SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY

(Department of Electronics and Communication Engineering)

DETAILED SYLLABUS

4- Years in B.Tech. in Electronics and Communication Engineering

ECE/ VLSI Design and Embedded Systems/ AI & ML

GAUTAM BUDDHA UNIVERSITY, GREATER NOIDA

2025-2029

SEMESTER I

Problem Solving Using C			
Course Code	**CS101**	**Course Credits**	**3**
Course Category	**PCC1**	**Course (U/P)**	**U**
Course Year (U/P)	**1U**	**Course Semester**	**1U**
No. of Lectures + Tutorials (Hrs/Week)	**03+00**	**Mid Sem. Exam Hours**	**1.5**
No. of Lectures (L+T)	**45**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	To provide knowledge of primary and derived data types used in C.
2.	To make them understand basic conditional and break statements used in C
3.	To provide a basic understanding of pointers and pointers arithmetic
4.	To enable the students to explore how pre-defined functions are used and also created in a program.
5.	Learn the difference between static and dynamic memory allocation methods and also learn various dynamic memory allocation methods.

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Understand the basic building blocks of C language like tokens, identifiers, constants and variables.
2.	Acquire knowledge of various conditional and loop statements.
3.	Judge which data structure to use among arrays, struct and union depending on the application.
4.	Use pointers and tell the difference between call by value and call by reference.
5.	Use dynamic memory allocation to create arrays, structures and union and also perform various operations on them.

UNIT I: **Introduction to Computers and Programming Concept**

Definition, characteristic, generation of computers, basic components of a computer system, memory, input, output and storage units, high level language and low-level language, Soft- ware: system software, application software, hardware, firmware, Operating System, compiler, interpreter and assembler, linker, loader, debugger, IDE. Introduction to algorithm and flowchart; representation of algorithm using flowchart symbol, pseudo code, basic algorithm de- sign, characteristics of good algorithm, development of algorithm.

UNIT II: Introduction to C Programming Language

Introduction to C programming language, declaring variables, preprocessor statements, arithmetic operators, programming style, keyboard input, relational operators, introduction, feature of C language, concepts, uses, basic program structure, simple data types, variables, constants, operators, comments, control flow statement: if, while, for, do-while, switch.

UNIT III: Data Types and Structures

Bitwise operators, Predefined and User defined data types, arrays, declaration and operations on arrays, searching and sorting on arrays, types of sorting, 2D arrays, passing 2D arrays to functions, structure, member accessing, structure and union, array of structures, functions, declaration and use of functions, parameter passing, recursion.

UNIT IV: Fundamentals of Pointers

Introduction to pointers, pointer notations in C, Declaration and usages of pointers, operations that can be performed on computers, use of pointers in programming exercises, parameter passing in pointers, call by value, call by references, array and characters using pointers, dynamic memory allocation.

UNIT V: File handling in C and ENUM

Introduction to file handling, file operations in C, defining and opening in file, reading a file, closing a file, input output operations on file, counting: characters, tabs, spaces, file opening modes, error handling in input/output operations, Enumerated data types, use of Enum, declaration of Enum.

Text Books

1. Herbert Schildt, *C: The Complete Reference*, McGraw Hill Education, Latest Edition.
2. Brian W. Kernighan and Dennis M. Ritchie, *The C Programming Language* (2nd Edition), Pearson Education, 1988.
3. E. Balagurusamy, Programming in ANSI C, Tata McGraw Hill Education, Latest Edition.
4. Alan R. Feuer, *The C Puzzle Book: Puzzles for the C Programming Language*, Prentice Hall, 1982
5. Peter Van Der Linden, *Expert C Programming: Deep C Secrets*, Dorling Kindersley (India), Latest Edition.

Environmental Studies			
Course Code	**ES101**	**Course Credits**	**4**
Course Category	**BSC2**	**Course (U/P)**	**U**
Course Year (U/P)	**1U**	**Course Semester**	**1U**
No. of Lectures + Tutorials (Hrs/Week)	**03+01**	**Mid Sem. Exam Hours**	**1.5**
No. of Lectures (L+T)	**45+15**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES
To impart knowledge on environment and environmental issues and challenges of local, national, and global significance for achieving environmental security and sustainable living.

COURSE OUTCOMES
At the end of the course, the students should be able to:
To knowledge and awareness so generated will enhance ability of the learners for conservation of environment and natural resources for a healthy planet Earth, and happy living of the present and future generations.

UNIT I: Introduction to Environmental Studies

Multidisciplinary nature of environmental studies; components of the Earth's environment-atmosphere, hydrosphere, lithosphere, and biosphere, Scope and importance; Concept of sustainability and sustainable development.

UNIT II: Ecosystems

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web, and ecological succession. Case studies of the following ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (pond, stream, lake, river, ocean, estuary).

UNIT III: Natural Resources: Renewable and Non--renewable Resources

Land resources and land-use changes; Land degradation, soil erosion and desertification, Deforestation: Causes and impacts due to mining and dam building on environment, forest, biodiversity and tribal population, Water : Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international and inter-state), Heating of Earth and circulation of air; air mass formation and precipitation, Energy resources: Renewable and non-renewable energy resources, use of alternate energy sources, growing energy needs, case studies.

