CMR UNIVERSITY
Private University Estd in Karnataka State by Act No. 45 of 2013

# School of Engineering and Technology

## Department of Electronics and Communication Engineering

## Course Outcome

| S. No. | Course Outcome | Batch |
|---|---|---|
| 1 | Course Outcome | 2018 |
| 2 | Course Outcome | 2019 |
| 3 | Course Outcome | 2020 |
| 4 | Course Outcome | 2021 |
| 5 | Course Outcome | 2022 |
| 6 | Course Outcome | 2023 |
| 7 | Course Outcome | 2024 |

CMR UNIVERSITY BANGALORE

# ECE-Course Outcome-2018

**4BMA101: Engineering Mathematics - I**

CO1: List nth order derivatives of different functions. (L1)

CO2: Demonstrate the use of partial derivatives. (L2)

CO3: Explain the concept of vector differentiation. (L2)

CO4: Classify the 1st order differential equation. (L2)

CO5: Apply the knowledge of matrices techniques. (L3)

**4BPH112: Engineering Physics for EC**

CO1: Explain drift and diffusion of charge carriers in semiconductor physics. (L2)

CO2: Describe I-V characteristics of PN junction diode and BJT. (L2)

CO3: Explain phase and group velocity, standing waves and energy of a vibrating string in transverse wave motion. (L2)

CO4: Describe Lorentz transformation equations using special theory of relativity. (L2)

CO5: Explain the working principle of lasers and optical fiber communication. (L2)

CO6: Describe the role of various measuring instruments for performing laboratory experiments. (L2)

CO7: Explain the experimental setup, observed measurements and corresponding results using appropriate physical quantities and theoretical formulae. (L2)

**4BEE103/203: Basic Electrical Engineering**

CO1: Analyze electrical circuits by relevant Laws in DC circuits. (L2)

CO2: Demonstrate the knowledge of single phase and three-phase power generation by using the phasor diagrams. (L2)

CO3: Select suitable transformer for a given application by considering its design parameters. (L1)

CO4: Describe the working principle of DC Machine, generators and motors. (L2)

CO5: Illustrate the concept of rotating magnetic field and applications. (L1)

**4BME104/204: Engineering Workshop Practice**

CO1: Select appropriate hand and power tools, machines, equipment and materials and demonstrate their correct use for simple making tasks. (L3)

CO2: Using basic math and measuring instruments that are appropriate build wooden model. (L6)

CO3: Demonstrate sheet metal model using development techniques, adhesives and fasteners. (L3)

CO4: Demonstrate welding technology for model making. (L3)

**4BCS105/205: Programming with Python**

CO1: Analyze the problem and apply suitable programming constructs, data structures and algorithms needed to implement a program to solve a simple problem. (L4)

CO2: Explain the various modules of any project by defining architecture. (L2)

CO3: Evaluate simple open source programs by appropriately editing and debugging the code. (L5)

CO4: Develop an application using python and raspberry pi to solve a real-life problem. (L6)

CO5: Choose a best possible way to solve a problem by listening to various opinions of diverse team and interviewing experts. (L3)

**4BHS106: Professional Communication I**

CO1: Demonstrate accurately use of grammar, punctuation and vocabulary in different types of communication. (L2)

CO2: Apply basic skills of paraphrasing and rewriting by taking and making effective notes. (L3)

CO3: Compose engaging creative writing pieces through techniques of speculation and prediction. (L6)

CO4: Compose compelling emails and letters using appropriate writing etiquette and rules of grammar. (L6)

CO5: Compose compelling formal and informal letters. (L6)

**4BHS107/207: Modern History of Engineering**

CO1: Formulate original thought, opinions and insights on engineering by critically analyzing the relationship between Engineering and Society, Environment, Philosophy, Economics and Polity by considering their positive and negative impact on each other. (L5)

CO2: Compare engineering innovations/ innovators from different periods of history by explaining their historical significance. (L2)

CO3: Explain the value and importance of professional and ethical responsibility in the engineering profession by analyzing impact of engineering on the world. (L2)

**4BMA201: Engineering Mathematics - II**

CO1: Understand discrete and continuous probability distributions to resolve various engineering problems. (L2)

CO2: Apply the method of least squares to estimate the parameters of a regression model. (L3)

CO3: Implement Test of Hypothesis for a population parameter for small sample and large sample cases. (L3)

CO4: Recognize Complex Number System, Elementary complex functions and analytic functions. (L1)

CO5: Interpret Cauchy integral formula and Cauchy Residue theorem to solve the complex integration. (L2)

**4BCH202/102: Engineering Chemistry**

CO1: Illustrate the concept of electrochemical cell by writing balanced redox reactions. (L2)

CO2: Explain the mechanism of corrosion in metals by framing stoichiometric chemical reaction. (L2)

CO3: Explain the polymer composites for photocatalytic and photovoltaic applications by examining the photogenerated charged carrier dynamics. (L2)

CO4: Classify different types of carbon forms and its applications by interpreting their structural properties. (L2)

CO5: Understand the synthesis of nanomaterials by determining appropriate solution method. (L2)

**4BME203/103: Computer Aided Engineering Drawing and Rapid Prototyping**

CO1: Draw orthographic projections (TV, FV and SV) of points, straight lines, surfaces using instruments and CAD software. (L1)

CO2: Apply concepts of basic engineering drawings to generate drawings of simple objects. (L3)

CO3: Draw projections of solids and its section using projection theory and visualization technique. (L3)

CO4: Demonstrate skill in developing a prototype using rapid prototyping. (L3)

CO5: Using isometric projections of combination of solids build model by laser cutting or 3D printing machine. (L6)

**4BEC204/104: Making with Electronics**

CO1: Associate basic engineering principles with operations of electronic components, equipment and circuits at an elementary level. (L2)

CO2: Identify and analyze basic electronic components and concepts using working models and experiments. (L1, L4)

CO3: Apply concepts learnt to design basic circuits to achieve desired specific outputs. (L3)

CO4: Develop in teams, simple interactive projects using Arduino that use the knowledge of circuit design and electronic components gained in the course. (L4)

CO5: Develop a Project with knowledge of module from Electronics. (L4)

**4BHS205/105: Environment and Sustainability**

CO1: Outline the expected consequences of continuous environment degradation in the society by relevant data analysis. (L2)

CO2: Demonstrate a rationale for climate change adaptation and mitigation by proposing appropriate actions in key sectors. (L2)

CO3: Explain the key issues under negotiation by summarizing the international climate change legal and policy framework. (L2)

CO4: Demonstrate knowledge of environment sustainability by analyzing relevant data about industrial impact on environment. (L2)

**4BHS206: Professional Communication-II**

CO1: Enhance reading comprehension, writing, listening and speaking skills needed to effective communication. (L3)

CO2: Express ideas opinions and to participate in group discussion. (L2)

CO3: Present effectively through various modes of presentation. (L3)

CO4: Understand the cultural sensitivity in communication and use it effectively. (L2)

CO5: Apply skills of socializing and networking in day to day professional communication. (L3)

**4BEC301: Engineering Mathematics-1 for ECE**

CO1: Solve Cauchy's homogeneous linear differential equations. (L3)

CO2: Calculate given integrals using Laplace transforms. (L3)

CO3: Solve linear differential equations by Laplace transform method. (L3)

CO4: Express periodic functions in terms of sine and cosine functions. (L2)

CO5: Design of series and shunt voltage regulators for a Power supply. (L4)

**4BHS506: Professional Communication-V**

CO1: Compose abstract and literature review as parts of academic writing. (L5)

CO2: Prepare agenda, minutes and memos in specific business set up. (L5)

CO3: Apply skills of argumentation using various techniques of arguments and deliberation. (L3)

CO4: Exhibit basics of interview etiquette in a given professional set up. (L3)

CO5: Exhibit basics of interview etiquette in a given professional set up. (L3)

**4BHS507: Prepare Program-III**

CO1: Use the concepts of work-time-efficiency and distance–time–speed to solve problems related to the measurement of effort or performance. (L3)

CO2: Analyze geometric shapes and use mensuration formulas to mathematically measure 2D and 3D solids. (L4)

CO3: Illustrate conceptual knowledge of blood relationships and direction sense through the creation of schematic diagrams and solving related problems. (L3)

CO4: Apply the concepts of input–output, series, as well as coding and decoding to discern specific patterns (finding the odd term, types of codes etc.) from given data to solve problems. (L3)

CO5: Apply the concepts of coding and decoding to discern specific patterns from given data to solve problems. (L3)

Here are the Course Outcomes (COs) from your document, formatted consistently:

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**4BEC508: Mini Project–I**

CO1: Conduct a survey of several available literature in the preferred field of study.

CO2: Demonstrate practical knowledge within the chosen area of technology for project development.

CO3: Analyze the problem requirements and arrive at workable design solution.

CO4: Compare and contrast the several existing solutions for the attempted problem.

CO5: Summarize the report and present the findings of the study conducted in the preferred domain.

**4BEC511: Digital VLSI Design**

CO1: Illustrate VLSI Design Flow for abstraction levels and its design complexity attributes.

CO2: Analyze an IC for manufacturing CMOS design and fabrication process of distinct IP/IC based design.

CO3: Construct a Verilog modules by employing FPGA.

CO4: Formulate chip design overview and TCL environmental setup.

CO5: Construct TCL scripting using basic syntax.

**4BEC512: Machine Learning**

CO1: Describe fundamental concepts and issues of machine learning.

CO2: Prepare data for Machine Learning IDA and EDA.

CO3: Describe Supervised Machine Learning algorithms like Linear Regression and Logistic Regression.

CO4: Explain Un-Supervised Machine Learning algorithms like Clustering.

CO5: Explain Artificial Neural Networks and Deep Learning.

**4BEC513: Random Process**

CO1: Apply the fundamental probability theory and random process to solve practical engineering problems.

CO2: Classify different type of random variables with appropriate CDF and PDF.

CO3: Interpret the key parameters of Random variables that underlie the random nature of the problems.

CO4: Demonstrate the knowledge of joint random variables in real time engineering problems.

CO5: Demonstrate the application of random process to characterize discrete and continuous channel models.

**4BHS6B1: Business Management for Engineers**

CO1: Apply the concepts related to entrepreneurship issues in business ideas.

CO2: Explain the factors influencing the practice of management in different contexts.

CO3: Develop suitable economic strategy regarding common business problems.

CO4: Analyze the marketing strategy for common engineering business problems.

CO5: Illustrate the leadership qualities in the operation of a new venture.

**4BEC602: Analog and Digital Communication**

CO1: Explain the working of amplitude modulators and receivers.

CO2: Explain the Angle modulation techniques.

CO3: Demonstrate the reception and demodulation of FM and also the various types of Noise.

CO4: Interpret pulse modulation techniques and base band data transmission.

CO5: Compare the digital modulation techniques.

**4BEC603: Embedded Systems**

CO1: Classify an Embedded System based on various design parameters and peripherals.

CO2: Explain the architectural features of 32-bit microcontroller ARM Cortex M3.

CO3: Explain the instruction set of 32-bit microcontroller ARM Cortex M3.

CO4: Make use of the knowledge gained for programming ARM Cortex M3 for different applications using C and assembly language.

CO5: Choose appropriate communication protocol for an application.

**4BEC604: CMOS VLSI Design**

CO1: Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.

CO2: Outline the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.

CO3: Explain memory elements along with timing considerations.

CO4: Illustrate testing and testability issues in VLSI design.

CO5: Construct CMOS subsystems and architectural issues with the design.

**4BEC605: Information Theory and Coding Design**

CO1: Analyze the fundamentals of probability theory & random process.

CO2: Illustrate with example the concept of information theory, source coding, channel capacity, channel coding and the relation among them.

CO3: Design the channel performance using Information theory.

CO4: Identify various error control code and apply linear block codes for error detection and correction.

CO5: Construct binary cyclic codes and convolutional codes for improving channel performance.

**4BHS606: Professional Communication–VI**

CO1: Demonstrate the advanced skills of presentation.

CO2: Compose technical documents following proper format and style.

CO3: Evaluate cases pertaining to a specific domain and recommend innovative suggestion/s to the case.

CO4: Apply the registers of technical English in oral and written mode of communication.

CO5: Collaborate and express themselves in an Interview round.

**4BHS607: Prepare Program-IV**

CO1: Solve problems of various arrangements (circular, linear etc) and criteria (expected value, biased dice etc.).

CO2: Use concepts from statistics (mean, median etc) and progressions (AP, GP, HP) to analyze groups of numbers on the mentioned parameters, indices and surds to solve problems related to representation of numbers (large integers, irrational roots etc.).

CO3: Examine four types of logical statements to solve puzzles based on syllogisms.

CO4: Apply the concepts of Venn diagrams and cubes to solve puzzles using set theory, breaking-building rules etc.

CO5: Combine logic with their knowledge of advanced English vocabulary and grammar to solve verbal data tasks (ex: para-completion etc.) and articulate their ideas.

**4BEC608: Mini Project – II**

CO1: Demonstrate practical knowledge within the chosen area of technology for project development.

CO2: Identify, analyze, formulate and handle computer/IT projects with a comprehensive and systematic approach to give workable design solutions.

CO3: Conduct a survey of several available literature in the preferred field of study and compare the several existing solutions for the attempted problem.

CO4: Propose innovative solution for the development of components, processes or technologies in CS/IT field.

CO5: Report and present the findings of the study conducted in the preferred domain as well develop effective communication skills for presentation of project related activities.

**4BEC621: Speech and Audio Processing**

CO1: Explain the speech production and different models.

CO2: Explain the frequency domain analysis, speech recognition and text to speech conversion.

CO3: Explain the signal processing models of Audio perception and Analysis.

CO4: Summarize different Audio compression methods.

CO5: Explain Spatial Audio Perception and rendering and Audio quality analysis.

**4BEC622: MEMS**

CO1: Explain the various techniques of Micro-fabrication and Micro–Machining.

CO2: Illustrate the properties of various materials used for MEMS fabrication.

CO3: Analyze various MEMS structures used for diversified applications.

CO4: Classify various sensors and actuators.

CO5: Introduction to MEMS and MEMS packaging design.

**4BEC623: RF IC's**

CO1: Explain the RF systems.

CO2: Describe the MOS device physics and distributed systems.

CO3: Explain bandwidth estimation, amplifiers, noise and LNA design.

CO4: Explain different power amplifiers and VCO.

CO5: Describe different architectures such as GSM radio architectures, CDMA, UMTS radio architectures.

**4BEC701: Microwave and Radar**

CO1: Acquire knowledge on the theory of microwave transmission, microwave generators and associated components.

CO2: Demonstrate microwave devices and monolithic microwave integrated circuits.

CO3: Understand the radar fundamentals and radar signals.

CO4: Illustrate the working principle of pulse Doppler radars and their applications and limitations.

CO5: Describe the working of various radar transmitters and receivers.

**4BEC702: Computer Communication Networks**

CO1: Explain Data Communication with key concepts of networks, its types and OSI network model.

CO2: Identify the data link layer from OSI model, understanding the concepts related to layer, protocols.

CO3: Demonstrate the concept of Wired LAN's standards and its architecture.

CO4: Explain various connecting devices, IP address and routing mobile IP.

CO5: Explain the various transport layer protocols, UDP and TCP service applications and flow and error control.

**4BEC802: Image and Video Processing**

CO1: Explain different methods for image acquisition, storage and representation in digital devices and role of image transforms in representing, highlighting, and modifying image features.

CO2: Interpret the mathematical principles in digital image enhancement and apply them in spatial domain.

CO3: Interpret the mathematical principles in digital image enhancement and apply them in frequency domain.

CO4: Summarize several image segmentation methods and morphological operations.

CO5: Explain the concept of video processing and different video compression techniques.

**4BEC803: Wireless Communication**

CO1: Explain the basics and types of wireless communication systems being used.

CO2: Explain the basic concepts of cellular system and the design requirements.

CO3: Demonstrate the basic principles behind radio resource management techniques such as frequency reuse, channel allocation and handoffs.

CO4: Interpret knowledge and gain awareness on the technologies used for effective share of spectrum by multiple access techniques i.e. TDMA, CDMA, FDMA etc.

CO5: Summarize the wireless standards being used across the world.

**4BEC804: Optical Communication**

CO1: Summarize the concepts and theory of optical fiber communication.

CO2: Explain various transmission characteristics of optical fibers.

CO3: Illustrate the working of LEDs and Laser diodes as optical sources.

CO4: Explain various techniques of optical amplification, wavelength conversion and regeneration.

CO5: Define and explain various types of optical fibers and their applications.

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**4BEC804: Optical Communication**

CO1: Summarize the concepts and theory of optical fiber communication.

CO2: Explain various transmission characteristics of optical fibers.

CO3: Illustrate the working of LEDs and Laser diodes as optical sources.

CO4: Explain various techniques of optical amplification, wavelength conversion and regeneration.

CO5: Define and explain various types of optical fibers and their applications.

**4BHS704: Prepare Program-V**

CO1: Apply number theory concepts and formulas to solve problems of base system, remainder theorem etc.

CO2: Categorize contradictions within the area of binary logic to solve problems using concepts of contradictions truth tellers, liars and alternators, pattern recognition problems (fillers, calendar etc.) by utilizing different functions that fit the given criteria.

CO3: Analyze the sufficiency of data and interpret its specific components by solving problems using data reasoning and interpretation of its numerical and graphic representations.

CO4: Make use of advanced arithmetic, algebra and mensuration techniques to solve a variety of problems using a range of concepts from partnership to permutation and combination.

CO5: Apply written and verbal communication techniques by reading and articulating themselves in the format of discussion, debate, interview, essay, letter etc.

**4BEC731: Internet of Things (IoT)**

CO1: Interpret the impact and challenges posed by IoT networks leading to new architectural models.

CO2: Compare and contrast the deployment of smart objects and the technologies to connect them to network.

CO3: Explain the role of IoT protocols for efficient network communication.

CO4: Explain the need for data analytics and security in IoT.

CO5: Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in industry.

**4BEC732: Advanced Digital Signal Processing**

CO1: Explain the concept of discrete random process.

CO2: Demonstrate the different methods for spectrum estimation.

CO3: Explain the different methods in linear estimation and prediction.

CO4: Explain adaptive filters.

CO5: Explain the wavelet transforms and its applications.

**4BEC733: Neural Network and Fuzzy Logic**

CO1: Compare the Biological and Artificial Neural Networks.

CO2: Classify the back propagation and counter propagation networks.

CO3: Explain adaptive resonant theory.

CO4: Compare crisp set and fuzzy set theory.

CO5: Apply fuzzy logic controller to real time systems.

**4BEC734: Adaptive Signal Processing**

CO1: Explain filtering solutions for optimising the cost function indicating error in estimation of parameters.

CO2: Evaluate the performance of various methods for designing adaptive filters.

CO3: Explain convergence and stability issues associated with adaptive filter design.

CO4: Design and implement filtering solutions for applications such as channel equalisation, interference cancelling and prediction.

CO5: Explain the role and importance of IIR digital filter synthesis.

**4BEC735: Advanced Communication Systems**

CO1: Understand different modulation, demodulation and equalization techniques and use them to analyze the error performance of digital modulation techniques in presence of AWGN noise.

CO2: Analyze and demonstrate the model of discrete time channel with ISI & the model of discrete time channel by equalizer.

CO3: Apply various types of equalizers used for channel modelling and adjusting the filter coefficients.

CO4: Develop the concept of Spread Spectrum Communications over wideband channels.

**4BEC736: Secure Communication**

CO1: Explain basic concepts related to number theory and finite fields.

CO2: Illustrate the various encryption techniques and symmetric ciphers.

CO3: Develop sequence generators and AES cipher.

CO4: Explain different type of theorems and algorithms used in basic cryptography.

CO5: Explain the different authentication techniques used in cryptography.

**4BHS801: Professional Ethics and Engineers**

CO1: Describe the Moral Values and Ethics.

CO2: Explain the Engineering Ethics.

CO3: Discuss the Responsibility as Engineers.

CO4: Examine the Safety and Risk.

CO5: Predict the working Ethics for Engineers.

**4BEC703: Internship**

CO1: Demonstrate the skills in professional career goals.

CO2: Administer the insight into a possible career path of interest with organizational structure, roles and responsibilities.

CO3: Develop professional connections with leadership strategy and skill development.

CO4: Identify the professions to suit the interest as a result of this experience.

CO5: Conquer additional skills that will need to be developed to ensure career readiness such as new technology, developing a broader network, additional coursework.

**4BEC805: Capstone Project – Build**

CO1: Compare the project built with other possible existing solutions to come to a conclusion about its feasibility and reliability.

CO2: Utilize proper project management techniques and planning methods to produce cost effective projects.

CO3: Recommend the need to implementing the project with supporting justification and possible areas to improve the same.

CO4: Compile a clear report that contains the step by step process to building the project that includes all calculations, analysis and fabrication methods involved.

CO5: Build the real world implementation of the design that will realize the objectives of the prototype/ design.

**4BEC741: Low Power VLSI**

CO1: Classify various second order effects in MOSFET device.

CO2: Illustrate the sources of power dissipation in CMOS based logic.

CO3: Construct a suitable circuit to reduce leakage power using suitable low power techniques.

CO4: Demonstrate the knowledge of joint random variables in real time engineering problems.

CO5: Identify the mechanisms of power dissipation in CMOS integrated circuits.

**4BEC744: Multimedia Communication and Networks**

CO1: Understand the basics of different multimedia networks and applications.

CO2: Interpret the digitization principle techniques required in different media types.

CO3: Classify the compression techniques required to compress text and image.

CO4: Analyze multimedia communication in Networks.

CO5: Explain the security system across different networks.

**4BEC745: Biomedical Signal Processing**

CO1: Explain the basic mathematical, scientific and computational skills necessary to analyse ECG signals.

CO2: Apply classical and modern filtering and compression techniques for ECG and EEG signals.

CO3: Develop a thorough understanding on basics of ECG feature extraction.

CO4: Analyze ECG signal with characteristic feature points.

CO5: Understand diagnosing bio-signals and classifying them.

**4BEC854: Advanced Embedded Systems**

CO1: Identify the building blocks of a typical Embedded System.

CO2: Demonstrate characteristics and attributes of an embedded system, hardware /software co-design and firmware design approaches.

CO3: Explain the architectural features of 32 bit microcontroller ARM Cortex M3.

CO4: Understand the different steps involved in the design and development of firmware for embedded systems.

CO5: Explain the need of real time operating system for embedded system applications.

**4BEC855: 4G LTE Advanced and 5G LTE**

CO1: Explain the evolution of 4G, system concepts and spectrum challenges.

CO2: Analyze the role of OFDM's and SC–FDMA access schemes.

CO3: Explain the evolution of 5G, system concepts and spectrum challenges.

CO4: Illustrate the 5G functional and physical architecture and its requirements.

CO5: Introduction to design of a Massive MIMO techniques.

**4BEC856: Optical Networks**

CO1: Describe the system components of optical communication system.

CO2: Apply the principles of communication to design optical network architecture.

CO3: Distinguish various routing techniques of Optical networks.

CO4: Describe the structure of packet switching and access network in Optical Communication system.

CO5: Explain the network design and network management system in Optical communication system.

**4BEC857: Multi-rate Systems, Filter Banks and Wavelets**

CO1: Understand the multirate systems and its applications.

CO2: Explain the concept of decimated filter banks.

CO3: Design paraunitariness filter banks.

CO4: Design Cosine module filter banks.

CO5: Design wavelet transform filter with the help of multirate filter.

# ECE-Course Outcome-2019

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CO1: List nth order derivatives of different functions. (L1)

CO2: Demonstrate the use of partial derivatives. (L2)

CO3: Explain the concept of vector differentiation. (L2)

CO4: Classify the 1st order differential equation. (L2)

CO5: Apply the knowledge of matrices techniques. (L3)

**4BPH112: Engineering Physics for EC**

CO1: Explain drift and diffusion of charge carriers in semiconductor physics. (L2)

CO2: Describe I-V characteristics of PN junction diode and BJT. (L2)

CO3: Explain phase and group velocity, standing waves and energy of a vibrating string in transverse wave motion. (L2)

CO4: Describe Lorentz transformation equations using special theory of relativity. (L2)

CO5: Explain the working principle of lasers and optical fiber communication. (L2)

CO6: Describe the role of various measuring instruments for performing laboratory experiments. (L2)

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CO1: Analyze electrical circuits by relevant Laws in DC circuits. (L2)

CO2: Demonstrate the knowledge of single phase and three-phase power generation by using the phasor diagrams. (L2)

CO3: Select suitable transformer for a given application by considering its design parameters. (L1)

CO4: Describe the working principle of DC Machine, generators and motors. (L2)

CO5: Illustrate the concept of rotating magnetic field and applications. (L1)

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CO1: Select appropriate hand and power tools, machines, equipment and materials and demonstrate their correct use for simple making tasks. (L3)

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CO1: Analyze the problem and apply suitable programming constructs, data structures and algorithms needed to implement a program to solve a simple problem. (L4)

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CO3: Compose engaging creative writing pieces through techniques of speculation and prediction. (L6)

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CO1: Formulate original thought, opinions and insights on engineering by critically analyzing the relationship between Engineering and Society, Environment, Philosophy, Economics and Polity by considering their positive and negative impact on each other. (L5)

CO2: Compare engineering innovations/ innovators from different periods of history by explaining their historical significance. (L2)

CO3: Explain the value and importance of professional and ethical responsibility in the engineering profession by analyzing impact of engineering on the world. (L2)

**Chemistry Cycle**

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CO5: Interpret Cauchy integral formula and Cauchy Residue theorem to solve the complex integration. (L2)

**4BCH202/102: Engineering Chemistry**

CO1: Illustrate the concept of electrochemical cell by writing balanced redox reactions. (L2)

CO2: Explain the mechanism of corrosion in metals by framing stoichiometric chemical reaction. (L2)

CO3: Explain the polymer composites for photocatalytic and photovoltaic applications by examining the photogenerated charged carrier dynamics. (L2)

CO4: Classify different types of carbon forms and its applications by interpreting their structural properties. (L2)

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CO2: Identify and analyze basic electronic components and concepts using working models and experiments. (L1, L4)

CO3: Apply concepts learnt to design basic circuits to achieve desired specific outputs. (L3)

CO4: Develop in teams, simple interactive projects using Arduino that use the knowledge of circuit design and electronic components gained in the course. (L4)

CO5: Develop a Project with knowledge of module from Electronics. (L4)

**4BHS205/105: Environment and Sustainability**

CO1: Outline the expected consequences of continuous environment degradation in the society by relevant data analysis. (L2)

CO2: Demonstrate a rationale for climate change adaptation and mitigation by proposing appropriate actions in key sectors. (L2)

CO3: Explain the key issues under negotiation by summarizing the international climate change legal and policy framework. (L2)

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CO1: Enhance reading comprehension, writing, listening and speaking skills needed to effective communication. (L3)

CO2: Express ideas opinions and to participate in group discussion. (L2)

CO3: Present effectively through various modes of presentation. (L3)

CO4: Understand the cultural sensitivity in communication and use it effectively. (L2)

CO5: Apply skills of socializing and networking in day to day professional communication. (L3)

**4BEC301: Engineering Mathematics-1 for ECE**

CO1: Solve Cauchy's homogeneous linear differential equations. (L3)

CO2: Calculate given integrals using Laplace transforms. (L3)

CO3: Solve linear differential equations by Laplace transform method. (L3)

CO4: Express periodic functions in terms of sine and cosine functions. (L2)

**4BEC302: Analog Electronic Circuits**

CO1: Demonstrate the device characteristics and working principles of BJT and MOSFET, and parameters of different types of amplifiers. (L2)

CO2: Analyze transistor biasing circuits and various amplifier configurations with small signal model. (L4)

CO3: Explain the operation of BJT and MOSFET current mirrors, differential amplifier and frequency response of an amplifier. (L3)

CO4: Analyze different types of feedback amplifiers and oscillators. (L4)

**4BEC303: Digital Electronics and HDL**

CO1: Make use of fundamental concepts to implement digital logic functions. (L3)

CO2: Demonstrate the design-methodology using VHDL. (L2)

CO3: Build a combinational logic circuit with HDL and implement it on programmable logic devices. (L3)

CO4: Develop synchronous and asynchronous sequential circuits, and realize using Hardware description Language and programmable logic devices. (L3)

**4BEC304: Electrical Circuits Theory**

CO1: Demonstrate the knowledge of KCL and KVL by solving electrical networks in phasor and time domain. (L2)

CO2: Select a suitable resonant circuit for a given resonant frequency. (L3)

CO3: Select suitable network theorems for reduction of a given network to simplify the solution for a network problem. (L2)

CO4: Analyze a network under steady and transient states by applying Laplace Transforms to a given circuit. (L3)

CO5: Choose suitable network parameters by transforming them appropriately to analyze a cascaded system. (L2)

**4BEC305: Engineering Electromagnetics**

CO1: Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law. (L1)

CO2: Determine potential and energy with respect to point charge and capacitance using Laplace's equation. (L2)

CO3: Calculate magnetic field, force with respect to magnetic materials. (L2)

CO4: Apply Maxwell's equations for time varying fields, EM waves in free space and conductors. (L3)

**4BHS306: Professional Communication–III**

CO1: Present effectively with an understanding of various aspects of presentation. (L3)

CO2: Develop persuasive proposals by incorporating fundamental writing techniques at an intermediate level. (L3)

CO3: Develop effective reports by incorporating fundamental writing techniques at an intermediate level. (L3)

CO4: Construct references by using a referencing style that is appropriate to the type of academic writing. (L6)

CO5: Construct graphical representation of information by accurately interpreting and visualizing the given data. (L4)

**4BHS307: Prepare Program–I**

CO1: Apply number theory and speed calculation methods for quick computation and manipulation of numbers. (L3)

CO2: Apply speed calculation methods for computing cubes and cube roots. (L3)

CO3: Apply the theory of linear and quadratic equations using methods of equation formation (indeterminate systems, equation comparisons etc.) to solve problems in several domains (e.g. age problems). (L3)

CO4: Analyze distributive and arrangements of puzzles to conclude logical solutions that adhere to the given parameters. (L4)

CO5: Apply basic English grammar rules (parts of speech, components and types of sentences) to identify errors in texts and construct correct sentences. (L3)

**4BHS308: Design Thinking–I**

CO1: Analyze the problems using the design thinking core concepts. (L3)

CO2: Summarize the blueprint into storytelling concepts. (L2)

CO3: Identify the failure in the concepts from creativity tools. (L3)

CO4: Select the product/service using state of art technique. (L2)

CO5: Develop the business model. (L3)

**4BEC401: Engineering Mathematics–II for ECE**

CO1: Solve first and second order ordinary differential equation using single step and multistep numerical methods. (L3)

CO2: Apply the trapezoidal and Simpson's 1/3 rule for numerical integration. (L3)

CO3: Formulate the partial differential equations for physical problems. (L2)

CO4: Determine the solution of partial differential equation by variable separable method. (L2)

CO5: Determine the solution of partial differential equation by using the Laplace transform. (L2)

**4BEC402: Linear Integrated Circuits**

CO1: Summarize the fabrication of integrated circuits and explain op-amp fundamentals. (L2)

CO2: Explain op-amp characteristics and learn about voltage follower, inverting / non-inverting & difference amplifier. (L2)

CO3: Develop circuits for op-amp based active filters. (L3)

CO4: Summarize op-amp applications in voltage regulators. (L2)

CO5: Explain applications of linear ICs in DAC, ADC, AGC, AVC. (L2)

**4BEC403: Microprocessor and Microcontroller**

CO1: Explain working of 8086 microprocessor and assembly language programming. (L2)

CO2: Develop code for various applications using 8086 microprocessors. (L3)

CO3: Explain working of 8051 microcontroller and assembly language programming. (L2)

CO4: Develop code for various applications using 8051 microcontrollers. (L3)

CO5: Explain working of higher end microprocessors. (L2)

**4BEC404: Instrumentation and Sensors**

CO1: Outline the operation and characteristics of instruments with the help of a block diagram. (L2)

CO2: Relate analog to digital conversion operation with digital voltmeter performance characteristics. (L2)

CO3: Explain the working principles of stimuli, measuring and display instruments. (L2)

CO4: Explain the principles of various sensors and signal conditioning circuits. (L2)

CO5: Classify the various types of transducers and their characteristics. (L2)

**4BEC405: Signals and Systems**

CO1: Classify the continuous and discrete time signals and systems. (L2)

CO2: Solve the system response using system's equation and using convolution. (L3)

CO3: Demonstrate the continuous time signals using Fourier series and Fourier Transform and the concept of sampling in time domain. (L2)

CO4: Demonstrate the discrete time signals using Fourier series and Fourier Transform and the concept of sampling in frequency domain. (L2)

CO5: Solve the Discrete time systems using Z transform and Discrete Time Fourier transforms. (L3)

**4BHS406: Professional Communication–IV**

CO1: Plan, prepare and create business profile, portfolios, brochures, newsletters and banners. (L6)

CO2: Apply the different aspects technical written communication in writing. (L3)

CO3: Compose different types of business Correspondence. (L6)

CO4: Compose documents related to professional correspondence. (L6)

CO5: Demonstrate different effective strategies of presentation keeping in mind the importance of effective Listening. (L3)

**4BHS407: Prepare Program–II**

CO1: Apply number theory and speed calculation methods for the quick computation and manipulation of numbers. (L2)

CO2: Apply the concepts of percentage and exponents for computing simple and compound interest. (L2)

CO3: Integrate concepts of logical connectives to breakdown linguistic components and solve puzzles that use logical connectors. (L2)

CO4: Solve puzzles based on logical connectors. (L2)

CO5: Utilize techniques of public debate within a team by taking on different roles and articulating complex ideas in a persuasive manner. (L2)

**4BHS408: Design Thinking-II**

CO1: Analyze user needs using structured techniques to discover unique product opportunity areas. (L3)

CO2: Define the problem in a human-centric manner as a problem statement after analyzing your observations in the previous stage. (L1)

CO3: Explain the solutions to tackle a given challenge by using iterative ideation techniques to generate alternative ideas, refine concepts and select the appropriate solution. (L3)

CO4: Apply techniques of effective communication and collaboration to deliver convincing presentations, share and receive feedback, work effectively in teams and visualize their ideas. (L3)

CO5: Demonstrate professionalism by adhering to deadlines, focusing on quality of work, maintaining detailed documentation and effectively using platforms for digital collaboration. (L2)

**4BEC441: Instrumentation and Sensors**

CO1: Outline the operation and characteristics of instruments with the help of a block diagram. (L2)

CO2: Relate analog to digital conversion operation with digital voltmeter performance characteristics. (L2)

CO3: Explain the working principles of stimuli, measuring and display instruments. (L2)

CO4: Explain the principles of various sensors and signal conditioning circuits. (L2)

CO5: Classify the various types of transducers and their characteristics. (L2)

**4BEC442: Industrial Electronics**

CO1: Explain the different types of power semiconductor devices and their switching characteristics. (L2)

CO2: Explain the operation, characteristics and performance parameters of controlled rectifiers. (L2)

CO3: Differentiate between the characteristics of DC and AC drives. (L2)

CO4: Explain the different modulation techniques of pulse width modulated inverters and understand the harmonic reduction methods. (L2)

CO5: Explain the practical application of power electronics converters in conditioning the power supply. (L2)

**4BEC444: Image Processing for Remote Sensing**

CO1: Identify the basic concepts and principles of remote sensing. (L1)

CO2: Distinguish between the types of resolutions in satellites and remote sensing systems. (L2)

CO3: Identify the components in Digital Image Processing and apply them to the fundamental steps. (L3)

CO4: Explain different methods in Image Acquisition, Wavelets and Compression Techniques. (L2)

CO5: Demonstrate the knowledge of techniques involved in Colour Image Processing. (L3)

**4BHS5A1: Sociology of Globalization and Sustainable Development**

CO1: Demonstrate understanding of globalization process with emphasis on inter-dependence of communities and societies. (L1)

CO2: Analyze the critical issues in social development in the given context. (L2)

CO3: Develop technological interventions for social and community development. (L3)

CO4: Explain the health and hygiene of the community. (L2)

CO5: Develop technological interventions for social and community development. (L3)

**4BEC502: Transmission Lines and Antennas**

CO1: Apply the concepts of electromagnetic fields and transmission lines. (L3)

CO2: Demonstrate different modes of propagation in waveguides. (L2)

CO3: Compare the fundamental parameters of antenna and wave propagation. (L3)

CO4: Identify Dipoles and Thin linear antennas. (L3)

CO5: Identify the working principle of various types of antenna and categorize them according to their applications. (L2)

**4BEC503: Digital Signal Processing**

CO1: Demonstrate the concept of filtering of long data sequence and fast Fourier Transform. (L2)

CO2: Explain the concept of transform analysis of LTI systems. (L2)

CO3: Develop FIR filter for the given specifications. (L3)

CO4: Develop IIR filter for the given specifications. (L3)

CO5: Explain the finite word length effect and concept of multi-rate signal processing. (L2)

**4BEC504: Power Electronics**

CO1: Describe the characteristics of different power devices and identify the applications. (L3)

CO2: Illustrate the working of step up and step down choppers. (L2)

CO3: Determine the output response of a thyristor circuit with various triggering options. (L3)

CO4: Determine the response of controlled rectifier with resistive and inductive loads. (L3)

CO5: Illustrate the working of various pulse width modulated inverters. (L2)

**4BEC505: Control Systems**

CO1: Develop a mathematical model for mechanical systems using Laplace Transform. (L3)

CO2: Analyze the performance characteristics of first and second order systems using standard test signals. (L4)

CO3: Test for the stability of a system using Routh–Hurwitz (RH) criterion and Root locus techniques in the time domain. (L3)

CO4: Analyze the stability of a system in the frequency domain using Bode plot and Nyquist criterion. (L4)

**4BHS506: Professional Communication-V**

CO1: Compose abstract and literature review as parts of academic writing. (L5)

CO2: Prepare agenda, minutes and memos in specific business set up. (L5)

CO3: Apply skills of argumentation using various techniques of arguments and deliberation. (L3)

CO4: Exhibit basics of interview etiquette in a given professional set up. (L3)

CO5: Plan and prepare presentation using media and advertisements. (L5)

**4BHS507: Prepare Program-III**

CO1: Use the concepts of work-time-efficiency and distance–time–speed to solve problems related to the measurement of effort or performance. (L3)

CO2: Analyze geometric shapes and use mensuration formulas to mathematically measure 2D and 3D solids. (L4)

CO3: Illustrate conceptual knowledge of blood relationships and direction sense through the creation of schematic diagrams and solving related problems. (L3)

CO4: Apply the concepts of input–output, series, as well as coding and decoding to discern specific patterns (finding the odd term, types of codes etc.) from given data to solve problems. (L3)

CO5: Apply the concepts of coding and decoding to discern specific patterns from given data to solve problems. (L3)

**4BEC508: Mini Project–I**

CO1: Conduct a survey of several available literature in the preferred field of study. (L5)

CO2: Demonstrate practical knowledge within the chosen area of technology for project development. (L2)

CO3: Analyze the problem requirements and arrive at workable design solutions. (L4)

CO4: Compare and contrast the several existing solutions for the attempted problem. (L5)

CO5: Summarize the report and present the findings of the study conducted in the preferred domain. (L2)

**4BEC511: Digital VLSI Design**

CO1: Illustrate VLSI Design Flow for abstraction levels and its design complexity attributes. (L2)

CO2: Analyze an IC for manufacturing CMOS design and fabrication process of distinct IP/IC based design. (L4)

CO3: Construct a Verilog modules by employing FPGA. (L3)

CO4: Formulate chip design overview and TCL environmental setup. (L6)

CO5: Construct TCL scripting using basic syntax. (L6)

**4BEC513: Random Process**

CO1: Apply the fundamental probability theory and random process to solve practical engineering problems. (L3)

CO2: Classify different type of random variables with appropriate CDF and PDF. (L2)

CO3: Interpret the key parameters of Random variables that underlie the random nature of the problems. (L2)

CO4: Demonstrate the knowledge of joint random variables in real time engineering problems. (L2)

CO5: Demonstrate the application of random process to characterize discrete and continuous channel models. (L2)

**4BEC514: Cloud Computing**

CO1: Explain main concepts, key technologies, strengths and limitations of cloud computing. (L2)

CO2: Explain the cloud enabling technologies that help in the development of cloud. (L2)

