A)

After the successful completion of this course, the student will be able to:

CO-1. Apply the concepts of grammar for communication

CO-2. Compose precise paragraphs

CO-3. Demonstrate professional etiquette

CO-4. Demonstrate appropriate verbal and non-verbal communication in the given context

CO-5. Develop professional written document

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 3 (MTF201A)

After the successful completion of this course, the student will be able to:

CO-1. State and explain the important theorems in Fourier series, transforms and vector integral calculus

CO-2. Solve simple problems in Fourier series, transforms and vector calculus

CO-3. Apply Fourier series, transforms and vector calculus in solving complex real world engineering problems

CO-4. Implement the programs to solve system of linear equations and non-linear equations of single variable using MATLAB

CO-5. Apply interpolation and numerical integration method in analyzing some real world problems

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Course Outcomes (COs)

Course Title & Code: Signals and Systems (ECC202A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the signals and systems, their classification and perform the basic operations on signals
- **CO-2.** Evaluate the time response of continuous-time and discrete-time systems LTI systems for specified inputs and impulse response
- **CO-3.** Compute the Fourier series of periodic signals, Fourier transform of aperiodic signals and z-transform of discrete-time signals
- **CO-4.** Solve problems on signal generation, signal manipulation, classification of signals and systems
- **CO-5.** Analyse signals and systems in both time and transformed domains
- **CO-6.** Use standard software tools to analyse and perform time and frequency domain analysis of signals and systems

Course Outcomes (COs)

Course Title & Code: Electronic Circuits (ECC203A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the principles of biasing the transistors, small and large signal amplifier configurations
- **CO-2.** Describe working principles of feedback amplifiers, power amplifiers and oscillators
- **CO-3.** Solve problems on stability factors, gain, impedance, efficiency, distortion of amplifiers, resonance frequency of oscillators and performance parameters of feedback amplifiers
- **CO-4.** Design transistor biasing circuits and small signal amplifier circuits
- **CO-5.** Analyse the stability aspects of amplifiers, performance of feedback amplifiers
- **CO-6.** Simulate and analyse the designs using standard circuit simulation tool

Course Outcomes (COs)

Course Title & Code: Network Analysis and Synthesis (ECC204A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain network concepts, network theorems and Two-Port networks.
- **CO-2.** Describe the elements of realizability Theory, synthesis of One-Port network with two kinds Of Elements and elements of transfer function synthesis
- **CO-3.** Solve simple problems related to network analysis and synthesis
- **CO-4.** Apply network concepts, network theorems and Two-Port networks.
- **CO-5.** Model a system using the realizability Theory, One-Port network synthesis and transfer function synthesis
- **CO-6.** Solve complex problems related to network analysis and synthesis

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Course Outcomes (COs)

Course Title & Code: Digital Logic Design (ECC205A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain basic concepts of digital electronics such as Boolean algebra, logic functions
- **CO-2.** Describe and Classify different types of digital circuit implementations
- **CO-3.** Solve problems on logic design and logic minimization, and also incorporate them in software tools
- **CO-4.** Analyze a practical problem and develop a logic design to solve the problem
- **CO-5.** Apply digital design concepts for complex digital circuits

Course Outcomes (COs)

Course Title & Code: Electronic Circuit Design Laboratory (ECL206A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the significance of the electronic circuit considered.
- **CO-2.** Design the electronic circuit for the given circuit specifications using appropriate electronic device and electronic components
- **CO-3.** Debug the electronic circuit considered and demonstrate corresponding output parameters using appropriate electronic equipment.
- **CO-4.** Analyze the electronic circuit with respect to the obtained output parameters and given specifications.
- **CO-5.** Write laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Digital Logic Design Laboratory (ECL207A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Simulate digital logic circuits using standard software
- **CO-2.** Plan an experimental setup to test and verify the truth tables of logic gates
- **CO-3.** Construct digital circuits such as latches, multiplexers and counters to verify their functionalities
- **CO-4.** Design and construct various code converters
- **CO-5.** Write a laboratory report in a prescribed format