UNIT IV: Biodiversity and Conservation

Levels of biological diversity: genetic, species and ecosystem diversity; Bio-geographic zones of India; Biodiversity patterns and global biodiversity hot spots, India as a mega-biodiversity nation; Endangered and endemic species of India, Threats to biodiversity: Habitat loss, poaching of wildlife, human-wildlife conflicts, biological invasion; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity, Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value.

UNIT V: Environmental Pollution

Environmental pollution: Types, causes, effects and control; Air, water, soil and noise pollution, nuclear hazards and human health risks, Solid waste management: Control measures of urban and industrial wastes, Pollution-related case studies.

UNIT VI: Environmental Policies and Practices

Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture, Environment Laws: Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and Control of Pollution) Act; Wildlife (Protection) Act; Forest (Conservation) Act; International agreements: Montreal and Kyoto protocols, and Convention on Biological Diversity (CBD), Nature reserves, tribal population and rights and human-wildlife conflicts in Indian context.

UNIT VII: Human Communities and the Environment

Human population growth: Impacts on environment, human health and welfare, Carbon foot print, Resettlement and rehabilitation of project-affected persons; case studies, Disaster management : Floods, earthquakes, cyclones and landslides, Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan, Environmental ethics: Role of Indian and other religions and cultures in environmental conservation, Environmental communication and public awareness, case studies (e.g.,CNG vehicles in Delhi).

UNIT VIII: Field Work

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc., Visit to a local polluted site--Urban/Rural/Industrial/Agricultural, Study of common plants, insects, birds, and basic principles of identification. Study of simple ecosystems: pond, river, Delhi Ridge, etc.

Text Books:

Carson, R., 2002, Silent Spring, Houghton Mifflin Harcourt, Boston.

1. Gadgil, M., and Guha, R. 1993. This Fissured Land: An Ecological History of India, University of California Press, California.
2. Gleeson, B. and Low, N. (Eds.) 1999. Global Ethics and Environment, Routledge, London.
3. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Development, Environment and Security. Stockholm Environmental Institute, Oxford University Press, Oxford.
4. Groom, M.J., Meffe, G.K. and Carroll, C.R. 2002 Principles of Conservation Biology, Sinauer Associates, Sunderland.
5. Grumbine, R. E., and Pandit, M.K., 2013. Threats from India's Himalayan dams, Science 339: 36-37.
6. McCully, P., 1996. Rivers No More: The Environmental Effects of Dams, Zed Books, London

English Proficiency			
Course Code	**EN101**	**Course Credits**	**2**
Course Category	**HSMC**	**Course (U/P)**	**U**
Course Year (U/P)	**1U**	**Course Semester**	**1U**
No. of Lectures + Tutorials (Hrs/Week)	**02+00**	**Mid Sem. Exam Hours**	**1.5**
No. of Lectures (L+T)	**30**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES
To impart knowledge on environment and environmental issues and challenges of local, national and global significance for achieving environmental security and sustainable living

COURSE OUTCOMES
At the end of the course the students should be able to:
Demonstrate an informed understanding of environmental conservation and sustainable resource management, applying this awareness to promote ecological well-being and responsible living for current and future generations.

UNIT I: Functional Grammar

Form and Functions; Sentences: Simple, Complex, and Compound, Tense, Mood, an Aspect; Sub-Verb Agreement and Concord; Common Errors Vocabulary Building Inflection and Derivation, Conversions, Idioms and Phrases, Words in Context.

UNIT II: Language Skills (LSRW)

Listening Skills Activity-based. Speaking Skills: Activity-based, Introduction to IPA, Use of Dictionary, Word stress, Reading Skills: Skimming and Scanning, Reading Comprehension, Writing Skills: Paragraph, Précis and Compositions, Note Making and Note Taking, Logical Ordering of Ideas and Contents, Figures of Speech.

UNIT III: Learning Through Thematic Texts

- *My Visions for India* Dr. Abdul Kalam
- *From In an Antique Land* Amitav Ghosh
- *The Gift of Magi* O' Henry
- *Master and Man* Leo N. Tolstoy
- *If* Rudyard Kipling
- *The Solitary Reaper* William Wordsworth

Text Books:

1. *Word for Word*, Pointon & Clark, Oxford University Press
2. Carter. Ronald: McCarthy, Michael (2006). *Cambridge Grammar of English. A Comprehensive Guide*. Cambridge University Press.

3. *An English Pronouncing Dictionary,* London. Dent, rpt in facsimile in Jones (2002). 17th edn, P. Roach. Hartman and J. Setter (eds), Cambridge: CUP, 2006.
4. Redman, Stuart. 2011 English Vocabulary 1 Use: Pre-intermediate and intermediate Cambridge CUP *Cambridge Phrasal Verbs Dictionary* Second edition, Cambridge University Press.

ICT Workshop I			
Course Code	**ICT81**	**Course Credits**	**1**
Course Category	**ESC2**	**Course (U/P)**	**U**
Course Year (U/P)	**1U**	**Course Semester**	**1U**
No. of Labs (Hrs/Week)	**1 (2 Hrs)**	**Mid Sem. Exam Hours**	**-**
Total Number of Labs	**10**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	Enable students to apply the Design Thinking methodology—empathy, ideation, prototyping, and testing—to real-world challenges, with a focus on customer-centric solutions for digital technology and smart systems.
2.	Cultivate students' ability to think critically and analytically by identifying barriers to effective problem solving, recognizing the human factors influencing decisions, and evaluating arguments using logic and evidence-based reasoning.
3.	Encourage students to explore and utilize open-source and freeware tools in CAD, circuit design, programming, and embedded systems via DIY projects, fostering hands-on innovation and real-life application of Engineering skills.