CO3: Develop the ability to use the architecture of compute and storage cloud, service and delivery models. (L3)

CO4: Explain core issues of cloud computing such as resource management and security. (L2)

CO5: Choose the appropriate technologies and approaches for implementation and use of cloud. (L3)

**4BEC515: Digital Switching Systems**

CO1: Understand the basics of communication networks and digital transmission of data. (L2)

CO2: Study about the evolution of switching systems and the digital switching. (L2)

CO3: Study about the switching systems communication traffic and its measurements. (L2)

CO4: Learn the technologies associated with the data switching operations. (L2)

CO5: Understand the use of software for the switching and its maintenance. (L2)

**4BHS6B1: Business Management for Engineers**

CO1: Apply the concepts related to entrepreneurship issues in business ideas. (L3)

CO2: Explain the factors influencing the practice of management in different contexts. (L2)

CO3: Develop suitable economic strategy regarding common business problems. (L3)

CO4: Analyze the marketing strategy for common engineering business problems. (L4)

CO5: Illustrate the leadership qualities in the operation of a new venture. (L2)

**4BEC602: Analog and Digital Communication**

CO1: Explain the working of amplitude modulators and receivers. (L2)

CO2: Explain the Angle modulation techniques. (L2)

CO3: Demonstrate the reception and demodulation of FM and also the various types of Noise. (L2)

CO4: Interpret pulse modulation techniques and base band data transmission. (L2)

CO5: Compare the digital modulation techniques. (L2)

**4BEC603: Embedded Systems**

CO1: Classify an Embedded System based on various design parameters and peripherals. (L2)

CO2: Explain the architectural features of 32-bit microcontroller ARM Cortex M3. (L2)

CO3: Explain the instruction set of 32-bit microcontroller ARM Cortex M3. (L2)

CO4: Make use of the knowledge gained for programming ARM Cortex M3 for different applications using C and assembly language. (L3)

CO5: Choose appropriate communication protocol for an application. (L3)

**4BEC604: CMOS VLSI Design**

CO1: Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling. (L2)

CO2: Outline the basic gates using the stick and layout diagrams with the knowledge of physical design aspects. (L2)

CO3: Explain memory elements along with timing considerations. (L2)

CO4: Illustrate testing and testability issues in VLSI design. (L2)

CO5: Construct CMOS subsystems and architectural issues with the design. (L2)

**4BEC605: Information Theory and Coding Design**

CO1: Analyze the fundamentals of probability theory & random process. (L4)

CO2: Illustrate with example the concept of information theory, source coding, channel capacity, channel coding and the relation among them. (L2)

CO3: Design the channel performance using Information theory. (L6)

CO4: Identify various error control code and apply linear block codes for error detection and correction. (L3)

CO5: Construct binary cyclic codes and convolutional codes for improving channel performance. (L6)

**4BHS606: Professional Communication–VI**

CO1: Demonstrate the advanced skills of presentation. (L3)

CO2: Compose technical documents following proper format and style. (L6)

CO3: Evaluate cases pertaining to a specific domain and recommend innovative suggestion/s to the case. (L4)

CO4: Apply the registers of technical English in oral and written mode of communication. (L3)

CO5: Collaborate and express themselves in an Interview round. (L6)

**4BHS607: Prepare Program-IV**

CO1: Solve problems of various arrangements (circular, linear etc) and criteria (expected value, biased dice etc.). (L3)

CO2: Use concepts from statistics (mean, median etc) and progressions (AP, GP, HP) to analyze groups of numbers on the mentioned parameters, indices and surds to solve problems related to representation of numbers (large integers, irrational roots etc.). (L3)

CO3: Examine four types of logical statements to solve puzzles based on syllogisms. (L3)

CO4: Apply the concepts of Venn diagrams and cubes to solve puzzles using set theory, breaking-building rules etc. (L3)

CO5: Combine logic with their knowledge of advanced English vocabulary and grammar to solve verbal data tasks (ex: para-completion etc.) and articulate their ideas. (L4)

**4BEC608: Mini Project – II**

CO1: Demonstrate practical knowledge within the chosen area of technology for project development. (L2)

CO2: Identify, analyze, formulate and handle computer/IT projects with a comprehensive and systematic approach to give workable design solutions. (L4)

CO3: Conduct a survey of several available literature in the preferred field of study and compare the several existing solutions for the attempted problem. (L5)

CO4: Propose innovative solution for the development of components, processes or technologies in CS/IT field. (L6)

CO5: Report and present the findings of the study conducted in the preferred domain as well develop effective communication skills for presentation of project related activities. (L3)

**4BEC621: Speech and Audio Processing**

CO1: Explain the speech production and different models. (L2)

CO2: Explain the frequency domain analysis, speech recognition and text to speech conversion. (L2)

CO3: Explain the signal processing models of Audio perception and Analysis. (L2)

CO4: Summarize different Audio compression methods. (L2)

CO5: Explain Spatial Audio Perception and rendering and Audio quality analysis. (L2)

**4BEC622: MEMS**

CO1: Explain the various techniques of Micro-fabrication and Micro–Machining. (L2)

CO2: Illustrate the properties of various materials used for MEMS fabrication. (L2)

CO3: Analyze various MEMS structures used for diversified applications. (L3)

CO4: Classify various sensors and actuators. (L2)

CO5: Introduction to MEMS and MEMS packaging design. (L3)

**4BEC623: RF IC's**

CO1: Explain the RF systems. (L2)

CO2: Describe the MOS device physics and distributed systems. (L2)

CO3: Explain bandwidth estimation, amplifiers, noise and LNA design. (L2)

CO4: Explain different power amplifiers and VCO. (L2)

CO5: Describe different architectures such as GSM radio architectures, CDMA, UMTS radio architectures. (L2)

**4BEC624: Introduction to Hybrid and Electric Vehicles**

CO1: Explain the concepts of various hybrid and electric vehicles. (L2)

CO2: Explain the vehicle power source characterization. (L2)

CO3: Analyze various battery and fuel cell based energy storage. (L3)

CO4: Classify various energy management strategies. (L2)

CO5: Introduction to design of a Hybrid Electric Vehicle (HEV), and Battery Electric Vehicle (BEV). (L3)

**4BEC625: Satellite Communication**

CO1: Explain the satellite orbits and its trajectories with the definitions of parameters associated with it. (L2)

CO2: Illustrate the electronic hardware systems associated with the satellite subsystem and earth station. (L2)

CO3: Explain the various applications of satellite with the focus on national satellite system. (L2)

CO4: Explain the satellite link parameters under various propagation conditions with the illustration of multiple access techniques. (L2)

CO5: Explain the Remote sensing satellites, Weather forecasting satellites and Navigational satellites. (L2)

**4BEC626: Fundamentals of Machine Learning**

CO1: Describe fundamental concepts and issues of machine learning. (L2)

CO2: Prepare data for Machine Learning IDA and EDA. (L2)

CO3: Describe Supervised Machine Learning algorithms like Linear Regression and Logistic Regression. (L2)

CO4: Explain Un-Supervised Machine Learning algorithms like Clustering. (L2)

CO5: Explain Artificial Neural Networks and Deep Learning. (L2)

**4BEC701: Microwave and Radar**

CO1: Acquire knowledge on the theory of microwave transmission, microwave generators and associated components. (L2)

CO2: Demonstrate microwave devices and monolithic microwave integrated circuits. (L2)

CO3: Understand the radar fundamentals and radar signals. (L2)

CO4: Illustrate the working principle of pulse Doppler radars and their applications and limitations. (L2)

CO5: Describe the working of various radar transmitters and receivers. (L2)

**4BEC702: Computer Communication Networks**

CO1: Explain Data Communication with key concepts of networks, its types and OSI network model. (L2)

CO2: Identify the data link layer from OSI model, understanding the concepts related to layer, protocols. (L3)

CO3: Demonstrate the concept of Wired LAN's standards and its architecture. (L2)

CO4: Explain various connecting devices, IP address and routing mobile IP. (L2)

CO5: Explain the various transport layer protocols, UDP and TCP service applications and flow and error control. (L2)

**4BEC802: Image and Video Processing**

CO1: Explain different methods for image acquisition, storage and representation in digital devices and role of image transforms in representing, highlighting, and modifying image features. (L2)

CO2: Interpret the mathematical principles in digital image enhancement and apply them in spatial domain. (L2)

CO3: Interpret the mathematical principles in digital image enhancement and apply them in frequency domain. (L2)

CO4: Summarize several image segmentation methods and morphological operations. (L2)

CO5: Explain the concept of video processing and different video compression techniques. (L2)

**4BEC803: Wireless Communication**

CO1: Explain the basics and types of wireless communication systems being used. (L2)

CO2: Explain the basic concepts of cellular system and the design requirements. (L2)

CO3: Demonstrate the basic principles behind radio resource management techniques such as frequency reuse, channel allocation and handoffs. (L2)

CO4: Interpret knowledge and gain awareness on the technologies used for effective share of spectrum by multiple access techniques i.e. TDMA, CDMA, FDMA etc. (L2)

CO5: Summarize the wireless standards being used across the world. (L2)

**4BEC804: Optical Communication**

CO1: Summarize the concepts and theory of optical fiber communication. (L2)

CO2: Explain various transmission characteristics of optical fibers. (L2)

CO3: Illustrate the working of LEDs and Laser diodes as optical sources. (L2)

CO4: Explore the functions and characteristics of optical detectors and receivers. (L2)

CO5: Discuss the WDM systems, optical amplifiers and DTL systems. (L1)

**4BHS704: Prepare Program-V**

CO1: Apply number theory concepts and formulas to solve problems of base system, remainder theorem etc. (L3)

CO2: Categorize contradictions within the area of binary logic to solve problems using concepts of contradictions truth tellers, liars and alternators, pattern recognition problems (fillers, calendar etc.) by utilizing different functions that fit the given criteria. (L3)

CO3: Analyze the sufficiency of data and interpret its specific components by solving problems using data reasoning and interpretation of its numerical and graphic representations. (L4)

CO4: Make use of advanced arithmetic, algebra and mensuration techniques to solve a variety of problems using a range of concepts from partnership to permutation and combination. (L3)

CO5: Apply written and verbal communication techniques by reading and articulating themselves in the format of discussion, debate, interview, essay, letter etc. (L3)

**4BEC705: Capstone Project–Design**

CO1: Demonstrate engineering knowledge and its framework for its implementation in the project design as well work in groups taking leadership role and communicate effectively. (L2)

CO2: Survey relevant literature in the chosen field of study that allows interrelation of design and research. (L4)

CO3: Model a prototype/ concept design that exhibits the feasibility of the solution from cost, engineering and environmental aspects. (L3)

CO4: Justify the project design with a structured report that covers all the work carried out between framing the problem statement to the project design. (L5)

CO5: Design conceptual ideas that address the issues with respect to real world problems. (L6)

**4BEC731: Internet of Things (IoT)**

CO1: Interpret the impact and challenges posed by IoT networks leading to new architectural models. (L2)

CO2: Compare and contrast the deployment of smart objects and the technologies to connect them to network. (L2)

CO3: Explain the role of IoT protocols for efficient network communication. (L2)

CO4: Explain the need for data analytics and security in IoT. (L2)

CO5: Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in industry. (L2)

**4BEC732: Advanced Digital Signal Processing**

CO1: Explain the concept of discrete random process. (L2)

CO2: Demonstrate the different methods for spectrum estimation. (L2)

CO3: Explain the different methods in linear estimation and prediction. (L2)

CO4: Explain adaptive filters. (L2)

CO5: Explain the wavelet transforms and its applications. (L2)

**4BEC733: Neural Network and Fuzzy Logic**

CO1: Compare the Biological and Artificial Neural Networks. (L2)

CO2: Classify the back propagation and counter propagation networks. (L2)

CO3: Explain adaptive resonant theory. (L2)

CO4: Compare crisp set and fuzzy set theory. (L2)

CO5: Apply fuzzy logic controller to real time systems. (L3)

**4BEC734: Adaptive Signal Processing**

CO1: Explain filtering solutions for optimising the cost function indicating error in estimation of parameters. (L2)

CO2: Evaluate the performance of various methods for designing adaptive filters. (L3)

CO3: Explain convergence and stability issues associated with adaptive filter design. (L2)

CO4: Design and implement filtering solutions for applications such as channel equalisation, interference cancelling and prediction. (L3)

CO5: Explain the role and importance of IIR digital filter synthesis. (L2)

**4BEC735: Advanced Communication Systems**

CO1: Understand different modulation, demodulation and equalization techniques and use them to analyze the error performance of digital modulation techniques in presence of AWGN noise. (L2)

CO2: Analyze and demonstrate the model of discrete time channel with ISI & the model of discrete time channel by equalizer. (L2)

CO3: Apply various types of equalizers used for channel modelling and adjusting the filter coefficients. (L2)

CO4: Develop the concept of Spread Spectrum Communications over wideband channels. (L2)

**4BEC736: Secure Communication**

CO1: Explain basic concepts related to number theory and finite fields. (L2)

CO2: Illustrate the various encryption techniques and symmetric ciphers. (L2)

CO3: Develop sequence generators and AES cipher. (L3)

CO4: Explain different type of theorems and algorithms used in basic cryptography. (L2)

CO5: Explain the different authentication techniques used in cryptography. (L2)

**4BHS801: Professional Ethics and Engineers**

CO1: Describe the Moral Values and Ethics. (L1)

CO2: Explain the Engineering Ethics. (L1)

CO3: Discuss the Responsibility as Engineers. (L2)

CO4: Examine the Safety and Risk. (L2)

CO5: Predict the working Ethics for Engineers. (L2)

**4BEC703: Internship**

CO1: Demonstrate the skills in professional career goals. (L2)

CO2: Administer the insight into a possible career path of interest with organizational structure, roles and responsibilities. (L3)

CO3: Develop professional connections with leadership strategy and skill development. (L4)

CO4: Identify the professions to suit the interest as a result of this experience. (L3)

CO5: Conquer additional skills that will need to be developed to ensure career readiness such as new technology, developing a broader network, additional coursework. (L4)

**4BEC805: Capstone Project – Build**

CO1: Compare the project built with other possible existing solutions to come to a conclusion about its feasibility and reliability. (L4)

CO2: Utilize proper project management techniques and planning methods to produce cost effective projects. (L3)

CO3: Recommend the need to implementing the project with supporting justification and possible areas to improve the same. (L5)

CO4: Compile a clear report that contains the step by step process to building the project that includes all calculations, analysis and fabrication methods involved. (L5)

CO5: Build the real world implementation of the design that will realize the objectives of the prototype/ design. (L6)

**4BEC741: Low Power VLSI**

CO1: Classify various second order effects in MOSFET device. (L3)

CO2: Illustrate the sources of power dissipation in CMOS based logic. (L2)

CO3: Construct a suitable circuit to reduce leakage power using suitable low power techniques. (L2)

CO4: Demonstrate the knowledge of joint random variables in real time engineering problems. (L3)

CO5: Identify the mechanisms of power dissipation in CMOS integrated circuits. (L3)

**4BEC744: Multimedia Communication and Networks**

CO1: Understand the basics of different multimedia networks and applications. (L2)

CO2: Interpret the digitization principle techniques required in different media types. (L2)

CO3: Classify the compression techniques required to compress text and image. (L2)

CO4: Analyze multimedia communication in Networks. (L2)

CO5: Explain the security system across different networks. (L2)

**4BEC745: Biomedical Signal Processing**

CO1: Explain the basic mathematical, scientific and computational skills necessary to analyse ECG signals. (L2)

CO2: Apply classical and modern filtering and compression techniques for ECG and EEG signals. (L3)

CO3: Develop a thorough understanding on basics of ECG feature extraction. (L3)

CO4: Analyze ECG signal with characteristic feature points. (L4)

CO5: Understand diagnosing bio-signals and classifying them. (L2)

**4BEC854: Advanced Embedded Systems**

CO1: Identify the building blocks of a typical Embedded System. (L3)

CO2: Demonstrate characteristics and attributes of an embedded system, hardware /software co-design and firmware design approaches. (L2)

CO3: Explain the architectural features of 32 bit microcontroller ARM Cortex M3. (L2)

CO4: Understand the different steps involved in the design and development of firmware for embedded systems. (L2)

CO5: Explain the need of real time operating system for embedded system applications. (L2)

**4BEC855: 4G LTE Advanced and 5G LTE**

CO1: Explain the evolution of 4G, system concepts and spectrum challenges. (L2)

CO2: Analyze the role of OFDM's and SC–FDMA access schemes. (L3)

CO3: Explain the evolution of 5G, system concepts and spectrum challenges. (L2)

CO4: Illustrate the 5G functional and physical architecture and its requirements. (L2)

CO5: Introduction to design of a Massive MIMO techniques. (L3)

**4BEC856: Optical Networks**

CO1: Describe the system components of optical communication system. (L2)

CO2: Apply the principles of communication to design optical network architecture. (L3)

CO3: Distinguish various routing techniques of Optical networks. (L2)

CO4: Describe the structure of packet switching and access network in Optical Communication system. (L2)

CO5: Explain the network design and network management system in Optical communication system. (L3)

**4BEC857: Multi-rate Systems, Filter Banks and Wavelets**

CO1: Understand the multirate systems and its applications. (L2)

CO2: Explain the concept of decimated filter banks. (L2)

CO3: Design paraunitariness filter banks. (L2)

CO4: Design Cosine module filter banks. (L4)

CO5: Design wavelet transform filter with the help of multirate filter. (L2)

# ECE-Course Outcome-2020

## 1st Semester

**4BMA101: Engineering Mathematics-I (L1-L3)**
**CO1**: List nth order derivatives of different functions. (L1)
**CO2**: Demonstrate the use of partial derivatives. (L2)
**CO3**: Explain the concept of vector differentiation. (L2)
**CO4**: Classify the 1st order differential equation. (L2)
**CO5**: Apply the knowledge of matrices techniques. (L3)
**4BPH112: Engineering Physics for ECE (L2)**
**CO1**: Explain drift and diffusion of charge carriers in semiconductor physics. (L2)
**CO2**: Describe I-V characteristics of PN junction diode and BJT. (L2)
**CO3**: Explain phase and group velocity, standing waves and energy of a vibrating string in transverse wave motion. (L2)
**CO4**: Describe Lorentz transformation equations using special theory of relativity. (L2)
**CO5**: Explain the working principle of lasers and optical fiber communication. (L2)
**CO6**: Describe the role of various measuring instruments for performing laboratory experiments. (L2)
**CO7**: Explain the experimental setup, observed measurements and corresponding results using appropriate physical quantities and theoretical formulae. (L2)
**4BEE103/203: Basic Electrical Engineering (L1-L2)**
**CO1**: Analyze electrical circuits by relevant Laws in DC circuits. (L2)
**CO2**: Demonstrate the knowledge of single phase and three-phase power generation by using the phasor diagrams. (L2)
**CO3**: Select suitable transformer for a given application by considering its design parameters. (L1)
**CO4**: Describe the working principle of DC Machine, generators and motors. (L2)
**CO5**: Illustrate the concept of rotating magnetic field and applications. (L1)
**4BME104/204: Engineering Workshop (L3-L6)**
**CO1**: Select appropriate hand and power tools, machines, equipment and materials and demonstrate their correct use for simple making tasks. (L3)
**CO2**: Using basic math and measuring instruments that are appropriate build wooden model. (L6)
**CO3**: Demonstrate sheet metal model using development techniques, adhesives and fasteners. (L3)
**CO4**: Demonstrate welding technology for model making. (L3)
**4BCS105/205: Programming with Python (L3-L6)**
**CO1**: Analyze the problem and apply suitable programming constructs, data structures and algorithms needed to implement a program to solve a simple problem. (L4)
**CO2**: Explain the various modules of any project by defining architecture. (L2)
**CO3**: Evaluate simple open source programs by appropriately editing and debugging the code. (L5)
**CO4**: Develop an application using python and raspberry pi to solve a real-life problem. (L6)
**CO5**: Choose a best possible way to solve a problem by listening to various opinions of diverse team and interviewing experts. (L3)
**4BHS106: Professional Communication I (L2-L6)**
**CO1**: Demonstrate accurately use of grammar, punctuation and vocabulary in different types of communication. (L2)
**CO2**: Apply basic skills of paraphrasing and rewriting by taking and making effective notes. (L3)
**CO3**: Compose engaging creative writing pieces through techniques of speculation and prediction. (L6)
**CO4**: Compose compelling emails and letters using appropriate writing etiquette and rules of

(L6)
**CO5**: Compose compelling formal and informal letters. (L6)

**4BHS107/207: Modern History of Engineering (L2-L5)**

**CO1**: Formulate original thought, opinions and insights on engineering by critically analyzing the relationship between Engineering and Society, Environment, Philosophy, Economics and Polity by considering their positive and negative impact on each other. (L5)
**CO2**: Compare engineering innovations/ innovators from different periods of history by explaining their historical significance. (L2)
**CO3**: Explain the value and importance of professional and ethical responsibility in the engineering profession by analyzing impact of engineering on the world. (L2)

## 2nd Semester

**4BMA201: Engineering Mathematics - II (L2-L3)**

**CO1**: Understand discrete and continuous probability distributions to resolve various engineering problems. (L2)
**CO2**: Apply the method of least squares to estimate the parameters of a regression model. (L3)
**CO3**: Implement Test of Hypothesis for a population parameter for small sample and large sample cases. (L3)
**CO4**: Recognize Complex Number System, Elementary complex functions and analytic functions. (L1)
**CO5**: Interpret Cauchy integral formula and Cauchy Residue theorem to solve the complex integration. (L2)

**4BCH202: Engineering Chemistry (L2)**

**CO1**: Illustrate the concept of electrochemical cell by writing balanced redox reactions. (L2)
**CO2**: Explain the mechanism of corrosion in metals by framing stoichiometric chemical reaction. (L2)
**CO3**: Explain the polymer composites for photocatalytic and photovoltaic applications by examining the photogenerated charged carrier dynamics. (L2)
**CO4**: Classify different types of carbon forms and its applications by interpreting their structural properties. (L2)
**CO5**: Understand the synthesis of nanomaterials by determining appropriate solution method. (L2)

**4BME203/103: Computer Aided Engineering Drawing and Rapid Prototyping (L1-L6)**

**CO1**: Draw orthographic projections (TV, FV and SV) of points, straight lines, surfaces using instruments and CAD software. (L1)
**CO2**: Apply concepts of basic engineering drawings to generate drawings of simple objects. (L3)
**CO3**: Draw projections of solids and its section using projection theory and visualization technique. (L3)
**CO4**: Demonstrate skill in developing a prototype using rapid prototyping. (L3)
**CO5**: Using isometric projections of combination of solids build model by laser cutting or 3D printing machine. (L6)

**4BEC204/104: Making With Electronics (L2-L4)**

**CO1**: Associate basic engineering principles with operations of electronic components, equipment and circuits at an elementary level. (L2)
**CO2**: Identify and analyze basic electronic components and concepts using working models and experiments. (L1, L4)
**CO3**: Apply concepts learnt to design basic circuits to achieve desired specific outputs. (L3)
**CO4**: Develop in teams, simple interactive projects using Arduino that use the knowledge of circuit design and electronic components gained in the course. (L4)
**CO5**: Develop a Project with knowledge of module from Electronics. (L4)

**4BHS205: Environment and Sustainability (L2)**

**CO1**: Outline the expected consequences of continuous environment degradation in the society by relevant data analysis. (L2)
**CO2**: Demonstrate a rationale for climate change adaptation and mitigation by proposing appropriate actions in key sectors. (L2)
**CO3**: Explain the key issues under negotiation by summarizing the international climate change legal and policy framework. (L2)
**CO4**: Demonstrate knowledge of environment sustainability by analyzing relevant data about industrial impact on environment. (L2)

**4BHS206: Professional Communication-II (L2-L3)**

**CO1**: Enhance reading comprehension, writing, listening and speaking skills needed to effective communication. (L3)
**CO2**: Express ideas opinions and to participate in group discussion. (L2)
**CO3**: Present effectively through various modes of presentation. (L3)
**CO4**: Understand the cultural sensitivity in communication and use it effectively. (L2)
**CO5**: Apply skills of socializing and networking in day to day professional communication. (L3)

## 3rd Semester

**4BEC301: Engineering Mathematics-1 for ECE (L2-L3)**

**CO1**: Solve Cauchy's homogeneous linear differential equations. (L3)
**CO2**: Calculate given integrals using Laplace transforms. (L3)
**CO3**: Solve linear differential equations by Laplace transform method. (L3)
**CO4**: Express periodic functions in terms of sine and cosine functions. (L2)
**CO5**: Calculate the double and triple integral in Cartesian and polar form. (L3)

**4BEC302: Analog Electronic Circuits (L2-L4)**

**CO1**: Demonstrate the device characteristics and working principles of BJT and MOSFET, and parameters of different types of amplifiers. (L2)
**CO2**: Analyze transistor biasing circuits and various amplifier configurations with small signal model. (L4)
**CO3**: Explain the operation of BJT and MOSFET current mirrors, differential amplifier and frequency response of an amplifier. (L3)
**CO4**: Analyze different types of feedback amplifiers and oscillators. (L4)
**CO5**: Design of series and shunt voltage regulators for a Power supply. (L4)

**4BEC303: Digital Electronics and HDL (L2-L6)**

**CO1**: Make use of fundamental concepts to implement digital logic functions. (L3)
**CO2**: Demonstrate the design-methodology using VHDL. (L2)
**CO3**: Build a combinational logic circuit with HDL and implement it on programmable logic devices. (L3)
**CO4**: Develop synchronous and asynchronous sequential circuits, and realize using Hardware description Language and programmable logic devices. (L3)
**CO5**: Design finite state machine for different applications. (L6)

**4BEC304: Electrical Circuits Theory (L2-L3)**

**CO1**: Demonstrate the knowledge of KCL and KVL by solving electrical networks in phasor and time domain. (L2)
**CO2**: Select a suitable resonant circuit for a given resonant frequency. (L3)
**CO3**: Select suitable network theorems for reduction of a given network to simplify the solution for a network problem. (L2)
**CO4**: Analyze a network under steady and transient states by applying Laplace Transforms t

circuit. (L3)
**CO5**: Choose suitable network parameters by transforming them appropriately to analyze a cascaded system. (L2)

**4BEC305: Engineering Electromagnetics (L1-L3)**

**CO1**: Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law. (L1)
**CO2**: Determine potential and energy with respect to point charge and capacitance using Laplace's equation. (L2)
**CO3**: Calculate magnetic field, force with respect to magnetic materials. (L2)
**CO4**: Apply Maxwell's equations for time varying fields, EM waves in free space and conductors. (L3)
**CO5**: Evaluate power associated with EM waves using Poynting theorem. (L2)

**4BHS306: Professional Communication–III (L3-L6)**

**CO1**: Present effectively with an understanding of various aspects of presentation. (L3)
**CO2**: Develop persuasive proposals by incorporating fundamental writing techniques at an intermediate level. (L3)
**CO3**: Develop effective reports by incorporating fundamental writing techniques at an intermediate level. (L3)
**CO4**: Construct references by using a referencing style that is appropriate to the type of academic writing. (L6)
**CO5**: Construct graphical representation of information by accurately interpreting and visualizing the given data. (L4)

**4BHS307: Prepare Program–I (L2-L4)**

**CO1**: Apply number theory and speed calculation methods for quick computation and manipulation of numbers. (L3)
**CO2**: Apply speed calculation methods for computing cubes and cube roots. (L3)
**CO3**: Apply the theory of linear and quadratic equations using methods of equation formation (indeterminate systems, equation comparisons etc.) to solve problems in several domains (e.g. age problems). (L3)
**CO4**: Analyze distributive and arrangements of puzzles to conclude logical solutions that adhere to the given parameters. (L4)
**CO5**: Apply basic English grammar rules (parts of speech, components and types of sentences) to identify errors in texts and construct correct sentences. (L3)

**4BHS308: Design Thinking–I (L3-L6)**

**CO1**: Analyze the problems using the design thinking core concepts. (L3)
**CO2**: Summarize the blueprint into storytelling concepts. (L2)
**CO3**: Identify the failure in the concepts from creativity tools. (L3)
**CO4**: Select the product/service using state of art technique. (L2)
**CO5**: Develop the business model. (L3)

## 4th Semester \

**4BEC401: Engineering Mathematics–II for ECE (L2-L3)**

**CO1**: Solve first and second order ordinary differential equation using single step and multistep numerical methods. (L3)
**CO2**: Apply the trapezoidal and Simpson's 1/3 rule for numerical integration. (L3)
**CO3**: Formulate the partial differential equations for physical problems. (L2)
**CO4**: Determine the solution of partial differential equation by variable separable method. (L2)
**CO5**: Determine the solution of partial differential equation by using the Laplace transform. (

**4BEC402: Linear Integrated Circuits (L2-L3)**

**CO1**: Summarize the fabrication of integrated circuits and explain op-amp fundamentals. (L2)

**CO2**: Explain op-amp characteristics and learn about voltage follower, inverting / non-inverting & difference amplifier. (L2)

**CO3**: Develop circuits for op-amp based active filters. (L3)

**CO4**: Summarize op-amp applications in voltage regulators. (L2)

**CO5**: Explain applications of linear ICs in DAC, ADC, AGC, AVC. (L2)

**4BEC403: Microprocessor and Microcontroller (L2-L3)**

**CO1**: Explain working of 8086 microprocessor and assembly language programming. (L2)

**CO2**: Develop code for various applications using 8086 microprocessors. (L3)

**CO3**: Explain working of 8051 microcontroller and assembly language programming. (L2)

**CO4**: Develop code for various applications using 8051 microcontrollers. (L3)

**CO5**: Explain working of higher end microprocessors. (L2)

**4BEC404: Instrumentation and Sensors (L2)**

**CO1**: Outline the operation and characteristics of instruments with the help of a block diagram. (L2)

**CO2**: Relate analog to digital conversion operation with digital voltmeter performance characteristics. (L2)

**CO3**: Explain the working principles of stimuli, measuring and display instruments. (L2)

**CO4**: Explain the principles of various sensors and signal conditioning circuits. (L2)

**CO5**: Classify the various types of transducers and their characteristics. (L2)

**4BEC405: Signals and Systems (L2-L3)**

**CO1**: Classify the continuous and discrete time signals and systems. (L2)

**CO2**: Solve the system response using system's equation and using convolution. (L3)

**CO3**: Demonstrate the continuous time signals using Fourier series and Fourier Transform and the concept of sampling in time domain. (L2)

**CO4**: Demonstrate the discrete time signals using Fourier series and Fourier Transform and the concept of sampling in frequency domain. (L2)

**CO5**: Solve the Discrete time systems using Z transform and Discrete Time Fourier transforms. (L3)

**4BHS406: Professional Communication–IV (L2-L6)**

**CO1**: Plan, prepare and create business profile, portfolios, brochures, newsletters and banners. (L6)

**CO2**: Apply the different aspects technical written communication in writing. (L3)

**CO3**: Compose different types of business Correspondence. (L6)

**CO4**: Compose documents related to professional correspondence. (L6)

**CO5**: Demonstrate different effective strategies of presentation keeping in mind the importance of effective Listening. (L3)

**4BHS407: Prepare Program – II (L2-L6)**

**CO1**: Apply number theory and speed calculation methods for quick computation and manipulation of numbers. (L2)

**CO2**: Apply the concepts of percentage and exponents for computing simple and compound interest. (L2)

**CO3**: Integrate concepts of logical connectives to breakdown linguistic components and solve puzzles that use logical connectors. (L2)

**CO4**: Solve puzzles based on logical connectors. (L2)

**CO5**: Utilize techniques of public debate within a team by taking on different roles and articulating complex ideas in a persuasive manner. (L2)

**4BHS408: Design Thinking – II (L2-L6)**

**CO1**: Analyze user needs using structured techniques to discover unique product opportunity areas. (L3)

**CO2**: Define the problem in a human-centric manner as a problem statement after analyzing

observations in the previous stage. (L1)
**CO3**: Explain the solutions to tackle a given challenge by using iterative ideation techniques to generate alternative ideas, refine concepts and select the appropriate solution. (L3)
**CO4**: Apply techniques of effective communication and collaboration to deliver convincing presentations, share and receive feedback, work effectively in teams and visualize their ideas. (L3)
**CO5**: Demonstrate professionalism by adhering to deadlines, focusing on quality of work, maintaining detailed documentation and effectively using platforms for digital collaboration. (L2)

**4BEC 441: Instrumentation and Sensors (L2-L3)**

**CO1**: Outline the operation and characteristics of instruments with the help of a block diagram. (L2)
**CO2**: Relate analog to digital conversion operation with digital voltmeter performance characteristics. (L2)
**CO3**: Explain the working principles of stimuli, measuring and display instruments. (L2)
**CO4**: Explain the principles of various sensors and signal conditioning circuits. (L2)
**CO5**: Classify the various types of transducers and their characteristics. (L2)

**4BEC 442: Industrial Electronics (L2-L3)**

**CO1**: Explain the different types of power semiconductor devices and their switching characteristics. (L2)
**CO2**: Explain the operation, characteristics, and performance parameters of controlled rectifiers. (L2)
**CO3**: Differentiate between the characteristics of DC and AC drives. (L2)
**CO4**: Explain the different modulation techniques of pulse width modulated inverters and understand the harmonic reduction methods. (L2)
**CO5**: Explain the practical application of power electronics converters in conditioning the power supply. (L2)

**4BEC 443: Information Theory and Coding (L2-L3)**

**CO1**: Explain the concept of information, entropy, and source coding theorem. (L2)
**CO2**: Demonstrate the knowledge of Shannon's source coding theorem and channel coding theorem for designing an efficient and error-free communication link. (L2)
**CO3**: Explain error correction and detection using parity check coding and other coding schemes. (L2)
**CO4**: Explain minimum distance coding and cyclic codes. (L2)
**CO5**: Discuss convolutional coding. (L2)

**4BEC 444: Image Processing for Remote Sensing (L2-L3)**

**CO1**: Identify the basic concepts and principles of remote sensing. (L2)
**CO2**: Distinguish between the types of resolutions in satellites and remote sensing systems. (L2)
**CO3**: Identify the components in Digital Image Processing and apply them to the fundamental steps. (L3)
**CO4**: Explain different methods in Image Acquisition, Wavelets, and Compression Techniques. (L2)
**CO5**: Demonstrate the knowledge of techniques involved in Colour Image Processing. (L3)
Here are the Course Outcomes (COs) from your document, formatted consistently:

# 5th Semester

**4BHS5A1: Sociology of Globalization and Sustainable Development**

CO1: Demonstrate understanding of globalization process with emphasis on inter-dependence of communities and societies. (L1)
CO2: Analyse the critical issues in social development in the given context. (L2)
CO3: Develop technological interventions for social and community development. (L3)
CO4: Explain the health and hygiene of the community. (L2)
CO5: Develop technological interventions for social and community development. (L3)

**4BEC502: Transmission Lines and Antennas**

CO1: Apply the concepts of electromagnetic fields and transmission lines. (L3)

CO2: Demonstrate different modes of propagation in waveguides. (L2)

CO3: Compare the fundamental parameters of antenna and wave propagation. (L3)

CO4: Identify Dipoles and Thin linear antennas. (L3)

CO5: Identify the working principle of various types of antenna and categorize them according to their applications. (L2)

**4BEC503: Digital Signal Processing**

CO1: Demonstrate the concept of filtering of long data sequence. (L2)

CO2: Develop the fast computation of discrete Fourier transform. (L3)

CO3: Explain the concept of transform analysis of LTI systems. (L2)

CO4: Develop FIR filter for the given specifications and study the effect of quantization of filter coefficients. (L3)

CO5: Develop IIR filter for the given specifications. (L3)

**4BEC504: Power Electronics**

CO1: Describe the characteristics of different power devices and identify the applications. (L3)

CO2: Illustrate the working of step up and step down choppers. (L2)

CO3: Determine the output response of a thyristor circuit with various triggering options. (L3)

CO4: Determine the response of controlled rectifier with resistive and inductive loads. (L3)

CO5: Illustrate the working of various pulse width modulated inverters. (L2)

**4BEC505: Control Systems**

CO1: Develop a mathematical model for mechanical systems using Laplace Transform. (L3)

CO2: Analyze the performance characteristics of first and second order systems using standard test signals. (L4)

CO3: Test for the stability of a system using Routh–Hurwitz (RH) criterion and Root locus techniques in the time domain. (L3)

CO4: Analyze the stability of a system in the frequency domain using Bode plot and Nyquist criterion. (L4)

CO5: Model a control system in continuous and discrete time using state variable techniques. (L3)

**4BHS506: Professional Communication-V**

CO1: Compose abstract and literature review as parts of academic writing. (L5)

CO2: Prepare agenda, minutes and memos in specific business set up. (L5)

CO3: Apply skills of argumentation using various techniques of arguments and deliberation. (L3)

CO4: Exhibit basics of interview etiquette in a given professional set up. (L3)

CO5: Plan and prepare presentation using media and advertisements. (L5)

**4BHS507: Prepare Program-III**

CO1: Use the concepts of work-time-efficiency and distance–time–speed to solve problems related to the measurement of effort or performance. (L3)

CO2: Analyze geometric shapes and use mensuration formulas to mathematically measure 2D and 3D solids. (L4)

CO3: Illustrate conceptual knowledge of blood relationships and direction sense through the creation of schematic diagrams and solving related problems. (L3)

CO4: Apply the concepts of input–output, series, as well as coding and decoding to discern specific patterns (finding the odd term, types of codes etc.) from given data to solve problems. (L3)

CO5: Apply the concepts of coding and decoding to discern specific patterns from given data to solve problems. (L3)

**4BEC508: Mini Project–I**

CO1: Conduct a survey of several available literature in the preferred field of study. (L5)

CO2: Demonstrate practical knowledge within the chosen area of technology for project development. (L2)
CO3: Analyze the problem requirements and arrive at workable design solutions. (L4)
CO4: Compare and contrast the several existing solutions for the attempted problem. (L5)
CO5: Summarize the report and present the findings of the study conducted in the preferred domain. (L2)

# Elective–I

**4BEC511: Digital VLSI Design**
CO1: Illustrate VLSI Design Flow for abstraction levels and its design complexity attributes. (L2)
CO2: Analyze an IC for manufacturing CMOS design and fabrication process of distinct IP/IC based design. (L4)
CO3: Construct a Verilog modules by employing FPGA. (L3)
CO4: Formulate chip design overview and TCL environmental setup. (L6)
CO5: Construct TCL scripting using basic syntax. (L6)

**4BEC513: Random Process**
CO1: Apply the fundamental probability theory and random process to solve practical engineering problems. (L3)
CO2: Classify different type of random variables with appropriate CDF and PDF. (L2)
CO3: Interpret the key parameters of Random variables that underlie the random nature of the problems. (L2)
CO4: Demonstrate the knowledge of joint random variables in real time engineering problems. (L2)
CO5: Demonstrate the application of random process to characterize discrete and continuous channel models. (L2)

**4BEC514: Cloud Computing**
CO1: Explain main concepts, key technologies, strengths and limitations of cloud computing. (L2)
CO2: Explain the cloud enabling technologies that help in the development of cloud. (L2)
CO3: Develop the ability to use the architecture of compute and storage cloud, service and delivery models. (L3)
CO4: Explain core issues of cloud computing such as resource management and security. (L2)
CO5: Choose the appropriate technologies and approaches for implementation and use of cloud. (L3)

**4BEC515: Digital Switching Systems**
CO1: Understand the basics of communication networks and digital transmission of data. (L2)
CO2: Study about the evolution of switching systems and the digital switching. (L2)
CO3: Study about the switching systems communication traffic and its measurements. (L2)
CO4: Learn the technologies associated with the data switching operations. (L2)
CO5: Understand the use of software for the switching and its maintenance. (L2)

**Sixth Semester Syllabus**

**4BHS6B1: Business Management for Engineers**
CO1: Apply the concepts related to entrepreneurship issues in business ideas. (L3)
CO2: Explain the factors influencing the practice of management in different contexts. (L2)
CO3: Develop suitable economic strategy regarding common business problems. (L3)
CO4: Analyze the marketing strategy for common engineering business problems. (L4)
CO5: Illustrate the leadership qualities in the operation of a new venture. (L2)

**4BEC602: Analog and Digital Communication**
CO1: Explain the working of amplitude modulators and receivers. (L2)
CO2: Explain the Angle modulation techniques. (L2)