Course Outcomes (COs)

Course Title & Code: Environmental Studies (BTN201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Define the multidisciplinary nature of environmental studies and recognize the need for public awareness
- **CO-2.** Classify and explain the various natural resources and their associated problems, ecosystem and environmental pollution
- **CO-3.** Describe biodiversity at local, national and global levels

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CO-4. Discuss various social issues pertaining to environment including sustainable development and energy issues

CO-5. Assess the impact of human population on the environment

Course Outcomes (COs)

Course Title & Code: Additional Mathematics - 1 (MTB103A)

After the successful completion of this course, the student will be able to:

CO-1. State and explain the important theorems and solve simple mathematical problems in one variable calculus and vector algebra

CO-2. State theorems and solve simple problems in two variable calculus

CO-3. Solve complex real world problems associated with one and two real analysis

CO-4. Illustrate fundamentals of MATLAB programming and write simple programs

CO-5. Solve complex mathematical problems associated with linear algebra and compare the results with that of solutions obtained using MATLAB

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 4 (MTF202A)

After the successful completion of this course, the student will be able to:

CO-1. Define and explain the concepts of correlation, regression, random variables, probability distribution, partial differential equations and complex analysis

CO-2. State theorems and solve simple problems in partial differential equations, complex analysis, probability, probability distributions

CO-3. Apply numerical methods to solve ordinary and partial differential equations using MATLAB

CO-4. Solve complex engineering problems associated with numerical methods using MATLAB

CO-5. Analyze real world problems associated with probability, probability distributions, partial differential equations and complex analysis

CO-6. Construct the Bar chart, pie chart, Histogram, Box-plot and fitting of curves by using MATLAB

Course Outcomes (COs)

Course Title & Code: Linear Integrated Circuits (ECC208A

After the successful completion of this course, the student will be able to:

CO-1. Explain Integrated Circuit fabrication processes, op-amp fundamentals and characteristics

CO-2. Discuss the various linear and non-linear applications of op-amps

CO-3. Design, compute and analyse op-amp based circuits

CO-4. Analyse the functionalities of linear and nonlinear ICs for various applications

CO-5. Design, model and analyse active filters, waveform generators, A/D and D/A converters

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Course Outcomes (COs)

Course Title & Code: Electromagnetic Theory (ECC209A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the concept of vector, co-ordinate systems, electrostatics, magnetostatics and electromagnetic waves
- **CO-2.** Derive Gauss Divergence theorem, Stokes' theorem, continuity equation, Maxwell's equations, wave equations, solutions of Laplace equation and uniform plane waves
- **CO-3.** Solve simple problems of electrostatics and electromagnetic wave propagation
- **CO-4.** Solve complex problems of capacitance, potential field, electric field and electric force
- **CO-5.** Analyze the concepts of divergence and curl, Faraday's laws of magnetic induction
- **CO-6.** Use standard software tools to solve and analyse specific parameters of electrostatics, magnetostatics and time varying magnetic fields

Course Outcomes (COs)

Course Title & Code: Microprocessors and Microcontrollers (ECC210A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain architectures of microprocessors, microcontrollers and their applications in embedded systems
- **CO-2.** Describe concepts of peripheral interfacing and programming of microprocessors and microcontrollers
- **CO-3.** Program and verify functionality of given application using microprocessor or microcontroller
- **CO-4.** Perform external peripheral interfacing using microprocessor or microcontroller for a given application
- **CO-5.** Design applications using microprocessors, microcontrollers and embedded board with external peripherals

Course Outcomes (COs)

Course Title & Code: Measurements and Instrumentation (ECC211A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe measurement standards, measurement units and measurement systems
- **CO-2.** Explain the principles and applications of signal and function generators
- **CO-3.** Describe different sensors and their usage in various applications.
- **CO-4.** Analyse the models of measurement systems and analyze their static and dynamic characteristics
- **CO-5.** Design appropriate signal conditioning circuits and choose recording / display devices
- **CO-6.** Design of instrumentation for a system and measure resistance, capacitance, inductance, current, voltage and power