COURSE OUTCOMES	
At the end of the course the students should be able to	
1.	Understand and should be able to apply their learned knowledge in real life applications.
2.	Identify common obstacles to effective problem solving and decision making and recognize the human variable M problem solving and decision making.
3.	Apply concepts to enhancing personal development and organizational performance and explain the key elements of problem solving and decision making, and the barriers associated with them.

In today's increasing complexity of digital technology and modem business, customers am increasingly choosing products and services based on the quality of the experiences they have w. them. To help meet these challenges, an approach known as "Design Thinking, playing a great role in finding meaningful pathways - its process and tools arc increasingly being adopted in Lean Six Sigma processes and in organizational innovation initiatives. Design thinking is a human-centered, iterative problem-solving process of discovery, ideation, and experimentation that employs various design-based techniques to gain insight and yield innovative solutions for virtually any type of organizational or business challenge. A Design Thinking mindset is essential for development of Internet of Things (AT) platform, smart products, and Smart Cities. Industry practitioners of Design Thinking include Apple, Google, Samsung, Libor, Airbnb, IDEO, Nike, Procter 8: Gamble, Singapore Airlines, DBS Bank to name a few.

In this action-oriented workshop-oriented course, students will work in teams (5.6), guided by a facilitator to experience a customer-centric approach A problem solving through re-imagination of the end-to-end customer experience journey. Students will develop skills such as ethnographers, visual thinkers, strategists, and storytellers through a hybrid of workshop discussions and activities. It covers building empathy through ethnographic research, generating ideas, prototyping, and testing new concepts. The goal of this course is that students acquire Design Thinking skills. This is an experiential teaming course where students learn by doing. Nowadays, Design Thinking and its tools are used by product and industrial design firms to ideate products. It is also used to solve so-called “wicked problems" — problems for which

neither question nor the answer is well defined. In addition, students are expected to sharpen their Critical Reasoning and problem-solving skills through an online MOOC on Courses & Critical reasoning is a methodology for using objective and evidence-(rased analysis for evaluation of statements and arguments. It also helps understand the fallacies and barriers that prevent reaching conclusions in a logical and cohesive manner.

Students are encouraged to explore by any Open-Source Software or Freeware software's related to (But not limited to) CAD (Computer-Aided Design), Circuit Design, PCB Design, Programming language, Robotics, Embedded System Development, Documentation) through (do-it-yourself) DIY projects.

List of Experiments (but not limited to):

1. To understand the basic of computer architecture and organization
2. To Understand basic of Network Topologies
3. To Understand and discuss Open-source Embedded board Development and Working
4. To Understand and discuss different Sensors
5. To Understand the Spice/Circuit Software

Text Books

1. Tim Browm Change by Design; Harper Collins (2009)

Problem Solving Using C Lab			
Course Code	**CS183**	**Course Credits**	**1**
Course Category	**LC1**	**Course (U/P)**	**U**
Course Year (U/P)	**1U**	**Course Semester**	**1U**
No. of Labs (Hrs/Week)	**1 (2 Hrs)**	**Mid Sem. Exam Hours**	**-**
Total no. of Labs	**10**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	To introduce students to the basic knowledge of programming fundamentals of C language.
2.	To impart writing skill of C programming to the students and solving problems.
3.	To impart the concepts like looping, array, functions, pointers, file, structure.
4.	Write programs to print output on the screen as well as in the files.
5.	Apply all the concepts that have been covered in the theory course.

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Recognize and understand the syntax and construction of C programming code
2.	Able to design and develop Computer programs, analyzes, and interprets the concept of pointers, declarations, initialization, operations on pointers and their usage.
3.	Able to define data types and use them in simple data processing applications also he/she must be able to use the concept of array of structures.
4.	Students must be able to define union and enumeration user defined data types.
5.	Develop confidence for self-education and ability for life-long learning needed for Computer language.

LIST OF EXPERIMENTS:

1. Write a C program to print your name, age, and address using basic I/O functions.
2. Write a program to perform arithmetic operations (addition, subtraction, multiplication, division, and modulus) on two integers entered by the user.
3. Implement a program to check whether a given number is prime or not using if-else.
4. Write a program using a loop to print the factorial of a number.
5. Write a program to create a simple calculator using switch-case.
6. Use nested for loops to display a multiplication table up to 10 x10.
7. Write a C program to add two 3x3 matrices and display the result.
8. Define a structure for student (roll, name, marks) and write a program to accept and display data for 5 students.
9. Write a function to calculate the average marks using structures and functions.

10. Use malloc () and free () to dynamically allocate memory for storing n integers and compute their sum.
11. Write a program to read a text file and count the number of characters, spaces, tabs, and lines.