CO3: Demonstrate the reception and demodulation of FM and also the various types of Noise. (L2)
CO4: Interpret pulse modulation techniques and base band data transmission. (L2)
CO5: Compare the digital modulation techniques. (L2)

**4BEC603: Embedded Systems**

CO1: Classify an Embedded System based on various design parameters and peripherals. (L2)
CO2: Explain the architectural features of 32-bit microcontroller ARM Cortex M3. (L2)
CO3: Explain the instruction set of 32-bit microcontroller ARM Cortex M3. (L2)
CO4: Make use of the knowledge gained for programming ARM Cortex M3 for different applications using C and assembly language. (L3)
CO5: Choose appropriate communication protocol for an application. (L3)

**4BEC604: CMOS VLSI Design**

CO1: Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling. (L2)
CO2: Outline the basic gates using the stick and layout diagrams with the knowledge of physical design aspects. (L2)
CO3: Explain memory elements along with timing considerations. (L2)
CO4: Illustrate testing and testability issues in VLSI design. (L2)
CO5: Construct CMOS subsystems and architectural issues with the design. (L2)

**4BEC605: Information Theory and Coding Design**

CO1: Analyze the fundamentals of probability theory & random process. (L4)
CO2: Illustrate with example the concept of information theory, source coding, channel capacity, channel coding and the relation among them. (L2)
CO3: Design the channel performance using Information theory. (L6)
CO4: Identify various error control code and apply linear block codes for error detection and correction. (L3)
CO5: Construct binary cyclic codes and convolutional codes for improving channel performance. (L6)
Here are the Course Outcomes (COs) from your document, formatted consistently:

**4BHS606: Professional Communication–VI**

CO1: Demonstrate the advanced skills of presentation. (L3)
CO2: Compose technical documents following proper format and style. (L6)
CO3: Evaluate cases pertaining to a specific domain and recommend innovative suggestion/s to the case. (L4)
CO4: Apply the registers of technical English in oral and written mode of communication. (L3)
CO5: Collaborate and express themselves in an Interview round. (L6)

**4BHS607: Prepare Program-IV**

CO1: Solve problems of various arrangements (circular, linear etc) and criteria (expected value, biased dice etc.). (L3)
CO2: Use concepts from statistics (mean, median etc) and progressions (AP, GP, HP) to analyze groups of numbers on the mentioned parameters, indices and surds to solve problems related to representation of numbers (large integers, irrational roots etc.). (L3)
CO3: Examine four types of logical statements to solve puzzles based on syllogisms. (L3)
CO4: Apply the concepts of Venn diagrams and cubes to solve puzzles using set theory, breaking-building rules etc. (L3)
CO5: Combine logic with their knowledge of advanced English vocabulary and grammar to solve verbal data tasks (ex: para-completion etc.) and articulate their ideas. (L4)

**4BEC608: Mini Project – II**

CO1: Demonstrate practical knowledge within the chosen area of technology for project development. (L2)

CO2: Identify, analyze, formulate and handle computer/IT projects with a comprehensive and systematic approach to give workable design solutions. (L4)
CO3: Conduct a survey of several available literature in the preferred field of study and compare the several existing solutions for the attempted problem. (L5)
CO4: Propose innovative solution for the development of components, processes or technologies in CS/IT field. (L6)
CO5: Report and present the findings of the study conducted in the preferred domain as well develop effective communication skills for presentation of project related activities. (L3)

# Elective–II

**4BEC621: Speech and Audio Processing**
CO1: Explain the speech production and different models. (L2)
CO2: Explain the frequency domain analysis, speech recognition and text to speech conversion. (L2)
CO3: Explain the signal processing models of Audio perception and Analysis. (L2)
CO4: Summarize different Audio compression methods. (L2)
CO5: Explain Spatial Audio Perception and rendering and Audio quality analysis. (L2)
**4BEC622: MEMS**
CO1: Explain the various techniques of Micro-fabrication and Micro–Machining. (L2)
CO2: Illustrate the properties of various materials used for MEMS fabrication. (L2)
CO3: Analyze various MEMS structures used for diversified applications. (L3)
CO4: Classify various sensors and actuators. (L2)
CO5: Introduction to MEMS and MEMS packaging design. (L3)
**4BEC623: RF IC's**
CO1: Explain the RF systems. (L2)
CO2: Describe the MOS device physics and distributed systems. (L2)
CO3: Explain bandwidth estimation, amplifiers, noise and LNA design. (L2)
CO4: Explain different power amplifiers and VCO. (L2)
CO5: Describe different architectures such as GSM radio architectures, CDMA, UMTS radio architectures. (L2)
**4BEC624: Introduction to Hybrid and Electric Vehicles**
CO1: Explain the concepts of various hybrid and electric vehicles. (L2)
CO2: Explain the vehicle power source characterization. (L2)
CO3: Analyze various battery and fuel cell based energy storage. (L3)
CO4: Classify various energy management strategies. (L2)
CO5: Introduction to design of a Hybrid Electric Vehicle (HEV), and Battery Electric Vehicle (BEV). (L3)
**4BEC625: Satellite Communication**
CO1: Explain the satellite orbits and its trajectories with the definitions of parameters associated with it. (L2)
CO2: Illustrate the electronic hardware systems associated with the satellite subsystem and earth station. (L2)
CO3: Explain the various applications of satellite with the focus on national satellite system. (L2)
CO4: Explain the satellite link parameters under various propagation conditions with the illustration of multiple access techniques. (L2)
CO5: Explain the Remote sensing satellites, Weather forecasting satellites and Navigational satellites. (L2)
**4BEC626: Fundamentals of Machine Learning**

CO1: Describe fundamental concepts and issues of machine learning. (L2)
CO2: Prepare data for Machine Learning IDA and EDA. (L2)
CO3: Describe Supervised Machine Learning algorithms like Linear Regression and Logistic Regression. (L2)
CO4: Explain Un-Supervised Machine Learning algorithms like Clustering. (L2)
CO5: Explain Artificial Neural Networks and Deep Learning. (L2)

**Seventh Semester Syllabus**

**4BEC701: Microwave and Radar**

CO1: Acquire knowledge on the theory of microwave transmission, microwave generators and associated components. (L2)
CO2: Demonstrate microwave devices and monolithic microwave integrated circuits. (L2)
CO3: Understand the radar fundamentals and radar signals. (L2)
CO4: Illustrate the working principle of pulse Doppler radars and their applications and limitations. (L2)
CO5: Describe the working of various radar transmitters and receivers. (L2)

**4BEC702: Computer Communication Networks**

CO1: Explain Data Communication with key concepts of networks, its types and OSI network model. (L2)
CO2: Identify the data link layer from OSI model, understanding the concepts related to layer, protocols. (L3)
CO3: Demonstrate the concept of Wired LAN's standards and its architecture. (L2)
CO4: Explain various connecting devices, IP address and routing mobile IP. (L2)
CO5: Explain the various transport layer protocols, UDP and TCP service applications and flow and error control. (L2)

**4BEC802: Image and Video Processing**

CO1: Explain different methods for image acquisition, storage and representation in digital devices and role of image transforms in representing, highlighting, and modifying image features. (L2)
CO2: Interpret the mathematical principles in digital image enhancement and apply them in spatial domain. (L2)
CO3: Interpret the mathematical principles in digital image enhancement and apply them in frequency domain. (L2)
CO4: Summarize several image segmentation methods and morphological operations. (L2)
CO5: Explain the concept of video processing and different video compression techniques. (L2)

**4BEC803: Wireless Communication**

CO1: Explain the basics and types of wireless communication systems being used. (L2)
CO2: Explain the basic concepts of cellular system and the design requirements. (L2)
CO3: Demonstrate the basic principles behind radio resource management techniques such as frequency reuse, channel allocation and handoffs. (L2)
CO4: Interpret knowledge and gain awareness on the technologies used for effective share of spectrum by multiple access techniques i.e. TDMA, CDMA, FDMA etc. (L2)
CO5: Summarize the wireless standards being used across the world. (L2)

**4BEC804: Optical Communication**

CO1: Summarize the concepts and theory of optical fiber communication. (L2)
CO2: Explain various transmission characteristics of optical fibers. (L2)
CO3: Illustrate the working of LEDs and Laser diodes as optical sources. (L2)
CO4: Explore the functions and characteristics of optical detectors and receivers. (L2)
CO5: Discuss the WDM systems, optical amplifiers and DTL systems. (L1)

**4BHS704: Prepare Program-V**

CO1: Apply number theory concepts and formulas to solve problems of base system, remainc

etc. (L3)
CO2: Categorize contradictions within the area of binary logic to solve problems using concepts of contradictions truth tellers, liars and alternators, pattern recognition problems (fillers, calendar etc.) by utilizing different functions that fit the given criteria. (L3)
CO3: Analyze the sufficiency of data and interpret its specific components by solving problems using data reasoning and interpretation of its numerical and graphic representations. (L4)
CO4: Make use of advanced arithmetic, algebra and mensuration techniques to solve a variety of problems using a range of concepts from partnership to permutation and combination. (L3)
CO5: Apply written and verbal communication techniques by reading and articulating themselves in the format of discussion, debate, interview, essay, letter etc. (L3)

**4BEC705: Capstone Project–Design**

CO1: Demonstrate engineering knowledge and its framework for its implementation in the project design as well work in groups taking leadership role and communicate effectively. (L2)
CO2: Survey relevant literature in the chosen field of study that allows interrelation of design and research. (L4)
CO3: Model a prototype/ concept design that exhibits the feasibility of the solution from cost, engineering and environmental aspects. (L3)
CO4: Justify the project design with a structured report that covers all the work carried out between framing the problem statement to the project design. (L5)
CO5: Design conceptual ideas that address the issues with respect to real world problems. (L6)

## Elective–III

**4BEC731: Internet of Things (IoT)**

CO1: Interpret the impact and challenges posed by IoT networks leading to new architectural models. (L2)
CO2: Compare and contrast the deployment of smart objects and the technologies to connect them to network. (L2)
CO3: Explain the role of IoT protocols for efficient network communication. (L2)
CO4: Explain the need for data analytics and security in IoT. (L2)
CO5: Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in industry. (L2)

**4BEC732: Advanced Digital Signal Processing**

CO1: Explain the concept of discrete random process. (L2)
CO2: Demonstrate the different methods for spectrum estimation. (L2)
CO3: Explain the different methods in linear estimation and prediction. (L2)
CO4: Explain adaptive filters. (L2)
CO5: Explain the wavelet transforms and its applications. (L2)

**4BEC733: Neural Network and Fuzzy Logic**

CO1: Compare the Biological and Artificial Neural Networks. (L2)
CO2: Classify the back propagation and counter propagation networks. (L2)
CO3: Explain adaptive resonant theory. (L2)
CO4: Compare crisp set and fuzzy set theory. (L2)
CO5: Apply fuzzy logic controller to real time systems. (L3)

**4BEC734: Adaptive Signal Processing**

CO1: Explain filtering solutions for optimising the cost function indicating error in estimation of parameters. (L2)
CO2: Evaluate the performance of various methods for designing adaptive filters. (L3)

CO3: Explain convergence and stability issues associated with adaptive filter design. (L2)
CO4: Design and implement filtering solutions for applications such as channel equalisation, interference cancelling and prediction. (L3)
CO5: Explain the role and importance of IIR digital filter synthesis. (L2)

**4BEC735: Advanced Communication Systems**

CO1: Understand different modulation, demodulation and equalization techniques and use them to analyze the error performance of digital modulation techniques in presence of AWGN noise. (L2)
CO2: Analyze and demonstrate the model of discrete time channel with ISI & the model of discrete time channel by equalizer. (L2)
CO3: Apply various types of equalizers used for channel modelling and adjusting the filter coefficients. (L2)
CO4: Develop the concept of Spread Spectrum Communications over wideband channels. (L2)

**4BEC736: Secure Communication**

CO1: Explain basic concepts related to number theory and finite fields. (L2)
CO2: Illustrate the various encryption techniques and symmetric ciphers. (L2)
CO3: Develop sequence generators and AES cipher. (L3)
CO4: Explain different type of theorems and algorithms used in basic cryptography. (L2)
CO5: Explain the different authentication techniques used in cryptography. (L2)

## Eighth Semester–VIII

**4BHS801: Professional Ethics and Engineers**

CO1: Describe the Moral Values and Ethics. (L1)
CO2: Explain the Engineering Ethics. (L1)
CO3: Discuss the Responsibility as Engineers. (L2)
CO4: Examine the Safety and Risk. (L2)
CO5: Predict the working Ethics for Engineers. (L2)

**4BEC703: Internship**

CO1: Demonstrate the skills in professional career goals. (L2)
CO2: Administer the insight into a possible career path of interest with organizational structure, roles and responsibilities. (L3)
CO3: Develop professional connections with leadership strategy and skill development. (L4)
CO4: Identify the professions to suit the interest as a result of this experience. (L3)
CO5: Conquer additional skills that will need to be developed to ensure career readiness such as new technology, developing a broader network, additional coursework. (L4)

**4BEC855: 4G LTE Advanced and 5G LTE**

CO1: Explain the evolution of 4G, system concepts and spectrum challenges. (L4)
CO2: Analyze the role of OFDM's and SC–FDMA access schemes. (L4)
CO3: Explain the evolution of 5G, system concepts and spectrum challenges. (L4)
CO4: Illustrate the 5G functional and physical architecture and its requirements. (L4)
CO5: Introduction to design of a Massive MIMO techniques. (L4)

**4BEC856: Optical Networks**

CO1: Describe the system components of optical communication system. (L2)
CO2: Apply the principles of communication to design optical network architecture. (L2)
CO3: Distinguish various routing techniques of Optical networks. (L2)
CO4: Describe the structure of packet switching and access network in Optical Communication system. (L2)
CO5: Explain the network design and network management system in Optical communicatio

(L2)

**4BEC857: Multi-rate Systems, Filter Banks and Wavelets**

CO1: Understand the multirate systems and its applications. (L2)

CO2: Explain the concept of decimated filter banks. (L2)

CO3: Design paraunitariness filter banks. (L2)

CO4: Design Cosine module filter banks. (L2)

CO5: Design wavelet transform filter with the help of multirate filter. (L2)

# ECE-Course Outcome-2021

### 4MATH1011: ENGINEERING MATHEMATICS -I

**CO1:** Apply the knowledge of calculus to analyse and approximate the functions. L3

**CO2:** Calculate rates of change of multivariate functions. L3

**CO3:** Solve multiple integrals for computing area and volume. L3

**CO4:** Make use of Gradient, divergence and curl for solving Engineering problems. L3

**CO5:** Use the concept vector integration to solve the flow problems. L3

### 4PHYS1011: ENGINEERING PHYSICS

**CO1:** Analyse the applications of quantum mechanics in technology. L4

**CO2:** Make use of Lasers and Optical fibres for different industrial applications. L3

**CO3:** Plot the I-V characteristics of photo-diode, LED, Zener diodes and solar cells. L3

**CO4:** Explain the use of Magnetic, Dielectric and Superconducting materials for different engineering applications. L2

**CO5:** Analyse the results obtained in different experiments. L4

### 4ENEE1011: ELEMENTS OF ELECTRICAL ENGINEERING

On successful completion of the course, students will be able to:

**CO1:** Analyze electrical circuits by relevant Laws in DC circuits. L4
**CO2:** Demonstrate the single phase and three-phase power generation by using the phasor diagrams. L3
**CO3:** Illustrate the construction and operation of DC machines and understand the concept of electrical wiring, protecting devices and earthing. L3

**CO4:** Explain the construction and operation of AC machines. L2

### 4CSGC1011: ELEMENTS OF COMPUTER ENGINEERING

**CO1:** Demonstrate functioning of different sub-systems, OS and different types of OS. L3

**CO2:** Use different types of data structures, operations and algorithms. L3

**CO3:** Describe the fundamental elements of relational database management systems. L2

**CO4:** Comprehend the layered protocol model & Classification of networks. L3

**CO5:** Demonstrate need for Linux OS and Linux commands. L3

### 4ENME1011: COMPUTER AIDED ENGINEERING DRAWING

**CO1:** Illustrate competence in basics of orthographic projections of points, lines, planes and solids in three different views. L3

**CO2:** Apply the concepts of orthographic projections for simple objects. L3

**CO3:** Develop surfaces of solids of simple objects. L3

### CPSHD1011: Design Thinking-1

O1: Apply teamwork towards building a solution. (LeveL 3)

O2: Apply basic Design Research (Level 3)

O3: Apply brainstorming as a way of innovative thinking. (Level 3)

O4: Apply story-telling in Design Thinking. (Level 3)

**CPSHL1021**: **Oral & Written Communication – 1**

On successful completion of the course, Students will be able to

**CO1**: Understand the skills required to use the English language effectively in all areas of communication. L1

**CO2**: Understand their areas of weaknesses and ways to improve upon them. L1

**CO3**: Understand the knowledge required in various situations, like in formal and informal settings. L1

**CO4**: Understand how to write official reports and proposals. L1

**4MATH1021: ENGINEERING MATHEMATICS II**

**CO1:** Solve first order linear ordinary differential equations L3

**CO2:** Solve higher order differential equations arising through physical processes. L3

**CO3:** Construct a variety of partial differential equations and solves them. L4

**CO4:** Use periodic signals to represent periodic functions in the form of Fourier series. L3

**CO5:** Make use of matrix theory for solving system of linear equations L3

**4CHEM1011: ENGINEERING CHEMISTRY**

**CO1:** Explain the construction and working of Energy storage devices. L2

**CO2:** Explain corrosion of metals, factors and prevention techniques. L2

**CO3:** Explain the importance of the modern emerging field of nanotechnology. L2

**CO4:** Use instruments which give quick and accurate results for material analysis. L3

**CO5:** Carry out different types of titrations for estimation of concentration of an analyte. L3

**4ENCE1011: ELEMENTS OF ELECTRONICS ENGINEERING**

On successful completion of the course, students will be able to:

**CO1:** Describe semiconductor devices and its applications L2

**CO2:** Analyze the various circuits of BJT L4

**CO3:** Employ op-amp in various circuits L3

**CO4:** Analyze digital circuits L4

**CO5:** Appreciate the importance of transducers and communication systems L5

**4ENME1021: ELEMENTS OF MECHANICAL ENGINEERING AND WORKSHOP**

**CO1:** Recognize the impact of energy sources on the environment and sustainability. L2

**CO2:** Explain the working principles of water, vapour and gas-powered systems. L2

**CO3:** Discuss the working principles of refrigeration systems and IC engines. L2

**CO4:** Compute various performance parameters of IC engines. L3

**CO5:** Demonstrate soldering, brazing and welding of sheet metal & welded joints. L2

**4ENCV1011: ELEMENTS OF CIVIL ENGINEERING**

**CO1:** Explain the basics of Civil Engineering and related fields. L2

**CO2:** Develop working models with the laws of mechanics. L3

**CO3:** Analyze equilibrium of coplanar, concurrent and non-concurrent forces. L4

**CO4:** Determine centroid and moment of inertia of simple geometric figures. L3

**CO5:** Apply D'Alembert's principle in any specific application. L3

**4CSPL1011: PROBLEM SOLVING USING PYTHON**

**CO1:** Understand the basis of algorithm problem solving L2

**CO2:** Develop python programs with conditionals and loops L4

**CO3:** Develop python programs for data structure applications L4

**CO4:** Develop GUI Python programs using Tkinter L4

**CO5:** Write Object Oriented programs using Python L4

## CPSHD2011 : Design Thinking-2

O1: Create an appropriate research plan to explore the problem, execute the design research and present findings as a team. (level 5)

O2: Evaluate research findings, identify insights and brainstorm solutions as a team. (level 4)

O3: Create a prototype and iterate based on feedback received as a team. (level 5)

**CPSHL2021 Oral & Written Communication – 2**

CO1: Understand the skills required to use the English language effectively in the business and corporate world. L1

CO2: Understand and be able to express points of view of others meaningfully. L2

CO3: Understand how to clearly interpret visuals and graphs. L3

CO4: Understand how to write technical content meant for specific audiences. L1

CO5: Understand how to write reviews and articles about books and published works. L1

**4MATH2011-Engineering Mathematics-III**

**CO1** Make use of C–R equations to form analytic functions L3

**CO2** Explain the concept of conformal, bilinear transformations and contour integration L2

**CO3** Apply Z-transforms for discrete functions. L3

**CO4** Solve linear differential equations by Laplace transform method L3

**CO5** Solve first and second order ordinary differential equation using single step and multistep numerical methods L3

**4ENCE2011: Analog System Design**

| | | |
|---|---|---|
| CO1 | Demonstrate the device characteristics and working principles of BJT and MOSFET, andparameters of different types of amplifiers | L2 |
| CO2 | Analyze transistor biasing circuits and various amplifier configurations with small signal model | L4 |
| CO3 | Explain the operation of BJT and MOSFET current mirrors, differential amplifier and frequency response of an amplifier | L3 |
| CO4 | Analyze different types of feedback amplifiers and oscillators | L4 |
| CO5 | Design of series and shunt voltage regulators for a Power supply | L4 |

**4ENCE2021: Digital System Design**

CO1 Make use of fundamental concepts to implement digital logic functions. L3
CO2 Demonstrate the design-methodology using VHDL L2
CO3 Build a combinational logic circuit with HDL and implement it on programmable logic devices.

L3

CO4 Develop synchronous and asynchronous sequential circuits, and realize using Hardware description Language and programmable logic devices. L3

CO5 Design finite state machine for different applications. L6

**4ENEE1021: Network Analysis**

CO1: Demonstrate the knowledge of KCL and KVL by solving electrical networks in phasor and time domain L2

CO2: Select a suitable resonant circuit for a given resonant frequency L3

CO3: Select suitable network theorems for reduction of a given network to simplify the solution for a network problem L2

CO4: Analyze a network under steady and transient states by applying Laplace Transforms to a given circuit L3

CO5: Choose suitable network parameters by transforming them appropriately

to analyses a cascaded system L2

**4CSPL2011: WEB DEVELOPMENT USING PYTHON AND DJANGO**

**CO1:** Create database using SQLite L6

**CO2:** Create web client programs using python L6

**CO3:** Create web server programs using python L6

**CO4:** Create website using Django framework L6

**CO5:** Create to-do application using Django and React JS L6

**CKSMM1011: Critical Inquiry**

CO1: Conduct an inquiry into the origins and sources of their beliefs.

CO2: Recognize how access to the same information can lead to varied interpretations.

CO3: Appreciate the validity of diverse views that are separate from their own.

CO4: Recognize the impact of uninterrogated beliefs on daily life.

CO5: Understand the connection between beliefs and action.

**CKSMM1021: Indian Democracy, Participation & Social Change**

CO1: Study a particular event in Indian history and trace the impact that can be felt to the present day.

CO2: Understand the impact of the way a democracy is structured.

CO3: Understand the freedoms that a citizen of India has, and what those mean in daily life.

CO4: Understand the duties of an Indian citizen and how they translate to daily life.

CO5: Gain an understanding of the workings of the government in their residential locality.

CO6: Trace the impact of a single vote from their area of residence to the national scale.

CO7: Understand the Indian democratic process and their role in it.

CO8: Identify ways in which they can contribute to the progress of the country.

**CPSSXX0X1: Project Management Fundamentals**

CO1: Understand the fundamental concepts of Project Management and use them in their professional career [L1].

CO2: Demonstrate their preparedness to manage any project in a professional manner [L1].

CO3: Apply the best practices of Project Management which will ensure their success in their professional life [L2].

**4MATH2021-Engineering Mathematics-IV**

CO1 Apply binomial, Poisson, normal and exponential probability distributions to solve engineering problems L3

CO2 Construct elementary regression models by the method of least squares L3

CO3 Explain the concept of testing of hypothesis for small and large samples L2

CO4 Solve first and second order ordinary differential equation using single step and multistep numerical methods L3

CO5 Apply the simplex algorithm to solve a linear programming problem L3

**4ENCC2011-Principles of Communication**

On successful completion of the course, students will be able to:

CO1 Explain the working of amplitude modulators and receivers L2

CO2 Explain the Angle modulation techniques L2

CO3 Demonstrate the reception and demodulation of FM and also the various types of Noise L2

CO4 Interpret pulse modulation techniques and base band data transmission L2

CO5 Compare the digital modulation techniques L2

**4ENVL1011- VLSI**

CO1 Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling L2

CO2 Outline the basic gates using the stick and layout diagrams with the knowledge of physical design aspects L2

CO3 Explain memory elements along with timing considerations L2

CO4 Illustrate testing and testability issues in VLSI design L2

CO5 Construct CMOS subsystems and architectural issues with the design L2

**4CSPL3011: PYTHON FOR DATA SCIENCE**

**CO1:** Analyze data science applications L4

**CO2:** Apply data collection and wrangling techniques L3

**CO3:** Analyze how to manipulate the uncharted datasets using Numpy L4

**CO4:** Analyze how to manipulate the uncharted datasets using Pandas L4

**CO5:** Apply visualization techniques L4

**CPSES1011: MAKING WITH ELECTRONICS**

**CO1:** Demonstrate the interfacing of basic input and output devices using Arduino. L2

**CO2:** Explain the working principles of various sensors and renewable energy sources. L2

**CO3:** Apply the understanding of Arduino programming by interfacing sensors and communication devices. L3

**CO4:** Demonstrate the interfacing of basic input and output devices using Raspberry Pi. L2

**CO5:** Analyze and Build a real-time application employing Arduino / Raspberry Pi. L4, L3

**4ENCC1011: DIGITAL SIGNAL PROCESSING(P)**

CO1 Demonstrate the concept of filtering of long data sequence and fast Fourier Transform L2

CO2 Explain the concept of transform analysis of LTI systems. L2

CO3 Develop FIR filter for the given specifications L3

| | | |
|---|---|---|
| CO4 | Develop IIR filter for the given specifications | L2 |
| CO5 | Explain the finite word length effect and concept of multi-rate signal processing | L3 |

**4ENCE2032: Embedded System & ARM Processor**

| | | |
|---|---|---|
| CO1 | The students should be able to understand the concepts of embedded systems, including their architecture, programming, and applications. | L3 |
| CO2 | The students should have a thorough understanding of ARM processors, including their architecture and instruction set. | L2 |
| CO3 | Ability to write and debug assembly language programs for ARM processors. | L3 |
| CO4 | Designing and implementing ARM Cortex-M Processor real-time operating systems (RTOS) and hardware interfaces. | L3 |
| CO5 | Familiarity with different communication protocols used in embedded systems, such as SPI, I2C | |

**4ENEE1071: POWER ELECTRONICS AND CONTROL**

| | | |
|---|---|---|
| CO1 | Describe the characteristics of different power devices and identify the applications | L3 |
| CO2 | Determine the response of controlled rectifier and AC voltage controllers with resistive and inductive loads | L2 |
| CO3 | Illustrate the working of various pulse width modulated inverters as well as Step up and step-down choppers | L3 |
| CO4 | Develop a mathematical model of system and analyze the performance characteristics of first and second order systems using standard test signals | L3 |
| CO5 | Test for the stability of a system in time as well as frequency domain and state space modeling of system | L2 |

**4ENCE1181: REAL TIME EMBEDDED SYSTEM AND LINUX**

| | | |
|---|---|---|
| CO1 | Know the basics of real-time embedded systems, including its architecture, components, and design techniques. | L3 |
| CO2 | Students will learn the basics of Linux operating system and its use in embedded systems. | L2 |
| CO3 | Explain about the Linux system programming and Real-Time Linux | L3 |
| CO4 | Writing device drivers for embedded, device drivers architecture of linux | L2 |
| CO5 | Use embedded Linux development tools for developing, debugging, and testing embedded systems. | L2 |

**4ENCE1191: Sensors & Robotics**

| | |
|---|---|
| CO1: Apply various calibration techniques and signal types for sensors. | **L3** |
| CO2: Classify and explain types of robots. | **L2** |

CO3: Apply various sensors in the robotics. **L3**

CO4: Explain robotic vision. **L5**

CO5: Recommend robotic system for various industries. **L6**

**4ENCE1201: Automotive Electronics**

**CO1:** Describe the basics of automobile dynamics and electronics for automobile. **L2**

**CO2:** Explain basics of automotive components, subsystems and Electronic Engine Control in today's automotive industry. **L5**

**CO3:** Apply available automotive sensors and actuators while interfacing with microcontrollers/ microprocessors during automotive system design. **L3**

**CO4:** Explain the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems. **L5**

**CO5:** Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems. **L6**

**4ENCE1211: Microelectronics(MOOC)**

| | | |
|---|---|---|
| CO1 | Understanding the basic principles of microelectronics, including semiconductor materials, device physics, and circuit design | L3 |
| CO2 | Understand the fabrication process of electronic devices, including the lithography, deposition, and etching techniques. | L2 |
| CO3 | Design and analyze electronic circuits and systems, such as analog and digital circuits, using different software tools, including SPICE and CAD. | L3 |
| CO4 | Ability to design and analyze digital and analog electronic circuits. | L3 |

CO5 Integrate different electronic components and subsystems to create complex systems,including microprocessors. L2

**4ENVL2011: Digital VLSI Design**

| | | |
|---|---|---|
| CO1 | Familiar with CMOS technology and the different CMOS circuit design techniques. They should also have an understanding of the impact of process variations on circuit performance. | L3 |
| CO2 | Understanding of the principles of digital circuits and VLSI design, including the different types of combinational circuit. | L2 |
| CO3 | Understand the principles of digital circuits and VLSI design, including the flip-flops, registers, and counters. | L3 |
| CO4 | Understand the physical design and layout techniques, including floor planning, placement, and routing. They should also be familiar with the different layout styles and design rules. | L3 |

CO5 Design the various components of the digital system, such as, registers, and memory cells, and Digital signal processing circuits. L2

**4ENVL1021: ASIC**

| | | |
|---|---|---|
| CO1 | Demonstrate knowledge in ASIC Design flow, Simulation Issues ASICs Design Techniques. ASIC Construction | L2 |
| CO2 | Write the Verilog/VHDL Code | L2 |
| CO3 | Design and simulation of digital ICs using Verilog | L3 |
| CO4 | Compare different testing procedures for VLSI circuits. | L4 |
| CO5 | Analyze the algorithms of partitioning, placement and routing | L4 |

**4ENVL1031: Nano Electronics (MOOC)**

| | |
|---|---|
| CO1: Explain principles behind Nano science engineering and Nanoelectronics. | **L2** |
| CO2: Apply the knowledge to prepare and characterize nanomaterials. | **L3** |
| CO3: Analyze the process flow required to fabricate state-of-the-art transistor technology | **L4** |
| CO4: Explain concepts of nanoscale MOSFET, CMOS scaling with its limits. | **L5** |
| CO5: Explain properties used for sensing and the use of smart dust sensors. | **L2** |

**4ENCC1041: OPTICAL COMMUNICATION**

| | | |
|---|---|---|
| CO1 | Summarize the concepts and theory of optical fiber communication | L2 |
| CO2 | Explain various transmission characteristics of optical fibers | L2 |
| CO3 | Illustrate the working of LEDs and Laser diodes as optical sources | L2 |
| CO4 | Explore the functions and characteristics of optical detectors and receivers | L2 |
| CO5 | Discuss the WDM systems, optical amplifiers and DTL systems | L1 |

**4ENCC1061: SATELLITE COMMUNICATION**

| | | |
|---|---|---|
| CO1 | Explain the satellite orbits and its trajectories with the definitions of parametersassociated with it | L2 |
| CO2 | Illustrate the electronic hardware systems associated with the satellite subsystem and earth station | L2 |
| CO3 | Explain the various applications of satellite with the focus on national satellite system | L2 |
| CO4 | Explain the satellite link parameters under various propagation conditions with the illustration of multiple access techniques | L2 |
| CO5 | Explain the Remote sensing satellites, Weather furcating satellites and Navigational satellites | L2 |

**4ENCC1251: Adaptive Signal Processing(MOOC)**

| | | |
|---|---|---|
| CO1 | Explain filtering solutions for optimising the cost function indicating error in estimation of parameters. | L2 |
| CO2 | Evaluate the performance of various methods for designing adaptive filters. | L3 |
| CO3 | Explain convergence and stability issues associated with adaptive filter design. | L2 |

CO4 Design and implement filtering solutions for applications such as channel equalisation, interference cancelling and prediction. L3

CO5 Explain the role and importance of IIR digital filter synthesis. L2

**4CSPL3021: ADVANCED PYTHON FOR AI**

CO1 Identify the basic concepts of neural networks and its components L2

CO2 Analyse neural network learning and adaption techniques L3

CO3 Explain the detailed concepts of single layer perceptron neural networks L2

**4CSGC3051: DATA MINING**

**CO1:** Explain the concepts of data mining and its issues L4

**CO2**: Analyse and apply association rule mining techniques L3

**CO3:** Analyse various classification algorithms L3

**CO4:** Elaborate the clustering algorithms L2

**CO5:** Illustrate the trends and applications L2

**4CSGC3041: Cryptography**

CO1: Explain the different concepts of cryptography L3

CO2: Describe the principles of symmetric and asymmetric cryptography L2

CO3: To apply the asymmetric key encipherment techniques L3

CO4: To apply the concepts of hashing algorithms L3

CO5: Understanding the real life examples of Cryptography L2

**4CSPL3051: Scripting Languages**

**CO1:** Comprehend the differences between typical scripting languages and typical system and application programming languages. L2

**CO2:** Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem. L2

**CO3:** Acquire programming skills in scripting language. L3

**CO4:** Understanding the text manipulation through Perl. L3

**CO5:** Understanding of how applications communicating with each other and how a widget toolkit used for building GUI in many languages. L2

**4CSPL3041: Advanced Java (MOOC)**

**: CO1:** Understand and implement advanced Java concepts

**CO2:** Design and implement server-side programs using Servlets and JSP

**CO3:** Implements applications using Java Server Faces

**CO4:** Incorporate cutting-edge frameworks in web application development

**CO5:** Design and implementation of ORM mapping using Hibernates

**4CSPL3061: Kotlin (OO+ Functional) (MOOC)**

**CO1:** To learn a readable, pragmatic, safe, and interoperable programming language

**CO2:** To think about nullability from the start by integrating nullability into the type system

**CO3:** Acquire programming skills in Kotlin

**CO4:** Understanding the Android development through Kotlin

**CO5:** To aid scalability in large-scale software development

**4ENEE1041: Measuring Instruments(MOOC)**

CO1.Explain elements of measuring instruments and classify measuring instruments and transducers. L2

CO2. Explain Static and Dynamic Characteristics of instruments. **L5**

CO3. Apply concept of various Bridges to measure Resistance, Capacitance and Inductance. **L3**

CO4. Explain the working of different electronic instruments. **L2**

CO5. Explain working of Display and Recording Devices. **L5**

**4ENCC1021: Introduction to Digital Image Processing**

| | | |
|---|---|---|
| CO1 | Understand the sensing, acquisition and storage of digital images | L1 |
| CO2 | Explain Intensity Transformation, Histogram and spatial filtering | L2 |
| CO3 | Demonstrate Different filtering techniques in frequency domain. | L3 |
| CO4 | Interpret Image reconstruction processes. | L2 |
| CO5 | Extends the Image processing techniques to color images. | L3 |

**4ENCC1031: Basics of Digital Communication**

CO1 Apply fundamental probability theory L2

CO2 Demonstrate the knowledge of signal vector interpretation L2

CO3 Interpret pulse modulation techniques and base band data transmission L3

CO4 Compare the digital modulation Techniques L3

CO5 Explain the concept of information, entropy and source coding theorems L2

**4ENME105: INTRODUCTION TO ROBOTICS**

1) Explain the basic configurations of robots. [L1]
2) Learn simple programs to control robots. [L2]
3) Illustrate the process of controlling a robot. [L2]
4) Explain the working of variety of sensors that can be used in robots. [L1]
   List the applications of robots in different fields. [L1]

**4BCE481: INTRODUCTION TO REMOTE SENSING**

CO1 Understand the importance of Remote Sensing L1

CO2 Understand the systems of Remote Sensing L1

CO3 Understand the different methods of Digital Image processing using software L2

CO4 Understand the concept of thematic maps L2

CO5 Understand the concept of digital elevation model L3

**4CSPL3041: Object Oriented Programming**

**CO1:** Discuss the concepts of object-oriented programming

**CO2:** Apply OOP concepts to develop programs using functions and class

**CO3:** Incorporate the inheritance and constructor concepts to develop applications in C++

**CO4:** Apply operator overloading concepts in C++

**CO5:** Exemplify the process of data file manipulations, templates and exception handling using C++

**4CSGC2011: Database Management Systems**

**CO1:** Demonstrate the basic elements of a relational database management system.

**CO2:** Identify the data models for relevant problems

**CO3:** Design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data.

**CO4:** Demonstrate their understanding of key notions of query evaluation and optimization techniques.

**CO5:** Extend normalization for the development of application softwares

**4CSGC1021:MS OFFICE**

CO1: Applying basic editing functions formatting skills on paragraphs, tables, lists, and pages

CO2: Applicable knowledge and uses of accepted business style formatting conventions.

CO3: Working knowledge of organizing and displaying large amounts and complex data CO4: Learnt to work with Master Slides to make editing your presentation easy

CO5: Learnt the importance of web and in social media

**6IDSS1031: BASICS OF ENTREPRENEURSHIP**

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

**CO3**: Consider the legal and financial conditions for starting a business venture. (Level 2)

**CO4**: Analyse the business environment in order to identify business opportunities.(Level 3)

**CO5**: Interpret their own business plan. (Level 4)

**5IDSS1011: Essentials of Human Rights and Public Interest Laws**

**CO1**: Understand core concepts involved in evolution and development of human rights law. (Level 2)

**CO2**: Understand constitutional aspects of human rights along with the statutory framework of National and State Human Rights Commissions(Level 3)

**CO3**: Examine the various dimensions of human rights law and understand the role of state on issues relating to the enforcement of human rights (Level 4)

**6IDSS1051: FINANCE FOR NON-FINANCE STUDENTS**

**CO1:** Impart the time value of money in valuation of securities. (Level 3)

**CO2:** Understand and focus on financial discipline and capital structure in organisations. (Level 3)

**CO3:** Appreciate new methods of financing, investing, operating and business decisions. (Level 3)

**CO4:** Assess appropriate measures related to dividend decisions in organisations. (Level 4)

**3IDSS1031: Introduction to Taxation**

**CO1**: Acquire the complete knowledge of basic concepts of income tax. (Level 1)

**CO2 & CO3:** Apply the provisions and compute income under different heads. (Level 2)

**CO4**: Identify and comply with the relevant Income from other Sources and Set-off and carry Forward of Losses. (Level 3)

**CO5**: Equip basics of goods and service tax (Level 4)

**3IDSS1071: Financial Markets and Personal Investment**

**CO1**: Able to understand the concepts of financial markets and personal investment. (Level 1)

**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

**CO3**: Able to assess the need and importance of the issue of IPO.

**CO4**: Able to judge the process of operations in secondary markets and the existence of different regulatory authorities in stock market operations (Level 3)

**CO5**: Able to make assessments and make investment in personal investment in their life. (Level 4)

**6IDSS1071: MARKETING -FOR THE UNINITIATED**

**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

**CO4**: Apply the necessary marketing skills. (Level 3)

**CO5**: Analyse the IMC and recent trends. (Level 4)

**NIDSS1011: NCC I**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1021: NCC II

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1031: NCC III

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1041: NCC IV

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### CKSHM1011: ENVIRONMENT AND SUSTAINABILITY

**CO1** Outline the expected consequences of continuous environment degradation in the society by relevant data analysis. L2

**CO2** Demonstrate a rationale for climate change adaptation and mitigation by proposing appropriate actions in key sectors.

L2

**CO3** Explain the key issues under negotiation by summarizing the international climate change legal and policy framework.

L2

**CO4** Demonstrate knowledge of environment sustainability by analyzing relevant data about industrial impact on environment.