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Course Outcomes (COs)

Course Title & Code: Linear Integrated Circuit Laboratory (ECL212A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Design electronic circuits using linear ICs for various applications
- **CO-2.** Construct /Build electronic circuits using Linear ICs
- **CO-3.** Test, evaluate and compare the performance of electronic circuits with theoretical designs
- **CO-4.** Write laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Microprocessors and Microcontrollers Laboratory (ECL213A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Develop the assembly level program on a Microprocessor / Microcontroller for a given application
- **CO-2.** Design circuits for performing given tasks using Arduino board
- **CO-3.** Interface external peripherals with Arduino board for given applications
- **CO-4.** Demonstrate the developed designs for different applications
- **CO-5.** Write the report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Innovation and Entrepreneurship (BAU201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the concepts and process of Innovation as well as entrepreneurship
- **CO-2.** Construct and apply the idea generation techniques
- **CO-3.** Discuss the opportunities for launching of new venture and various entry strategies
- **CO-4.** Examine innovative ideas for the creation and management of entrepreneurship
- **CO-5.** Formulate and present a viable business plan to the investors appraisal

Course Outcomes (COs)

Course Title & Code: Additional Mathematics - 2 (MTB104A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the fundamentals of ordinary differential equations State theorems and solvesimple problems in two variable calculus
- **CO-2.** Solve standard forms of ordinary differential equations Illustrate fundamentals of Linear algebra
- **CO-3.** Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations
- **CO-4.** Apply numerical methods to solve nonlinear equations in one variable, system of linear equations, interpolation and numerical quadrature, and implement the same using MATLAB
- **CO-5.** Solve complex problems associated with nonlinear equations and linear systems, interpolation and numerical integration using MATLAB

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Course Outcomes (COs)

Course Title & Code: Analog Communication (ECC301A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the principles in random process and its relevance to channel distortion andnoise signals in communication systems
- **CO-2.** Describe the Fourier representation and analysis of signal as applied to analogcommunication systems
- **CO-3.** Solve simple problems related to analog communication system design
- **CO-4.** Derive and analyse various analog modulation schemes and their performance forbandwidth, modulation index, efficiency and transmission power
- **CO-5.** Design and analyse analog communications systems
- **CO-6.** Solve complex problems related to analog communication and compare the resultswith that of the solutions obtained using software tools

Course Outcomes (COs)

Course Title & Code: Digital Signal Processing (ECC302A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe types of signals, transforms, filters, algorithms and its properties.
- **CO-2.** Explain the filter design techniques, types of transformations, and multirate principles in signal processing.
- **CO-3.** Determine Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT),
- **CO-4.** Determine convolution using DFT and filter structures for discrete time sequences
- **CO-5.** Design digital filters using IIR and FIR using structures
- **CO-6.** Use software tools to apply principles of Fourier transforms for spectral analysis of digital signals and systems

Course Outcomes (COs)

Course Title & Code: Microwave Engineering (ECC303A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain microwave transmission lines, waveguides, microwave devices, amplifiers and oscillators
- **CO-2.** Derive the transmission lines equations, waveguide mode equations, microwave amplifier equations and network parameters for microwave circuits
- **CO-3.** Compute transmission line parameters, waveguides modes, amplifiers performance metrics, network parameters for microwave devices / networks
- **CO-4.** Analyse the transmission line parameters, waveguides, microwave devices, amplifiers, oscillators and network parameters for various networks
- **CO-5.** Design and analyse various microwave subsystems and networks
- **CO-6.** Solve complex problems on transmission line parameters, waveguides modes, amplifiers performance metrics, network parameters for microwave devices / networks and CEM

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Course Outcomes (COs)