Electronics and Electrical Engineering Lab			
Course Code	**ICT85**	**Course Credits**	**1**
Course Category	**LC2**	**Course (U/P)**	**U**
Course Year (U/P)	**1U**	**Course Semester**	**1U**
No. of Labs (Hrs/Week)	**1 (2 Hrs)**	**Mid Sem. Exam Hours**	**-**
Total no. of Labs	**10**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	Familiarize themselves with electronic lab instrumentation, such as CROs, multimeter, function generators, and power supplies.
2.	Apply fundamental electrical principles to verify circuit laws and theorems through hands-on experiments.
3.	Analyse and interpret behaviour of AC circuits, including resonance and power measurements in three-phase systems.
4.	Explore semiconductor device characteristics, including diodes, transistors, and rectifiers, under various biasing conditions.
5.	Implement analog circuit configurations using operational amplifiers for arithmetic operations and transistor configurations for amplification modes.

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Demonstrate effective use of laboratory instruments (CRO, multimeter, function generator, power supply) and identify active/passive components for circuit analysis.
2.	Verify foundational electrical theorems and laws such as KCL, KVL, and Thevenin's Theorem through experimental setups.
3.	Analyse the resonance behaviour of RLC circuits and measure relevant parameters, including resonance frequency and quality factor.
4.	Examine diode-based circuits, including PN junction and Zener characteristics, and determine rectifier performance metrics (V_{rms}, V_{dc}, ripple factor).
5.	Explore operational amplifier configurations and transistor characteristics in CB, CE, and CC modes to understand analog signal processing.

LIST OF EXPERIMENTS:

1. Study of Lab Equipment and Components: CRO, Multi-meter, Function Generator, Power Supply; Active, Passive Components, and Bread Board.
2. Study and verify Kirchhoff's Current Law (KCL) and Krichoff's Voltage Law (KVL).
3. Study and verify Thevenin's Theorem.
4. Study and verify Resonance in series and parallel R-L-C series circuit, and measurement of resonance frequencies.
5. Measurement of power in 3- three-phase circuit by the two-wattmeter method and determination of its power factor for star as well as delta-connected loads.

6. Study the PN junction diode characteristics under Forward & Reverse bias conditions and determine the static and dynamic resistance.
7. Study the Half & Full wave rectifier circuit and determine: V_{rms}, V_{dc}, and ripple factor.
8. Study and plot the characteristics of a Zener diode and its breakdown voltage.
9. Study the applications of Operational Amplifier (LM741) as an Adder and a Subtractor.
10. Study and plot the input and output transistor characteristics in Common Base (CB), Common Emitter (CE), and Common Collector (CC) configurations.

Career Skills			
Course Code	**ICTV1**	**Course Credits**	**2**
Course Category	**VAC1**	**Course (U/P)**	**U**
Course Year (U/P)	**1U**	**Course Semester**	**1U**
No. of Lectures + Tutorials (Hrs/Week)	**02+00**	**Mid Sem. Exam Hours**	**1.5**
No. of Lectures (L+T)	**30**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	To assess a student's overall cognitive ability.
2.	Evaluating their capacity to learn, reason logically.
3.	Solve problems across various domains.

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Apply structured approaches to solve complex problems using logical reasoning and domain-specific knowledge.
2.	Evaluate diverse perspectives and arguments to enhance critical thinking and informed judgment.
3.	Analyse data and scenarios to extract meaningful insights and support evidence-based conclusions.
4.	Demonstrate sound decision-making skills under time constraints and high-pressure environments.

UNIT I: Number System and Work Efficiency

Number System: Divisibility Rules, Remainder Theorem, Unit Digit, Series, Number of Factors, Simplification, LCM and HCF; **Time and Work:** Efficiency, Ratio of Work Done, Work Done in Given Time, Combined Work of Multiple People, Individual Work Rates, and Problems Involving Days and Hours.

UNIT II: Time and Distance

Basic Concepts, Average Speed, Relative Speed, Time and Distance Conversions, Problems Involving Uniform Motion, and Different Scenarios like Trains Crossing Each Other or a Man Walking on a Moving Train.

UNIT III: Percentage, Profit & Loss, Interest

Percentage: Basic Percentage Calculations, Percentage Increase and Decrease, Finding Given Percentage of a Number, Percentage Relationship Between Two Numbers.

Profit and Loss: Cost Price, Selling Price, Marked Price, Profit Percentage, Loss Percentage, and Calculation of Profit or Loss.

Simple Interest: Calculating the Interest Earned on a Principal Amount at a Fixed Rate Over a Specific Period of Time, Understanding the Formula, Converting Time Units, Calculating Simple Interest, Finding the Principal Amount.

Compound Interest: Basic Formula, Different Compounding Frequencies, Comparison with Simple Interest.

UNIT IV: Logical and Analytical Reasoning

Number Series, Alphabet Series, Analogy and Classification, Blood Relations, Direction Sense, Coding-Decoding, Ranking and Order, Syllogisms, Puzzles (Seating Arrangement and Scheduling), Statement and Conclusion, Cause and Effect, and Data Sufficiency.

Text Books

1. Magical Book on Quicker Maths by M. Tyra.
2. Quantitative Aptitude for Competitive Examinations by R.S. Aggarwal.
3. A Modern Approach to Logical Reasoning by R.S. Aggarwal.
4. Advance Maths by Rakesh Yadav.
5. SSC Elementary and Advanced Maths BY Kiran.