**4ENCC1071: COMPUTER COMMUNICATION NETWORKS**

| | | |
|---|---|---|
| CO1 | Explain Data Communication with key concepts of networks, its types and OSI network model. | L2 |
| CO2 | Identify the data link layer from OSI model, understanding the concepts related to layer, protocols. | L3 |
| CO3 | Demonstrate the concept of Wired LAN's standards and its architecture. | L2 |
| CO4 | Explain various connecting devices, IP address and routing mobile IP. | L2 |
| CO5 | Explain the various transport layer protocols, UDP and TCP service applications and flow and error control. | L2 |

**4ENCC2022: Advanced Digital Communication (P)**

**CO1** Explain merits and demerits of different modulation techniques & coding techniques, spread spectrum signals and channel behaviors L2

**CO2** Analyze various modulation, equalization, diversity and coding techniques for communication systems L3

**CO3** Compare performance of different types of modulation on different wireless application fading channels. L2

**CO4** Design and demonstrate various modulation/coding equalization techniques and measure their performance. L2

**4ENCE1061: Real Time Operating System(RTOS)**

CO1: Explain the key characteristics and requirements of real-time systems

CO2: Analyze different real-time scheduling algorithms (e.g., Rate Monotonic Scheduling, Earliest Deadline First)

CO3: Implement memory allocation and deallocation strategies in an RTOS environment

CO4: Apply debugging techniques and use performance profiling tools to optimize real-time applications.

CO5: Utilize IPC methods like message queues, pipes, mailboxes, and shared memory to manage communication between tasks.

**4ENCE1221: Advanced Embedded Systems**

| | | |
|---|---|---|
| CO1 | Identify the building blocks of a typical Embedded System. | L3 |
| CO2 | Demonstrate characteristics and attributes of an embedded system, hardware /software co-design and firmware design approaches. | L2 |
| CO3 | Explain the architectural features of 32 bit microcontroller ARM Cortex M3. | L2 |
| CO4 | Understand the different steps involved in the design and development of firmware for embedded systems. | L2 |
| CO5 | Explain the need of real time operating system for embedded system applications. | L2 |

**4ENCE1081: Wearable Electronics**

CO1. Identify and understand the need for development of wearable devices and its influence on various sectors. L2

CO2. Discus the applications of various wearable inertial sensors for biomedical applications. L3

CO3. Comprehend the design and development of various wearable bio-electrode and physiological activity monitoring devices for use in healthcare applications. L3

CO4. Discuss and analyze the usage of various biochemical and gas sensors as wearable devices. L4

CO5. Identify the use of various wearable locomotive tools for safety and security, navigation. L2

**4ENCE1231: Micro Electrical mechanical System(MEMS)(MOOC)**

CO1. Describe technologies related to Micro Electro Mechanical Systems. **L2**

CO2. Explain design and fabrication processes involved with MEMS Devices. **L5**

CO3. Analyze the MEMS devices and develop suitable mathematical models. **L3**

CO4. Explain various application areas for MEMS device. **L2**

CO5. Describe the Micromanufacturing. **L5**

**4ENVL1041: LOW POWER VLSI**

| | | |
|---|---|---|
| CO1 | Classify various second order effects in MOSFET device | L3 |
| CO2 | Illustrate the sources of power dissipation in CMOS based logic | L2 |
| CO3 | Construct a suitable circuit to reduce leakage power using suitable low power techniques | L2 |
| CO4 | Demonstrate the knowledge of joint random variables in real time engineering problems | L3 |
| CO5 | Identify the mechanisms of power dissipation in CMOS integrated circuits | L3 |

**4ENVL2021:CMOS Analog Design**

| | | |
|---|---|---|
| CO1 | Students should be familiar with the basic principles of CMOS (Complementary Metal-Oxide-Semiconductor) technology, including device physics, process technology, and layout design rules. | L3 |
| CO2 | Students should be able to analyze and design analog amplifier circuits, such as Cascode Amplifier and Differential Amplifier. | L2 |

| | | |
|---|---|---|
| CO3 | Students should be able to design basic analog building blocks, such as voltage references, current sources, and operational amplifiers, using CMOS technology. | L3 |
| CO4 | Students should be able to analyze and design basic analog circuits, such as filters, oscillators and Data Converters using common circuit topologies and devices. | L3 |
| CO5 | Students should be able to perform layout design of analog circuits, including physical design rules, device sizing, and parasitic extraction. | L2 |

**4ENVL1051:System on Chip(SOC)(MOOC)**

| | | |
|---|---|---|
| CO1 | Understanding of the basic concepts and principles of SoC design, different design methodologies and memory and Bus Architecture. | L3 |
| CO2 | Understand working principles of processor architecture, Introduction to interconnects and bus protocol. | L2 |
| CO3 | Know the SoC Peripherals and Design Methodology | L3 |
| CO4 | Learn about different testing and validation techniques used in SoC design, including low-power design, Design for testability (DFT) | L3 |
| CO5 | Advanced topics in SoC design, including system-level design, and security. | L2 |

**4ENCC1111: RADAR**

| | | |
|---|---|---|
| CO1 | Describe the fundamentals of radar and design matched filters in noise environment | L2 |
| CO2 | Explain the various parameter configurations which can be efficiently achieved. | L2 |
| CO3 | Describe the types of pulse compression techniques for increasing range resolution. | L2 |
| CO4 | Illustrate statistical framework necessary for the development of automatic target detection. | L3 |
| CO | Analyze radar system performance, both in search and track modes, and with low and medium pulse repetition frequencies. | L4 |

**4ENCC2031:Mobile Communication**

| | | |
|---|---|---|
| CO1 | Explain the cellular concepts like frequency reuse, fading, equalization, GSM, CDMA. | L2 |
| CO2 | Illustrate hand-off and inference and apply the concept to calculate link budget using path loss model | L3 |
| CO3 | Describe equalization and different diversity techniques. | L2 |
| CO4 | Explain the concept of GSM in real time applications. | L2 |
| CO5 | Analyze different multiple access techniques in mobile communication. | L4 |

**4ENCC1261:Pattern Recognition**

| | | |
|---|---|---|
| CO1 | Explain Bayesian decision theory and learning. | L2 |
| CO2 | Explain the various techniques involved in pattern recognition | L2 |
| CO3 | Illustrate the various pattern recognition techniques into supervised and unsupervised. | L3 |
| CO4 | Analyzing the artificial neural network based pattern recognition | L4 |
| CO5 | Describe the applications of pattern recognition in various applications | L2 |

**4ENCC1271: ADHOC AND SENSOR NETWORKS**

| | | |
|---|---|---|
| CO1 | Explain the basics of Ad hoc networks and Wireless Sensor Networks | L2 |
| CO2 | Describe the different routing protocols. | L2 |
| CO3 | Describe the appropriate physical and MAC layer protocols | L2 |
| CO4 | Analyze the transport layer and security issues possible in Ad hoc and sensor networks. | L4 |
| CO5 | Illustrate the OS used in Wireless Sensor Networks and build basic modules. | L3 |

**4ENCC1281: Multi-Rate Signal Processing and Filter Banks**

| | | |
|---|---|---|
| CO1 | Understand the multi-rate systems and its applications | L2 |
| CO2 | Explain the concept of decimated filter banks | L2 |
| CO3 | Design paraunitariness filter banks | L2 |
| CO4 | Design Cosine module filter banks | L4 |
| CO5 | Design wavelet transform filter with the help of multi-rate filter | L2 |

**4ENCC2101: INFORMATION THEORY AND CODING**

| | | |
|---|---|---|
| CO1 | Explain the concept of information, entropy and source coding theorem | L2 |
| CO2 | Demonstrate the knowledge of Shannon's source coding theorem and channel coding theorem for designing an efficient and error free communication link | L2 |
| CO3 | Explain error correction and detection using parity check coding and other coding schemes | L2 |
| CO4 | Explain minimum distance coding and cyclic codes | L2 |
| CO5 | Discuss Convolutional coding | |

**4ENCC1291:Opto Electronics(MOOC)**

| | | |
|---|---|---|
| CO1 | Explain the basics of solid state physics and understand the nature and characteristics of light. | L2 |
| CO2 | Explain different methods of luminescence, display devices and laser types and their applications. | L2 |

CO3 Explain the principle of optical detection mechanism in different detection devices. L2

CO4 Illustrating the different light modulation techniques and the concepts and applications of optical switching. L3

CO5 Analyze the integration process and application of opto electronic integrated circuits in transmitters and receivers. L4

**4CSPL3111: Object Oriented Analysis Design**

**CO1:** To learn techniques for testing and validating object-oriented systems, including unit testing, integration testing, and acceptance testing, to ensure the correctness and reliability of the software. L1

**CO2:** To develop skills in collaborating effectively within a team environment, including communication, task allocation, and version control, to collectively design and implement object-oriented systems. L5

**CO3:** To understand the importance of non-functional requirements, such as performance, scalability, and security and learn how to incorporate them into the analysis and design process. L3

**CO4:** To stay updated with the latest trends and technologies in object-oriented analysis and design, allowing them to adapt and apply new techniques and tools as they evolve. L3

**CO5:** To demonstrate ethical and professional behaviour in the analysis and design of software systems, considering legal and societal implications, as well as adhering to industry best practices and standards. L5

**CSPL3121: Web Technology Frameworks**

**CO1:** Students will be able to Develop a solid understanding of the MERN stack and how it can be used to build scalable, high-performance full-stack web applications. L1

**CO2:** Students will Gain hands-on experience with building web applications using the MERN stack, including setting up a development environment, creating and connecting to databases, building APIs, and integrating frontend and backend code. L5

**CO3:** Students will be able to learn best practices for building secure, performant, and maintainable web applications including implementing authentication and authorization, optimizing database queries, and using tools for debuggin and testing. L3

**CO4:**. Students will be able to understand how to design and implement scalable, distributed web applications that can handle large amounts of traffic and users, and deploy these applications to the cloud using popular cloud services. L3

**CO5:**. Students will be able to Acquire the skills and knowledge necessary to be able to build real-world web applications using the MERN stack and gain confidence in their ability to create high-quality, professional-grade software. L5

**4CSPL3131: Application Development using MERN Stack (MOOC)**

CO1: To Discover the details of HTML,CSS and their properties and applications L2

CO2: Use the tools required to build JavaScript based SPAs

L2

CO3: Discover the details of React, the React Way, and how to get the maximum out of this library L3

C04: Discover the details of Nodejs and how to get the maximum out of this library L3

Co5: To Discover the details of SQL,MongoDB and Nosql L2

**4ENCE1131: Introduction to Nanotechnology**

CO1: Describe fundamentals of nanotechnology. **L2**

CO2: Classify nanostructures. **L2**

CO3:.Analyze biomaterials. **L4**

CO4: Develop smart materials. **L3**

CO5: Explain nanotoxicology. **L2**

**4ENCE1241: 8051 Microcontroller**

CO1. Explain the basics of Microprocessor and Microcontroller. **L2**

CO2. Relate to the 8051 Microcontroller architecture and Pin description. **L4**

CO3. Analyze 8051 Addressing modes and use the 8051 instruction set. **L4**

CO4. Program the on-chip peripherals in 8051. **L3**

CO5. Design and develop applications using 8051 Assembly language and C program. **L6**

**4ENCE1051: Basics of Embedded System**

CO1 :Classify an Embedded System based on various design parameters and peripherals L

2 CO2 :Explain the architectural features of 32-bit microcontroller ARM Cortex M3 L2 CO3 ;Explain the instruction set of 32-bit microcontroller ARM Cortex M3 L2

CO4 Make use of the knowledge gained for programming ARM Cortex M3 for different applications using C and assembly language L3

CO5: Choose appropriate communication protocol for an application L3

**4ENCE1251:INDUSTRIAL ELECTRONICS(MOOC)**

**CO1** Explain the different types of power semi–conductor devices and their switching characteristics L2

**CO2** Explain the operation, characteristics and performance parameters of controlled rectifiers L2

**CO3** Differentiate between the characteristics of DC and AC drives L2

**CO4** Explain the different modulation techniques of pulse width modulated inverters and to u nderstand the harmonic reduction methods L2

**CO** Explain the practical application of power electronics converters in conditioning the power supply L2

**4ENCC1091:Basics of Satellite Communication**

**CO1** Explain the satellite orbits and its trajectories with the definitions of parameters associated with it L2

**CO2** Illustrate the electronic hardware systems associated with the satellite subsystem and earth station L3

**CO3** Analyze the satellite Link design L3

**CO4** Explain the various methods of Satellite access L2

**CO5** Explain various satellite applications L2

**4CSPL2071: Web Technology**

**CO1:** Students will be able to create simple static web pages using HTML and CSS. L1

**CO2:** Students will be able to add interactivity to web pages using JavaScript. L5

**CO3:** Students will be able to design responsive web pages that adapt to different screen sizes using framework such as Bootstrap. L3

**CO4:**. Students will be able to create server-side applications using a server-side language such as PHP or Python. L3

**CO5:**. Students will be able to design and implement web applications that consume external APIs usingRESTful web services L5

**4CSPL2051: Mobile Application Development**

**CO1:** Explain the fundamental concepts of mobile application development L2

**CO2:** Design the application with activities and fragments L2

**CO3:** Apply different user interfaces to their application L3

**CO4:** Demonstrate the use of views and pictures L2

**CO5:** Use the different services in the application L3

**4CSGC2101 : Machine Learning for Beginners**

**CO1:** Explain the concepts of Machine Learning Categories L4

**CO2:** Analyse the fundamentals of Machine Learning L3

**CO3:** Analyse various models in Machine learning L3

**CO4:** Illustrate the Text Mining and Recommender Systems L2

**CO5:** Elucidate the Deep and Reinforcement Learning L2

**6IDSS1031: BASICS OF ENTREPRENEURSHIP**

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

**CO3**: Consider the legal and financial conditions for starting a business venture. (Level 2)

**CO4**: Analyse the business environment in order to identify business opportunities.(Level 3)

**CO5**: Interpret their own business plan. (Level 4)

## 5IDSS1011: Essentials of Human Rights and Public Interest Laws

**CO1**: Understand core concepts involved in evolution and development of human rights law. (Level 2)

**CO2**: Understand constitutional aspects of human rights along with the statutory framework of National and State Human Rights Commissions(Level 3)

**CO3**: Examine the various dimensions of human rights law and understand the role of state on issues relating to the enforcement of human rights (Level 4)

## 6IDSS1051: FINANCE FOR NON-FINANCE STUDENTS

**CO1:** Impart the time value of money in valuation of securities. (Level 3)

**CO2:** Understand and focus on financial discipline and capital structure in organisations. (Level 3)

**CO3:** Appreciate new methods of financing, investing, operating and business decisions. (Level 3)

**CO4:** Assess appropriate measures related to dividend decisions in organisations. (Level 4)

## 3IDSS1071: Financial Markets and Personal Investment

**CO1**: Able to understand the concepts of financial markets and personal investment. (Level 1)

**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

**CO3**: Able to assess the need and importance of the issue of IPO.

**CO4**: Able to judge the process of operations in secondary markets and the existence of different regulatory authorities in stock market operations (Level 3)

**CO5**: Able to make assessments and make investment in personal investment in their life. (Level 4)

## 6IDSS1071: MARKETING -FOR THE UNINITIATED

**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

**CO4**: Apply the necessary marketing skills. (Level 3)

**CO5**: Analyse the IMC and recent trends. (Level 4)

## NIDSS1011: NCC I

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1021: NCC II

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1031: NCC III

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1041: NCC IV

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### CCSHS1011: SOCIOLOGY OF GLOBALIZATION AND SUSTAINABLE DEVELOPMENT

**CO1** Demonstrate understanding of globalization process with emphasis on inter-dependence of communities and societies L1

**CO2** Analyse the critical issues in social development in the given context L2 **CO3** Develop technological interventions for social and community development L3 **CO4** Explain the health and hygiene of the community L2 **CO5** Develop technological interventions for social and community development L3

**4ENCC1241: WIRELESS COMMUNICATION**

**CO1** Explain the basics and types of wireless communication systems being used L2

**CO2** Explain the basic concepts of cellular system and the design requirements L2

**CO3** Demonstrate the basic principles behind radio resource management techniques such as frequency reuse, channel allocation and handoffs L2

**CO4** Interpret knowledge and gain awareness on the technologies used for effective share of spectrum by multiple access techniques i.e. TDMA, CDMA, FDMA etc. L2

**CO5** Summarize the wireless standards being used across the world L2

## 4ENCC1132: IMAGE AND VIDEO PROCESSING

CO1 Understand the sensing, acquisition and storage of digital images L1
CO2 Explain Intensity Transformation, Histogram and spatial filtering L2

CO3 Demonstrate Different filtering techniques in frequency domain. L3

CO4 Interpret Image reconstruction processes. L2

CO5 Extends the Image processing techniques to color images. L3

**4ENCC1051: IoT and Wireless Sensor Networks**

**CO1**. Understand choice and application of IoT & M2M communication protocols. L2

**CO2** Describe Cloud computing and design principles of IoT. L2

**CO3**. Relate to MQTT clients, MQTT server and its programming. L3

**CO4**. Describe the architectures and its communication protocols of WSNs. L3

**CO5.** Identify the uplink and downlink communication protocols associated with specific application of IOT /WSNs L3

**4ENCE1101: Biomedical Electronics**

**CO1.** Introduce the student to the electronic devices and theory of operation in the medical area. L2
**CO2.** Data Interpretation: Learn to design, test, and analyze electronic circuits using oscilloscopes and

other electronics test equipment. Apply knowledge of engineering and science to interpret data. Develop an understanding of and develop the skills necessary to communicate findings and interpretations in an effective laboratory report. L3

**CO3.** Electronic circuits for Biomedical Applications: Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits. L4

**CO4.** Work in Multi-disciplinary teams: Learn to work and communicate effectively with peers on multi- disciplinary teams to attain a common goal. L4

**CO5.** Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals. L3

**4ENCE1111: VIRTUAL INSTRUMENTATION(MOOC)**

After studying this course, students will be able to:

CO1. Recognize and describe various aspects of VI. **L2**

CO2. Develop a virtual instrumentation model using the front panel controls & indicators and loops. **L6**

CO3. Analyze and design various array operations using LabVIEW functions. **L3**

CO4. Evaluate the various forms of output representations using graphs, charts and File I/Os. **L5**

**4ENCE2051: ADVANCED CONTROL SYSTEM**

CO1: Apply state variable approach for linear time invariant systems in both the continuous and discrete time systems. **L3**

CO2: Apply state space analysis to analyze, design and test for Controllability and Observability of a given system **L3**

CO3: Design pole assignment and state observer using state feedback. **L6**

CO4: Describe Nonlinearity and develop the describing function for the nonlinearity present to assess the stability of the system. **L5**

CO5: Develop Lyapunov function for the stability analysis of nonlinear systems. **L6**

**4ENCE1121: CAN Protocol and Controller**

1. Understand the CAN protocol and able to know that what features affecting the reliability of the communication system. L2
2. To design and implement the CAN protocol and able to learn the layers of CAN communication system. L3
3. Understand the reliability issues through different types of analysis method. L2
4. Identify the commercial tools for configuring, analyzing and calibrating a CAN communication system. L3

Know the summary of the main transport level and application-level protocols that are based on CAN. L3

**4ENVL1061:CMOS RF Design**

| | | |
|---|---|---|
| **CO1** | Understand the principles of RF design, including transmission line theory, impedance matching, noise analysis, and RF amplifier design. | L3 |
| **CO2** | Understand the characteristics and limitations of CMOS technology and its applications in RF design. | L2 |

| | | |
|---|---|---|
| **CO3** | Design and analyze RF circuits using CMOS technology, including low-noise amplifiers, mixers, Design techniques for mixers and frequency converters. | L3 |
| **CO4** | Design and analyze RF circuits using CMOS technology, including voltage-controlled oscillators, Phase-Locked Loops and power amplifiers. | L3 |
| **CO5** | Know the current research trends and challenges in CMOS RF design | L2 |

**4ENVL1071:Mixed Signal Analysis**

| | | |
|---|---|---|
| CO1 | Understanding of mixed signal systems, design process and associated challenges. | L2 |
| CO2 | Understand the concepts of signal processing, including Fourier analysis, time-domain and frequency-domain analysis, filtering, and noise analysis. | L2 |
| CO3 | Analyze the Linear and nonlinear circuits as well as different types of noise. | L3 |
| CO4 | Understand the basic principles of mixed signal systems, including analog-to-digital conversion (ADC), digital-to-analog conversion (DAC), and mixed-signal design methodologies. | L4 |
| CO5 | Analyze and optimize mixed-signal system performance in terms of signal integrity, noise, distortion, and power consumption | L4 |

## 4ENVL1081: VLSI TESING

**: CO1**: Acquire knowledge about fault modeling & collapsing.

**CO2**: Analyse various combinational ATPG techniques.

**CO3**: Evaluate the significance of sequential test pattern generation.

**CO4**: Develop fault simulation techniques & fault diagnosis methods.

**4ENCC1141: Multimedia Communication**

**CO1:** Demonstrate comprehension of multimedia communication principles through assessments.

**CO2**: Apply information representation techniques to encode multimedia data effectively.
**CO3:** Implement compression algorithms to optimize multimedia data storage and transmission.
**CO4:** Analyze distributed multimedia systems' features and resource management strategies.

**CO5:** Configure and troubleshoot multimedia information networks, including LANs and internet protocols.

**4ENCC1151 : MIMO COMMUNICATION**

**CO1:** Students will acquire a solid comprehension of the fundamental concepts and principles that form the foundation of MIMO Communications L4

**CO2**: Students will develop the ability to identify and analyze complex problems in various domains and apply MIMO techniques to devise effective solutions. L3

**CO3:** Students will be able to select appropriate MIMO Communication algorithms based on problem requirements L3

**CO4:** Students will learn how to design and develop MIMO System models by defining the problem domain. L2

**CO5:** Students will be able to evaluate the performance of MIMO Techniques models using appropriate evaluation metrics and statistical analysis techniques

**4ENCC1161: Vehicular Communication**

**CO1:** Students will acquire a solid comprehension of the fundamental concepts and principles that form the foundation of Vehicular Communication L4

**CO2:** Students will develop the ability to identify Random models, flow and traffic models, behavioural models, trace and survey-based models, joint transport and communication simulations. L3

**CO3:** Students will be able to select appropriate layer among Physical Layer and MAC Layer for Vehicular Communications requirements L3

**CO4:** Students will learn how VANET Routing protocols are developed; and how Standards and Regulations are followed. L2

**CO5:** Students will be able to Develop critical thinking for Emerging VANET Applications L2

**4ENCC1171: Microwave & Antenna**

**CO1** Acquire knowledge on the theory of microwave transmission, microwave generators and L2

**CO2** Demonstrate microwave devices and monolithic microwave integrated circuits L2

**CO3** Compare the fundamental parameters of antenna and wave propagation. L3

**CO4** Identify Dipoles and Thin linear antennas.. L3

**CO5** Identify the working principle of various types of antenna and categorize them according to their applications L2

**4ENCC1121: LTE and 5G Communication**

**CO1:** Understand the fundamental concepts of 4G LTE and its architecture L3

**CO2:** Analyze the role of OFDM's and SC–FDMA access schemes. L3

**CO3:** Explain the evolution of 5G, system concepts, and spectrum challenges L3

**CO4:** Illustrate the 5G functional and physical architecture and its requirements L4

**CO5:** Analyze the security issues and challenges in 5G communication systems. L3

**CPSAE1011: BUSINESS MANAGEMENT FOR ENGINEERS**

**CO1** Apply the concepts related to entrepreneurship issues in business ideas L3

**CO2** Explain the factors influencing the practice of management in different contexts L2

**CO3** Develop suitable economic strategy regarding common business problems L3

**CO4** Analyze the marketing strategy for common engineering business problems L4

**CO5** Illustrate the leadership qualities in the operation of a new venture

## 6IDSS1031: BASICS OF ENTREPRENEURSHIP

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

**CO3**: Consider the legal and financial conditions for starting a business venture. (Level 2)

**CO4**: Analyse the business environment in order to identify business opportunities.(Level 3)

**CO5**: Interpret their own business plan. (Level 4)

## 5IDSS1011: Essentials of Human Rights and Public Interest Laws

**CO1**: Understand core concepts involved in evolution and development of human rights law. (Level 2)

**CO2**: Understand constitutional aspects of human rights along with the statutory framework of National and State Human Rights Commissions(Level 3)

**CO3**: Examine the various dimensions of human rights law and understand the role of state on issues relating to the enforcement of human rights (Level 4)

## 6IDSS1051: FINANCE FOR NON-FINANCE STUDENTS

**CO1:** Impart the time value of money in valuation of securities. (Level 3)

**CO2:** Understand and focus on financial discipline and capital structure in organisations. (Level 3)

**CO3:** Appreciate new methods of financing, investing, operating and business decisions. (Level 3)

**CO4:** Assess appropriate measures related to dividend decisions in organisations. (Level 4)

## 3IDSS1071: Financial Markets and Personal Investment

**CO1**: Able to understand the concepts of financial markets and personal investment. (Level 1)

**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

**CO3**: Able to assess the need and importance of the issue of IPO.

**CO4**: Able to judge the process of operations in secondary markets and the existence of different regulatory authorities in stock market operations (Level 3)

**CO5**: Able to make assessments and make investment in personal investment in their life. (Level 4)

## 6IDSS1071: MARKETING -FOR THE UNINITIATED

**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

**CO4**: Apply the necessary marketing skills. (Level 3)

**CO5**: Analyse the IMC and recent trends. (Level 4)

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### NIDSS1021: NCC II

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### NIDSS1031: NCC III

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

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### NIDSS1041: NCC IV

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

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**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**CPSHS1021: Business Management For Engineers**

**CO1**: Describe basic business concepts and the importance of business management in engineering.(L2)

**CO2**: Analyze business situations using SWOT analysis( L3)

**CO3**: Analyze operational strategies and the processes for shift using Lean and Six Sigma principles.(L3) **CO4**: Interpret financial statements and the cost estimation and break-even analysis (L2) **CO5**: differentiate between leadership styles and demonstrate effective team management. (L3)

**CKSMA1031 - Introduction to Philosophy (IPT)**

CO1: Recognize the importance of rationally deducing a question

or a problem. CO2: To develop appreciation towards various

philosophical ideologies.

CO3: To enable the students to form their own philosophy of life

**CKSMA1051 - Introduction to the History and Theories of Knowledge [IHK]**

CO1: Students will have basic understanding of Indian and Western theories of Knowledge. (Lv.2)
CO2: Students will be able to distinguish between Indian and Western theories of Knowledge (Lv.4)
CO3: Students will be able to critique systems of knowledge production (Lv.5)

**CKSMA1061 - Introduction to Indian Aesthetics [IIA]**

CO1: Explain the foundational concepts in Indian

Aesthetics (Lv.2) CO2: Compare Indian and Western

theories of Aesthetics.(Lv.4) CO3: Critique Indian

Aesthetic theories.(Lv.5)

CO4: Assess the importance of Aesthetic values in contemporary art on the basis of Indian Aesthetic theories (Lv.5)

**CKSMA1071 - Gender and Society (GSY)**

CO1: Define gender (Lv.1)

CO2: Understand the processes by which gender has been defined throughout

history (Lv.2) CO3: Analyze the role gender plays in society (Lv.4)

CO4: Critique gender-relations and its effect on society (Lv.5)

CO4: Investigate how gender can be reframed to create a more equitable society (Lv.6)

**CKSMA1081 - Philosophy of Money [PHM]**

CO1: Defining the political theory of money put forward by Aristotle, Locke, Fichte, Marx, and Keynes (Lv.1)

CO2: Explaining the historical and political crisis that led to reimagining the role of money vis-à-vis power (Lv.2)

CO3: Analyzing the contemporary changes in conceptions of money (eg: cryptocurrency) (Lv.4)
CO4: Critiquing the role that money plays in democratic societies (Lv.5)

**[CKSAA1033]: Arts and Philosophy (A & P):Introduction to Philosophical Thoughts**

CO1: Examine various philosophical systems and apply the concepts to actual states of affairs. (L4)

CO2: To be able to evaluate the moral acts of individuals belonging to different cultures and societies. (L4)

CO3: Analyze, evaluate, and recognize their psychic inclination towards the specific

philosophical thought system. (L6)

**4DISS4021: CAPSTONE PROJECT – BUILD**

| | | |
|---|---|---|
| **CO1** | Compare the project built with other possible existing solutions to come to a conclusion about its feasibility and reliability. | L4 |
| **CO2** | Utilize proper project management techniques and planning methods to produce cost effective projects | L3 |
| **CO3** | Recommend the need to implementing the project with supporting justification and possible areas to improve the same | L5 |
| **CO4** | Compile a clear report that contains the step by step process to building the project that includes all calculations, analysis and fabrication methods involved | L5 |

**CO5** Build the real world implementation of the design that will realize the objectives of the6 prototype/ design

**4DISS3011/21/31: INTERNSHIP**

| | | |
|---|---|---|
| **CO1** | Demonstrate the skills in professional career goals | L2 |
| **CO2** | Administer the insight into a possible career path of interest with organizational structure, roles and responsibilities | L3 |
| **CO3** | Develop professional connections with leadership strategy and skill development | L4 |
| **CO4** | Identify the professions to suit the interest as a result of this experience | L3 |
| **CO5** | Conquer additional skills that will need to be developed to ensure career readiness such as new technology, developing a broader network, additional coursework | L4 |

# ECE-Course Outcome-2022

### 4MATH1011: ENGINEERING MATHEMATICS -I

**CO1:** Apply the knowledge of calculus to analyse and approximate the functions. L3

**CO2:** Calculate rates of change of multivariate functions. L3

**CO3:** Solve multiple integrals for computing area and volume. L3

**CO4:** Make use of Gradient, divergence and curl for solving Engineering problems. L3

**CO5:** Use the concept vector integration to solve the flow problems. L3

### 4PHYS1011: ENGINEERING PHYSICS

**CO1:** Analyse the applications of quantum mechanics in technology. L4

**CO2:** Make use of Lasers and Optical fibres for different industrial applications. L3

**CO3:** Plot the I-V characteristics of photo-diode, LED, Zener diodes and solar cells. L3

**CO4:** Explain the use of Magnetic, Dielectric and Superconducting materials for different engineering applications. L2

**CO5:** Analyse the results obtained in different experiments. L4

### 4ENEE1011: ELEMENTS OF ELECTRICAL ENGINEERING

On successful completion of the course, students will be able to:

**CO1:** Analyze electrical circuits by relevant Laws in DC circuits. L4
**CO2:** Demonstrate the single phase and three-phase power generation by using the phasor diagrams. L3
**CO3:** Illustrate the construction and operation of DC machines and understand the concept of electrical wiring, protecting devices and earthing. L3

**CO4:** Explain the construction and operation of AC machines. L2

### 4CSGC1011: ELEMENTS OF COMPUTER ENGINEERING

**CO1:** Demonstrate functioning of different sub-systems, OS and different types of OS. L3

**CO2:** Use different types of data structures, operations and algorithms. L3

**CO3:** Describe the fundamental elements of relational database management systems. L2

**CO4:** Comprehend the layered protocol model & Classification of networks. L3

**CO5:** Demonstrate need for Linux OS and Linux commands. L3

### 4ENME1011: COMPUTER AIDED ENGINEERING DRAWING

**CO1:** Illustrate competence in basics of orthographic projections of points, lines, planes and solids in three different views. L3

**CO2:** Apply the concepts of orthographic projections for simple objects. L3

**CO3:** Develop surfaces of solids of simple objects. L3

### CPSHD1011: Design Thinking-1

O1: Apply teamwork towards building a solution. (LeveL 3)

O2: Apply basic Design Research (Level 3)

O3: Apply brainstorming as a way of innovative thinking. (Level 3)

O4: Apply story-telling in Design Thinking. (Level 3)

**CPSHL1021**: **Oral & Written Communication – 1**

On successful completion of the course, Students will be able to

**CO1**: Understand the skills required to use the English language effectively in all areas of communication. L1

**CO2**: Understand their areas of weaknesses and ways to improve upon them. L1

**CO3**: Understand the knowledge required in various situations, like in formal and informal settings. L1

**CO4**: Understand how to write official reports and proposals. L1

**4MATH1021: ENGINEERING MATHEMATICS II**

**CO1:** Solve first order linear ordinary differential equations L3

**CO2:** Solve higher order differential equations arising through physical processes. L3

**CO3:** Construct a variety of partial differential equations and solves them. L4

**CO4:** Use periodic signals to represent periodic functions in the form of Fourier series. L3

**CO5:** Make use of matrix theory for solving system of linear equations L3

**4CHEM1011: ENGINEERING CHEMISTRY**

**CO1:** Explain the construction and working of Energy storage devices. L2

**CO2:** Explain corrosion of metals, factors and prevention techniques. L2

**CO3:** Explain the importance of the modern emerging field of nanotechnology. L2

**CO4:** Use instruments which give quick and accurate results for material analysis. L3

**CO5:** Carry out different types of titrations for estimation of concentration of an analyte. L3

**4ENCE1011: ELEMENTS OF ELECTRONICS ENGINEERING**

On successful completion of the course, students will be able to:

**CO1:** Describe semiconductor devices and its applications L2

**CO2:** Analyze the various circuits of BJT L4

**CO3:** Employ op-amp in various circuits L3

**CO4:** Analyze digital circuits L4

**CO5:** Appreciate the importance of transducers and communication systems L5

**4ENME1021: ELEMENTS OF MECHANICAL ENGINEERING AND WORKSHOP**

**CO1:** Recognize the impact of energy sources on the environment and sustainability. L2

**CO2:** Explain the working principles of water, vapour and gas-powered systems. L2

**CO3:** Discuss the working principles of refrigeration systems and IC engines. L2

**CO4:** Compute various performance parameters of IC engines. L3

**CO5:** Demonstrate soldering, brazing and welding of sheet metal & welded joints. L2

**4ENCV1011: ELEMENTS OF CIVIL ENGINEERING**

**CO1:** Explain the basics of Civil Engineering and related fields. L2

**CO2:** Develop working models with the laws of mechanics. L3

**CO3:** Analyze equilibrium of coplanar, concurrent and non-concurrent forces. L4

**CO4:** Determine centroid and moment of inertia of simple geometric figures. L3

**CO5:** Apply D'Alembert's principle in any specific application. L3

**4CSPL1011: PROBLEM SOLVING USING PYTHON**

**CO1:** Understand the basis of algorithm problem solving L2

**CO2:** Develop python programs with conditionals and loops L4

**CO3:** Develop python programs for data structure applications L4

**CO4:** Develop GUI Python programs using Tkinter L4

**CO5:** Write Object Oriented programs using Python L4

## CPSHD2011 : Design Thinking-2

O1: Create an appropriate research plan to explore the problem, execute the design research and present findings as a team. (level 5)

O2: Evaluate research findings, identify insights and brainstorm solutions as a team. (level 4)

O3: Create a prototype and iterate based on feedback received as a team. (level 5)

**CPSHL2021 Oral & Written Communication – 2**

CO1: Understand the skills required to use the English language effectively in the business and corporate world. L1

CO2: Understand and be able to express points of view of others meaningfully. L2

CO3: Understand how to clearly interpret visuals and graphs. L3

CO4: Understand how to write technical content meant for specific audiences. L1

CO5: Understand how to write reviews and articles about books and published works. L1

**4MATH2011-Engineering Mathematics-III**

**CO1** Make use of C–R equations to form analytic functions L3

**CO2** Explain the concept of conformal, bilinear transformations and contour integration L2

**CO3** Apply Z-transforms for discrete functions. L3

**CO4** Solve linear differential equations by Laplace transform method L3

**CO5** Solve first and second order ordinary differential equation using single step and multistep numerical methods L3

**4ENCE2011: Analog System Design**

| | | |
|---|---|---|
| CO1 | Demonstrate the device characteristics and working principles of BJT and MOSFET, andparameters of different types of amplifiers | L2 |
| CO2 | Analyze transistor biasing circuits and various amplifier configurations with small signal model | L4 |
| CO3 | Explain the operation of BJT and MOSFET current mirrors, differential amplifier and frequency response of an amplifier | L3 |
| CO4 | Analyze different types of feedback amplifiers and oscillators | L4 |
| CO5 | Design of series and shunt voltage regulators for a Power supply | L4 |

**4ENCE2021: Digital System Design**

CO1 Make use of fundamental concepts to implement digital logic functions. L3

CO2 Demonstrate the design-methodology using VHDL L2

CO3 Build a combinational logic circuit with HDL and implement it on programmable logic devices.

L3

CO4 Develop synchronous and asynchronous sequential circuits, and realize using Hardware description Language and programmable logic devices. L3

CO5 Design finite state machine for different applications. L6

**4ENEE1021: Network Analysis**

CO1: Demonstrate the knowledge of KCL and KVL by solving electrical networks in phasor and time domain L2

CO2: Select a suitable resonant circuit for a given resonant frequency L3

CO3: Select suitable network theorems for reduction of a given network to simplify the solution for a network problem L2

CO4: Analyze a network under steady and transient states by applying Laplace Transforms to a given circuit L3

CO5: Choose suitable network parameters by transforming them appropriately

to analyses a cascaded system L2

**4CSPL2011: WEB DEVELOPMENT USING PYTHON AND DJANGO**

**CO1:** Create database using SQLite L6

**CO2:** Create web client programs using python L6

**CO3:** Create web server programs using python L6

**CO4:** Create website using Django framework L6

**CO5:** Create to-do application using Django and React JS L6

**CKSMM1011: Critical Inquiry**

CO1: Conduct an inquiry into the origins and sources of their beliefs.

CO2: Recognize how access to the same information can lead to varied interpretations.

CO3: Appreciate the validity of diverse views that are separate from their own. CO4: Recognize the impact of uninterrogated beliefs on daily life.

CO5: Understand the connection between beliefs and action.

**CKSMM1021: Indian Democracy, Participation & Social Change**

CO1: Study a particular event in Indian history and trace the impact that can be felt to the present day.

CO2: Understand the impact of the way a democracy is structured.

CO3: Understand the freedoms that a citizen of India has, and what those mean in daily life.

CO4: Understand the duties of an Indian citizen and how they translate to daily life.

CO5: Gain an understanding of the workings of the government in their residential locality.

CO6: Trace the impact of a single vote from their area of residence to the national scale.

CO7: Understand the Indian democratic process and their role in it.

CO8: Identify ways in which they can contribute to the progress of the country.

**CPSSXX0X1: Project Management Fundamentals**

CO1: Understand the fundamental concepts of Project Management and use them in their professional career [Level-1].

CO2: Demonstrate their preparedness to manage any project in a professional manner [Level-1].

CO3: Apply the best practices of Project Management which will ensure their success in their professional life [ [Level-2].