Course Title & Code: Control Systems (ECC304A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the mathematical models of physical systems such as electrical, mechanical, electro mechanical, thermal and determine their transfer functions
- **CO-2.** Analyse time and frequency domain response of a system
- **CO-3.** Evaluate the system stability with time and frequency domain techniques and design suitable compensators
- **CO-4.** Design a controller to meet the specifications of an application
- **CO-5.** Analyse the performance of a controller and the feedback system
- **CO-6.** Use standard software tools to analyse the systems in time and frequency domain

Course Outcomes (COs)

Course Title & Code: HDL Programming (ECC305A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe and compare different Hardware Description Languages (HDLs), design methodologies and modeling techniques
- **CO-2.** Explain the lexical conventions, data types, constructs, delay concepts and synthesis approaches of HDL
- **CO-3.** Design, develop and analyze HDL for digital circuits and Finite State Machines
- **CO-4.** Design and develop the HDL for a given digital system's specification
- **CO-5.** Simulate, synthesize and analyze the HDL for a given digital system using standard EDA tools
- **CO-6.** Apply the concepts of HDL to solve problems related to real time scenario

Course Outcomes (COs)

Course Title & Code: Engineering Economics (ECH301A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the concepts related to engineering decision making, time value of money, cash- flow analysis, financial accounting, budget, and project management
- **CO-2.** Describe the factors related to microeconomics and macroeconomics
- **CO-3.** Solve simple problems related to engineering decision making, time value of money, cash-flow analysis, financial accounting, budget, microeconomics, macroeconomics and project management
- **CO-4.** Analyse a financial budget and interpret from economics point of view
- **CO-5.** Develop a project management report related to an electronic product/system considering the financial and economic aspects

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Course Outcomes (COs)

Course Title & Code: Analog Communication Laboratory (ECL306A)

After the successful completion of this course, the student will be able to:

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CO-1. Design, model and simulate analog communication circuits and sub-systems
CO-2. Build designed analog communication systems
CO-3. Analyse and evaluate standard analog communication systems through theirwaveforms
CO-4. Write the analysis report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Digital Signal Processing Laboratory (ECL307A)

After the successful completion of this course, the student will be able to:

CO-1. Simulate key concepts of signal processing using software tools
CO-2. Design, model, simulate and analyse analogue and digital filters
CO-3. Develop routines for DSP algorithms using standard software and compare the results obtained by analytical method
CO-4. Design, model, simulate and analyse given communication and image processing applications
CO-5. Write laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Information Theory (ECC308A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the types of information sources, encoding techniques, channels and channel capacity.
CO-2. Explain the basic concepts of information theory, Shannon's theorems, and various encoding techniques.
CO-3. Solve simple problems to compute entropy, information measures and evaluate various codes.
CO-4. Design encoders and decoders for error control coding techniques
CO-5. Solve complex problems to compute entropy, information measures and evaluate various codes.
CO-6. Use software tools for implementation and performance analysis of error detection and correction codes.

Course Outcomes (COs)

Course Title & Code: Digital Communication (ECC309A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the baseband pulse modulation schemes, line coding schemes, and Nyquist criterion for digital transmissions.
CO-2. Discuss geometric representation of signals, M-ary modulation schemes, equalization techniques of digital communication systems
CO-3. Explain coherent and non-coherent receiver structures, synchronization, spread spectrum techniques and multicarrier modulations
CO-4. Analyse digital base band communication systems by applying digital coding, Nyquist criterion, PSD, eye pattern and equalization

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CO-5. Evaluate M-ary modulation schemes, digital receiver structures, synchronization and spread spectrum schemes and multicarrier modulations for digital communication systems

CO-6. Use software tools for programming and performance analysis of blocksets of digital communication system

Course Outcomes (COs)

Course Title & Code: Antenna and Propagation (ECC310A)

After the successful completion of this course, the student will be able to:

CO-1. Describe antenna theory, wave propagation, antenna arrays and their performance metrics