Electronics and Electrical Engineering			
Course Code	**ICT01**	**Course Credits**	**4**
Course Category	**ESC1**	**Course (U/P)**	**U**
Course Year (U/P)	**1U**	**Course Semester**	**1U**
No. of Lectures + Tutorials (Hrs/Week)	**03+01**	**Mid Sem. Exam Hours**	**1.5**
No. of Lectures (L+T)	**45+15**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	To equip students with foundational knowledge of electrical laws and circuit theorems for analysing and designing resistive and reactive networks under DC and AC conditions.
2.	To introduce key concepts of electromechanical energy conversion and guide learners in understanding the operation, characteristics, and industrial applications of electrical machines and systems.
3.	To develop conceptual clarity on semiconductor materials, doping mechanisms, and PN junction behaviour to support deeper engagement with device-level electronics.
4.	To enable students to apply diode properties in designing circuits for signal processing, rectification, and voltage control, integrating theoretical knowledge with practical implementation.
5.	To empower learners with the analytical skills to assess and optimize the performance of BJTs, MOSFETs, and Op-Amps in amplifier and feedback configurations within electronic systems.

COURSE OUTCOMES	
At the end of the course, the students should be able to:	
1.	Apply core electrical laws and theorems to analyse and design DC and AC circuits.
2.	Interpret the principles and performance characteristics of electrical machines and power systems, including transformers, motors, and generators.
3.	Demonstrate understanding of semiconductor physics, including carrier movement, doping, and PN junction behaviour.
4.	Design and evaluate diode-based circuits for signal conditioning, rectification, and voltage regulation.
5.	Analyse advanced semiconductor devices such as BJTs, MOSFETs, and Op-Amps in various amplifier configurations and control systems.

UNIT I: Fundamentals of Electrical Engineering (Core Concepts & Circuits)
Basics of Charge, Current, Voltage, Power, Energy& Efficiency, and Ohm's Law: Practical Relevance & Limitations, Kirchhoff's Laws (KCL & KVL): Network Solving Techniques, Superposition, Thevenin, Norton, and Maximum Power Transfer Theorems.

UNIT II: AC Circuits, Power Systems & Electrical Machines
Sinusoidal AC Signals – Representation and Properties (RMS, Average, Peak Values, Form Factor; Introduction to Single-phase and Three-phase Systems, Power Calculation: Active, Reactive, Apparent Power, Phase Angle, Power Factor and its Improvement Techniques; Transformers: Construction, EMF Equation, Efficiency, Applications; Introduction to

Electrical Machines: DC (series and shunt) and AC Machines (single phase &3 phase induction motor, synchronous generator).

UNIT III: Basic Semiconductor Electronics

Metals, Insulators, and Semiconductor materials, Intrinsic and Extrinsic Semiconductors, Doping, Mobility, Drift Current and Diffusion Current, Current conduction in Semiconductors; P-N Junction diode, Characteristics and its operation, P-N Junction resistances and capacitances (depletion and diffusion), Breakdowns in PN junction diodes.

UNIT IV: Diode Applications

Clipping and clamping circuits, Rectifier circuits, Zener diode, and Zener diode as voltage regulators, voltage multipliers, switching behaviour of P-N diode. Tunnel Diodes, Varactor Diode, Light Emitting Diode.

UNIT V: Semiconductor Devices

Bipolar junction transistor (BJT): Introduction and types, construction, and characteristics in CB, CE & CC modes; **Metal Oxide Semiconductor Field Effect Transistor (MOSFET):** Introduction and types, construction, input and transfer characteristics; **Operational Amplifiers (Op-Amps):** Op-Amp, Practical Op-Amp, Open loop and closed loop configurations, Applications of Op-Amps as inverting and non-inverting amplifier.

Text Books

1. P.V. Prasad, S.Sivanagaraju, “Electrical Engineering: Concepts and Applications,” Cengage, 2018
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw-Hill, 2010.
3. Robert L. Boylestad / Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Education.
4. George Kennedy, “Electronic Communication Systems”, McGraw-Hill Publication
5. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.

Applied Mathematics I			
Course Code	**MA111**	**Course Credits**	**4**
Course Category	**BSC1**	**Course (U/P)**	**U**
Course Year (U/P)	**1U**	**Course Semester**	**1U**
No. of Lectures + Tutorials (Hrs/Week)	**03+01**	**Mid Sem. Exam Hours**	**1.5**
No. of Lectures (L+T)	**45+15**	**End Sem. Exam Hours**	**3**

UNIT I: Elementary transformations, linear dependence and independence of vectors, rank of a matrix (echelon & normal form), inverse of a matrix by elementary operations; solution of non-homogeneous and homogeneous systems of linear equations**.**

UNIT II: Linear transformations; eigenvalues and eigenvectors, diagonalization of a matrix; Cayley-Hamilton's theorem (without proof) and its applications.

UNIT III: Successive differentiation, Leibnitz theorem; functions of several variables: limits, continuity and differentiability, partial differentiation; Euler's Theorem for homogeneous functions; composite functions, total derivatives, change of variables; Taylor's and Maclaurin's Series; maxima and minima of functions of two variables.

UNIT IV: Double integration in Cartesian and polar coordinates; evaluation of double integrals by substitution and changing the order of integration; triple integral; applications of multiple integrals to find area as a double integral, volume as a triple integral, and surface area.