**4MATH2021-Engineering Mathematics-IV**

CO1 Apply binomial, Poisson, normal and exponential probability distributions to solve engineering problems L3

CO2 Construct elementary regression models by the method of least squares L3

CO3 Explain the concept of testing of hypothesis for small and large samples L2

CO4 Solve first and second order ordinary differential equation using single step and multistep numerical methods

L3

CO5 Apply the simplex algorithm to solve a linear programming problem L3

**4ENCC2011-Principles of Communication**

On successful completion of the course, students will be able to:

CO1 Explain the working of amplitude modulators and receivers L2

CO2 Explain the Angle modulation techniques L2

CO3 Demonstrate the reception and demodulation of FM and also the various types of Noise
L2

CO4 Interpret pulse modulation techniques and base band data transmission L2

CO5 Compare the digital modulation techniques L2

**4ENVL1011- VLSI**

CO1 Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling L2

CO2 Outline the basic gates using the stick and layout diagrams with the knowledge of physical design aspects L2

CO3 Explain memory elements along with timing considerations L2

CO4 Illustrate testing and testability issues in VLSI design L2

CO5 Construct CMOS subsystems and architectural issues with the design L2

**4CSPL3011: PYTHON FOR DATA SCIENCE**

**CO1:** Analyze data science applications L4

**CO2:** Apply data collection and wrangling techniques L3

**CO3:** Analyze how to manipulate the uncharted datasets using Numpy L4

**CO4:** Analyze how to manipulate the uncharted datasets using Pandas L4

**CO5:** Apply visualization techniques L4

**CPSES1011: MAKING WITH ELECTRONICS**

**CO1:** Demonstrate the interfacing of basic input and output devices using Arduino. L2

**CO2:** Explain the working principles of various sensors and renewable energy sources. L2

**CO3:** Apply the understanding of Arduino programming by interfacing sensors and communication

devices. L3

**CO4:** Demonstrate the interfacing of basic input and output devices using Raspberry Pi. L2

**CO5:** Analyze and Build a real-time application employing Arduino / Raspberry Pi. L4, L3

**4ENCC1011: DIGITAL SIGNAL PROCESSING(P)**

| | | |
|---|---|---|
| CO1 | Demonstrate the concept of filtering of long data sequence and fast Fourier Transform | L2 |
| CO2 | Explain the concept of transform analysis of LTI systems. | L2 |
| CO3 | Develop FIR filter for the given specifications | L3 |
| CO4 | Develop IIR filter for the given specifications | L2 |
| CO5 | Explain the finite word length effect and concept of multi-rate signal processing | L3 |

**4ENCE2032: Embedded System & ARM Processor**

| | | |
|---|---|---|
| CO1 | The students should be able to understand the concepts of embedded systems, including their architecture, programming, and applications. | L3 |
| CO2 | The students should have a thorough understanding of ARM processors, including their architecture and instruction set. | L2 |
| CO3 | Ability to write and debug assembly language programs for ARM processors. | L3 |
| CO4 | Designing and implementing ARM Cortex-M Processor real-time operating systems (RTOS) and hardware interfaces. | L3 |
| CO5 | Familiarity with different communication protocols used in embedded systems, such as SPI, I2C | |

**4ENEE1071: POWER ELECTRONICS AND CONTROL**

| | | |
|---|---|---|
| CO1 | Describe the characteristics of different power devices and identify the applications | L3 |
| CO2 | Determine the response of controlled rectifier and AC voltage controllers with resistive and inductive loads | L2 |
| CO3 | Illustrate the working of various pulse width modulated inverters as well as Step up and step-down choppers | L3 |
| CO4 | Develop a mathematical model of system and analyze the performance characteristics of first and second order systems using standard test signals | L3 |
| CO5 | Test for the stability of a system in time as well as frequency domain and state space modeling of system | L2 |

**4ENCE1181: REAL TIME EMBEDDED SYSTEM AND LINUX**

| | | |
|---|---|---|
| CO1 | Know the basics of real-time embedded systems, including its architecture, components, and design techniques. | L3 |
| CO2 | Students will learn the basics of Linux operating system and its use in embedded systems. | L2 |
| CO3 | Explain about the Linux system programming and Real-Time Linux | L3 |
| CO4 | Writing device drivers for embedded, device drivers architecture of linux | L2 |
| CO5 | Use embedded Linux development tools for developing, debugging, and testing embedded systems. | L2 |

**4ENCE1191: Sensors & Robotics**

CO1: Apply various calibration techniques and signal types for sensors. **L3**

CO2: Classify and explain types of robots. **L2**

CO3: Apply various sensors in the robotics. **L3**

CO4: Explain robotic vision. **L5**

CO5: Recommend robotic system for various industries. **L6**

**4ENCE1201: Automotive Electronics**

**CO1:** Describe the basics of automobile dynamics and electronics for automobile. **L2**

**CO2:** Explain basics of automotive components, subsystems and Electronic Engine Control in today's automotive industry. **L5**

**CO3:** Apply available automotive sensors and actuators while interfacing with microcontrollers/ microprocessors during automotive system design. **L3**

**CO4:** Explain the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems. **L5**

**CO5:** Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems. **L6**

**4ENCE1211: Microelectronics(MOOC)**

| | | |
|---|---|---|
| CO1 | Understanding the basic principles of microelectronics, including semiconductor materials, device physics, and circuit design | L3 |
| CO2 | Understand the fabrication process of electronic devices, including the lithography, deposition, and etching techniques. | L2 |
| CO3 | Design and analyze electronic circuits and systems, such as analog and digital circuits, using different software tools, including SPICE and CAD. | L3 |
| CO4 | Ability to design and analyze digital and analog electronic circuits. | L3 |
| CO5 | Integrate different electronic components and subsystems to create complex systems,including microprocessors. | L2 |

**4ENVL2011: Digital VLSI Design**

| | | |
|---|---|---|
| CO1 | Familiar with CMOS technology and the different CMOS circuit design techniques. They should also have an understanding of the impact of process variations on circuit performance. | L3 |
| CO2 | Understanding of the principles of digital circuits and VLSI design, including the different types of combinational circuit. | L2 |
| CO3 | Understand the principles of digital circuits and VLSI design, including the flip-flops, registers, and counters. | L3 |
| CO4 | Understand the physical design and layout techniques, including floor planning, placement, and routing. They should also be familiar with the different layout styles and design rules. | L3 |
| CO5 | Design the various components of the digital system, such as, registers, and memory cells, and Digital signal processing circuits. | L2 |

**4ENVL1021: ASIC**

| | | |
|---|---|---|
| CO1 | Demonstrate knowledge in ASIC Design flow, Simulation Issues ASICs Design Techniques. ASIC Construction | L2 |
| CO2 | Write the Verilog/VHDL Code | L2 |
| CO3 | Design and simulation of digital ICs using Verilog | L3 |
| CO4 | Compare different testing procedures for VLSI circuits. | L4 |
| CO5 | Analyze the algorithms of partitioning, placement and routing | L4 |

**4ENVL1031: Nano Electronics (MOOC)**

| | |
|---|---|
| CO1: Explain principles behind Nano science engineering and Nanoelectronics. | **L2** |
| CO2: Apply the knowledge to prepare and characterize nanomaterials. | **L3** |
| CO3: Analyze the process flow required to fabricate state-of-the-art transistor technology | **L4** |
| CO4: Explain concepts of nanoscale MOSFET, CMOS scaling with its limits. | **L5** |
| CO5: Explain properties used for sensing and the use of smart dust sensors. | **L2** |

**4ENCC1041: OPTICAL COMMUNICATION**

| | | |
|---|---|---|
| CO1 | Summarize the concepts and theory of optical fiber communication | L2 |
| CO2 | Explain various transmission characteristics of optical fibers | L2 |
| CO3 | Illustrate the working of LEDs and Laser diodes as optical sources | L2 |
| CO4 | Explore the functions and characteristics of optical detectors and receivers | L2 |
| CO5 | Discuss the WDM systems, optical amplifiers and DTL systems | L1 |

**4ENCC1061: SATELLITE COMMUNICATION**

| | | |
|---|---|---|
| CO1 | Explain the satellite orbits and its trajectories with the definitions of parametersassociated with it | L2 |
| CO2 | Illustrate the electronic hardware systems associated with the satellite subsystem and earth station | L2 |

CO3 Explain the various applications of satellite with the focus on national satellite system L2

CO4 Explain the satellite link parameters under various propagation conditions with the illustration of multiple access techniques L2

CO5 Explain the Remote sensing satellites, Weather furcating satellites and Navigational satellites L2

**4ENCC1251: Adaptive Signal Processing(MOOC)**

CO1 Explain filtering solutions for optimising the cost function indicating error in estimation of parameters. L2

CO2 Evaluate the performance of various methods for designing adaptive filters. L3

CO3 Explain convergence and stability issues associated with adaptive filter design. L2

CO4 Design and implement filtering solutions for applications such as channel equalisation, interference cancelling and prediction. L3

CO5 Explain the role and importance of IIR digital filter synthesis. L2

**4CSPL3021: ADVANCED PYTHON FOR AI**

CO1 Identify the basic concepts of neural networks and its components L2

CO2 Analyse neural network learning and adaption techniques L3

CO3 Explain the detailed concepts of single layer perceptron neural networks L2

**4CSGC3051: DATA MINING**

**CO1:** Explain the concepts of data mining and its issues L4

**CO2**: Analyse and apply association rule mining techniques L3

**CO3:** Analyse various classification algorithms L3

**CO4:** Elaborate the clustering algorithms L2

**CO5:** Illustrate the trends and applications L2

**4CSGC3041: Cryptography**

CO1: Explain the different concepts of cryptography L3

CO2: Describe the principles of symmetric and asymmetric cryptography L2

CO3: To apply the asymmetric key encipherment techniques L3

CO4: To apply the concepts of hashing algorithms L3

CO5: Understanding the real life examples of Cryptography L2

**4CSPL3051: Scripting Languages**

**CO1:** Comprehend the differences between typical scripting languages and typical system and application programming languages. L2

**CO2:** Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem. L2

**CO3:** Acquire programming skills in scripting language. L3

**CO4:** Understanding the text manipulation through Perl. L3

**CO5:** Understanding of how applications communicating with each other and how a widget toolkit used for building GUI in many languages. L2

**4CSPL3041: Advanced Java (MOOC)**

**: CO1:** Understand and implement advanced Java concepts

**CO2:** Design and implement server-side programs using Servlets and JSP

**CO3:** Implements applications using Java Server Faces

**CO4:** Incorporate cutting-edge frameworks in web application development

**CO5:** Design and implementation of ORM mapping using Hibernates

**4CSPL3061: Kotlin (OO+ Functional) (MOOC)**

**CO1:** To learn a readable, pragmatic, safe, and interoperable programming language

**CO2:** To think about nullability from the start by integrating nullability into the type system

**CO3:** Acquire programming skills in Kotlin

**CO4:** Understanding the Android development through Kotlin

**CO5:** To aid scalability in large-scale software development

**4ENEE1041: Measuring Instruments(MOOC)**

CO1.Explain elements of measuring instruments and classify measuring instruments and transducers. L2

CO2. Explain Static and Dynamic Characteristics of instruments. **L5**

CO3. Apply concept of various Bridges to measure Resistance, Capacitance and Inductance. **L3**

CO4. Explain the working of different electronic instruments. **L2**

CO5. Explain working of Display and Recording Devices. **L5**

**4ENCC1021: Introduction to Digital Image Processing**

| | | |
|---|---|---|
| CO1 | Understand the sensing, acquisition and storage of digital images | L1 |
| CO2 | Explain Intensity Transformation, Histogram and spatial filtering | L2 |
| CO3 | Demonstrate Different filtering techniques in frequency domain. | L3 |
| CO4 | Interpret Image reconstruction processes. | L2 |
| CO5 | Extends the Image processing techniques to color images. | L3 |

**4ENCC1031: Basics of Digital Communication**

CO1 Apply fundamental probability theory L2

CO2 Demonstrate the knowledge of signal vector interpretation L2

CO3 Interpret pulse modulation techniques and base band data transmission L3

CO4 Compare the digital modulation Techniques L3

CO5 Explain the concept of information, entropy and source coding theorems L2

**4ENME105: INTRODUCTION TO ROBOTICS**

1) Explain the basic configurations of robots. [L1]
2) Learn simple programs to control robots. [L2]
3) Illustrate the process of controlling a robot. [L2]
4) Explain the working of variety of sensors that can be used in robots. [L1]
   List the applications of robots in different fields. [L1]

**4BCE481: INTRODUCTION TO REMOTE SENSING**

CO1 Understand the importance of Remote Sensing L1

CO2 Understand the systems of Remote Sensing L1

CO3 Understand the different methods of Digital Image processing using software L2

CO4 Understand the concept of thematic maps L2

CO5 Understand the concept of digital elevation model L3

**4CSPL3041: Object Oriented Programming**

**CO1:** Discuss the concepts of object-oriented programming

**CO2:** Apply OOP concepts to develop programs using functions and class

**CO3:** Incorporate the inheritance and constructor concepts to develop applications in C++

**CO4:** Apply operator overloading concepts in C++

**CO5:** Exemplify the process of data file manipulations, templates and exception handling using C++

**4CSGC2011: Database Management Systems**

**CO1:** Demonstrate the basic elements of a relational database management system.

**CO2:** Identify the data models for relevant problems

**CO3:** Design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data.

**CO4:** Demonstrate their understanding of key notions of query evaluation and optimization techniques.

**CO5:** Extend normalization for the development of application softwares

**4CSGC1021:MS OFFICE**

CO1: Applying basic editing functions formatting skills on paragraphs, tables, lists, and pages

CO2: Applicable knowledge and uses of accepted business style formatting conventions.

CO3: Working knowledge of organizing and displaying large amounts and complex data CO4: Learnt to work with Master Slides to make editing your presentation easy

CO5: Learnt the importance of web and in social media

**6IDSS1031: BASICS OF ENTREPRENEURSHIP**

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

**CO3**: Consider the legal and financial conditions for starting a business venture. (Level 2)

**CO4**: Analyse the business environment in order to identify business opportunities.(Level 3)

**CO5**: Interpret their own business plan. (Level 4)

**5IDSS1011: Essentials of Human Rights and Public Interest Laws**

**CO1**: Understand core concepts involved in evolution and development of human rights law. (Level 2)

**CO2**: Understand constitutional aspects of human rights along with the statutory framework of National and State Human Rights Commissions(Level 3)

**CO3**: Examine the various dimensions of human rights law and understand the role of state on issues relating to the enforcement of human rights (Level 4)

**6IDSS1051: FINANCE FOR NON-FINANCE STUDENTS**

**CO1:** Impart the time value of money in valuation of securities. (Level 3)

**CO2:** Understand and focus on financial discipline and capital structure in organisations. (Level 3)

**CO3:** Appreciate new methods of financing, investing, operating and business decisions. (Level 3)

**CO4:** Assess appropriate measures related to dividend decisions in organisations. (Level 4)

**3IDSS1031: Introduction to Taxation**

**CO1**: Acquire the complete knowledge of basic concepts of income tax. (Level 1)

**CO2 & CO3:** Apply the provisions and compute income under different heads. (Level 2)

**CO4**: Identify and comply with the relevant Income from other Sources and Set-off and carry Forward of Losses. (Level 3)

**CO5**: Equip basics of goods and service tax (Level 4)

**3IDSS1071: Financial Markets and Personal Investment**

**CO1**: Able to understand the concepts of financial markets and personal investment. (Level 1)

**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

**CO3**: Able to assess the need and importance of the issue of IPO.

**CO4**: Able to judge the process of operations in secondary markets and the existence of different regulatory authorities in stock market operations (Level 3)

**CO5**: Able to make assessments and make investment in personal investment in their life. (Level 4)

**6IDSS1071: MARKETING -FOR THE UNINITIATED**

**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

**CO4**: Apply the necessary marketing skills. (Level 3)

**CO5**: Analyse the IMC and recent trends. (Level 4)

**NIDSS1011: NCC I**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**NIDSS1021: NCC II**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**NIDSS1031: NCC III**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**NIDSS1041: NCC IV**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**CKSHM1011: ENVIRONMENT AND SUSTAINABILITY**

**CO1** Outline the expected consequences of continuous environment degradation in the society by relevant data analysis. L2

**CO2** Demonstrate a rationale for climate change adaptation and mitigation by proposing appropriate actions in key sectors.

L2

**CO3** Explain the key issues under negotiation by summarizing the international climate change legal and policy framework.

L2

**CO4** Demonstrate knowledge of environment sustainability by analyzing relevant data about industrial impact on environment.

**4ENCC1071: COMPUTER COMMUNICATION NETWORKS**

| | | |
|---|---|---|
| CO1 | Explain Data Communication with key concepts of networks, its types and OSI network model. | L2 |
| CO2 | Identify the data link layer from OSI model, understanding the concepts related to layer, protocols. | L3 |
| CO3 | Demonstrate the concept of Wired LAN's standards and its architecture. | L2 |
| CO4 | Explain various connecting devices, IP address and routing mobile IP. | L2 |
| CO5 | Explain the various transport layer protocols, UDP and TCP service applications and flow and error control. | L2 |

**4ENCC2022: Advanced Digital Communication (P)**

**CO1** Explain merits and demerits of different modulation techniques & coding techniques, spread spectrum signals and channel behaviors L2

**CO2** Analyze various modulation, equalization, diversity and coding techniques for communication systems L3

**CO3** Compare performance of different types of modulation on different wireless application fading channels. L2

**CO4** Design and demonstrate various modulation/coding equalization techniques and measure their performance. L2

**4ENCE1061: Real Time Operating System(RTOS)**

CO1: Explain the key characteristics and requirements of real-time systems

CO2: Analyze different real-time scheduling algorithms (e.g., Rate Monotonic Scheduling, Earliest Deadline First)

CO3: Implement memory allocation and deallocation strategies in an RTOS environment

CO4: Apply debugging techniques and use performance profiling tools to optimize real-time applications.

CO5: Utilize IPC methods like message queues, pipes, mailboxes, and shared memory to manage communication between tasks.

**4ENCE1221: Advanced Embedded Systems**

| | | |
|---|---|---|
| CO1 | Identify the building blocks of a typical Embedded System. | L3 |
| CO2 | Demonstrate characteristics and attributes of an embedded system, hardware /software co-design and firmware design approaches. | L2 |
| CO3 | Explain the architectural features of 32 bit microcontroller ARM Cortex M3. | L2 |
| CO4 | Understand the different steps involved in the design and development of firmware for embedded systems. | L2 |
| CO5 | Explain the need of real time operating system for embedded system applications. | L2 |

**4ENCE1081: Wearable Electronics**

CO1. Identify and understand the need for development of wearable devices and its influence on various sectors. L2

CO2. Discus the applications of various wearable inertial sensors for biomedical applications. L3

CO3. Comprehend the design and development of various wearable bio-electrode and physiological activity monitoring devices for use in healthcare applications. L3

CO4. Discuss and analyze the usage of various biochemical and gas sensors as wearable devices. L4

CO5. Identify the use of various wearable locomotive tools for safety and security, navigation. L2

**4ENCE1231: Micro Electrical mechanical System(MEMS)(MOOC)**

CO1. Describe technologies related to Micro Electro Mechanical Systems. **L2**

CO2. Explain design and fabrication processes involved with MEMS Devices. **L5**

CO3. Analyze the MEMS devices and develop suitable mathematical models. **L3**

CO4. Explain various application areas for MEMS device. **L2**

CO5. Describe the Micromanufacturing. **L5**

**4ENVL1041: LOW POWER VLSI**

| | | |
|---|---|---|
| CO1 | Classify various second order effects in MOSFET device | L3 |

| | | |
|---|---|---|
| CO2 | Illustrate the sources of power dissipation in CMOS based logic | L2 |
| CO3 | Construct a suitable circuit to reduce leakage power using suitable low power techniques | L2 |
| CO4 | Demonstrate the knowledge of joint random variables in real time engineering problems | L3 |
| CO5 | Identify the mechanisms of power dissipation in CMOS integrated circuits | L3 |

**4ENVL2021:CMOS Analog Design**

| | | |
|---|---|---|
| CO1 | Students should be familiar with the basic principles of CMOS (Complementary Metal-Oxide-Semiconductor) technology, including device physics, process technology, and layout design rules. | L3 |
| CO2 | Students should be able to analyze and design analog amplifier circuits, such as Cascode Amplifier and Differential Amplifier. | L2 |
| CO3 | Students should be able to design basic analog building blocks, such as voltage references, current sources, and operational amplifiers, using CMOS technology. | L3 |
| CO4 | Students should be able to analyze and design basic analog circuits, such as filters, oscillators and Data Converters using common circuit topologies and devices. | L3 |
| CO5 | Students should be able to perform layout design of analog circuits, including physical design rules, device sizing, and parasitic extraction. | L2 |

**4ENVL1051:System on Chip(SOC)(MOOC)**

| | | |
|---|---|---|
| CO1 | Understanding of the basic concepts and principles of SoC design, different design methodologies and memory and Bus Architecture. | L3 |
| CO2 | Understand working principles of processor architecture, Introduction to interconnects and bus protocol. | L2 |
| CO3 | Know the SoC Peripherals and Design Methodology | L3 |
| CO4 | Learn about different testing and validation techniques used in SoC design, including low-power design, Design for testability (DFT) | L3 |
| CO5 | Advanced topics in SoC design, including system-level design, and security. | L2 |

**4ENCC1111: RADAR**

| | | |
|---|---|---|
| CO1 | Describe the fundamentals of radar and design matched filters in noise environment | L2 |
| CO2 | Explain the various parameter configurations which can be efficiently achieved. | L2 |
| CO3 | Describe the types of pulse compression techniques for increasing range resolution. | L2 |
| CO4 | Illustrate statistical framework necessary for the development of automatic target detection. | L3 |
| CO | Analyze radar system performance, both in search and track modes, and with low and medium pulse repetition frequencies. | L4 |

**4ENCC2031:Mobile Communication**

| | | |
|---|---|---|
| CO1 | Explain the cellular concepts like frequency reuse, fading, equalization, GSM, CDMA. | L2 |
| CO2 | Illustrate hand-off and inference and apply the concept to calculate link budget using path loss model | L3 |
| CO3 | Describe equalization and different diversity techniques. | L2 |
| CO4 | Explain the concept of GSM in real time applications. | L2 |
| CO5 | Analyze different multiple access techniques in mobile communication. | L4 |

**4ENCC1261:Pattern Recognition**

| | | |
|---|---|---|
| CO1 | Explain Bayesian decision theory and learning. | L2 |
| CO2 | Explain the various techniques involved in pattern recognition | L2 |
| CO3 | Illustrate the various pattern recognition techniques into supervised and unsupervised. | L3 |
| CO4 | Analyzing the artificial neural network based pattern recognition | L4 |
| CO5 | Describe the applications of pattern recognition in various applications | L2 |

**4ENCC1271: ADHOC AND SENSOR NETWORKS**

| | | |
|---|---|---|
| CO1 | Explain the basics of Ad hoc networks and Wireless Sensor Networks | L2 |
| CO2 | Describe the different routing protocols. | L2 |
| CO3 | Describe the appropriate physical and MAC layer protocols | L2 |
| CO4 | Analyze the transport layer and security issues possible in Ad hoc and sensor networks. | L4 |
| CO5 | Illustrate the OS used in Wireless Sensor Networks and build basic modules. | L3 |

**4ENCC1281: Multi-Rate Signal Processing and Filter Banks**

| | | |
|---|---|---|
| CO1 | Understand the multi-rate systems and its applications | L2 |
| CO2 | Explain the concept of decimated filter banks | L2 |
| CO3 | Design paraunitariness filter banks | L2 |
| CO4 | Design Cosine module filter banks | L4 |
| CO5 | Design wavelet transform filter with the help of multi-rate filter | L2 |

**4ENCC2101: INFORMATION THEORY AND CODING**

| | | |
|---|---|---|
| CO1 | Explain the concept of information, entropy and source coding theorem | L2 |
| CO2 | Demonstrate the knowledge of Shannon's source coding theorem and channel coding theorem for designing an efficient and error free communication link | L2 |

CO3 Explain error correction and detection using parity check coding and other coding schemes L2

CO4 Explain minimum distance coding and cyclic codes L2

CO5 Discuss Convolutional coding

**4ENCC1291:Opto Electronics(MOOC)**

CO1 Explain the basics of solid state physics and understand the nature and characteristics of light. L2

CO2 Explain different methods of luminescence, display devices and laser types and their applications. L2

CO3 Explain the principle of optical detection mechanism in different detection devices. L2

CO4 Illustrating the different light modulation techniques and the concepts and applications of optical switching. L3

CO5 Analyze the integration process and application of opto electronic integrated circuits in transmitters and receivers. L4

**4CSPL3111: Object Oriented Analysis Design**

**CO1:** To learn techniques for testing and validating object-oriented systems, including unit testing, integration testing, and acceptance testing, to ensure the correctness and reliability of the software. L1

**CO2:** To develop skills in collaborating effectively within a team environment, including communication, task allocation, and version control, to collectively design and implement object-oriented systems. L5

**CO3:** To understand the importance of non-functional requirements, such as performance, scalability, and security and learn how to incorporate them into the analysis and design process. L3

**CO4:** To stay updated with the latest trends and technologies in object-oriented analysis and design, allowing them to adapt and apply new techniques and tools as they evolve. L3

**CO5:** To demonstrate ethical and professional behaviour in the analysis and design of software systems, considering legal and societal implications, as well as adhering to industry best practices and standards. L5

**CSPL3121: Web Technology Frameworks**

**CO1:** Students will be able to Develop a solid understanding of the MERN stack and how it can be used to build scalable, high-performance full-stack web applications. L1

**CO2:** Students will Gain hands-on experience with building web applications using the MERN stack, including setting up a development environment, creating and connecting to databases, building APIs, and integrating frontend and backend code. L5

**CO3:** Students will be able to learn best practices for building secure, performant, and maintainable web applications including implementing authentication and authorization, optimizing database queries, and using tools for debuggin and testing. L3

**CO4:**. Students will be able to understand how to design and implement scalable, distributed web applications that can handle large amounts of traffic and users, and deploy these applications to the cloud using popular cloud services. L3

**CO5:**. Students will be able to Acquire the skills and knowledge necessary to be able to build real-world web applications using the MERN stack and gain confidence in their ability to create high-quality, professional-grade software. L5

**4CSPL3131: Application Development using MERN Stack (MOOC)**

CO1: To Discover the details of HTML,CSS and their properties and applications L2

CO2: Use the tools required to build JavaScript based SPAs

L2

CO3: Discover the details of React, the React Way, and how to get the maximum out of this library L3

C04: Discover the details of Nodejs and how to get the maximum out of this library L3

Co5: To Discover the details of SQL,MongoDB and Nosql L2

**4ENCE1131: Introduction to Nanotechnology**

CO1: Describe fundamentals of nanotechnology. **L2**

CO2: Classify nanostructures. **L2**

CO3:.Analyze biomaterials. **L4**

CO4: Develop smart materials. **L3**

CO5: Explain nanotoxicology. **L2**

**4ENCE1241: 8051 Microcontroller**

CO1. Explain the basics of Microprocessor and Microcontroller. **L2**

CO2. Relate to the 8051 Microcontroller architecture and Pin description. **L4**

CO3. Analyze 8051 Addressing modes and use the 8051 instruction set. **L4**

CO4. Program the on-chip peripherals in 8051. **L3**

CO5. Design and develop applications using 8051 Assembly language and C program. **L6**

**4ENCE1051: Basics of Embedded System**

CO1 :Classify an Embedded System based on various design parameters and peripherals

L

2 CO2 :Explain the architectural features of 32-bit microcontroller ARM Cortex M3 L2 CO3 ;Explain the instruction set of 32-bit microcontroller ARM Cortex M3 L2

CO4 Make use of the knowledge gained for programming ARM Cortex M3 for different applications using C and assembly language L3

CO5: Choose appropriate communication protocol for an application L3

**4ENCE1251:INDUSTRIAL ELECTRONICS(MOOC)**

**CO1** Explain the different types of power semi–conductor devices and their switching characteristics L2

**CO2** Explain the operation, characteristics and performance parameters of controlled rectifiers L2

**CO3** Differentiate between the characteristics of DC and AC drives L2

**CO4** Explain the different modulation techniques of pulse width modulated inverters and to u nderstand the harmonic reduction methods L2

**CO** Explain the practical application of power electronics converters in conditioning the power supply L2

**4ENCC1091:Basics of Satellite Communication**

**CO1** Explain the satellite orbits and its trajectories with the definitions of parameters associated with it L2

**CO2** Illustrate the electronic hardware systems associated with the satellite subsystem and earth station L3

**CO3** Analyze the satellite Link design L3

**CO4** Explain the various methods of Satellite access L2

**CO5** Explain various satellite applications L2

**4CSPL2071: Web Technology**

**CO1:** Students will be able to create simple static web pages using HTML and CSS. L1

**CO2:** Students will be able to add interactivity to web pages using JavaScript. L5

**CO3:** Students will be able to design responsive web pages that adapt to different screen sizes using framework such as Bootstrap. L3

**CO4:**. Students will be able to create server-side applications using a server-side language such as PHP or Python. L3

**CO5:**. Students will be able to design and implement web applications that consume external APIs usingRESTful web services L5

**4CSPL2051: Mobile Application Development**

**CO1:** Explain the fundamental concepts of mobile application development L2

**CO2:** Design the application with activities and fragments L2

**CO3:** Apply different user interfaces to their application L3

**CO4:** Demonstrate the use of views and pictures L2

**CO5:** Use the different services in the application L3

**4CSGC2101 : Machine Learning for Beginners**

**CO1:** Explain the concepts of Machine Learning Categories L4

**CO2:** Analyse the fundamentals of Machine Learning L3

**CO3:** Analyse various models in Machine learning L3

**CO4:** Illustrate the Text Mining and Recommender Systems L2

**CO5:** Elucidate the Deep and Reinforcement Learning L2

## 6IDSS1031: BASICS OF ENTREPRENEURSHIP

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

**CO3**: Consider the legal and financial conditions for starting a business venture. (Level 2)

**CO4**: Analyse the business environment in order to identify business opportunities.(Level 3)

**CO5**: Interpret their own business plan. (Level 4)

## 5IDSS1011: Essentials of Human Rights and Public Interest Laws

**CO1**: Understand core concepts involved in evolution and development of human rights law. (Level 2)

**CO2**: Understand constitutional aspects of human rights along with the statutory framework of National and State Human Rights Commissions(Level 3)

**CO3**: Examine the various dimensions of human rights law and understand the role of state on issues relating to the enforcement of human rights (Level 4)

## 6IDSS1051: FINANCE FOR NON-FINANCE STUDENTS

**CO1:** Impart the time value of money in valuation of securities. (Level 3)

**CO2:** Understand and focus on financial discipline and capital structure in organisations. (Level 3)

**CO3:** Appreciate new methods of financing, investing, operating and business decisions. (Level 3)

**CO4:** Assess appropriate measures related to dividend decisions in organisations. (Level 4)

## 3IDSS1071: Financial Markets and Personal Investment

**CO1**: Able to understand the concepts of financial markets and personal investment. (Level 1)

**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

**CO3**: Able to assess the need and importance of the issue of IPO.

**CO4**: Able to judge the process of operations in secondary markets and the existence of different regulatory authorities in stock market operations (Level 3)

**CO5**: Able to make assessments and make investment in personal investment in their life. (Level 4)

## 6IDSS1071: MARKETING -FOR THE UNINITIATED

**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

**CO4**: Apply the necessary marketing skills. (Level 3)

**CO5**: Analyse the IMC and recent trends. (Level 4)

## NIDSS1011: NCC I

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

## NIDSS1021: NCC II

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

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## NIDSS1031: NCC III

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

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## NIDSS1041: NCC IV

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**CCSHS1011: SOCIOLOGY OF GLOBALIZATION AND SUSTAINABLE DEVELOPMENT**

| | | |
|---|---|---|
| **CO1** | Demonstrate understanding of globalization process with emphasis on inter-dependence of communities and societies | L1 |

**CO2** Analyse the critical issues in social development in the given context L2 **CO3** Develop technological interventions for social and community development L3 **CO4** Explain the health and hygiene of the community L2 **CO5** Develop technological interventions for social and community development L3

**4ENCC1241: WIRELESS COMMUNICATION**

| | | |
|---|---|---|
| **CO1** | Explain the basics and types of wireless communication systems being used | L2 |
| **CO2** | Explain the basic concepts of cellular system and the design requirements | L2 |
| **CO3** | Demonstrate the basic principles behind radio resource management techniques such as frequency reuse, channel allocation and handoffs | L2 |
| **CO4** | Interpret knowledge and gain awareness on the technologies used for effective share of spectrum by multiple access techniques i.e. TDMA, CDMA, FDMA etc. | L2 |
| **CO5** | Summarize the wireless standards being used across the world | L2 |

**4ENCC1132: IMAGE AND VIDEO PROCESSING**

| | | |
|---|---|---|
| CO1 | Understand the sensing, acquisition and storage of digital images | L1 |
| CO2 | Explain Intensity Transformation, Histogram and spatial filtering | L2 |
| CO3 | Demonstrate Different filtering techniques in frequency domain. | L3 |
| CO4 | Interpret Image reconstruction processes. | L2 |
| CO5 | Extends the Image processing techniques to color images. | L3 |

**4ENCC1051: IoT and Wireless Sensor Networks**

**CO1**. Understand choice and application of IoT & M2M communication protocols. L2

**CO2** Describe Cloud computing and design principles of IoT. L2

**CO3**. Relate to MQTT clients, MQTT server and its programming. L3

**CO4**. Describe the architectures and its communication protocols of WSNs. L3

**CO5.** Identify the uplink and downlink communication protocols associated with specific application of IOT /WSNs L3

**4ENCE1101: Biomedical Electronics**

**CO1.** Introduce the student to the electronic devices and theory of operation in the medical area. L2

**CO2.** Data Interpretation: Learn to design, test, and analyze electronic circuits using oscilloscopes and other electronics test equipment. Apply knowledge of engineering and science to interpret data. Develop an understanding of and develop the skills necessary to communicate findings and interpretations in an effective laboratory report. L3

**CO3.** Electronic circuits for Biomedical Applications: Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits. L4

**CO4.** Work in Multi-disciplinary teams: Learn to work and communicate effectively with peers on multi- disciplinary teams to attain a common goal. L4

**CO5.** Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals. L3

**4ENCE1111: VIRTUAL INSTRUMENTATION(MOOC)**

After studying this course, students will be able to:

CO1. Recognize and describe various aspects of VI. **L2**

CO2. Develop a virtual instrumentation model using the front panel controls & indicators and loops. **L6**

CO3. Analyze and design various array operations using LabVIEW functions. **L3**

CO4. Evaluate the various forms of output representations using graphs, charts and File I/Os. **L5**

**4ENCE2051: ADVANCED CONTROL SYSTEM**

CO1: Apply state variable approach for linear time invariant systems in both the continuous and discrete time systems. **L3**

CO2: Apply state space analysis to analyze, design and test for Controllability and Observability of a given system **L3**

CO3: Design pole assignment and state observer using state feedback. **L6**

CO4: Describe Nonlinearity and develop the describing function for the nonlinearity present to assess the stability of the system. **L5**

CO5: Develop Lyapunov function for the stability analysis of nonlinear systems. **L6**

**4ENCE1121: CAN Protocol and Controller**

1. Understand the CAN protocol and able to know that what features affecting the reliability of the communication system. L2
2. To design and implement the CAN protocol and able to learn the layers of CAN communication system. L3
3. Understand the reliability issues through different types of analysis method. L2
4. Identify the commercial tools for configuring, analyzing and calibrating a CAN communication system.

L3

Know the summary of the main transport level and application-level protocols that are based on CAN. L3

**4ENVL1061:CMOS RF Design**

| | | |
|---|---|---|
| **CO1** | Understand the principles of RF design, including transmission line theory, impedance matching, noise analysis, and RF amplifier design. | L3 |
| **CO2** | Understand the characteristics and limitations of CMOS technology and its applications in RF design. | L2 |
| **CO3** | Design and analyze RF circuits using CMOS technology, including low-noise amplifiers, mixers, Design techniques for mixers and frequency converters. | L3 |
| **CO4** | Design and analyze RF circuits using CMOS technology, including voltage-controlled oscillators, Phase-Locked Loops and power amplifiers. | L3 |
| **CO5** | Know the current research trends and challenges in CMOS RF design | L2 |

**4ENVL1071:Mixed Signal Analysis**

| | | |
|---|---|---|
| CO1 | Understanding of mixed signal systems, design process and associated challenges. | L2 |
| CO2 | Understand the concepts of signal processing, including Fourier analysis, time-domain and frequency-domain analysis, filtering, and noise analysis. | L2 |
| CO3 | Analyze the Linear and nonlinear circuits as well as different types of noise. | L3 |
| CO4 | Understand the basic principles of mixed signal systems, including analog-to-digital conversion (ADC), digital-to-analog conversion (DAC), and mixed-signal design methodologies. | L4 |
| CO5 | Analyze and optimize mixed-signal system performance in terms of signal integrity, noise, distortion, and power consumption | L4 |

## 4ENVL1081: VLSI TESING

**: CO1**: Acquire knowledge about fault modeling & collapsing.

**CO2**: Analyse various combinational ATPG techniques.

**CO3**: Evaluate the significance of sequential test pattern generation.

**CO4**: Develop fault simulation techniques & fault diagnosis methods.

**4ENCC1141: Multimedia Communication**

**CO1:** Demonstrate comprehension of multimedia communication principles through assessments.

**CO2**: Apply information representation techniques to encode multimedia data effectively.
**CO3:** Implement compression algorithms to optimize multimedia data storage and transmission.
**CO4:** Analyze distributed multimedia systems' features and resource management strategies.

**CO5:** Configure and troubleshoot multimedia information networks, including LANs and internet protocols.

**4ENCC1151 : MIMO COMMUNICATION**

**CO1:** Students will acquire a solid comprehension of the fundamental concepts and principles that form the foundation of MIMO Communications L4

**CO2**: Students will develop the ability to identify and analyze complex problems in various domains and apply MIMO techniques to devise effective solutions. L3

**CO3:** Students will be able to select appropriate MIMO Communication algorithms based on problem requirements L3

**CO4:** Students will learn how to design and develop MIMO System models by defining the problem domain. L2

**CO5:** Students will be able to evaluate the performance of MIMO Techniques models using appropriate evaluation metrics and statistical analysis techniques

**4ENCC1161: Vehicular Communication**

**CO1:** Students will acquire a solid comprehension of the fundamental concepts and principles that form the foundation of Vehicular Communication L4

**CO2:** Students will develop the ability to identify Random models, flow and traffic models, behavioural models, trace and survey-based models, joint transport and communication simulations. L3

**CO3:** Students will be able to select appropriate layer among Physical Layer and MAC Layer for Vehicular Communications requirements L3

**CO4:** Students will learn how VANET Routing protocols are developed; and how Standards and Regulations are followed. L2

**CO5:** Students will be able to Develop critical thinking for Emerging VANET Applications L2

**4ENCC1171: Microwave & Antenna**

**CO1** Acquire knowledge on the theory of microwave transmission, microwave generators and L2

**CO2** Demonstrate microwave devices and monolithic microwave integrated circuits L2

**CO3** Compare the fundamental parameters of antenna and wave propagation. L3

**CO4** Identify Dipoles and Thin linear antennas.. L3

**CO5** Identify the working principle of various types of antenna and categorize them according to their applications L2

**4ENCC1121: LTE and 5G Communication**

**CO1:** Understand the fundamental concepts of 4G LTE and its architecture L3

**CO2:** Analyze the role of OFDM's and SC–FDMA access schemes. L3

**CO3:** Explain the evolution of 5G, system concepts, and spectrum challenges L3

**CO4:** Illustrate the 5G functional and physical architecture and its requirements L4

**CO5:** Analyze the security issues and challenges in 5G communication systems. L3

**CPSAE1011: BUSINESS MANAGEMENT FOR ENGINEERS**

**CO1** Apply the concepts related to entrepreneurship issues in business ideas L3

| | | |
|---|---|---|
| **CO2** | Explain the factors influencing the practice of management in different contexts | L2 |
| **CO3** | Develop suitable economic strategy regarding common business problems | L3 |
| **CO4** | Analyze the marketing strategy for common engineering business problems | L4 |
| **CO5** | Illustrate the leadership qualities in the operation of a new venture | |

**6IDSS1031: BASICS OF ENTREPRENEURSHIP**

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

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**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

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**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

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### NIDSS1011: NCC I

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

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### NIDSS1021: NCC II

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

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### NIDSS1031: NCC III

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

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### CPSHS1021: Business Management For Engineers

**CO1**: Describe basic business concepts and the importance of business management in engineering.(L2)

**CO2**: Analyze business situations using SWOT analysis( L3)

**CO3**: Analyze operational strategies and the processes for shift using Lean and Six Sigma principles.(L3) **CO4**: Interpret financial statements and the cost estimation and break-even analysis (L2) **CO5**: differentiate between leadership styles and demonstrate effective team management. (L3)

### CKSMA1031 - Introduction to Philosophy (IPT)

CO1: Recognize the importance of rationally deducing a question

or a problem. CO2: To develop appreciation towards various

philosophical ideologies.