CO-2. Explain the various antenna performance parameters, measurement techniques and design guidelines with respect to various antenna configurations

CO-3. Discuss radio wave propagation and computational electromagnetics techniques

CO-4. Discuss the principles and theorems in aperture and reflector antenna

CO-5. Analyse antenna arrays, performance metrics of various antenna

CO-6. Use software tools for analysis of various antenna characteristics and performance metrics

Course Outcomes (COs)

Course Title & Code: Computer Networks (ECC311A)

After the successful completion of this course, the student will be able to:

CO-1. Explain the fundamentals of data communications, functionalities of OSI layers, algorithms and protocols, frame formats, network security issues related to data communications

CO-2. Describe error detection and correction for communication, structure of wired and wireless networks, point to point protocols for communication and QoS performance measurements

CO-3. Solve numerical problems related to data communications

CO-4. Design the protocols and algorithms for data communication

CO-5. Analyse the networks and interpret their performance

CO-6. Develop the protocols and algorithms for end to end communication and simulations using standard tools

Course Outcomes (COs)

Course Title & Code: Digital Communication Laboratory (ECL312A)

After the successful completion of this course, the student will be able to:

CO-1. Design, model and simulate digital communication circuits and sub-systems

CO-2. Build sub-systems of digital communication systems using kits

CO-3. Analyse and evaluate standard digital communication systems through their waveforms

CO-4. Write the analysis report as per the prescribed format

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Course Outcomes (COs)

Course Title & Code: Antenna and Microwave Laboratory (ECL313A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Plan the experimental setup to achieve the stated aim
- **CO-2.** Conduct experiments as per the standard procedures and tabulate the measured values
- **CO-3.** Calculate the required parameters and plot the results
- **CO-4.** Interpret, compare with standard results and draw conclusions
- **CO-5.** Write laboratory report as per the prescribed format
- **CO-6.** Conduct experiments as per the standard procedures and tabulate the measured values

Course Outcomes (COs)

Course Title & Code: Seminar (ECC314A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Prepare and deliver seminar on a given topic.
- **CO-2.** Write a report on the seminar topic.

Course Outcomes (COs)

Course Title & Code: Biomedical Signal Processing (ECE311A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the origin, dynamics, time and frequency domain analysis of various biomedical signals
- **CO-2.** Describe filter and transform techniques to process the biomedical signals
- **CO-3.** Compute the features of biomedical signals from the events by solving problems in time and frequency domain
- **CO-4.** Analyze biomedical signals in time domain, frequency domain using various statistical and transform features
- **CO-5.** Design and implement digital filters in spatial and frequency domain for removing artefacts present in the medical images
- **CO-6.** Implement various time and frequency domain algorithms for event detection in ECG and EEG signals using software tools

Course Outcomes (COs)

Course Title & Code: Embedded Systems and IoT (ECE312A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the concepts and techniques of designing embedded system, RTOS and IoT
- **CO-2.** Explain the hardware and software considerations for embedded systems
- **CO-3.** Discuss the architecture, principles and layer protocols for IoT
- **CO-4.** Apply the memory interfacing, exceptions and interrupts in an embedded system

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CO-5. Design and develop a real time application of embedded and IoT system design development using appropriate development tool kits

Course Outcomes (COs)

Course Title & Code: Statistical Signal Processing (ECE313A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the concepts of statistical estimation, hypothesis testing and decision theory
- **CO-2.** Analyze the performance of signal modeling approaches and various filteringtechniques
- **CO-3.** Develop Maximum likelihood and Bayesian estimators for various sensor transmission scenarios
- **CO-4.** Analyze and evaluate multiple hypothesis testing techniques to detect events in sensor transmissions
- **CO-5.** Analyze the performance of various signal modeling approaches
- **CO-6.** Evaluate the performance of recursive models and adaptive filters on finite length data records

Course Outcomes (COs)