Text Books

1. Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", 5th Edition, Narosa Publishing House Pvt. Ltd. 2016
2. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2010.
3. Greenberg M., "Advanced Engineering Mathematics", 2nd Edition, Pearson Education, 1998.
4. Thomas, G. B., Weir, M. D., & Hass, J. (2018). Thomas' calculus: Multivariable (14th ed.). Pearson
5. Apostol, T. M. (1969). Calculus, Volume II: Multivariable calculus and linear algebra, with applications to differential equations and probability (2nd ed.). John Wiley & Sons.

SEMESTER II

Problem Solving using Python			
Course Code	**EC102**	**Course Credits**	**2**
Course Category	**PCC2**	**Course (U/ P)**	**U**
Course Year (U/ P)	**1U**	**Course Semester (U/ P)**	**2U**
No. of Lectures + Tutorials (Hrs/Week)	**02+00**	**Mid Sem. Exam Hours**	**1.5**
Total No. of Lectures (L +T)	**30+00**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	Master the fundamentals of writing Python scripts.
2.	Learn core Python scripting elements such as variables and flow control structures.
3.	Discover how to work with lists and sequence data.
4.	Write Python functions to facilitate code reuse.
5.	Use Python to read and write files.

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Problem solving and programming capability.
2.	Explain basic principles of Python programming language
3.	Implement database and GUI applications.
4.	Implement object-oriented concepts
5.	Define and demonstrate the use of built-in data structures “lists” and “dictionary”

UNIT I: Python Basics, Conditional & Loops

Installation of Python and python Notebook, Python Objects, Number & Booleans, Strings, Operators - Arithmetic, Bitwise, comparison and Assignment operators, Operators Precedence andassociativity. Conditions (If else, if-elif-else), Loops (While, for), Break and Continue statements,Range Functions

UNIT II: String Objects and List Objects

String object basics, String methods, Splitting and Joining Strings, String format functions, listobject basics, list methods, List comprehensions.

UNIT III: Tuples, Set, Dictionaries & Functions

Tuples, Sets, Dictionary Object basics, Dictionary Object methods, Dictionary View Objects.Functions basics, Parameter passing, Iterators

UNIT IV: Oops Concepts & Working with Files

OOPS basic concepts, creating classes and Objects, Inheritance, Multiple Inheritance, working with files, Reading and writing files, Buffered read and write, Other File methods.

UNIT V: Modules, Exception Handling & Database Programming

Using Standard Module, creating new modules, Exceptions Handling with Try-except, Creating, Inserting and retrieving Table, Updating and deleting the data.

Text Books

1. Head First Python 2e: A Brain-Friendly Guide Paperback – Illustrated, 16 by PaulBarry, Oreilly.
2. Python: The Complete Reference Paperback – 20 March 2018 by Martin C.Brown (Author), TMH Publication.
3. Let Us Python by Yashavant Kanetkar, 1 January 2019, BPB publication
4. Python Programming, A modular approach, First Edition, By Pearson Publication by Taneja Sheetal and Kumar Naveen, 26 September 2017.
5. Learning Python: Powerful Object-Oriented Programming, Fifth Edition (Greyscale Indian Edition) Learning Python: Powerful Object-Oriented Programming, Fifth Edition (Greyscale Indian Edition).

Applied Mathematics II			
Course Code	**MA112**	**Course Credits**	**4**
Course Category	**BCS3**	**Course (U/ P)**	**U**
Course Year (U/ P)	**1U**	**Course Semester (U/ P)**	**2U**
No. of Lectures + Tutorials (Hrs/Week)	**03+01**	**Mid Sem. Exam Hours**	**1.5**
Total No. of Lectures (L +T)	**45+15**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	To identify a random variable that describes randomness or an uncertainty in certain realistic situation. It can be either discrete or continuous type.
2.	To learn important probability distributions like: in the discrete case, study of the Binomial and the Poisson Distributions and in the continuous case the Normal Distributions
3.	To build the linear relationship between two variables and also to predict how a dependent variable changes based on adjustments to an independent variable
4.	To interpret the types of sampling, sampling distribution of means and variance, Estimations of statistical parameters
5.	To give comprehensive knowledge of probability theory to make inferences about a population from large and small samples

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Evaluate randomness in certain realistic situation which can be either discrete or continuous type and compute statistical constants of these random variables.
2.	Provide very good insight which is essential for industrial applications by learning probability distributions.
3.	Higher up thinking skills to make objective, data-driven decisions by using correlation and regression.
4.	Assess the importance of sampling distribution of a given statistic of a random sample.
5.	Analyse and interpret statistical inference using samples of a given size which is taken from a population.

UNIT I: Concept of probability, additive and multiplicative law of probability, total and conditional probabilities, Baye's theorem. Definition and properties of random variables, discrete and continuous random variables, probability mass and density functions, distribution functions.

UNIT II: Concepts of bi-variate random variables-Joint, marginal and conditional distributions. Transformations of one and two-dimensional random variables. Mathematical expectation-Definition and its properties. Variance, standard deviation, Covariance. Moment generating function-Definition and their properties.

UNIT III: Discrete Distributions: Binomial, Poisson and geometric distributions with their properties. Continuous distributions- Uniform, Exponential and Normal distributions with their properties.