CO3: To enable the students to form their own philosophy of life

### CKSMA1051 - Introduction to the History and Theories of Knowledge [IHK]

CO1: Students will have basic understanding of Indian and Western theories of Knowledge. (Lv.2)
CO2: Students will be able to distinguish between Indian and Western theories of Knowledge (Lv.4)
CO3: Students will be able to critique systems of knowledge production (Lv.5)

### CKSMA1061 - Introduction to Indian Aesthetics [IIA]

CO1: Explain the foundational concepts in Indian

Aesthetics (Lv.2) CO2: Compare Indian and Western

theories of Aesthetics.(Lv.4) CO3: Critique Indian

Aesthetic theories.(Lv.5)

CO4: Assess the importance of Aesthetic values in contemporary art on the basis of Indian Aesthetic theories (Lv.5)

**CKSMA1071 - Gender and Society (GSY)**

CO1: Define gender (Lv.1)

CO2: Understand the processes by which gender has been defined throughout

history (Lv.2) CO3: Analyze the role gender plays in society (Lv.4)

CO4: Critique gender-relations and its effect on society (Lv.5)

CO4: Investigate how gender can be reframed to create a more equitable society (Lv.6)

**CKSMA1081 - Philosophy of Money [PHM]**

CO1: Defining the political theory of money put forward by Aristotle, Locke, Fichte, Marx, and Keynes (Lv.1)

CO2: Explaining the historical and political crisis that led to reimagining the role of money vis-à-vis power (Lv.2)

CO3: Analyzing the contemporary changes in conceptions of money (eg: cryptocurrency) (Lv.4)
CO4: Critiquing the role that money plays in democratic societies (Lv.5)

**[CKSAA1033]: Arts and Philosophy (A & P):Introduction to Philosophical Thoughts**

CO1: Examine various philosophical systems and apply the concepts to actual states of affairs. (L4)

CO2: To be able to evaluate the moral acts of individuals belonging to different cultures and societies. (L4)

CO3: Analyze, evaluate, and recognize their psychic inclination towards the specific

philosophical thought system. (L6)

**4DISS4021: CAPSTONE PROJECT – BUILD**

| | | |
|---|---|---|
| **CO1** | Compare the project built with other possible existing solutions to come to a conclusion about its feasibility and reliability. | L4 |

| | | |
|---|---|---|
| **CO2** | Utilize proper project management techniques and planning methods to produce cost effective projects | L3 |
| **CO3** | Recommend the need to implementing the project with supporting justification and possible areas to improve the same | L5 |
| **CO4** | Compile a clear report that contains the step by step process to building the project that includes all calculations, analysis and fabrication methods involved | L5 |

**CO5** Build the real world implementation of the design that will realize the objectives of the6 prototype/ design

**4DISS3011/21/31: INTERNSHIP**

| | | |
|---|---|---|
| **CO1** | Demonstrate the skills in professional career goals | L2 |
| **CO2** | Administer the insight into a possible career path of interest with organizational structure,<br>roles and responsibilities | L3 |
| **CO3** | Develop professional connections with leadership strategy and skill development | L4 |
| **CO4** | Identify the professions to suit the interest as a result of this experience | L3 |

**CO5** Conquer additional skills that will need to be developed to ensure career readiness such as new technology, developing a broader network, additional coursework L4

# ECE-Course Outcome-2023

### 4MATH1011: ENGINEERING MATHEMATICS -I

**CO1:** Apply the knowledge of calculus to analyse and approximate the functions. L3

**CO2:** Calculate rates of change of multivariate functions. L3

**CO3:** Solve multiple integrals for computing area and volume. L3

**CO4:** Make use of Gradient, divergence and curl for solving Engineering problems. L3

**CO5:** Use the concept vector integration to solve the flow problems. L3

### 4PHYS1011: ENGINEERING PHYSICS

**CO1:** Analyse the applications of quantum mechanics in technology. L4

**CO2:** Make use of Lasers and Optical fibres for different industrial applications. L3

**CO3:** Plot the I-V characteristics of photo-diode, LED, Zener diodes and solar cells. L3

**CO4:** Explain the use of Magnetic, Dielectric and Superconducting materials for different engineering applications. L2

**CO5:** Analyse the results obtained in different experiments. L4

### 4ENEE1081: ELEMENTS OF ELECTRICAL & ELECTRONICS ENGINEERING

**CO1**: Analyze electrical circuits by relevant Laws in DC circuits. L4

**CO2**: Demonstrate the single phase and three-phase power generation by using the phasor diagrams. L3

**CO3**: Analyze digital circuits L4

**CO4:** Demonstrate the knowledge of Karnaugh maps by simplifying the algebraic equations and design the combinational circuits. L2

### 4CSGC1011: ELEMENTS OF COMPUTER ENGINEERING

**CO1:** Demonstrate functioning of different sub-systems, OS and different types of OS. L3

**CO2:** Use different types of data structures, operations and algorithms. L3

**CO3:** Describe the fundamental elements of relational database management systems. L2

**CO4:** Comprehend the layered protocol model & Classification of networks. L3

**CO5:** Demonstrate need for Linux OS and Linux commands. L3

### 4ENME1011: COMPUTER AIDED ENGINEERING DRAWING

**CO1:** Illustrate competence in basics of orthographic projections of points, lines, planes and solids in three different views. L3

**CO2:** Apply the concepts of orthographic projections for simple objects. L3

**CO3:** Develop surfaces of solids of simple objects. L3

### CPSHD1011: Design Thinking-1

**CO1:** Apply teamwork towards building a solution. (L3)

**CO2:** Apply basic Design Research (L3)

**CO3:** Apply brainstorming as a way of innovative thinking. (L3)

**CO4:** Apply story-telling in Design Thinking. (L3)

## CPSHL2041: Oral and Written Communication

**CO1:** Identify the Speech sounds and accent of British English and American English. (L1)

**CO2:** Express themselves in different professional setting. (L2)

**CO3:** Use the different methods and classifications of reading. (L3)

**CO4:** Draft letters, E-mails using appropriate tone and structure. (L3)

**CO5:** Construct sentences to improve their Verbal Skills.(L3). (L4)

### 4MATH1021: ENGINEERING MATHEMATICS II

**CO1:** Solve first order linear ordinary differential equations L3

**CO2:** Solve higher order differential equations arising through physical processes. L3

**CO3:** Construct a variety of partial differential equations and solves them. L4

**CO4:** Use periodic signals to represent periodic functions in the form of Fourier series. L3

**CO5:** Make use of matrix theory for solving system of linear equations L3

### 4CHEM1012: ENGINEERING CHEMISTRY

**CO1:** Explain the construction and working of Energy storage devices. L2

**CO2:** Explain corrosion of metals, factors and prevention techniques. L2

**CO3:** Explain the importance of the modern emerging field of nanotechnology. L2

**CO4:** Use instruments which give quick and accurate results for material analysis. L3

**CO5:** Carry out different types of titrations for estimation of concentration of an analyte. L3

### 4ENME1022: ELEMENTS OF MECHANICAL ENGINEERING AND WORKSHOP

**CO1:** Recognize the impact of energy sources on the environment and sustainability. L2

**CO2:** Explain the working principles of water, vapour and gas-powered systems. L2

**CO3:** Discuss the working principles of refrigeration systems and IC engines. L2

**CO4:** Compute various performance parameters of IC engines. L3

**CO5:** Demonstrate soldering, brazing and welding of sheet metal & welded joints. L2

### 4ENCV1011: ELEMENTS OF CIVIL ENGINEERING

**CO1:** Explain the basics of Civil Engineering and related fields L2

**CO2:** Develop working models with the laws of mechanics. L3

**CO3:** Analyze equilibrium of coplanar, concurrent and non-concurrent forces. L4

**CO4:** Determine centroid and moment of inertia of simple geometric figures. L3

**CO5:** Apply D'Alembert's principle in any specific application. L3

### 4CSPL1011: PROBLEM SOLVING USING PYTHON

**CO1:** Understand the basis of algorithm problem solving L2

**CO2:** Develop python programs with conditionals and loops L4

**CO3:** Develop python programs for data structure applications L4

**CO4:** Develop GUI Python programs using Tkinter L4

**CO5:** Write Object Oriented programs using Python L4

## CPSHD2011: Design Thinking-2

**CO1:** Create an appropriate research plan to explore the problem, execute the design research and present findings as a team. (L5)

**CO2:** Evaluate research findings, identify insights and brainstorm solutions as a team. (L4)

**CO3:** Create a prototype and iterate based on feedback received as a team. (L5)

## CPSAL1111: Functional English

**CO1:** Define Social Values and Critical Thinking skills (L1)

**CO2:** Compare the poetical terms and integrate creative ideas in the English Language. (L2) CO3: Develop vocabulary and interpret in one academic and professional life.(L2)

**CO4:** Develop skills of comprehending and analytical to improve their language proficiency. (L3)

**CO5:** Construct sentences to improve their Verbal Skills.(L3)

### 4MATH2011-Engineering Mathematics-III

**CO1** Make use of C–R equations to form analytic functions L3

**CO2** Explain the concept of conformal, bilinear transformations and contour integration L2

**CO3** Apply Z-transforms for discrete functions. L3

**CO4** Solve linear differential equations by Laplace transform method L3

**CO5** Solve first and second order ordinary differential equation using single step and multistep numerical methods L3

### 4CSPL1111: PROBLEM SOLVING AND PROGRAMMING USING C

**CO1:** Explain the basic computer concepts and programming principles of C language L2

**CO2:** Develop C programs to solve simple mathematical, engineering problems using conditionals and looping constructs L4

**CO3:** Develop C programs to demonstrate the applications of arrays in C L4

**CO4:** Execute programs to demonstrate the basic concepts of Strings and Pointers L3

**CO5:** Develop C programs to demonstrate the applications of functions in C L4

**4ENCE2011: Analog System Design**

**CO1:** Demonstrate the device characteristics and working principles of PN Junction diode, BJT and MOSFET, and parameters of different types of amplifiers

**CO2:** Analyse transistor biasing circuits and various amplifier configurations with small signal model

**CO3:** Explain the operation of BJT and MOSFET current mirrors, differential amplifier and frequency response of an amplifier

**CO4:** Analyse of different types of feedback amplifiers and oscillators

**CO5:** Design of power device and power amplifier

**4ENCE2031: Digital System Design Using Verilog HDL**

**CO1:** Ability to simplify & design any combinational logic circuit with minimum gates.

**CO2**: Ability to design any sequential network with minimum number of gates.

**CO3:** Demonstrate the basic knowledge of Verilog HDL to design digital circuit.

**CO4:** Ability to apply HDL in modeling combinational and sequential circuits using different abstraction levels.

**CO5:** Use EDA tools to design and synthesize digital circuit target to FPGA processor.

**4ENEE1022: Network Analysis and Synthesis**

**CO1:** Demonstrate the knowledge of KCL and KVL by solving electrical networks in phasor and time domain.

**CO2:** Select suitable network theorems for reduction of a given network to simplify the solution for a network problem.

**CO3:** Analyze a network under steady and transient states by applying Laplace Transforms to a given.

**CO4:** Choose suitable network parameters by transforming them appropriately to analyses a cascaded system.

**CO5:** Synthesize the passive network, low pass and high pass passive filter.

**CKSMM1011: Critical Inquiry**

**CO1:** Conduct an inquiry into the origins and sources of

their beliefs.

**CO2:** Recognize how access to the same information can lead to varied interpretations.

**CO3:** Appreciate the validity of diverse views that are separate from

their own.

**CO4:** Recognize the impact of uninterrogated beliefs on daily life.

**CO5:** Understand the connection between beliefs and action.

**CKSMM1021: Indian Democracy, Participation & Social Change**

**CO1:** Study a particular event in Indian history and trace the impact that can be felt to the present day.

**CO2:** Understand the impact of the way a democracy is structured.

**CO3:** Understand the freedoms that a citizen of India has, and what those mean in daily life.

**CO4:** Understand the duties of an Indian citizen and how they translate to daily life.

**CO5:** Gain an understanding of the workings of the government in their residential locality.

**CO6:** Trace the impact of a single vote from their area of residence to the national scale.

**CO7:** Understand the Indian democratic process and their role in it.

**CO8:** Identify ways in which they can contribute to the progress of the country.

**CPSSXX0X1: Project Management Fundamentals**

**CO1:** Understand the fundamental concepts of Project Management and use them in their professional career [L1].

**CO2:** Demonstrate their preparedness to manage any project in a professional manner [L1].

**CO3:** Apply the best practices of Project Management which will ensure their success in their professional life [L2].

**CKSAM1051: Indian Constitution**

**CO1:** Study a particular event in Indian history and trace the impact that can be felt to the present day.

**CO2:** Understand the impact of the way a democracy is structured.

**CO3:** Understand the freedoms that a citizen of India has, and what those mean in daily life.

**CO4:** Understand the duties of an Indian citizen and how they translate to daily life.

**CO5:** Gain an understanding of the workings of the government in their residential locality.

**CO6:** Trace the impact of a single vote from their area of residence to the national scale.

**CO7:** Understand the Indian democratic process and their role in it.

**CO8:** Identify ways in which they can contribute to the progress of the country.

**Career Essentials GPSBD1171**

**CO1:** Assess personal strengths, weaknesses, and interests to construct a viable career plan. (L5)

**CO2:** Analyse the importance of social and emotional intelligence to facilitate successful relationships. (L4)

**CO3:** Understand the implications of digital footprints on personal and professional life. (L2)

**CO4:** Construct a professional resume and customise it for various job applications / internship applications. (L3)

**CO5:** Build awareness on thoughtfulness, develop honesty, discipline and decisiveness. (L3)

**4MATH2021-Engineering Mathematics-IV**

CO1 Apply binomial, Poisson, normal and exponential probability distributions to solve engineering problems L3

CO2 Construct elementary regression models by the method of least squares L3

CO3 Explain the concept of testing of hypothesis for small and large samples L2

CO4 Solve first and second order ordinary differential equation using single step and multistep numerical methods

L3

CO5 Apply the simplex algorithm to solve a linear programming problem L3

**4ENCC2011-Principles of Communication**

On successful completion of the course, students will be able to:

CO1 Explain the working of amplitude modulators and receivers L2

CO2 Explain the Angle modulation techniques L2

CO3 Demonstrate the reception and demodulation of FM and also the various types of Noise
L2

CO4 Interpret pulse modulation techniques and base band data transmission L2

CO5 Compare the digital modulation techniques L2

**4ENVL1011- VLSI**

CO1 Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling L2

CO2 Outline the basic gates using the stick and layout diagrams with the knowledge of physical design aspects L2

CO3 Explain memory elements along with timing considerations L2

CO4 Illustrate testing and testability issues in VLSI design L2

| | | |
|---|---|---|
| CO5 | Construct CMOS subsystems and architectural issues with the design | L2 |

**4CSPL3011: PYTHON FOR DATA SCIENCE**

| | |
|---|---|
| **CO1:** Analyze data science applications | L4 |
| **CO2:** Apply data collection and wrangling techniques | L3 |
| **CO3:** Analyze how to manipulate the uncharted datasets using Numpy | L4 |
| **CO4:** Analyze how to manipulate the uncharted datasets using Pandas | L4 |
| **CO5:** Apply visualization techniques | L4 |

**CPSES1011: MAKING WITH ELECTRONICS**

| | |
|---|---|
| **CO1:** Demonstrate the interfacing of basic input and output devices using Arduino. | L2 |
| **CO2:** Explain the working principles of various sensors and renewable energy sources. | L2 |
| **CO3:** Apply the understanding of Arduino programming by interfacing sensors and communication devices. | L3 |
| **CO4:** Demonstrate the interfacing of basic input and output devices using Raspberry Pi. | L2 |
| **CO5:** Analyze and Build a real-time application employing Arduino / Raspberry Pi. | L4, L3 |

**4ENCC1011: DIGITAL SIGNAL PROCESSING(P)**

| | | |
|---|---|---|
| CO1 | Demonstrate the concept of filtering of long data sequence and fast Fourier Transform | L2 |
| CO2 | Explain the concept of transform analysis of LTI systems. | L2 |
| CO3 | Develop FIR filter for the given specifications | L3 |
| CO4 | Develop IIR filter for the given specifications | L2 |
| CO5 | Explain the finite word length effect and concept of multi-rate signal processing | L3 |

**4ENCE2032: Embedded System & ARM Processor**

| | | |
|---|---|---|
| CO1 | The students should be able to understand the concepts of embedded systems, including their architecture, programming, and applications. | L3 |
| CO2 | The students should have a thorough understanding of ARM processors, including their architecture and instruction set. | L2 |
| CO3 | Ability to write and debug assembly language programs for ARM processors. | L3 |
| CO4 | Designing and implementing ARM Cortex-M Processor real-time operating systems (RTOS) and hardware interfaces. | L3 |
| CO5 | Familiarity with different communication protocols used in embedded systems, such as SPI, I2C | |

**4ENEE1071: POWER ELECTRONICS AND CONTROL**

| | | |
|---|---|---|
| CO1 | Describe the characteristics of different power devices and identify the applications | L3 |

| | | |
|---|---|---|
| CO2 | Determine the response of controlled rectifier and AC voltage controllers with resistive and inductive loads | L2 |
| CO3 | Illustrate the working of various pulse width modulated inverters as well as Step up and step-down choppers | L3 |
| CO4 | Develop a mathematical model of system and analyze the performance characteristics of first and second order systems using standard test signals | L3 |
| CO5 | Test for the stability of a system in time as well as frequency domain and state space modeling of system | L2 |

**4ENCE1181: REAL TIME EMBEDDED SYSTEM AND LINUX**

| | | |
|---|---|---|
| CO1 | Know the basics of real-time embedded systems, including its architecture, components, and design techniques. | L3 |
| CO2 | Students will learn the basics of Linux operating system and its use in embedded systems. | L2 |
| CO3 | Explain about the Linux system programming and Real-Time Linux | L3 |
| CO4 | Writing device drivers for embedded, device drivers architecture of linux | L2 |
| CO5 | Use embedded Linux development tools for developing, debugging, and testing embedded systems. | L2 |

**4ENCE1191: Sensors & Robotics**

| | |
|---|---|
| CO1: Apply various calibration techniques and signal types for sensors. | **L3** |
| CO2: Classify and explain types of robots. | **L2** |
| CO3: Apply various sensors in the robotics. | **L3** |
| CO4: Explain robotic vision. | **L5** |
| CO5: Recommend robotic system for various industries. | **L6** |

**4ENCE1201: Automotive Electronics**

| | |
|---|---|
| **CO1:** Describe the basics of automobile dynamics and electronics for automobile. | **L2** |
| **CO2:** Explain basics of automotive components, subsystems and Electronic Engine Control in today's automotive industry. | **L5** |
| **CO3:** Apply available automotive sensors and actuators while interfacing with microcontrollers/ microprocessors during automotive system design. | **L3** |
| **CO4:** Explain the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems. | **L5** |
| **CO5:** Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems. | **L6** |

**4ENCE1211: Microelectronics(MOOC)**

| | | |
|---|---|---|
| CO1 | Understanding the basic principles of microelectronics, including semiconductor materials, device physics, and circuit design | L3 |

| | | |
|---|---|---|
| CO2 | Understand the fabrication process of electronic devices, including the lithography, deposition, and etching techniques. | L2 |
| CO3 | Design and analyze electronic circuits and systems, such as analog and digital circuits, using different software tools, including SPICE and CAD. | L3 |
| CO4 | Ability to design and analyze digital and analog electronic circuits. | L3 |

CO5 Integrate different electronic components and subsystems to create complex systems,including microprocessors. L2

**4ENVL2011: Digital VLSI Design**

| | | |
|---|---|---|
| CO1 | Familiar with CMOS technology and the different CMOS circuit design techniques. They should also have an understanding of the impact of process variations on circuit performance. | L3 |
| CO2 | Understanding of the principles of digital circuits and VLSI design, including the different types of combinational circuit. | L2 |
| CO3 | Understand the principles of digital circuits and VLSI design, including the flip-flops, registers, and counters. | L3 |
| CO4 | Understand the physical design and layout techniques, including floor planning, placement, and routing. They should also be familiar with the different layout styles and design rules. | L3 |

CO5 Design the various components of the digital system, such as, registers, and memory cells, and Digital signal processing circuits. L2

**4ENVL1021: ASIC**

| | | |
|---|---|---|
| CO1 | Demonstrate knowledge in ASIC Design flow, Simulation Issues ASICs Design Techniques. ASIC Construction | L2 |
| CO2 | Write the Verilog/VHDL Code | L2 |
| CO3 | Design and simulation of digital ICs using Verilog | L3 |
| CO4 | Compare different testing procedures for VLSI circuits. | L4 |
| CO5 | Analyze the algorithms of partitioning, placement and routing | L4 |

**4ENVL1031: Nano Electronics (MOOC)**

| | |
|---|---|
| CO1: Explain principles behind Nano science engineering and Nanoelectronics. | **L2** |
| CO2: Apply the knowledge to prepare and characterize nanomaterials. | **L3** |
| CO3: Analyze the process flow required to fabricate state-of-the-art transistor technology | **L4** |
| CO4: Explain concepts of nanoscale MOSFET, CMOS scaling with its limits. | **L5** |
| CO5: Explain properties used for sensing and the use of smart dust sensors. | **L2** |

**4ENCC1041: OPTICAL COMMUNICATION**

| | | |
|---|---|---|
| CO1 | Summarize the concepts and theory of optical fiber communication | L2 |
| CO2 | Explain various transmission characteristics of optical fibers | L2 |

| | | |
|---|---|---|
| CO3 | Illustrate the working of LEDs and Laser diodes as optical sources | L2 |
| CO4 | Explore the functions and characteristics of optical detectors and receivers | L2 |
| CO5 | Discuss the WDM systems, optical amplifiers and DTL systems | L1 |

**4ENCC1061: SATELLITE COMMUNICATION**

| | | |
|---|---|---|
| CO1 | Explain the satellite orbits and its trajectories with the definitions of parametersassociated with it | L2 |
| CO2 | Illustrate the electronic hardware systems associated with the satellite subsystem and earth station | L2 |
| CO3 | Explain the various applications of satellite with the focus on national satellite system | L2 |
| CO4 | Explain the satellite link parameters under various propagation conditions with the illustration of multiple access techniques | L2 |
| CO5 | Explain the Remote sensing satellites, Weather furcating satellites and Navigational satellites | L2 |

**4ENCC1251: Adaptive Signal Processing(MOOC)**

| | | |
|---|---|---|
| CO1 | Explain filtering solutions for optimising the cost function indicating error in estimation of parameters. | L2 |
| CO2 | Evaluate the performance of various methods for designing adaptive filters. | L3 |
| CO3 | Explain convergence and stability issues associated with adaptive filter design. | L2 |
| CO4 | Design and implement filtering solutions for applications such as channel equalisation, interference cancelling and prediction. | L3 |
| CO5 | Explain the role and importance of IIR digital filter synthesis. | L2 |

**4CSPL3021: ADVANCED PYTHON FOR AI**

| | | |
|---|---|---|
| CO1 | Identify the basic concepts of neural networks and its components | L2 |
| CO2 | Analyse neural network learning and adaption techniques | L3 |
| CO3 | Explain the detailed concepts of single layer perceptron neural networks | L2 |

**4CSGC3051: DATA MINING**

| | | |
|---|---|---|
| **CO1:** | Explain the concepts of data mining and its issues | L4 |
| **CO2**: | Analyse and apply association rule mining techniques | L3 |
| **CO3:** | Analyse various classification algorithms | L3 |
| **CO4:** | Elaborate the clustering algorithms | L2 |
| **CO5:** | Illustrate the trends and applications | L2 |

**4CSGC3041: Cryptography**

CO1: Explain the different concepts of cryptography L3

CO2: Describe the principles of symmetric and asymmetric cryptography L2

CO3: To apply the asymmetric key encipherment techniques L3

CO4: To apply the concepts of hashing algorithms L3

CO5: Understanding the real life examples of Cryptography L2

**4CSPL3051: Scripting Languages**

**CO1:** Comprehend the differences between typical scripting languages and typical system and application programming languages. L2

**CO2:** Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem. L2

**CO3:** Acquire programming skills in scripting language. L3

**CO4:** Understanding the text manipulation through Perl. L3

**CO5:** Understanding of how applications communicating with each other and how a widget toolkit used for building GUI in many languages. L2

**4CSPL3041: Advanced Java (MOOC)**

**: CO1:** Understand and implement advanced Java concepts

**CO2:** Design and implement server-side programs using Servlets and JSP

**CO3:** Implements applications using Java Server Faces

**CO4:** Incorporate cutting-edge frameworks in web application development

**CO5:** Design and implementation of ORM mapping using Hibernates

**4CSPL3061: Kotlin (OO+ Functional) (MOOC)**

**CO1:** To learn a readable, pragmatic, safe, and interoperable programming language

**CO2:** To think about nullability from the start by integrating nullability into the type system

**CO3:** Acquire programming skills in Kotlin

**CO4:** Understanding the Android development through Kotlin

**CO5:** To aid scalability in large-scale software development

**4ENEE1041: Measuring Instruments(MOOC)**

CO1.Explain elements of measuring instruments and classify measuring instruments and transducers. L2

CO2. Explain Static and Dynamic Characteristics of instruments. **L5**

CO3. Apply concept of various Bridges to measure Resistance, Capacitance and Inductance. **L3**

CO4. Explain the working of different electronic instruments. **L2**

CO5. Explain working of Display and Recording Devices. **L5**

**4ENCC1021: Introduction to Digital Image Processing**

| | | |
|---|---|---|
| CO1 | Understand the sensing, acquisition and storage of digital images | L1 |
| CO2 | Explain Intensity Transformation, Histogram and spatial filtering | L2 |

CO3 Demonstrate Different filtering techniques in frequency domain. L3

CO4 Interpret Image reconstruction processes. L2

CO5 Extends the Image processing techniques to color images. L3

**4ENCC1031: Basics of Digital Communication**

CO1 Apply fundamental probability theory L2

CO2 Demonstrate the knowledge of signal vector interpretation L2

CO3 Interpret pulse modulation techniques and base band data transmission L3

CO4 Compare the digital modulation Techniques L3

CO5 Explain the concept of information, entropy and source coding theorems L2

**4ENME105: INTRODUCTION TO ROBOTICS**

1) Explain the basic configurations of robots. [L1]
2) Learn simple programs to control robots. [L2]
3) Illustrate the process of controlling a robot. [L2]
4) Explain the working of variety of sensors that can be used in robots. [L1]
   List the applications of robots in different fields. [L1]

**4BCE481: INTRODUCTION TO REMOTE SENSING**

CO1 Understand the importance of Remote Sensing L1

CO2 Understand the systems of Remote Sensing L1

CO3 Understand the different methods of Digital Image processing using software L2

CO4 Understand the concept of thematic maps L2

CO5 Understand the concept of digital elevation model L3

**4CSPL3041: Object Oriented Programming**

**CO1:** Discuss the concepts of object-oriented programming

**CO2:** Apply OOP concepts to develop programs using functions and class

**CO3:** Incorporate the inheritance and constructor concepts to develop applications in C++

**CO4:** Apply operator overloading concepts in C++

**CO5:** Exemplify the process of data file manipulations, templates and exception handling using C++

**4CSGC2011: Database Management Systems**

**CO1:** Demonstrate the basic elements of a relational database management system.

**CO2:** Identify the data models for relevant problems

**CO3:** Design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data.

**CO4:** Demonstrate their understanding of key notions of query evaluation and optimization techniques.

**CO5:** Extend normalization for the development of application softwares

**4CSGC1021:MS OFFICE**

CO1: Applying basic editing functions formatting skills on paragraphs, tables, lists, and pages

CO2: Applicable knowledge and uses of accepted business style formatting conventions.

CO3: Working knowledge of organizing and displaying large amounts and complex data CO4: Learnt to work with Master Slides to make editing your presentation easy

CO5: Learnt the importance of web and in social media

**6IDSS1031: BASICS OF ENTREPRENEURSHIP**

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

**CO3**: Consider the legal and financial conditions for starting a business venture. (Level 2)

**CO4**: Analyse the business environment in order to identify business opportunities.(Level 3)

**CO5**: Interpret their own business plan. (Level 4)

**5IDSS1011: Essentials of Human Rights and Public Interest Laws**

**CO1**: Understand core concepts involved in evolution and development of human rights law. (Level 2)

**CO2**: Understand constitutional aspects of human rights along with the statutory framework of National and State Human Rights Commissions(Level 3)

**CO3**: Examine the various dimensions of human rights law and understand the role of state on issues relating to the enforcement of human rights (Level 4)

**6IDSS1051: FINANCE FOR NON-FINANCE STUDENTS**

**CO1:** Impart the time value of money in valuation of securities. (Level 3)

**CO2:** Understand and focus on financial discipline and capital structure in organisations. (Level 3)

**CO3:** Appreciate new methods of financing, investing, operating and business decisions. (Level 3)

**CO4:** Assess appropriate measures related to dividend decisions in organisations. (Level 4)

**3IDSS1031: Introduction to Taxation**

**CO1**: Acquire the complete knowledge of basic concepts of income tax. (Level 1)

**CO2 & CO3:** Apply the provisions and compute income under different heads. (Level 2)

**CO4**: Identify and comply with the relevant Income from other Sources and Set-off and carry Forward of Losses. (Level 3)

**CO5**: Equip basics of goods and service tax (Level 4)

**3IDSS1071: Financial Markets and Personal Investment**

**CO1**: Able to understand the concepts of financial markets and personal investment. (Level 1)

**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

**CO3**: Able to assess the need and importance of the issue of IPO.

**CO4**: Able to judge the process of operations in secondary markets and the existence of different regulatory authorities in stock market operations (Level 3)

**CO5**: Able to make assessments and make investment in personal investment in their life. (Level 4)

**6IDSS1071: MARKETING -FOR THE UNINITIATED**

**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

**CO4**: Apply the necessary marketing skills. (Level 3)

**CO5**: Analyse the IMC and recent trends. (Level 4)

**NIDSS1011: NCC I**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**NIDSS1021: NCC II**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**NIDSS1031: NCC III**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**NIDSS1041: NCC IV**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**CKSHM1011: ENVIRONMENT AND SUSTAINABILITY**

**CO1** Outline the expected consequences of continuous environment degradation in the society by relevant data analysis. L2

**CO2** Demonstrate a rationale for climate change adaptation and mitigation by proposing appropriate actions in key sectors.

L2

**CO3** Explain the key issues under negotiation by summarizing the international climate change legal and policy framework.

L2

**CO4** Demonstrate knowledge of environment sustainability by analyzing relevant data about industrial impact on environment.

**4ENCC1071: COMPUTER COMMUNICATION NETWORKS**

| | | |
|---|---|---|
| CO1 | Explain Data Communication with key concepts of networks, its types and OSI network model. | L2 |
| CO2 | Identify the data link layer from OSI model, understanding the concepts related to layer, protocols. | L3 |
| CO3 | Demonstrate the concept of Wired LAN's standards and its architecture. | L2 |

| | | |
|---|---|---|
| CO4 | Explain various connecting devices, IP address and routing mobile IP. | L2 |
| CO5 | Explain the various transport layer protocols, UDP and TCP service applications and flow and error control. | L2 |

**4ENCC2022: Advanced Digital Communication (P)**

**CO1** Explain merits and demerits of different modulation techniques & coding techniques, spread spectrum signals and channel behaviors L2

**CO2** Analyze various modulation, equalization, diversity and coding techniques for communication systems L3

**CO3** Compare performance of different types of modulation on different wireless application fading channels. L2

**CO4** Design and demonstrate various modulation/coding equalization techniques and measure their performance. L2

**4ENCE1061: Real Time Operating System(RTOS)**

CO1: Explain the key characteristics and requirements of real-time systems

CO2: Analyze different real-time scheduling algorithms (e.g., Rate Monotonic Scheduling, Earliest Deadline First)

CO3: Implement memory allocation and deallocation strategies in an RTOS environment

CO4: Apply debugging techniques and use performance profiling tools to optimize real-time applications.

CO5: Utilize IPC methods like message queues, pipes, mailboxes, and shared memory to manage communication between tasks.

**4ENCE1221: Advanced Embedded Systems**

| | | |
|---|---|---|
| CO1 | Identify the building blocks of a typical Embedded System. | L3 |
| CO2 | Demonstrate characteristics and attributes of an embedded system, hardware /software co-design and firmware design approaches. | L2 |
| CO3 | Explain the architectural features of 32 bit microcontroller ARM Cortex M3. | L2 |
| CO4 | Understand the different steps involved in the design and development of firmware for embedded systems. | L2 |
| CO5 | Explain the need of real time operating system for embedded system applications. | L2 |

**4ENCE1081: Wearable Electronics**

CO1. Identify and understand the need for development of wearable devices and its influence on various sectors. L2

CO2. Discus the applications of various wearable inertial sensors for biomedical applications. L3

CO3. Comprehend the design and development of various wearable bio-electrode and physiological activity monitoring devices for use in healthcare applications. L3

CO4. Discuss and analyze the usage of various biochemical and gas sensors as wearable devices. L4

CO5. Identify the use of various wearable locomotive tools for safety and security, navigation. L2

**4ENCE1231: Micro Electrical mechanical System(MEMS)(MOOC)**

CO1. Describe technologies related to Micro Electro Mechanical Systems. **L2**

CO2. Explain design and fabrication processes involved with MEMS Devices. **L5**

CO3. Analyze the MEMS devices and develop suitable mathematical models. **L3**

CO4. Explain various application areas for MEMS device. **L2**

CO5. Describe the Micromanufacturing. **L5**

**4ENVL1041: LOW POWER VLSI**

| | | |
|---|---|---|
| CO1 | Classify various second order effects in MOSFET device | L3 |
| CO2 | Illustrate the sources of power dissipation in CMOS based logic | L2 |
| CO3 | Construct a suitable circuit to reduce leakage power using suitable low power techniques | L2 |
| CO4 | Demonstrate the knowledge of joint random variables in real time engineering problems | L3 |
| CO5 | Identify the mechanisms of power dissipation in CMOS integrated circuits | L3 |

**4ENVL2021:CMOS Analog Design**

| | | |
|---|---|---|
| CO1 | Students should be familiar with the basic principles of CMOS (Complementary Metal-Oxide-Semiconductor) technology, including device physics, process technology, and layout design rules. | L3 |
| CO2 | Students should be able to analyze and design analog amplifier circuits, such as Cascode Amplifier and Differential Amplifier. | L2 |
| CO3 | Students should be able to design basic analog building blocks, such as voltage references, current sources, and operational amplifiers, using CMOS technology. | L3 |
| CO4 | Students should be able to analyze and design basic analog circuits, such as filters, oscillators and Data Converters using common circuit topologies and devices. | L3 |
| CO5 | Students should be able to perform layout design of analog circuits, including physical design rules, device sizing, and parasitic extraction. | L2 |

**4ENVL1051:System on Chip(SOC)(MOOC)**

| | | |
|---|---|---|
| CO1 | Understanding of the basic concepts and principles of SoC design, different design methodologies and memory and Bus Architecture. | L3 |
| CO2 | Understand working principles of processor architecture, Introduction to interconnects and bus protocol. | L2 |
| CO3 | Know the SoC Peripherals and Design Methodology | L3 |
| CO4 | Learn about different testing and validation techniques used in SoC design, including low-power design, Design for testability (DFT) | L3 |
| CO5 | Advanced topics in SoC design, including system-level design, and security. | L2 |

**4ENCC1111: RADAR**

| | | |
|---|---|---|
| CO1 | Describe the fundamentals of radar and design matched filters in noise environment | L2 |
| CO2 | Explain the various parameter configurations which can be efficiently achieved. | L2 |
| CO3 | Describe the types of pulse compression techniques for increasing range resolution. | L2 |
| CO4 | Illustrate statistical framework necessary for the development of automatic target detection. | L3 |
| CO | Analyze radar system performance, both in search and track modes, and with low and medium pulse repetition frequencies. | L4 |

**4ENCC2031:Mobile Communication**

| | | |
|---|---|---|
| CO1 | Explain the cellular concepts like frequency reuse, fading, equalization, GSM, CDMA. | L2 |
| CO2 | Illustrate hand-off and inference and apply the concept to calculate link budget using path loss model | L3 |
| CO3 | Describe equalization and different diversity techniques. | L2 |
| CO4 | Explain the concept of GSM in real time applications. | L2 |
| CO5 | Analyze different multiple access techniques in mobile communication. | L4 |

**4ENCC1261:Pattern Recognition**

| | | |
|---|---|---|
| CO1 | Explain Bayesian decision theory and learning. | L2 |
| CO2 | Explain the various techniques involved in pattern recognition | L2 |
| CO3 | Illustrate the various pattern recognition techniques into supervised and unsupervised. | L3 |
| CO4 | Analyzing the artificial neural network based pattern recognition | L4 |
| CO5 | Describe the applications of pattern recognition in various applications | L2 |

**4ENCC1271: ADHOC AND SENSOR NETWORKS**

| | | |
|---|---|---|
| CO1 | Explain the basics of Ad hoc networks and Wireless Sensor Networks | L2 |
| CO2 | Describe the different routing protocols. | L2 |
| CO3 | Describe the appropriate physical and MAC layer protocols | L2 |
| CO4 | Analyze the transport layer and security issues possible in Ad hoc and sensor networks. | L4 |
| CO5 | Illustrate the OS used in Wireless Sensor Networks and build basic modules. | L3 |

**4ENCC1281: Multi-Rate Signal Processing and Filter Banks**

| | | |
|---|---|---|
| CO1 | Understand the multi-rate systems and its applications | L2 |
| CO2 | Explain the concept of decimated filter banks | L2 |
| CO3 | Design paraunitariness filter banks | L2 |
| CO4 | Design Cosine module filter banks | L4 |

| | | |
|---|---|---|
| CO5 | Design wavelet transform filter with the help of multi-rate filter | L2 |

**4ENCC2101: INFORMATION THEORY AND CODING**

| | | |
|---|---|---|
| CO1 | Explain the concept of information, entropy and source coding theorem | L2 |
| CO2 | Demonstrate the knowledge of Shannon's source coding theorem and channel coding theorem for designing an efficient and error free communication link | L2 |
| CO3 | Explain error correction and detection using parity check coding and other coding schemes | L2 |
| CO4 | Explain minimum distance coding and cyclic codes | L2 |
| CO5 | Discuss Convolutional coding | |

**4ENCC1291:Opto Electronics(MOOC)**

| | | |
|---|---|---|
| CO1 | Explain the basics of solid state physics and understand the nature and characteristics of light. | L2 |
| CO2 | Explain different methods of luminescence, display devices and laser types and their applications. | L2 |
| CO3 | Explain the principle of optical detection mechanism in different detection devices. | L2 |
| CO4 | Illustrating the different light modulation techniques and the concepts and applications of optical switching. | L3 |
| CO5 | Analyze the integration process and application of opto electronic integrated circuits in transmitters and receivers. | L4 |

**4CSPL3111: Object Oriented Analysis Design**

**CO1:** To learn techniques for testing and validating object-oriented systems, including unit testing, integration testing, and acceptance testing, to ensure the correctness and reliability of the software. L1

**CO2:** To develop skills in collaborating effectively within a team environment, including communication, task allocation, and version control, to collectively design and implement object-oriented systems. L5

**CO3:** To understand the importance of non-functional requirements, such as performance, scalability, and security and learn how to incorporate them into the analysis and design process. L3

**CO4:** To stay updated with the latest trends and technologies in object-oriented analysis and design, allowing them to adapt and apply new techniques and tools as they evolve. L3

**CO5:** To demonstrate ethical and professional behaviour in the analysis and design of software systems, considering legal and societal implications, as well as adhering to industry best practices and standards. L5

**CSPL3121: Web Technology Frameworks**

**CO1:** Students will be able to Develop a solid understanding of the MERN stack and how it can be used to build scalable, high-performance full-stack web applications. L1

**CO2:** Students will Gain hands-on experience with building web applications using the MERN stack, including setting up a development environment, creating and connecting to databases, building APIs, and integrating frontend and backend code. L5

**CO3:** Students will be able to learn best practices for building secure, performant, and maintainable web applications including implementing authentication and authorization, optimizing database queries, and using tools for debuggin and testing. L3

**CO4:**. Students will be able to understand how to design and implement scalable, distributed web applications that can handle large amounts of traffic and users, and deploy these applications to the cloud using popular cloud services. L3

**CO5:**. Students will be able to Acquire the skills and knowledge necessary to be able to build real-world web applications using the MERN stack and gain confidence in their ability to create high-quality, professional-grade software. L5

**4CSPL3131: Application Development using MERN Stack (MOOC)**

CO1: To Discover the details of HTML,CSS and their properties and applications L2

CO2: Use the tools required to build JavaScript based SPAs

L2

CO3: Discover the details of React, the React Way, and how to get the maximum out of this library L3

C04: Discover the details of Nodejs and how to get the maximum out of this library L3