Course Title & Code: Image Processing (ECE314A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the fundamental techniques for image processing, filtering, restoration and morphological processing, segmentation
- **CO-2.** Explain the principles of various image processing algorithms
- **CO-3.** Analyse and evaluate image processing algorithms for a specific application
- **CO-4.** Apply image processing algorithms for various applications
- **CO-5.** Apply image filtering and segmentation techniques for various applications
- **CO-6.** Use software tools to model, simulate and analyse image processing algorithms for developing image processing applications

Course Outcomes (COs)

Course Title & Code: Biomedical Image Processing (ECE411A

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the imaging modalities, image properties, time and frequency domain analysis of various biomedical images
- **CO-2.** Compute the spatial and frequency domain features to anlyse the biomedical images
- **CO-3.** Describe the principles of image enhancement, image restoration, image segmentation, and morphological operations
- **CO-4.** Analyze the biomedical images in time domain, frequency domain using various statistical and transform features
- **CO-5.** Design and implement digital filters in spatial and frequency domain for removing artefacts present in the medical images
- **CO-6.** Implement appropriate image enhancement, morphological, segmentation and filtering algorithms for a specific application using software tools

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Course Outcomes (COs)

Course Title & Code: Programmable Logic Design using FPGA (ECE412A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain digital logic blocks, different FPGA architectures and their components
- **CO-2.** Describe FPGA design flow, combinational and sequential logic blocks, and synthesisreports
- **CO-3.** Design digital filters for DSP and image processing applications
- **CO-4.** Develop digital logics for various applications
- **CO-5.** Program and verify functionality of design using FPGA design tool
- **CO-6.** Develop applications using FPGA design tool and system generator

Course Outcomes (COs)

Course Title & Code: Optical Communication (ECE413A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe characteristics of fiber optic devices for optical communication system
- **CO-2.** Explain the principles of fiber optic passive and active devices, optical network components and the optical measuring instruments
- **CO-3.** Solve simple numerical problems on optical devices and optical networks
- **CO-4.** Solve complex numerical problems on optical devices and optical networks using standard software tools
- **CO-5.** Develop a simulation model for active and passive optical devices
- **CO-6.** Analyze performance of various optical networks topologies

Course Outcomes (COs)

Course Title & Code: DSP Architecture (ECE414A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the architectures and programming instructions of Digital Signal Processors
- **CO-2.** Describe DSP algorithms and interfacing capabilities of DSP processors for different applications
- **CO-3.** Design applications by interfacing peripherals with DSP Processor
- **CO-4.** Identify the trade-offs necessary in algorithm design for real-time DSP implementation
- **CO-5.** Design DSP algorithms using a suitable programming language
- **CO-6.** Implement and verify DSP algorithms on suitable Digital Signal Processors using development boards and tool kits

Course Outcomes (COs)

Course Title & Code: Principles of Medical Imaging (ECE421A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the fundamental principles of medical imaging techniques such as X-ray, CT, Ultrasound, MRI and NMR

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CO-2. Discuss the formation and reconstruction of medical images
CO-3. Discuss the artefacts and emerging trends in medical image processing
CO-4. Apply the basic mathematical principles for the generation of tomographic medical images
CO-5. Analyse medical images acquired with the discussed modalities for imaging artefacts
CO-6. Apply and analyse the projection and reconstruction of medical images using Matlab programming

Course Outcomes (COs)

Course Title & Code: Electronic Board Design (ECE422A)

After the successful completion of this course, the student will be able to:

CO-1. Explain the concepts associated with high speed interconnects and elements of PCB Fabrication such stack up, process, materials, chemicals etc.
CO-2. Describe signal integrity and power integrity in terms of crosstalk, reflection, EMI, power distribution network, IR drop and ground bounce respectively (analytical and theoretical questions)
CO-3. Solve numerical based on signal integrity and power integrity in terms of crosstalk, reflection, EMI, and power distribution network
CO-4. Perform component library development, schematic capture, component placement, and routing for PCB development of any given circuit design using standard software tools
CO-5. Analyse the signal integrity of the designed circuit with respect to crosstalk, reflection, EMI and IR drop (both analytical and tool based)
CO-6. Apply design optimization techniques to improve signal integrity of the designed circuit