UNIT IV: Linear Correlation, Correlation Coefficient, Rank Correlation Coefficient, Regression. Central limit theorem.

Text Books

1. Montgomery, Douglas C., and George C. Runger. “Applied Statistics and Probability for Engineers”, Seventh Edition. John Wiley & Sons, 2018.
2. Sheldon Ross M., “Introduction to Probability and Statistics for Engineers and Scientists”, Academic Press, 6thEdtion, 2020.
3. Devore, Jay L. "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage, 2010.
4. Scheaffer, Richard, Madhuri Mulekar, and James McClave. “Probability and Statistics for Engineers”. Nelson Education, 2010.
5. A. M. Mood, Graybill and Boes, “Introduction to the Theory of Statistics”. McGraw Hill, 3rd edition.

Digital Logic Design			
Course Code	**EC104**	**Course Credits**	**4**
Course Category	**ESC3**	**Course (U/ P)**	**U**
Course Year (U/ P)	**1U**	**Course Semester (U/ P)**	**2U**
No. of Lectures + Tutorials (Hrs/Week)	**03+01**	**Mid Sem. Exam Hours**	**1.5**
Total No. of Lectures (L +T)	**45+15**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	To understand basic number systems, codes and logical gates.
2.	To understand the concepts of Boolean algebra.
3.	To understand the use of minimization logic to solve the Boolean logic expressions.
4.	To understand the design of combinational and sequential circuits.
5.	To understand the state reduction methods for Sequential circuits.

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Understand number systems and codes.
2.	Solve Boolean expressions using Minimization methods.
3.	Design the sequential and combinational circuits.
4.	Apply state reduction methods to solve sequential circuits.
5.	Understand the role and working of counters.

UNIT I: Minimization of Logic Functions

Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables, incompletely specified functions (Don't Care terms), Simplifying Max term equations. Quine-McCluskey minimization technique- Quine- McCluskey using don't care terms, Reduced Prime Implicant Tables, Map entered variables.

UNIT II: Combinational Circuits

General approach, Decoders-BCD decoders, Encoders. Digital multiplexers-Using multiplexers as Boolean function generators. Adders and subtractors- Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics.

UNIT III: Sequential Circuits

Basic Bistable Element, Latches, SR Latch, Application of SR Latch, A Switch Debouncer, The S-R Latch, the gated SR Latch, the gated D Latch, The Master-Slave Flip-Flops (Pulse- Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip- Flop, Edge Triggered Flip Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop.

UNIT IV: Applications of Sequential Circuits

Characteristic Equations, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops Design of a Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flop.

UNIT V: Models

Introduction, Mealy and Moore Models, State Machine Notation, Synchronous Sequential Circuit Analysis and Design. Construction of state Diagrams, Counter Design.

Text Books

1. Digital Design by M. Morris Mano, 5th Edition, Pearson Education, 2013.
2. Introduction to Logic Circuits & Logic Design with Verilog by Brock J. LaMeres, 2nd Edition, Springer, 2017.
3. Computer System Architecture by M. Morris Mano, 3rd Edition, Pearson Education, 1993
4. Fundamentals of Logic Design by Charles H. Roth Jr. and Larry L. Kinney, 7th Edition, Cengage Learning, 2013.
5. Fundamentals of Digital Logic and Microcomputer Design by M. Rafiquzzaman, 5th Edition, Wiley, 2005.

Applied Linear Algebra			
Course Code	**EC106**	**Course Credits**	**3**
Course Category	**BCS4**	**Course (U/ P)**	**U**
Course Year (U/ P)	**1U**	**Course Semester (U/ P)**	**2U**
No. of Lectures + Tutorials (Hrs/Week)	**03+00**	**Mid Sem. Exam Hours**	**1.5**
Total No. of Lectures (L +T)	**45+00**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	This course aims at introducing students to the fundamental concepts of linear algebra by starting with linear equations and culminating in abstract vector spaces and linear transformations.
2.	Students should grasp the core concepts of linear algebra, including vector spaces, subspaces, bases, and dimensions.
3.	Understanding linear transformations, their representation by matrices, and their properties (like kernel and range) is crucial.
4.	Students need to learn how to find and utilize eigenvalues and eigenvectors, which are essential for analysing transformations and solving certain types of differential equations.
5.	Students should be able to diagonalize matrices and linear transformations.

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Apply linear algebra concepts to solve a wide range of engineering problems.
2.	Translate real-world scenarios into mathematical models using linear algebra.
3.	Analyse data and systems using linear algebra techniques.
4.	Linear algebra is foundational for many engineering disciplines, and students should be able to apply it within their chosen specialization.
5.	Use software tools to perform computations and visualize results.

UNIT I: Linear Equations and Matrices

Introduction of system of linear equations, Elementary Operations, System in triangular and Echelon form, Existence of solution, Methods of solution- Gaussian elimination and Gauss Jordan methods – inverse matrix - LDU factorization – Applications to electrical networks and cryptography.

UNIT II: Vector Spaces and Subspaces

Vector spaces and subspaces – Linear Independence, Basis and Dimension – Row, Column and Null spaces – Rank and Nullity – Bases for subspaces – Inevitability – Applications in Interpolation and Wronskian.