Co5: To Discover the details of SQL,MongoDB and Nosql L2

**4ENCE1131: Introduction to Nanotechnology**

CO1: Describe fundamentals of nanotechnology. **L2**

CO2: Classify nanostructures. **L2**

CO3:.Analyze biomaterials. **L4**

CO4: Develop smart materials. **L3**

CO5: Explain nanotoxicology. **L2**

**4ENCE1241: 8051 Microcontroller**

CO1. Explain the basics of Microprocessor and Microcontroller. **L2**

CO2. Relate to the 8051 Microcontroller architecture and Pin description. **L4**

CO3. Analyze 8051 Addressing modes and use the 8051 instruction set. **L4**

CO4. Program the on-chip peripherals in 8051. **L3**

CO5. Design and develop applications using 8051 Assembly language and C program. **L6**

**4ENCE1051: Basics of Embedded System**

CO1 :Classify an Embedded System based on various design parameters and peripherals

L

2 CO2 :Explain the architectural features of 32-bit microcontroller ARM Cortex M3 L2 CO3 ;Explain the instruction set of 32-bit microcontroller ARM Cortex M3 L2

CO4 Make use of the knowledge gained for programming ARM Cortex M3 for different applications using C and assembly language L3

CO5: Choose appropriate communication protocol for an application L3

**4ENCE1251:INDUSTRIAL ELECTRONICS(MOOC)**

**CO1** Explain the different types of power semi–conductor devices and their switching characteristics L2

**CO2** Explain the operation, characteristics and performance parameters of controlled rectifiers L2

**CO3** Differentiate between the characteristics of DC and AC drives L2

**CO4** Explain the different modulation techniques of pulse width modulated inverters and to u nderstand the harmonic reduction methods L2

**CO** Explain the practical application of power electronics converters in conditioning the power supply L2

**4ENCC1091:Basics of Satellite Communication**

**CO1** Explain the satellite orbits and its trajectories with the definitions of parameters associated with it L2

**CO2** Illustrate the electronic hardware systems associated with the satellite subsystem and earth station L3

**CO3** Analyze the satellite Link design L3

**CO4** Explain the various methods of Satellite access L2

**CO5** Explain various satellite applications L2

**4CSPL2071: Web Technology**

**CO1:** Students will be able to create simple static web pages using HTML and CSS. L1

**CO2:** Students will be able to add interactivity to web pages using JavaScript. L5

**CO3:** Students will be able to design responsive web pages that adapt to different screen sizes using framework such as Bootstrap. L3

**CO4:**. Students will be able to create server-side applications using a server-side language such as PHP or Python. L3

**CO5:**. Students will be able to design and implement web applications that consume external APIs usingRESTful web services L5

**4CSPL2051: Mobile Application Development**

**CO1:** Explain the fundamental concepts of mobile application development L2

**CO2:** Design the application with activities and fragments L2

**CO3:** Apply different user interfaces to their application L3

**CO4:** Demonstrate the use of views and pictures L2

**CO5:** Use the different services in the application L3

**4CSGC2101 : Machine Learning for Beginners**

**CO1:** Explain the concepts of Machine Learning Categories L4

**CO2:** Analyse the fundamentals of Machine Learning L3

**CO3:** Analyse various models in Machine learning L3

**CO4:** Illustrate the Text Mining and Recommender Systems L2

**CO5:** Elucidate the Deep and Reinforcement Learning L2

**6IDSS1031: BASICS OF ENTREPRENEURSHIP**

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

**CO3**: Consider the legal and financial conditions for starting a business venture. (Level 2)

**CO4**: Analyse the business environment in order to identify business opportunities.(Level 3)

**CO5**: Interpret their own business plan. (Level 4)

**5IDSS1011: Essentials of Human Rights and Public Interest Laws**

**CO1**: Understand core concepts involved in evolution and development of human rights law. (Level 2)

**CO2**: Understand constitutional aspects of human rights along with the statutory framework of National and State Human Rights Commissions(Level 3)

**CO3**: Examine the various dimensions of human rights law and understand the role of state on issues relating to the enforcement of human rights (Level 4)

**6IDSS1051: FINANCE FOR NON-FINANCE STUDENTS**

**CO1:** Impart the time value of money in valuation of securities. (Level 3)

**CO2:** Understand and focus on financial discipline and capital structure in organisations. (Level 3)

**CO3:** Appreciate new methods of financing, investing, operating and business decisions. (Level 3)

**CO4:** Assess appropriate measures related to dividend decisions in organisations. (Level 4)

**3IDSS1071: Financial Markets and Personal Investment**

**CO1**: Able to understand the concepts of financial markets and personal investment. (Level 1)

**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

**CO3**: Able to assess the need and importance of the issue of IPO.

**CO4**: Able to judge the process of operations in secondary markets and the existence of different regulatory authorities in stock market operations (Level 3)

**CO5**: Able to make assessments and make investment in personal investment in their life. (Level 4)

### 6IDSS1071: MARKETING -FOR THE UNINITIATED

**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

**CO4**: Apply the necessary marketing skills. (Level 3)

**CO5**: Analyse the IMC and recent trends. (Level 4)

### NIDSS1011: NCC I

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1021: NCC II

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1031: NCC III

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**NIDSS1041: NCC IV**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**CCSHS1011: SOCIOLOGY OF GLOBALIZATION AND SUSTAINABLE DEVELOPMENT**

**CO1** Demonstrate understanding of globalization process with emphasis on inter-dependence of communities and societies L1

**CO2** Analyse the critical issues in social development in the given context L2 **CO3** Develop technological interventions for social and community development L3 **CO4** Explain the health and hygiene of the community L2 **CO5** Develop technological interventions for social and community development L3

**4ENCC1241: WIRELESS COMMUNICATION**

| | | |
|---|---|---|
| **CO1** | Explain the basics and types of wireless communication systems being used | L2 |
| **CO2** | Explain the basic concepts of cellular system and the design requirements | L2 |
| **CO3** | Demonstrate the basic principles behind radio resource management techniques such as frequency reuse, channel allocation and handoffs | L2 |
| **CO4** | Interpret knowledge and gain awareness on the technologies used for effective share of spectrum by multiple access techniques i.e. TDMA, CDMA, FDMA etc. | L2 |

| | | |
|---|---|---|
| **CO5** | Summarize the wireless standards being used across the world | L2 |

## 4ENCC1132: IMAGE AND VIDEO PROCESSING

| | | |
|---|---|---|
| CO1 | Understand the sensing, acquisition and storage of digital images | L1 |
| CO2 | Explain Intensity Transformation, Histogram and spatial filtering | L2 |
| CO3 | Demonstrate Different filtering techniques in frequency domain. | L3 |
| CO4 | Interpret Image reconstruction processes. | L2 |
| CO5 | Extends the Image processing techniques to color images. | L3 |

### 4ENCC1051: IoT and Wireless Sensor Networks

**CO1**. Understand choice and application of IoT & M2M communication protocols. L2

**CO2** Describe Cloud computing and design principles of IoT. L2

**CO3**. Relate to MQTT clients, MQTT server and its programming. L3

**CO4**. Describe the architectures and its communication protocols of WSNs. L3

**CO5.** Identify the uplink and downlink communication protocols associated with specific application of IOT /WSNs L3

### 4ENCE1101: Biomedical Electronics

**CO1.** Introduce the student to the electronic devices and theory of operation in the medical area. L2

**CO2.** Data Interpretation: Learn to design, test, and analyze electronic circuits using oscilloscopes and other electronics test equipment. Apply knowledge of engineering and science to interpret data. Develop an understanding of and develop the skills necessary to communicate findings and interpretations in an effective laboratory report. L3

**CO3.** Electronic circuits for Biomedical Applications: Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits. L4

**CO4.** Work in Multi-disciplinary teams: Learn to work and communicate effectively with peers on multi- disciplinary teams to attain a common goal. L4

**CO5.** Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals. L3

### 4ENCE1111: VIRTUAL INSTRUMENTATION(MOOC)

After studying this course, students will be able to:

CO1. Recognize and describe various aspects of VI. **L2**

CO2. Develop a virtual instrumentation model using the front panel controls & indicators and loops. **L6**

CO3. Analyze and design various array operations using LabVIEW functions. **L3**

CO4. Evaluate the various forms of output representations using graphs, charts and File I/Os. **L5**

### 4ENCE2051: ADVANCED CONTROL SYSTEM

CO1: Apply state variable approach for linear time invariant systems in both the continuous and discrete time systems. **L3**

CO2: Apply state space analysis to analyze, design and test for Controllability and Observability of a given system **L3**

CO3: Design pole assignment and state observer using state feedback. **L6**

CO4: Describe Nonlinearity and develop the describing function for the nonlinearity present to assess the stability of the system. **L5**

CO5: Develop Lyapunov function for the stability analysis of nonlinear systems. **L6**

**4ENCE1121: CAN Protocol and Controller**

1. Understand the CAN protocol and able to know that what features affecting the reliability of the communication system. L2
2. To design and implement the CAN protocol and able to learn the layers of CAN communication system. L3
3. Understand the reliability issues through different types of analysis method. L2
4. Identify the commercial tools for configuring, analyzing and calibrating a CAN communication system. L3

Know the summary of the main transport level and application-level protocols that are based on CAN. L3

**4ENVL1061:CMOS RF Design**

| | | |
|---|---|---|
| **CO1** | Understand the principles of RF design, including transmission line theory, impedance matching, noise analysis, and RF amplifier design. | L3 |
| **CO2** | Understand the characteristics and limitations of CMOS technology and its applications in RF design. | L2 |
| **CO3** | Design and analyze RF circuits using CMOS technology, including low-noise amplifiers, mixers, Design techniques for mixers and frequency converters. | L3 |
| **CO4** | Design and analyze RF circuits using CMOS technology, including voltage-controlled oscillators, Phase-Locked Loops and power amplifiers. | L3 |
| **CO5** | Know the current research trends and challenges in CMOS RF design | L2 |

**4ENVL1071:Mixed Signal Analysis**

| | | |
|---|---|---|
| CO1 | Understanding of mixed signal systems, design process and associated challenges. | L2 |
| CO2 | Understand the concepts of signal processing, including Fourier analysis, time-domain and frequency-domain analysis, filtering, and noise analysis. | L2 |
| CO3 | Analyze the Linear and nonlinear circuits as well as different types of noise. | L3 |
| CO4 | Understand the basic principles of mixed signal systems, including analog-to-digital conversion (ADC), digital-to-analog conversion (DAC), and mixed-signal design methodologies. | L4 |
| CO5 | Analyze and optimize mixed-signal system performance in terms of signal integrity, noise, distortion, and power consumption | L4 |

## 4ENVL1081: VLSI TESING

**: CO1**: Acquire knowledge about fault modeling & collapsing.

**CO2**: Analyse various combinational ATPG techniques.

**CO3**: Evaluate the significance of sequential test pattern generation.

**CO4**: Develop fault simulation techniques & fault diagnosis methods.

**4ENCC1141: Multimedia Communication**

**CO1:** Demonstrate comprehension of multimedia communication principles through assessments.

**CO2**: Apply information representation techniques to encode multimedia data effectively.
**CO3:** Implement compression algorithms to optimize multimedia data storage and transmission.
**CO4:** Analyze distributed multimedia systems' features and resource management strategies.

**CO5:** Configure and troubleshoot multimedia information networks, including LANs and internet protocols.

| **4ENCC1151** | **: MIMO COMMUNICATION** |
|---|---|

**CO1:** Students will acquire a solid comprehension of the fundamental concepts and principles that form the foundation of MIMO Communications L4

**CO2**: Students will develop the ability to identify and analyze complex problems in various domains and apply MIMO techniques to devise effective solutions. L3

**CO3:** Students will be able to select appropriate MIMO Communication algorithms based on problem requirements L3

**CO4:** Students will learn how to design and develop MIMO System models by defining the problem domain. L2

**CO5:** Students will be able to evaluate the performance of MIMO Techniques models using appropriate evaluation metrics and statistical analysis techniques

**4ENCC1161: Vehicular Communication**

**CO1:** Students will acquire a solid comprehension of the fundamental concepts and principles that form the foundation of Vehicular Communication L4

**CO2:** Students will develop the ability to identify Random models, flow and traffic models, behavioural models, trace and survey-based models, joint transport and communication simulations. L3

**CO3:** Students will be able to select appropriate layer among Physical Layer and MAC Layer for Vehicular Communications requirements L3

**CO4:** Students will learn how VANET Routing protocols are developed; and how Standards and Regulations are followed. L2

**CO5:** Students will be able to Develop critical thinking for Emerging VANET Applications L2

**4ENCC1171: Microwave & Antenna**

**CO1** Acquire knowledge on the theory of microwave transmission, microwave generators and L2

**CO2** Demonstrate microwave devices and monolithic microwave integrated circuits L2

**CO3** Compare the fundamental parameters of antenna and wave propagation. L3

**CO4** Identify Dipoles and Thin linear antennas.. L3

**CO5** Identify the working principle of various types of antenna and categorize them according to their applications L2

**4ENCC1121: LTE and 5G Communication**

**CO1:** Understand the fundamental concepts of 4G LTE and its architecture L3

**CO2:** Analyze the role of OFDM's and SC–FDMA access schemes. L3

**CO3:** Explain the evolution of 5G, system concepts, and spectrum challenges L3

**CO4:** Illustrate the 5G functional and physical architecture and its requirements L4

**CO5:** Analyze the security issues and challenges in 5G communication systems. L3

**CPSAE1011: BUSINESS MANAGEMENT FOR ENGINEERS**

**CO1** Apply the concepts related to entrepreneurship issues in business ideas L3

**CO2** Explain the factors influencing the practice of management in different contexts L2

**CO3** Develop suitable economic strategy regarding common business problems L3

**CO4** Analyze the marketing strategy for common engineering business problems L4

**CO5** Illustrate the leadership qualities in the operation of a new venture

**6IDSS1031: BASICS OF ENTREPRENEURSHIP**

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

**CO3**: Consider the legal and financial conditions for starting a business venture. (Level 2)

**CO4**: Analyse the business environment in order to identify business opportunities.(Level 3)

**CO5**: Interpret their own business plan. (Level 4)

5IDSS1011: Essentials of Human Rights and Public Interest Laws

**CO1**: Understand core concepts involved in evolution and development of human rights law. (Level 2)

**CO2**: Understand constitutional aspects of human rights along with the statutory framework of National and State Human Rights Commissions(Level 3)

**CO3**: Examine the various dimensions of human rights law and understand the role of state on issues relating to the enforcement of human rights (Level 4)

**6IDSS1051: FINANCE FOR NON-FINANCE STUDENTS**

**CO1:** Impart the time value of money in valuation of securities. (Level 3)

**CO2:** Understand and focus on financial discipline and capital structure in organisations. (Level 3)

**CO3:** Appreciate new methods of financing, investing, operating and business decisions. (Level 3)

**CO4:** Assess appropriate measures related to dividend decisions in organisations. (Level 4)

**3IDSS1071: Financial Markets and Personal Investment**

**CO1**: Able to understand the concepts of financial markets and personal investment. (Level 1)

**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

**CO3**: Able to assess the need and importance of the issue of IPO.

**CO4**: Able to judge the process of operations in secondary markets and the existence of different regulatory authorities in stock market operations (Level 3)

**CO5**: Able to make assessments and make investment in personal investment in their life. (Level 4)

### 6IDSS1071: MARKETING -FOR THE UNINITIATED

**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

**CO4**: Apply the necessary marketing skills. (Level 3)

**CO5**: Analyse the IMC and recent trends. (Level 4)

### NIDSS1011: NCC I

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1021: NCC II

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

## NIDSS1031: NCC III

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

## NIDSS1041: NCC IV

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

## CPSHS1021: Business Management For Engineers

**CO1**: Describe basic business concepts and the importance of business management in engineering.(L2)

**CO2**: Analyze business situations using SWOT analysis( L3)

**CO3**: Analyze operational strategies and the processes for shift using Lean and Six Sigma principles.(L3) **CO4**: Interpret financial statements and the cost estimation and break-even analysis (L2) **CO5**: differentiate between leadership styles and demonstrate effective team management. (L3)

## CKSMA1031 - Introduction to Philosophy (IPT)

CO1: Recognize the importance of rationally deducing a question

or a problem. CO2: To develop appreciation towards various

philosophical ideologies.

CO3: To enable the students to form their own philosophy of life

## CKSMA1051 - Introduction to the History and Theories of Knowledge [IHK]

CO1: Students will have basic understanding of Indian and Western theories of Knowledge. (Lv.2)
CO2: Students will be able to distinguish between Indian and Western theories of Knowledge (Lv.4)
CO3: Students will be able to critique systems of knowledge production (Lv.5)

**CKSMA1061 - Introduction to Indian Aesthetics [IIA]**

CO1: Explain the foundational concepts in Indian

Aesthetics (Lv.2) CO2: Compare Indian and Western

theories of Aesthetics.(Lv.4) CO3: Critique Indian

Aesthetic theories.(Lv.5)

CO4: Assess the importance of Aesthetic values in contemporary art on the basis of Indian Aesthetic theories (Lv.5)

**CKSMA1071 - Gender and Society (GSY)**

CO1: Define gender (Lv.1)

CO2: Understand the processes by which gender has been defined throughout

history (Lv.2) CO3: Analyze the role gender plays in society (Lv.4)

CO4: Critique gender-relations and its effect on society (Lv.5)

CO4: Investigate how gender can be reframed to create a more equitable society (Lv.6)

**CKSMA1081 - Philosophy of Money [PHM]**

CO1: Defining the political theory of money put forward by Aristotle, Locke, Fichte, Marx, and Keynes (Lv.1)

CO2: Explaining the historical and political crisis that led to reimagining the role of money vis-à-vis power (Lv.2)

CO3: Analyzing the contemporary changes in conceptions of money (eg: cryptocurrency) (Lv.4)
CO4: Critiquing the role that money plays in democratic societies (Lv.5)

**[CKSAA1033]: Arts and Philosophy (A & P):Introduction to Philosophical Thoughts**

CO1: Examine various philosophical systems and apply the concepts to actual states of affairs. (L4)

CO2: To be able to evaluate the moral acts of individuals belonging to different cultures and societies. (L4)

CO3: Analyze, evaluate, and recognize their psychic inclination towards the specific philosophical thought system. (L6)

**4DISS4021: CAPSTONE PROJECT – BUILD**

| | | |
|---|---|---|
| **CO1** | Compare the project built with other possible existing solutions to come to a conclusion about its feasibility and reliability. | L4 |
| **CO2** | Utilize proper project management techniques and planning methods to produce cost effective projects | L3 |
| **CO3** | Recommend the need to implementing the project with supporting justification and possible areas to improve the same | L5 |
| **CO4** | Compile a clear report that contains the step by step process to building the project that includes all calculations, analysis and fabrication methods involved | L5 |

**CO5** Build the real world implementation of the design that will realize the objectives of the6 prototype/ design

**4DISS3011/21/31: INTERNSHIP**

| | | |
|---|---|---|
| **CO1** | Demonstrate the skills in professional career goals | L2 |
| **CO2** | Administer the insight into a possible career path of interest with organizational structure, roles and responsibilities | L3 |
| **CO3** | Develop professional connections with leadership strategy and skill development | L4 |
| **CO4** | Identify the professions to suit the interest as a result of this experience | L3 |

**CO5** Conquer additional skills that will need to be developed to ensure career readiness such as new technology, developing a broader network, additional coursework L4

# ECE-Course Outcome-2024

### 4MATH1011: ENGINEERING MATHEMATICS -I

**CO1:** Apply the knowledge of calculus to analyse and approximate the functions. L3

**CO2:** Calculate rates of change of multivariate functions. L3

**CO3:** Solve multiple integrals for computing area and volume. L3

**CO4:** Make use of Gradient, divergence and curl for solving Engineering problems. L3

**CO5:** Use the concept vector integration to solve the flow problems. L3

### 4PHYS1012: ENGINEERING PHYSICS

**CO1:** Analyse the applications of quantum mechanics in technology. L4

**CO2:** Make use of Lasers and Optical fibres for different industrial applications. L3

**CO3:** Plot the I-V characteristics of photo-diode, LED, Zener diodes and solar cells. L3

**CO4:** Explain the use of Magnetic, Dielectric and Superconducting materials for different engineering applications. L2

**CO5:** Analyse the results obtained in different experiments. L4

### 4ENEE1012: FUNDAMENTALS OF ELECTRICAL ENGINEERING

**CO1:** Examine the concepts of DC circuits and understand various sources of energy. L4
**CO2:** Demonstrate the single phase and three-phase power generation by using the phasor diagrams. L3
**CO3:** Illustrate the construction and operation of DC machines and understand the concept of electrical wiring, protecting devices and earthing. L3

**CO4:** Explain the construction and operation of AC machines. L2

### 4ENEE1081: ELEMENTS OF ELECTRICAL & ELECTRONICS ENGINEERING

**CO1**: Analyze electrical circuits by relevant Laws in DC circuits. L4

**CO2**: Demonstrate the single phase and three-phase power generation by using the phasor diagrams. L3

**CO3**: Analyze digital circuits L4

**CO4:** Demonstrate the knowledge of Karnaugh maps by simplifying the algebraic equations and design the combinational circuits. L2

### 4CSGC1011: ELEMENTS OF COMPUTER ENGINEERING

**CO1:** Demonstrate functioning of different sub-systems, OS and different types of OS. L3

**CO2:** Use different types of data structures, operations and algorithms. L3

**CO3:** Describe the fundamental elements of relational database management systems. L2

**CO4:** Comprehend the layered protocol model & Classification of networks. L3

**CO5:** Demonstrate need for Linux OS and Linux commands. L3

### 4ENME1011: COMPUTER AIDED ENGINEERING DRAWING

**CO1:** Illustrate competence in basics of orthographic projections of points, lines, planes and solids in three different views. L3

**CO2:** Apply the concepts of orthographic projections for simple objects. L3

**CO3:** Develop surfaces of solids of simple objects. L3

### CPSHD1011: Design Thinking-1

**CO1:** Apply teamwork towards building a solution. (L3)

**CO2:** Apply basic Design Research (L3)

**CO3:** Apply brainstorming as a way of innovative thinking. (L3)

**CO4:** Apply story-telling in Design Thinking. (L3)

## CPSHL2041: Oral and Written Communication

**CO1:** Identify the Speech sounds and accent of British English and American English. (L1)

**CO2:** Express themselves in different professional setting. (L2)

**CO3:** Use the different methods and classifications of reading. (L3)

**CO4:** Draft letters, E-mails using appropriate tone and structure. (L3)

**CO5:** Construct sentences to improve their Verbal Skills.(L3). (L4)

### 4MATH1021: ENGINEERING MATHEMATICS II

**CO1:** Solve first order linear ordinary differential equations L3

**CO2:** Solve higher order differential equations arising through physical processes. L3

**CO3:** Construct a variety of partial differential equations and solves them. L4

**CO4:** Use periodic signals to represent periodic functions in the form of Fourier series. L3

**CO5:** Make use of matrix theory for solving system of linear equations L3

### 4CHEM1013: ENGINEERING CHEMISTRY

**CO1:** Apply electrochemical systems for various engineering application L2

**CO2:** Explain the construction and working of Energy storage devices. L2

**CO3**: Employ chemical analysis techniques and experimental design to solve engineering problems and projects.

### 4ENCV1071: Engineering Mechanics

**CO1 -**Apply principles to resolve and compose forces, calculate moments, and determine resultants[L3] **CO2** -Analyze and solve equilibrium problems, including 2D truss analysis using the methods of joints and sections.[L4]

**CO3** -Apply knowledge to solve friction problems and calculate support reactions in statically determinate beams.[L3]

**CO4** -Apply fundamental principles and theorems to find centroids and calculate moments of inertia for geometric figures.[L3]

**CO5 -** Analyze motion types, apply Newton's laws and D'Alembert's principle to solve problems involving displacement, velocity, and acceleration.[L4]

**4ENCE1012 - FUNDAMENTALS OF ELECTRONICS ENGINEERING**

| | |
|---|---|
| **CO1:** Describe semiconductor devices and its applications | L2 |
| **CO2:** Analyze the various circuits of BJT | L4 |
| **CO3:** Analyze the various circuits of FET | L3 |
| **CO4:** Employ op-amp in various circuits | L4 |
| **CO5:** Analyze digital circuits | L5 |

**4ENME1022: ELEMENTS OF MECHANICAL ENGINEERING AND WORKSHOP**

| | |
|---|---|
| **CO1:** Recognize the impact of energy sources on the environment and sustainability. | L2 |
| **CO2:** Explain the working principles of water, vapour and gas-powered systems. | L2 |
| **CO3:** Discuss the working principles of refrigeration systems and IC engines. | L2 |
| **CO4:** Compute various performance parameters of IC engines. | L3 |
| **CO5:** Demonstrate soldering, brazing and welding of sheet metal & welded joints. | L2 |

**4ENCV1011: ELEMENTS OF CIVIL ENGINEERING**

| | |
|---|---|
| **CO1:** Explain the basics of Civil Engineering and related fields | L2 |
| **CO2:** Develop working models with the laws of mechanics. | L3 |
| **CO3:** Analyze equilibrium of coplanar, concurrent and non-concurrent forces. | L4 |
| **CO4:** Determine centroid and moment of inertia of simple geometric figures. | L3 |
| **CO5:** Apply D'Alembert's principle in any specific application. | L3 |

**4CSPL1011: PROBLEM SOLVING USING PYTHON**

| | |
|---|---|
| **CO1:** Understand the basis of algorithm problem solving | L2 |
| **CO2:** Develop python programs with conditionals and loops | L4 |
| **CO3:** Develop python programs for data structure applications | L4 |
| **CO4:** Develop GUI Python programs using Tkinter | L4 |
| **CO5:** Write Object Oriented programs using Python | L4 |

## CPSHD2012: Design Thinking-2

**CO 1 : Students will develop and apply research plans, using diverse tools to generate insights in order to drive innovative solutions. (Apply - Level 3)**

**CO 2 : Students will translate creative ideas into practical proofs of concept. (Create - Level 5)**

**CO 3 : Students will design and build prototypes, using user feedback for iterative improvements. (Analyze - Level 4)**

**CO 4 : Students will use creative storytelling techniques to clearly and engagingly present their ideas and processes. (Apply - Level 3)**

## CPSAL1111: Functional English

**CO1:** Define Social Values and Critical Thinking skills (L1)

**CO2:** Compare the poetical terms and integrate creative ideas in the English Language. (L2) CO3: Develop vocabulary and interpret in one academic and professional life.(L2)

**CO4:** Develop skills of comprehending and analytical to improve their language proficiency. (L3)

**CO5:** Construct sentences to improve their Verbal Skills.(L3)

### 4MATH2011-Engineering Mathematics-III

**CO1** Make use of C–R equations to form analytic functions L3

**CO2** Explain the concept of conformal, bilinear transformations and contour integration L2

**CO3** Apply Z-transforms for discrete functions. L3

**CO4** Solve linear differential equations by Laplace transform method L3

**CO5** Solve first and second order ordinary differential equation using single step and multistep numerical methods L3

## 4CSPL1111: PROBLEM SOLVING AND PROGRAMMING USING C

**CO1:** Explain the basic computer concepts and programming principles of C language L2

**CO2:** Develop C programs to solve simple mathematical, engineering problems using conditionals and looping constructs L4

**CO3:** Develop C programs to demonstrate the applications of arrays in C L4

**CO4:** Execute programs to demonstrate the basic concepts of Strings and Pointers L3

**CO5:** Develop C programs to demonstrate the applications of functions in C L4

### CPSHD1013 : Design Thinking – I

**CO1:** Implement design thinking methodologies to identify and address complex problems.**(Level 3) CO2:** Empathize with users and stakeholders to understand their needs effectively.**(Level 2)**

**CO3:** Generate innovative ideas by engaging in ideation and prototyping processes**(Level 5)**

**CO4:** Effectively communicate solutions using pitching techniques. **(Level 4)**

### CPSSF1011: French –Level-1

**CO1**: Introduce themselves and others, and use common French salutations appropriately.(L1,L2)

**CO2**: Use polite expressions in French appropriately in social interactions. ( L2)

**CO3**: Discuss daily activities with improved fluency and accuracy (L3)

**CO4**: Identify and use parts of speech correctly in sentences. (L2)

**CPSSF1021: German –Level-1**

**CO1**: Introduce themselves and others, and use common German salutations appropriately.(L1,L2)

**CO2**: Use polite expressions in German appropriately in social interactions. ( L2)

**CO3**: Discuss daily activities with improved fluency and accuracy (L3)

**CO4**: Identify and use parts of speech correctly in sentences.

**CPSSF1041: Spanish –Level-1**

**CO1**: Introduce themselves and others, and use common Spanish salutations appropriately.(L1,L2)

**CO2**: Use polite expressions in Spanish appropriately in social interactions. ( L2)

**CO3**: Discuss daily activities with improved fluency and accuracy (L3)

**CO4**: Identify and use parts of speech correctly in sentences.

**CPSAL1091 HINDI LANGUAGE**

**CO**1 : [ **Level** ] इस सत्र के अतिं तक विद्याधथि हिदिं ी भाषा को ललखना और बोलना पर्ू ि रूप से सीखगें

**CO** 2 : [ **Level** ] हिदिं ी साहित्य से जड़ु ने और जानने का उत्साि विद्याधथियों में पर्ू ि रूप से रिगा।

**CO** 3 : [ **Level** ] बौद्धिक विकास के साथ -साथ विचारों में ननपर्ु ता , नई सस्ि ंकृ नत के अनुभिों का

विकास।

**CPSAL1111 FUNCTIONAL ENGLISH**

CO1: Define Social Values and Critical Thinking skills (L1)

CO2: Compare the poetical terms and integrate creative ideas in the English Language. (L2)

CO3: Develop vocabulary and interpret in one academic and professional life.(L2)

CO4: Develop skills of comprehending and analytical to improve their language proficiency. (L3)

CO5: Construct sentences to improve their Verbal Skills.(L3)

**CPSAL1101 ಕನ ಡ**

**CO1: [Level2] ಕನ ಡ ಅ ರ ಯ ಬ .**

**CO2: [Level 4] ಕನ ಡ ಅ ರಗಳ ಉ ರ ಯ ಬ ಅ !.**

**CO3: [Level 4] ಕನ ಡ "# ರಗಳ ರಚ%ಯ ಬ.**

**CO4: [Level 5,6] ಕನ ಡ &'ಯ() ನ (ಂಗ, ವಚನಗಳ ಸ- .ಪವ0 ಅ123 .**

**CO5: [Level4] ಕನ ಡ &'ಯ() ಸರಳ ಪದ ಮ! 6ಕ7 ರಚ%ಯ0 ಪ8 9ೇ;<  .**

**4ENCE2011: Analog System Design**

**CO1:** Demonstrate the device characteristics and working principles of PN Junction diode, BJT and MOSFET, and parameters of different types of amplifiers

**CO2:** Analyse transistor biasing circuits and various amplifier configurations with small signal model

**CO3:** Explain the operation of BJT and MOSFET current mirrors, differential amplifier and frequency response of an amplifier

**CO4:** Analyse of different types of feedback amplifiers and oscillators

**CO5:** Design of power device and power amplifier

**4ENCE2031: Digital System Design Using Verilog HDL**

**CO1:** Ability to simplify & design any combinational logic circuit with minimum gates.

**CO2**: Ability to design any sequential network with minimum number of gates.

**CO3:** Demonstrate the basic knowledge of Verilog HDL to design digital circuit.

**CO4:** Ability to apply HDL in modeling combinational and sequential circuits using different abstraction levels.

**CO5:** Use EDA tools to design and synthesize digital circuit target to FPGA processor.

**4ENEE1022: Network Analysis and Synthesis**

**CO1:** Demonstrate the knowledge of KCL and KVL by solving electrical networks in phasor and time domain.

**CO2:** Select suitable network theorems for reduction of a given network to simplify the solution for a network problem.

**CO3:** Analyze a network under steady and transient states by applying Laplace Transforms to a given.

**CO4:** Choose suitable network parameters by transforming them appropriately to analyses a cascaded system.

**CO5:** Synthesize the passive network, low pass and high pass passive filter.

**CKSMM1011: Critical Inquiry**

**CO1:** Conduct an inquiry into the origins and sources of

their beliefs.

**CO2:** Recognize how access to the same information can lead to varied interpretations.

**CO3:** Appreciate the validity of diverse views that are separate from

their own.

**CO4:** Recognize the impact of uninterrogated beliefs on daily life.

**CO5:** Understand the connection between beliefs and action.

**CKSMM1021: Indian Democracy, Participation & Social Change**

**CO1:** Study a particular event in Indian history and trace the impact that can be felt to the present day.

**CO2:** Understand the impact of the way a democracy is structured.

**CO3:** Understand the freedoms that a citizen of India has, and what those mean in daily life.

**CO4:** Understand the duties of an Indian citizen and how they translate to daily life.

**CO5:** Gain an understanding of the workings of the government in their residential locality.

**CO6:** Trace the impact of a single vote from their area of residence to the national scale.

**CO7:** Understand the Indian democratic process and their role in it.

**CO8:** Identify ways in which they can contribute to the progress of the country.

**CPSSXX0X1: Project Management Fundamentals**

**CO1:** Understand the fundamental concepts of Project Management and use them in their professional career [L1].

**CO2:** Demonstrate their preparedness to manage any project in a professional manner [L1].

**CO3:** Apply the best practices of Project Management which will ensure their success in their professional life [L2].

**CKSAM1051: Indian Constitution**

**CO1:** Study a particular event in Indian history and trace the impact that can be felt to the present day.

**CO2:** Understand the impact of the way a democracy is structured.

**CO3:** Understand the freedoms that a citizen of India has, and what those mean in daily life.

**CO4:** Understand the duties of an Indian citizen and how they translate to daily life.

**CO5:** Gain an understanding of the workings of the government in their residential locality.

**CO6:** Trace the impact of a single vote from their area of residence to the national scale.

**CO7:** Understand the Indian democratic process and their role in it.

**CO8:** Identify ways in which they can contribute to the progress of the country.

**Career Essentials GPSBD1171**

**CO1:** Assess personal strengths, weaknesses, and interests to construct a viable career plan. (L5)

**CO2:** Analyse the importance of social and emotional intelligence to facilitate successful relationships. (L4)

**CO3:** Understand the implications of digital footprints on personal and professional life. (L2)

**CO4:** Construct a professional resume and customise it for various job applications / internship applications. (L3)

**CO5:** Build awareness on thoughtfulness, develop honesty, discipline and decisiveness. (L3)

**4MATH2021-Engineering Mathematics-IV**

| | |
|---|---|
| CO1 Apply binomial, Poisson, normal and exponential probability distributions to solve engineering problems | L3 |
| CO2 Construct elementary regression models by the method of least squares | L3 |
| CO3 Explain the concept of testing of hypothesis for small and large samples | L2 |
| CO4 Solve first and second order ordinary differential equation using single step and multistep numerical methods | L3 |
| CO5 Apply the simplex algorithm to solve a linear programming problem | L3 |

**4ENCC2011-Principles of Communication**

On successful completion of the course, students will be able to:

| | | |
|---|---|---|
| CO1 | Explain the working of amplitude modulators and receivers | L2 |
| CO2 | Explain the Angle modulation techniques | L2 |
| CO3 | Demonstrate the reception and demodulation of FM and also the various types of Noise | L2 |
| CO4 | Interpret pulse modulation techniques and base band data transmission | L2 |
| CO5 | Compare the digital modulation techniques | L2 |

**4ENVL1011- VLSI**

| | | |
|---|---|---|
| CO1 | Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling | L2 |
| CO2 | Outline the basic gates using the stick and layout diagrams with the knowledge of physical design aspects | L2 |
| CO3 | Explain memory elements along with timing considerations | L2 |

| | | |
|---|---|---|
| CO4 | Illustrate testing and testability issues in VLSI design | L2 |
| CO5 | Construct CMOS subsystems and architectural issues with the design | L2 |

**4CSPL3011: PYTHON FOR DATA SCIENCE**

| | |
|---|---|
| **CO1:** Analyze data science applications | L4 |
| **CO2:** Apply data collection and wrangling techniques | L3 |
| **CO3:** Analyze how to manipulate the uncharted datasets using Numpy | L4 |
| **CO4:** Analyze how to manipulate the uncharted datasets using Pandas | L4 |
| **CO5:** Apply visualization techniques | L4 |

**CPSES1011: MAKING WITH ELECTRONICS**

| | |
|---|---|
| **CO1:** Demonstrate the interfacing of basic input and output devices using Arduino. | L2 |
| **CO2:** Explain the working principles of various sensors and renewable energy sources. | L2 |
| **CO3:** Apply the understanding of Arduino programming by interfacing sensors and communication devices. | L3 |
| **CO4:** Demonstrate the interfacing of basic input and output devices using Raspberry Pi. | L2 |
| **CO5:** Analyze and Build a real-time application employing Arduino / Raspberry Pi. | L4, L3 |

**4ENCC1011: DIGITAL SIGNAL PROCESSING(P)**

| | | |
|---|---|---|
| CO1 | Demonstrate the concept of filtering of long data sequence and fast Fourier Transform | L2 |
| CO2 | Explain the concept of transform analysis of LTI systems. | L2 |
| CO3 | Develop FIR filter for the given specifications | L3 |
| CO4 | Develop IIR filter for the given specifications | L2 |
| CO5 | Explain the finite word length effect and concept of multi-rate signal processing | L3 |

**4ENCE2032: Embedded System & ARM Processor**

| | | |
|---|---|---|
| CO1 | The students should be able to understand the concepts of embedded systems, including their architecture, programming, and applications. | L3 |
| CO2 | The students should have a thorough understanding of ARM processors, including their architecture and instruction set. | L2 |
| CO3 | Ability to write and debug assembly language programs for ARM processors. | L3 |
| CO4 | Designing and implementing ARM Cortex-M Processor real-time operating systems (RTOS) and hardware interfaces. | L3 |
| CO5 | Familiarity with different communication protocols used in embedded systems, such as SPI, I2C | |

**4ENEE1071: POWER ELECTRONICS AND CONTROL**

| | | |
|---|---|---|
| CO1 | Describe the characteristics of different power devices and identify the applications | L3 |
| CO2 | Determine the response of controlled rectifier and AC voltage controllers with resistive and inductive loads | L2 |
| CO3 | Illustrate the working of various pulse width modulated inverters as well as Step up and step-down choppers | L3 |
| CO4 | Develop a mathematical model of system and analyze the performance characteristics of first and second order systems using standard test signals | L3 |
| CO5 | Test for the stability of a system in time as well as frequency domain and state space modeling of system | L2 |

**4ENCE1181: REAL TIME EMBEDDED SYSTEM AND LINUX**

| | | |
|---|---|---|
| CO1 | Know the basics of real-time embedded systems, including its architecture, components, and design techniques. | L3 |
| CO2 | Students will learn the basics of Linux operating system and its use in embedded systems. | L2 |
| CO3 | Explain about the Linux system programming and Real-Time Linux | L3 |
| CO4 | Writing device drivers for embedded, device drivers architecture of linux | L2 |
| CO5 | Use embedded Linux development tools for developing, debugging, and testing embedded systems. | L2 |

**4ENCE1191: Sensors & Robotics**

CO1: Apply various calibration techniques and signal types for sensors. **L3**

CO2: Classify and explain types of robots. **L2**

CO3: Apply various sensors in the robotics. **L3**

CO4: Explain robotic vision. **L5**

CO5: Recommend robotic system for various industries. **L6**

**4ENCE1201: Automotive Electronics**

**CO1:** Describe the basics of automobile dynamics and electronics for automobile. **L2**

**CO2:** Explain basics of automotive components, subsystems and Electronic Engine Control in today's automotive industry. **L5**

**CO3:** Apply available automotive sensors and actuators while interfacing with microcontrollers/ microprocessors during automotive system design. **L3**

**CO4:** Explain the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems. **L5**

**CO5:** Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems. **L6**

**4ENCE1211: Microelectronics(MOOC)**

| | | |
|---|---|---|
| CO1 | Understanding the basic principles of microelectronics, including semiconductor materials, device physics, and circuit design | L3 |
| CO2 | Understand the fabrication process of electronic devices, including the lithography, deposition, and etching techniques. | L2 |
| CO3 | Design and analyze electronic circuits and systems, such as analog and digital circuits, using different software tools, including SPICE and CAD. | L3 |
| CO4 | Ability to design and analyze digital and analog electronic circuits. | L3 |

CO5 Integrate different electronic components and subsystems to create complex systems,including microprocessors. L2