Course Outcomes (COs)

Course Title & Code: Wireless Communications (ECE423A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the basic principles various wireless communication systems and standards, principles of cellular communications and cellular processes
CO-2. Explain propagation effects such as fading, time delay spread, and Doppler spread,capacity of wireless channels, principles of multicarrier modulation
CO-3. Derive and calculate the Bit Error Rate as a function of Signal to Noise Ratio for wiredand wireless channels with and without diversity, traffic load of a network
CO-4. Design the transmitter and receiver configurations based on the performance requiredfrom a wireless communication system
CO-5. Analyze the performance of wireless systems with given channel parameters with and without diversity
CO-6. Implement wireless communication system using standard software tools and extractthe performance plots of the system

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Course Outcomes (COs)

Course Title & Code: Speech Processing (ECE424A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain Speech Signal production models, phonetic representation, Hearing andAuditory Perception, Short-Time Analysis of Speech, The Speech Spectrogram
- **CO-2.** Describe the Homomorphic Speech Analysis, Linear Predictive Analysis, Digital Speech Coding, Text-to-Speech Synthesis Methods, Automatic Speech Recognition
- **CO-3.** Solve simple problems related to speech processing
- **CO-4.** Analyse Speech Signal production models, phonetic representation, Hearing and Auditory Perception, Short-Time Analysis of Speech, Speech Spectrogram and Homomorphic Speech Analysis
- **CO-5.** Develop algorithms related to Linear Predictive Analysis, Digital Speech Coding, Text-to-Speech Synthesis Methods and Automatic Speech Recognition
- **CO-6.** Solve complex problems related to speech processing and analyse using suitable softwaretools

Course Outcomes (COs)

Course Title & Code: Project Work -1/Internship (ECP401A/ECI401A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Recognise the need for developing a new or improving an existing engineering product/system through an organised survey of literature
- **CO-2.** Define engineering design specifications
- **CO-3.** Design, model, solve, analyse the product/system to meet the design specifications
- **CO-4.** Evaluate the performance of the modelled system and justify its performance
- **CO-5.** Demonstrate the system working in a virtual environment and make a presentation
- **CO-6.** Write a technical report Alternatively,
- **CO-7.** Write a report on experiences during internship
- **CO-8.** Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Electronic Devices and Appliances (OEE411A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain concepts of electronics and its subfields
- **CO-2.** Apply principles of electronics to construct and analyze electronic circuits and devices
- **CO-3.** Identify components and circuits of an electronic device/appliance at sub-circuitry level and realizeits functionality
- **CO-4.** Test electronic device/appliance functionality using appropriate tools and procedure
- **CO-5.** Solve identified problemof an electronic device/appliance by applying standard diagnostic and troubleshooting procedure

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Course Outcomes (COs)

Course Title & Code: Fundamentals of Telecommunication (OEE412A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the working principles of communication system/subsystems
- **CO-2.** Describe the functioning of radio, television, voice, cellular communication systems
- **CO-3.** Discuss the blocksets of radio, television, voice and cellular communications systems/subsystems
- **CO-4.** Differentiate communication methods based on architectures and applications
- **CO-5.** Develop system blocks and solve simple problems in designing of radio, television, voice and cellular systems

Course Outcomes (COs)

Course Title & Code: Project Work -2 (ECP402A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Recognize the need for developing a new or improving an existing engineering product/system through an organized survey of literature
- **CO-2.** Define engineering design specifications
- **CO-3.** Design, model, solve, analyse the product/system to meet the design specifications
- **CO-4.** Evaluate the performance of the modelled system and justify its performance
- **CO-5.** Demonstrate the system working in a virtual environment and make a presentation
- **CO-6.** Write a project report

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