**4ENVL2011: Digital VLSI Design**

| | | |
|---|---|---|
| CO1 | Familiar with CMOS technology and the different CMOS circuit design techniques. They should also have an understanding of the impact of process variations on circuit performance. | L3 |
| CO2 | Understanding of the principles of digital circuits and VLSI design, including the different types of combinational circuit. | L2 |
| CO3 | Understand the principles of digital circuits and VLSI design, including the flip-flops, registers, and counters. | L3 |
| CO4 | Understand the physical design and layout techniques, including floor planning, placement, and routing. They should also be familiar with the different layout styles and design rules. | L3 |

CO5 Design the various components of the digital system, such as, registers, and memory cells, and Digital signal processing circuits. L2

**4ENVL1021: ASIC**

| | | |
|---|---|---|
| CO1 | Demonstrate knowledge in ASIC Design flow, Simulation Issues ASICs Design Techniques. ASIC Construction | L2 |
| CO2 | Write the Verilog/VHDL Code | L2 |
| CO3 | Design and simulation of digital ICs using Verilog | L3 |
| CO4 | Compare different testing procedures for VLSI circuits. | L4 |
| CO5 | Analyze the algorithms of partitioning, placement and routing | L4 |

**4ENVL1031: Nano Electronics (MOOC)**

| | |
|---|---|
| CO1: Explain principles behind Nano science engineering and Nanoelectronics. | **L2** |
| CO2: Apply the knowledge to prepare and characterize nanomaterials. | **L3** |
| CO3: Analyze the process flow required to fabricate state-of-the-art transistor technology | **L4** |
| CO4: Explain concepts of nanoscale MOSFET, CMOS scaling with its limits. | **L5** |
| CO5: Explain properties used for sensing and the use of smart dust sensors. | **L2** |

**4ENCC1041: OPTICAL COMMUNICATION**

| | | |
|---|---|---|
| CO1 | Summarize the concepts and theory of optical fiber communication | L2 |
| CO2 | Explain various transmission characteristics of optical fibers | L2 |
| CO3 | Illustrate the working of LEDs and Laser diodes as optical sources | L2 |
| CO4 | Explore the functions and characteristics of optical detectors and receivers | L2 |
| CO5 | Discuss the WDM systems, optical amplifiers and DTL systems | L1 |

**4ENCC1061: SATELLITE COMMUNICATION**

| | | |
|---|---|---|
| CO1 | Explain the satellite orbits and its trajectories with the definitions of parametersassociated with it | L2 |
| CO2 | Illustrate the electronic hardware systems associated with the satellite subsystem and earth station | L2 |
| CO3 | Explain the various applications of satellite with the focus on national satellite system | L2 |
| CO4 | Explain the satellite link parameters under various propagation conditions with the illustration of multiple access techniques | L2 |
| CO5 | Explain the Remote sensing satellites, Weather furcating satellites and Navigational satellites | L2 |

**4ENCC1251: Adaptive Signal Processing(MOOC)**

| | | |
|---|---|---|
| CO1 | Explain filtering solutions for optimising the cost function indicating error in estimation of parameters. | L2 |
| CO2 | Evaluate the performance of various methods for designing adaptive filters. | L3 |
| CO3 | Explain convergence and stability issues associated with adaptive filter design. | L2 |
| CO4 | Design and implement filtering solutions for applications such as channel equalisation, interference cancelling and prediction. | L3 |
| CO5 | Explain the role and importance of IIR digital filter synthesis. | L2 |

**4CSPL3021: ADVANCED PYTHON FOR AI**

| | | |
|---|---|---|
| CO1 | Identify the basic concepts of neural networks and its components | L2 |
| CO2 | Analyse neural network learning and adaption techniques | L3 |
| CO3 | Explain the detailed concepts of single layer perceptron neural networks | L2 |

**4CSGC3051: DATA MINING**

| | | |
|---|---|---|
| **CO1:** | Explain the concepts of data mining and its issues | L4 |
| **CO2**: | Analyse and apply association rule mining techniques | L3 |
| **CO3:** | Analyse various classification algorithms | L3 |
| **CO4:** | Elaborate the clustering algorithms | L2 |

**CO5:** Illustrate the trends and applications L2

**4CSGC3041: Cryptography**

CO1: Explain the different concepts of cryptography L3

CO2: Describe the principles of symmetric and asymmetric cryptography L2

CO3: To apply the asymmetric key encipherment techniques L3

CO4: To apply the concepts of hashing algorithms L3

CO5: Understanding the real life examples of Cryptography L2

**4CSPL3051: Scripting Languages**

**CO1:** Comprehend the differences between typical scripting languages and typical system and application programming languages. L2

**CO2:** Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem. L2

**CO3:** Acquire programming skills in scripting language. L3

**CO4:** Understanding the text manipulation through Perl. L3

**CO5:** Understanding of how applications communicating with each other and how a widget toolkit used for building GUI in many languages. L2

**4CSPL3041: Advanced Java (MOOC)**

**: CO1:** Understand and implement advanced Java concepts

**CO2:** Design and implement server-side programs using Servlets and JSP

**CO3:** Implements applications using Java Server Faces

**CO4:** Incorporate cutting-edge frameworks in web application development

**CO5:** Design and implementation of ORM mapping using Hibernates

**4CSPL3061: Kotlin (OO+ Functional) (MOOC)**

**CO1:** To learn a readable, pragmatic, safe, and interoperable programming language

**CO2:** To think about nullability from the start by integrating nullability into the type system

**CO3:** Acquire programming skills in Kotlin

**CO4:** Understanding the Android development through Kotlin

**CO5:** To aid scalability in large-scale software development

**4ENEE1041: Measuring Instruments(MOOC)**

CO1.Explain elements of measuring instruments and classify measuring instruments and transducers. L2

CO2. Explain Static and Dynamic Characteristics of instruments. **L5**

CO3. Apply concept of various Bridges to measure Resistance, Capacitance and Inductance. **L3**

CO4. Explain the working of different electronic instruments. **L2**

CO5. Explain working of Display and Recording Devices. **L5**

**4ENCC1021: Introduction to Digital Image Processing**

CO1 Understand the sensing, acquisition and storage of digital images L1

| | | |
|---|---|---|
| CO2 | Explain Intensity Transformation, Histogram and spatial filtering | L2 |
| CO3 | Demonstrate Different filtering techniques in frequency domain. | L3 |
| CO4 | Interpret Image reconstruction processes. | L2 |
| CO5 | Extends the Image processing techniques to color images. | L3 |

**4ENCC1031: Basics of Digital Communication**

| | | |
|---|---|---|
| CO1 | Apply fundamental probability theory | L2 |
| CO2 | Demonstrate the knowledge of signal vector interpretation | L2 |
| CO3 | Interpret pulse modulation techniques and base band data transmission | L3 |
| CO4 | Compare the digital modulation Techniques | L3 |
| CO5 | Explain the concept of information, entropy and source coding theorems | L2 |

**4ENME105: INTRODUCTION TO ROBOTICS**

1) Explain the basic configurations of robots. [L1]
2) Learn simple programs to control robots. [L2]
3) Illustrate the process of controlling a robot. [L2]
4) Explain the working of variety of sensors that can be used in robots. [L1]
   List the applications of robots in different fields. [L1]

**4BCE481: INTRODUCTION TO REMOTE SENSING**

| | | |
|---|---|---|
| CO1 | Understand the importance of Remote Sensing | L1 |
| CO2 | Understand the systems of Remote Sensing | L1 |
| CO3 | Understand the different methods of Digital Image processing using software | L2 |
| CO4 | Understand the concept of thematic maps | L2 |
| CO5 | Understand the concept of digital elevation model | L3 |

**4CSPL3041: Object Oriented Programming**

**CO1:** Discuss the concepts of object-oriented programming

**CO2:** Apply OOP concepts to develop programs using functions and class

**CO3:** Incorporate the inheritance and constructor concepts to develop applications in C++

**CO4:** Apply operator overloading concepts in C++

**CO5:** Exemplify the process of data file manipulations, templates and exception handling using C++

**4CSGC2011: Database Management Systems**

**CO1:** Demonstrate the basic elements of a relational database management system.

**CO2:** Identify the data models for relevant problems

**CO3:** Design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data.

**CO4:** Demonstrate their understanding of key notions of query evaluation and optimization techniques.

**CO5:** Extend normalization for the development of application softwares

**4CSGC1021:MS OFFICE**

CO1: Applying basic editing functions formatting skills on paragraphs, tables, lists, and pages

CO2: Applicable knowledge and uses of accepted business style formatting conventions.

CO3: Working knowledge of organizing and displaying large amounts and complex data CO4: Learnt to work with Master Slides to make editing your presentation easy

CO5: Learnt the importance of web and in social media

**6IDSS1031: BASICS OF ENTREPRENEURSHIP**

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

**CO3**: Consider the legal and financial conditions for starting a business venture. (Level 2)

**CO4**: Analyse the business environment in order to identify business opportunities.(Level 3)

**CO5**: Interpret their own business plan. (Level 4)

**5IDSS1011: Essentials of Human Rights and Public Interest Laws**

**CO1**: Understand core concepts involved in evolution and development of human rights law. (Level 2)

**CO2**: Understand constitutional aspects of human rights along with the statutory framework of National and State Human Rights Commissions(Level 3)

**CO3**: Examine the various dimensions of human rights law and understand the role of state on issues relating to the enforcement of human rights (Level 4)

**6IDSS1051: FINANCE FOR NON-FINANCE STUDENTS**

**CO1:** Impart the time value of money in valuation of securities. (Level 3)

**CO2:** Understand and focus on financial discipline and capital structure in organisations. (Level 3)

**CO3:** Appreciate new methods of financing, investing, operating and business decisions. (Level 3)

**CO4:** Assess appropriate measures related to dividend decisions in organisations. (Level 4)

**3IDSS1031: Introduction to Taxation**

**CO1**: Acquire the complete knowledge of basic concepts of income tax. (Level 1)

**CO2 & CO3:** Apply the provisions and compute income under different heads. (Level 2)

**CO4**: Identify and comply with the relevant Income from other Sources and Set-off and carry Forward of Losses. (Level 3)

**CO5**: Equip basics of goods and service tax (Level 4)

### 3IDSS1071: Financial Markets and Personal Investment

**CO1**: Able to understand the concepts of financial markets and personal investment. (Level 1)

**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

**CO3**: Able to assess the need and importance of the issue of IPO.

**CO4**: Able to judge the process of operations in secondary markets and the existence of different regulatory authorities in stock market operations (Level 3)

**CO5**: Able to make assessments and make investment in personal investment in their life. (Level 4)

### 6IDSS1071: MARKETING -FOR THE UNINITIATED

**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

**CO4**: Apply the necessary marketing skills. (Level 3)

**CO5**: Analyse the IMC and recent trends. (Level 4)

### NIDSS1011: NCC I

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1021: NCC II

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1031: NCC III

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**NIDSS1041: NCC IV**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their trainings and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**CKSHM1011: ENVIRONMENT AND SUSTAINABILITY**

**CO1** Outline the expected consequences of continuous environment degradation in the society by relevant data analysis. L2

**CO2** Demonstrate a rationale for climate change adaptation and mitigation by proposing appropriate actions in key sectors.

L2

**CO3** Explain the key issues under negotiation by summarizing the international climate change legal and policy framework.

L2

**CO4** Demonstrate knowledge of environment sustainability by analyzing relevant data about industrial impact on environment.

**4ENCC1071: COMPUTER COMMUNICATION NETWORKS**

| | | |
|---|---|---|
| CO1 | Explain Data Communication with key concepts of networks, its types and OSI network model. | L2 |
| CO2 | Identify the data link layer from OSI model, understanding the concepts related to layer, protocols. | L3 |
| CO3 | Demonstrate the concept of Wired LAN's standards and its architecture. | L2 |

| | | |
|---|---|---|
| CO4 | Explain various connecting devices, IP address and routing mobile IP. | L2 |
| CO5 | Explain the various transport layer protocols, UDP and TCP service applications and flow and error control. | L2 |

**4ENCC2022: Advanced Digital Communication (P)**

**CO1** Explain merits and demerits of different modulation techniques & coding techniques, spread spectrum signals and channel behaviors L2

**CO2** Analyze various modulation, equalization, diversity and coding techniques for communication systems L3

**CO3** Compare performance of different types of modulation on different wireless application fading channels. L2

**CO4** Design and demonstrate various modulation/coding equalization techniques and measure their performance. L2

**4ENCE1061: Real Time Operating System(RTOS)**

CO1: Explain the key characteristics and requirements of real-time systems

CO2: Analyze different real-time scheduling algorithms (e.g., Rate Monotonic Scheduling, Earliest Deadline First)

CO3: Implement memory allocation and deallocation strategies in an RTOS environment

CO4: Apply debugging techniques and use performance profiling tools to optimize real-time applications.

CO5: Utilize IPC methods like message queues, pipes, mailboxes, and shared memory to manage communication between tasks.

**4ENCE1221: Advanced Embedded Systems**

| | | |
|---|---|---|
| CO1 | Identify the building blocks of a typical Embedded System. | L3 |
| CO2 | Demonstrate characteristics and attributes of an embedded system, hardware /software co-design and firmware design approaches. | L2 |
| CO3 | Explain the architectural features of 32 bit microcontroller ARM Cortex M3. | L2 |
| CO4 | Understand the different steps involved in the design and development of firmware for embedded systems. | L2 |
| CO5 | Explain the need of real time operating system for embedded system applications. | L2 |

**4ENCE1081: Wearable Electronics**

CO1. Identify and understand the need for development of wearable devices and its influence on various sectors. L2

CO2. Discus the applications of various wearable inertial sensors for biomedical applications. L3

CO3. Comprehend the design and development of various wearable bio-electrode and physiological activity monitoring devices for use in healthcare applications. L3

CO4. Discuss and analyze the usage of various biochemical and gas sensors as wearable devices. L4

CO5. Identify the use of various wearable locomotive tools for safety and security, navigation. L2

**4ENCE1231: Micro Electrical mechanical System(MEMS)(MOOC)**

CO1. Describe technologies related to Micro Electro Mechanical Systems. **L2**

CO2. Explain design and fabrication processes involved with MEMS Devices. **L5**

CO3. Analyze the MEMS devices and develop suitable mathematical models. **L3**

CO4. Explain various application areas for MEMS device. **L2**

CO5. Describe the Micromanufacturing. **L5**

**4ENVL1041: LOW POWER VLSI**

| | | |
|---|---|---|
| CO1 | Classify various second order effects in MOSFET device | L3 |
| CO2 | Illustrate the sources of power dissipation in CMOS based logic | L2 |
| CO3 | Construct a suitable circuit to reduce leakage power using suitable low power techniques | L2 |
| CO4 | Demonstrate the knowledge of joint random variables in real time engineering problems | L3 |
| CO5 | Identify the mechanisms of power dissipation in CMOS integrated circuits | L3 |

**4ENVL2021:CMOS Analog Design**

| | | |
|---|---|---|
| CO1 | Students should be familiar with the basic principles of CMOS (Complementary Metal-Oxide-Semiconductor) technology, including device physics, process technology, and layout design rules. | L3 |
| CO2 | Students should be able to analyze and design analog amplifier circuits, such as Cascode Amplifier and Differential Amplifier. | L2 |
| CO3 | Students should be able to design basic analog building blocks, such as voltage references, current sources, and operational amplifiers, using CMOS technology. | L3 |
| CO4 | Students should be able to analyze and design basic analog circuits, such as filters, oscillators and Data Converters using common circuit topologies and devices. | L3 |
| CO5 | Students should be able to perform layout design of analog circuits, including physical design rules, device sizing, and parasitic extraction. | L2 |

**4ENVL1051:System on Chip(SOC)(MOOC)**

| | | |
|---|---|---|
| CO1 | Understanding of the basic concepts and principles of SoC design, different design methodologies and memory and Bus Architecture. | L3 |
| CO2 | Understand working principles of processor architecture, Introduction to interconnects and bus protocol. | L2 |
| CO3 | Know the SoC Peripherals and Design Methodology | L3 |
| CO4 | Learn about different testing and validation techniques used in SoC design, including low-power design, Design for testability (DFT) | L3 |
| CO5 | Advanced topics in SoC design, including system-level design, and security. | L2 |

**4ENCC1111: RADAR**

| | | |
|---|---|---|
| CO1 | Describe the fundamentals of radar and design matched filters in noise environment | L2 |
| CO2 | Explain the various parameter configurations which can be efficiently achieved. | L2 |
| CO3 | Describe the types of pulse compression techniques for increasing range resolution. | L2 |
| CO4 | Illustrate statistical framework necessary for the development of automatic target detection. | L3 |
| CO | Analyze radar system performance, both in search and track modes, and with low and medium pulse repetition frequencies. | L4 |

**4ENCC2031:Mobile Communication**

| | | |
|---|---|---|
| CO1 | Explain the cellular concepts like frequency reuse, fading, equalization, GSM, CDMA. | L2 |
| CO2 | Illustrate hand-off and inference and apply the concept to calculate link budget using path loss model | L3 |
| CO3 | Describe equalization and different diversity techniques. | L2 |
| CO4 | Explain the concept of GSM in real time applications. | L2 |
| CO5 | Analyze different multiple access techniques in mobile communication. | L4 |

**4ENCC1261:Pattern Recognition**

| | | |
|---|---|---|
| CO1 | Explain Bayesian decision theory and learning. | L2 |
| CO2 | Explain the various techniques involved in pattern recognition | L2 |
| CO3 | Illustrate the various pattern recognition techniques into supervised and unsupervised. | L3 |
| CO4 | Analyzing the artificial neural network based pattern recognition | L4 |
| CO5 | Describe the applications of pattern recognition in various applications | L2 |

**4ENCC1271: ADHOC AND SENSOR NETWORKS**

| | | |
|---|---|---|
| CO1 | Explain the basics of Ad hoc networks and Wireless Sensor Networks | L2 |
| CO2 | Describe the different routing protocols. | L2 |
| CO3 | Describe the appropriate physical and MAC layer protocols | L2 |
| CO4 | Analyze the transport layer and security issues possible in Ad hoc and sensor networks. | L4 |
| CO5 | Illustrate the OS used in Wireless Sensor Networks and build basic modules. | L3 |

**4ENCC1281: Multi-Rate Signal Processing and Filter Banks**

| | | |
|---|---|---|
| CO1 | Understand the multi-rate systems and its applications | L2 |
| CO2 | Explain the concept of decimated filter banks | L2 |
| CO3 | Design paraunitariness filter banks | L2 |
| CO4 | Design Cosine module filter banks | L4 |

| | | |
|---|---|---|
| CO5 | Design wavelet transform filter with the help of multi-rate filter | L2 |

**4ENCC2101: INFORMATION THEORY AND CODING**

| | | |
|---|---|---|
| CO1 | Explain the concept of information, entropy and source coding theorem | L2 |
| CO2 | Demonstrate the knowledge of Shannon's source coding theorem and channel coding theorem for designing an efficient and error free communication link | L2 |
| CO3 | Explain error correction and detection using parity check coding and other coding schemes | L2 |
| CO4 | Explain minimum distance coding and cyclic codes | L2 |
| CO5 | Discuss Convolutional coding | |

**4ENCC1291:Opto Electronics(MOOC)**

| | | |
|---|---|---|
| CO1 | Explain the basics of solid state physics and understand the nature and characteristics of light. | L2 |
| CO2 | Explain different methods of luminescence, display devices and laser types and their applications. | L2 |
| CO3 | Explain the principle of optical detection mechanism in different detection devices. | L2 |
| CO4 | Illustrating the different light modulation techniques and the concepts and applications of optical switching. | L3 |
| CO5 | Analyze the integration process and application of opto electronic integrated circuits in transmitters and receivers. | L4 |

**4CSPL3111: Object Oriented Analysis Design**

**CO1:** To learn techniques for testing and validating object-oriented systems, including unit testing, integration testing, and acceptance testing, to ensure the correctness and reliability of the software. L1

**CO2:** To develop skills in collaborating effectively within a team environment, including communication, task allocation, and version control, to collectively design and implement object-oriented systems. L5

**CO3:** To understand the importance of non-functional requirements, such as performance, scalability, and security and learn how to incorporate them into the analysis and design process. L3

**CO4:** To stay updated with the latest trends and technologies in object-oriented analysis and design, allowing them to adapt and apply new techniques and tools as they evolve. L3

**CO5:** To demonstrate ethical and professional behaviour in the analysis and design of software systems, considering legal and societal implications, as well as adhering to industry best practices and standards. L5

**CSPL3121: Web Technology Frameworks**

**CO1:** Students will be able to Develop a solid understanding of the MERN stack and how it can be used to build scalable, high-performance full-stack web applications. L1

**CO2:** Students will Gain hands-on experience with building web applications using the MERN stack, including setting up a development environment, creating and connecting to databases, building APIs, and integrating frontend and backend code. L5

**CO3:** Students will be able to learn best practices for building secure, performant, and maintainable web applications including implementing authentication and authorization, optimizing database queries, and using tools for debuggin and testing. L3

**CO4:**. Students will be able to understand how to design and implement scalable, distributed web applications that can handle large amounts of traffic and users, and deploy these applications to the cloud using popular cloud services. L3

**CO5:**. Students will be able to Acquire the skills and knowledge necessary to be able to build real-world web applications using the MERN stack and gain confidence in their ability to create high-quality, professional-grade software. L5

**4CSPL3131: Application Development using MERN Stack (MOOC)**

CO1: To Discover the details of HTML,CSS and their properties and applications L2

CO2: Use the tools required to build JavaScript based SPAs

L2

CO3: Discover the details of React, the React Way, and how to get the maximum out of this library L3

C04: Discover the details of Nodejs and how to get the maximum out of this library L3

Co5: To Discover the details of SQL,MongoDB and Nosql L2

**4ENCE1131: Introduction to Nanotechnology**

CO1: Describe fundamentals of nanotechnology. **L2**

CO2: Classify nanostructures. **L2**

CO3:.Analyze biomaterials. **L4**

CO4: Develop smart materials. **L3**

CO5: Explain nanotoxicology. **L2**

**4ENCE1241: 8051 Microcontroller**

CO1. Explain the basics of Microprocessor and Microcontroller. **L2**

CO2. Relate to the 8051 Microcontroller architecture and Pin description. **L4**

CO3. Analyze 8051 Addressing modes and use the 8051 instruction set. **L4**

CO4. Program the on-chip peripherals in 8051. **L3**

CO5. Design and develop applications using 8051 Assembly language and C program. **L6**

**4ENCE1051: Basics of Embedded System**

CO1 :Classify an Embedded System based on various design parameters and peripherals

L

2 CO2 :Explain the architectural features of 32-bit microcontroller ARM Cortex M3 L2 CO3 ;Explain the instruction set of 32-bit microcontroller ARM Cortex M3 L2

CO4 Make use of the knowledge gained for programming ARM Cortex M3 for different applications using C and assembly language L3

CO5: Choose appropriate communication protocol for an application L3

**4ENCE1251:INDUSTRIAL ELECTRONICS(MOOC)**

**CO1** Explain the different types of power semi–conductor devices and their switching characteristics L2

**CO2** Explain the operation, characteristics and performance parameters of controlled rectifiers L2

**CO3** Differentiate between the characteristics of DC and AC drives L2

**CO4** Explain the different modulation techniques of pulse width modulated inverters and to u nderstand the harmonic reduction methods L2

**CO** Explain the practical application of power electronics converters in conditioning the power supply L2

**4ENCC1091:Basics of Satellite Communication**

**CO1** Explain the satellite orbits and its trajectories with the definitions of parameters associated with it L2

**CO2** Illustrate the electronic hardware systems associated with the satellite subsystem and earth station L3

**CO3** Analyze the satellite Link design L3

**CO4** Explain the various methods of Satellite access L2

**CO5** Explain various satellite applications L2

**4CSPL2071: Web Technology**

**CO1:** Students will be able to create simple static web pages using HTML and CSS. L1

**CO2:** Students will be able to add interactivity to web pages using JavaScript. L5

**CO3:** Students will be able to design responsive web pages that adapt to different screen sizes using framework such as Bootstrap. L3

**CO4:**. Students will be able to create server-side applications using a server-side language such as PHP or Python. L3

**CO5:**. Students will be able to design and implement web applications that consume external APIs usingRESTful web services L5

**4CSPL2051: Mobile Application Development**

**CO1:** Explain the fundamental concepts of mobile application development L2

**CO2:** Design the application with activities and fragments L2

**CO3:** Apply different user interfaces to their application L3

**CO4:** Demonstrate the use of views and pictures L2

**CO5:** Use the different services in the application L3

**4CSGC2101 : Machine Learning for Beginners**

**CO1:** Explain the concepts of Machine Learning Categories L4

**CO2:** Analyse the fundamentals of Machine Learning L3

**CO3:** Analyse various models in Machine learning L3

**CO4:** Illustrate the Text Mining and Recommender Systems L2

**CO5:** Elucidate the Deep and Reinforcement Learning L2

**6IDSS1031: BASICS OF ENTREPRENEURSHIP**

**CO1**: Take risk to start a new enterprise and can help the established business. (Level 4)

**CO2**: Identify the elements of success of entrepreneurial ventures. (Level 2)

**CO3**: Consider the legal and financial conditions for starting a business venture. (Level 2)

**CO4**: Analyse the business environment in order to identify business opportunities.(Level 3)

**CO5**: Interpret their own business plan. (Level 4)

**5IDSS1011: Essentials of Human Rights and Public Interest Laws**

**CO1**: Understand core concepts involved in evolution and development of human rights law. (Level 2)

**CO2**: Understand constitutional aspects of human rights along with the statutory framework of National and State Human Rights Commissions(Level 3)

**CO3**: Examine the various dimensions of human rights law and understand the role of state on issues relating to the enforcement of human rights (Level 4)

**6IDSS1051: FINANCE FOR NON-FINANCE STUDENTS**

**CO1:** Impart the time value of money in valuation of securities. (Level 3)

**CO2:** Understand and focus on financial discipline and capital structure in organisations. (Level 3)

**CO3:** Appreciate new methods of financing, investing, operating and business decisions. (Level 3)

**CO4:** Assess appropriate measures related to dividend decisions in organisations. (Level 4)

**3IDSS1071: Financial Markets and Personal Investment**

**CO1**: Able to understand the concepts of financial markets and personal investment. (Level 1)

**CO2**: Able to analyze the existence of different types of financial markets and their relative importance. (Level 3)

**CO3**: Able to assess the need and importance of the issue of IPO.

**CO4**: Able to judge the process of operations in secondary markets and the existence of different regulatory authorities in stock market operations (Level 3)

**CO5**: Able to make assessments and make investment in personal investment in their life. (Level 4)

### 6IDSS1071: MARKETING -FOR THE UNINITIATED

**CO1**: Understand the basic concepts of marketing. (Level 2)

**CO2**: Analyze market segment and target market. (Level 4)

**CO3**: Evaluate the marketing mix to make effective marketing decisions. (Level 6)

**CO4**: Apply the necessary marketing skills. (Level 3)

**CO5**: Analyse the IMC and recent trends. (Level 4)

### NIDSS1011: NCC I

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

**CO2:** To practice a regimented way of life of the armed force in their training and ensure maximum benefits to the students and the society. (L1/L3)

**CO3:** The cadets will employ and engage in practicing disciplined routines such as cleaning and maintaining their line area, organizing security in and around the camp, making part of the purchase committee, organizing the mess and distribution of food, etc. (L5/L6)

**CO4:** The cadets will understand and develop specific skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

### NIDSS1021: NCC II

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

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### NIDSS1031: NCC III

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

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**NIDSS1041: NCC IV**

**CO1:** To understand, apply and practically explore the knowledge of community service and socio-political consciousness they acquired from this paper during camps and field works. (L1/L2)

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**CO4:** The cadets will understand and develop specified skill sets such as problem solving, decision making, critical thinking, team work, etc. to address real life problems and prescribe practical solution; the students will understand the process of decision analysis (L2/L3/L5/L6)

**CCSHS1011: SOCIOLOGY OF GLOBALIZATION AND SUSTAINABLE DEVELOPMENT**

**CO1** Demonstrate understanding of globalization process with emphasis on inter-dependence of communities and societies L1

**CO2** Analyse the critical issues in social development in the given context L2 **CO3** Develop technological interventions for social and community development L3 **CO4** Explain the health and hygiene of the community L2 **CO5** Develop technological interventions for social and community development L3

**4ENCC1241: WIRELESS COMMUNICATION**

| | | |
|---|---|---|
| **CO1** | Explain the basics and types of wireless communication systems being used | L2 |
| **CO2** | Explain the basic concepts of cellular system and the design requirements | L2 |
| **CO3** | Demonstrate the basic principles behind radio resource management techniques such as frequency reuse, channel allocation and handoffs | L2 |
| **CO4** | Interpret knowledge and gain awareness on the technologies used for effective share of spectrum by multiple access techniques i.e. TDMA, CDMA, FDMA etc. | L2 |

| | | |
|---|---|---|
| **CO5** | Summarize the wireless standards being used across the world | L2 |

## 4ENCC1132: IMAGE AND VIDEO PROCESSING

| | | |
|---|---|---|
| CO1 | Understand the sensing, acquisition and storage of digital images | L1 |
| CO2 | Explain Intensity Transformation, Histogram and spatial filtering | L2 |
| CO3 | Demonstrate Different filtering techniques in frequency domain. | L3 |
| CO4 | Interpret Image reconstruction processes. | L2 |

CO5 Extends the Image processing techniques to color images. L3

### 4ENCC1051: IoT and Wireless Sensor Networks

**CO1**. Understand choice and application of IoT & M2M communication protocols. L2

**CO2** Describe Cloud computing and design principles of IoT. L2

**CO3**. Relate to MQTT clients, MQTT server and its programming. L3

**CO4**. Describe the architectures and its communication protocols of WSNs. L3

**CO5.** Identify the uplink and downlink communication protocols associated with specific application of IOT /WSNs L3

### 4ENCE1101: Biomedical Electronics

**CO1.** Introduce the student to the electronic devices and theory of operation in the medical area. L2

**CO2.** Data Interpretation: Learn to design, test, and analyze electronic circuits using oscilloscopes and other electronics test equipment. Apply knowledge of engineering and science to interpret data. Develop an understanding of and develop the skills necessary to communicate findings and interpretations in an effective laboratory report. L3

**CO3.** Electronic circuits for Biomedical Applications: Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits. L4

**CO4.** Work in Multi-disciplinary teams: Learn to work and communicate effectively with peers on multi- disciplinary teams to attain a common goal. L4

**CO5.** Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals. L3

### 4ENCE1111: VIRTUAL INSTRUMENTATION(MOOC)

After studying this course, students will be able to:

CO1. Recognize and describe various aspects of VI. **L2**

CO2. Develop a virtual instrumentation model using the front panel controls & indicators and loops. **L6**

CO3. Analyze and design various array operations using LabVIEW functions. **L3**

CO4. Evaluate the various forms of output representations using graphs, charts and File I/Os. **L5**

### 4ENCE2051: ADVANCED CONTROL SYSTEM

CO1: Apply state variable approach for linear time invariant systems in both the continuous and discrete time systems. **L3**

CO2: Apply state space analysis to analyze, design and test for Controllability and Observability of a given system **L3**

CO3: Design pole assignment and state observer using state feedback. **L6**

CO4: Describe Nonlinearity and develop the describing function for the nonlinearity present to assess the stability of the system. **L5**

CO5: Develop Lyapunov function for the stability analysis of nonlinear systems. **L6**

**4ENCE1121: CAN Protocol and Controller**

1. Understand the CAN protocol and able to know that what features affecting the reliability of the communication system. L2
2. To design and implement the CAN protocol and able to learn the layers of CAN communication system. L3
3. Understand the reliability issues through different types of analysis method. L2
4. Identify the commercial tools for configuring, analyzing and calibrating a CAN communication system. L3

Know the summary of the main transport level and application-level protocols that are based on CAN. L3

**4ENVL1061:CMOS RF Design**

| | | |
|---|---|---|
| **CO1** | Understand the principles of RF design, including transmission line theory, impedance matching, noise analysis, and RF amplifier design. | L3 |
| **CO2** | Understand the characteristics and limitations of CMOS technology and its applications in RF design. | L2 |
| **CO3** | Design and analyze RF circuits using CMOS technology, including low-noise amplifiers, mixers, Design techniques for mixers and frequency converters. | L3 |
| **CO4** | Design and analyze RF circuits using CMOS technology, including voltage-controlled oscillators, Phase-Locked Loops and power amplifiers. | L3 |
| **CO5** | Know the current research trends and challenges in CMOS RF design | L2 |

**4ENVL1071:Mixed Signal Analysis**

| | | |
|---|---|---|
| CO1 | Understanding of mixed signal systems, design process and associated challenges. | L2 |
| CO2 | Understand the concepts of signal processing, including Fourier analysis, time-domain and frequency-domain analysis, filtering, and noise analysis. | L2 |
| CO3 | Analyze the Linear and nonlinear circuits as well as different types of noise. | L3 |
| CO4 | Understand the basic principles of mixed signal systems, including analog-to-digital conversion (ADC), digital-to-analog conversion (DAC), and mixed-signal design methodologies. | L4 |
| CO5 | Analyze and optimize mixed-signal system performance in terms of signal integrity, noise, distortion, and power consumption | L4 |

## 4ENVL1081: VLSI TESING

**: CO1**: Acquire knowledge about fault modeling & collapsing.

**CO2**: Analyse various combinational ATPG techniques.

**CO3**: Evaluate the significance of sequential test pattern generation.

**CO4**: Develop fault simulation techniques & fault diagnosis methods.

**4ENCC1141: Multimedia Communication**

**CO1:** Demonstrate comprehension of multimedia communication principles through assessments.

**CO2**: Apply information representation techniques to encode multimedia data effectively.
**CO3:** Implement compression algorithms to optimize multimedia data storage and transmission.
**CO4:** Analyze distributed multimedia systems' features and resource management strategies.

**CO5:** Configure and troubleshoot multimedia information networks, including LANs and internet protocols.

| **4ENCC1151** | **: MIMO COMMUNICATION** |
|---|---|

**CO1:** Students will acquire a solid comprehension of the fundamental concepts and principles that form the foundation of MIMO Communications L4

**CO2**: Students will develop the ability to identify and analyze complex problems in various domains and apply MIMO techniques to devise effective solutions. L3

**CO3:** Students will be able to select appropriate MIMO Communication algorithms based on problem requirements L3

**CO4:** Students will learn how to design and develop MIMO System models by defining the problem domain. L2

**CO5:** Students will be able to evaluate the performance of MIMO Techniques models using appropriate evaluation metrics and statistical analysis techniques

**4ENCC1161: Vehicular Communication**

**CO1:** Students will acquire a solid comprehension of the fundamental concepts and principles that form the foundation of Vehicular Communication L4

**CO2:** Students will develop the ability to identify Random models, flow and traffic models, behavioural models, trace and survey-based models, joint transport and communication simulations. L3

**CO3:** Students will be able to select appropriate layer among Physical Layer and MAC Layer for Vehicular Communications requirements L3

**CO4:** Students will learn how VANET Routing protocols are developed; and how Standards and Regulations are followed. L2

**CO5:** Students will be able to Develop critical thinking for Emerging VANET Applications L2

**4ENCC1171: Microwave & Antenna**

**CO1** Acquire knowledge on the theory of microwave transmission, microwave generators and L2

**CO2** Demonstrate microwave devices and monolithic microwave integrated circuits L2

**CO3** Compare the fundamental parameters of antenna and wave propagation. L3

**CO4** Identify Dipoles and Thin linear antennas.. L3

**CO5** Identify the working principle of various types of antenna and categorize them according to their applications L2

**4ENCC1121: LTE and 5G Communication**

**CO1:** Understand the fundamental concepts of 4G LTE and its architecture L3

**CO2:** Analyze the role of OFDM's and SC–FDMA access schemes. L3

**CO3:** Explain the evolution of 5G, system concepts, and spectrum challenges L3

**CO4:** Illustrate the 5G functional and physical architecture and its requirements L4

**CO5:** Analyze the security issues and challenges in 5G communication systems. L3

**CPSAE1011: BUSINESS MANAGEMENT FOR ENGINEERS**

| | | |
|---|---|---|
| **CO1** | Apply the concepts related to entrepreneurship issues in business ideas | L3 |
| **CO2** | Explain the factors influencing the practice of management in different contexts | L2 |
| **CO3** | Develop suitable economic strategy regarding common business problems | L3 |
| **CO4** | Analyze the marketing strategy for common engineering business problems | L4 |
| **CO5** | Illustrate the leadership qualities in the operation of a new venture | |

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### NIDSS1021: NCC II

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## CPSHS1021: Business Management For Engineers

**CO1**: Describe basic business concepts and the importance of business management in engineering.(L2)

**CO2**: Analyze business situations using SWOT analysis( L3)

**CO3**: Analyze operational strategies and the processes for shift using Lean and Six Sigma principles.(L3) **CO4**: Interpret financial statements and the cost estimation and break-even analysis (L2) **CO5**: differentiate between leadership styles and demonstrate effective team management. (L3)

## CKSMA1031 - Introduction to Philosophy (IPT)

CO1: Recognize the importance of rationally deducing a question

or a problem. CO2: To develop appreciation towards various

philosophical ideologies.

CO3: To enable the students to form their own philosophy of life

## CKSMA1051 - Introduction to the History and Theories of Knowledge [IHK]

CO1: Students will have basic understanding of Indian and Western theories of Knowledge. (Lv.2)
CO2: Students will be able to distinguish between Indian and Western theories of Knowledge (Lv.4)
CO3: Students will be able to critique systems of knowledge production (Lv.5)

**CKSMA1061 - Introduction to Indian Aesthetics [IIA]**

CO1: Explain the foundational concepts in Indian

Aesthetics (Lv.2) CO2: Compare Indian and Western

theories of Aesthetics.(Lv.4) CO3: Critique Indian

Aesthetic theories.(Lv.5)

CO4: Assess the importance of Aesthetic values in contemporary art on the basis of Indian Aesthetic theories (Lv.5)

**CKSMA1071 - Gender and Society (GSY)**

CO1: Define gender (Lv.1)

CO2: Understand the processes by which gender has been defined throughout

history (Lv.2) CO3: Analyze the role gender plays in society (Lv.4)

CO4: Critique gender-relations and its effect on society (Lv.5)

CO4: Investigate how gender can be reframed to create a more equitable society (Lv.6)

**CKSMA1081 - Philosophy of Money [PHM]**

CO1: Defining the political theory of money put forward by Aristotle, Locke, Fichte, Marx, and Keynes (Lv.1)

CO2: Explaining the historical and political crisis that led to reimagining the role of money vis-à-vis power (Lv.2)

CO3: Analyzing the contemporary changes in conceptions of money (eg: cryptocurrency) (Lv.4)
CO4: Critiquing the role that money plays in democratic societies (Lv.5)

**[CKSAA1033]: Arts and Philosophy (A & P):Introduction to Philosophical Thoughts**

CO1: Examine various philosophical systems and apply the concepts to actual states of affairs. (L4)

CO2: To be able to evaluate the moral acts of individuals belonging to different cultures and societies. (L4)

CO3: Analyze, evaluate, and recognize their psychic inclination towards the specific philosophical thought system. (L6)

**4DISS4021: CAPSTONE PROJECT – BUILD**

| | | |
|---|---|---|
| **CO1** | Compare the project built with other possible existing solutions to come to a conclusion about its feasibility and reliability. | L4 |
| **CO2** | Utilize proper project management techniques and planning methods to produce cost effective projects | L3 |
| **CO3** | Recommend the need to implementing the project with supporting justification and possible areas to improve the same | L5 |
| **CO4** | Compile a clear report that contains the step by step process to building the project that includes all calculations, analysis and fabrication methods involved | L5 |

**CO5** Build the real world implementation of the design that will realize the objectives of the6 prototype/ design

**4DISS3011/21/31: INTERNSHIP**

| | | |
|---|---|---|
| **CO1** | Demonstrate the skills in professional career goals | L2 |
| **CO2** | Administer the insight into a possible career path of interest with organizational structure,<br>roles and responsibilities | L3 |
| **CO3** | Develop professional connections with leadership strategy and skill development | L4 |
| **CO4** | Identify the professions to suit the interest as a result of this experience | L3 |

**CO5** Conquer additional skills that will need to be developed to ensure career readiness such as new technology, developing a broader network, additional coursework L4