UNIT III: Linear Transformations

Definition and Examples - properties - The Range and Kernel - Invertible linear transformations — Matrices of linear transformations - Vector space of linear transformations - change of bases - similarity, Application in computer graphics, - change of bases - similarity.

UNIT IV: Inner Product Spaces

Inner products - The lengths and angles of vectors - Matrix representations of inner products - Orthogonal projections - Gram-Schmidt orthogonalization.

UNIT V: Applications of Inner Product Spaces

QR factorization - Singular Value Decomposition - Projection orthogonal projections - relations of fundamental subspaces - Least square solutions - Orthogonal projection matrices.

Text Books

1. Strang, G. (2006). *Linear algebra and its applications* (4th ed.). Brooks/Cole.
2. Lang, Serge. *Introduction to Linear Algebra*. 2nd ed., Springer-Verlag, 1986.
3. Hefferon, Jim. *Linear Algebra*. 3rd ed. 2017.

Engineering Physics			
Course Code	**PH102**	**Course Credits**	**4**
Course Category	**BSC5**	**Course (U/ P)**	**U**
Course Year (U/ P)	**1U**	**Course Semester (U/ P)**	**2U**
No. of Lectures + Tutorials (Hrs/Week)	**03+01**	**Mid Sem. Exam Hours**	**1.5**
Total No. of Lectures (L +T)	**45+15**	**End Sem. Exam Hours**	**3**

UNIT I: Optics Interference

Coherent sources; Conditions for interference; Division of wavefront: Young's double-slit experiment, Fresnel's bi-prism; Division of amplitude: Uniform and wedge-shaped films; Newton's rings method **Diffraction:** Difference between interference and diffraction; Fresnel and Fraunhofer diffractions; Fraunhofer diffraction by single slit and double slit; Diffraction grating and Resolving power. **Polarization:** Polarization of light: Brewster's law and Malus law; Concept of double refraction by uni-axial crystals; Polariods; Nicol prism; Quarter and half wave plate.

UNIT II: Electromagnetic (EM) Theory

Vector algebra; Coordinate systems, Gauss divergence theorem, Stokes theorem; Maxwell's equations: EM wave equations in differential and integral forms; Transverse nature and speed of EM waves; EM energy density and Poynting vector.

UNIT III: Relativity

Frame of reference; Special theory of relativity; Lorentz transformation; Length contraction and time dilation; Twin paradox; Doppler's effect; Mass and energy equivalence; Massless particles.

UNIT IV: Quantum Mechanics

Origin of quantum theory; Photo-electric effect; Compton Effect; Dual nature of light; de-Broglie waves; Davisson Germer experiment; Phase and group velocities; Uncertainty principle; Quantum mechanical wave function; Schrodinger wave equation; Particle in a box (1D); Tunnel effect (Qualitative).

UNIT V: Solid State Physics

Brief discussion of solids, Crystals, and bonds; Band theory of solids; X-ray diffraction (Bragg's law); **Lasers**: Introduction to Laser (He-Ne laser and Ruby laser); **Nanotechnology:** Properties of nanoparticles; Carbon nanotubes; Applications

Text Books

1. H. K. Malik & A. K. Singh, Engineering Physics, Tata McGraw Hill Education Pvt. Ltd.
2. Satya Prakash & V. Saluja, Engineering Physics, Pragati Prakashan.
3. D. J. Griffiths, Introduction to Electrodynamics, PHI Learning Pvt. Ltd.
4. Arthur Beiser, Concepts of Modern Physics, Tata McGraw-Hill Edition.
5. G. Aruldhas, Engineering Physics, PHI Learning Pvt. Ltd.

Digital Logic Design Lab			
Course Code	**EC180**	**Course Credits**	**1**
Course Category	**ESC4**	**Course (U/ P)**	**U**
Course Year (U/ P)	**1U**	**Course Semester (U/ P)**	**2U**
No. of Labs (Hrs/Week)	**1 (2 Hrs)**	**Mid Sem. Exam Hours**	**-**
Total No. of Labs	**10**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	Gaining practical experience with the functionalities of various digital ICs.
2.	Learning to design and implement Boolean expressions using logic gates and ICs.
3.	Designing and realizing circuits like adders, subtractors, multiplexers, and decoders.
4.	Designing and implementing circuits like flip-flops, counters, and shift registers.
5.	Analysing the behaviour of digital circuits and verifying their functionality through truth tables and other methods.

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Students will develop practical skills in designing, implementing, and testing digital circuits, which are essential for various engineering fields.
2.	The lab experience will enhance problem-solving skills by allowing students to design solutions for specific digital logic problems.
3.	Students will be able to design and implement various combinational and sequential logic circuits.
4.	Students will gain hands-on experience with digital ICs, breadboards, and other lab equipment, fostering a strong understanding of hardware implementation.
5.	The lab will solidify theoretical concepts by providing practical experience in building and testing digital systems, leading to a deeper understanding of digital logic.

List of Experiments

1. To verify the De-Morgan's theorems using NAND/NOR gates.
2. To design the full adder and half adder using AND, OR and X- OR gates.
3. To implement the logic circuits using decoder.
4. To implement the logic circuits using multiplexer.
5. To design parity generator and checker circuits.
6. To design and implement RS FLIP FLOP using basic latches.
7. Realization and testing of basic logic gates using discrete components.
8. Design 4-bit adder using IC 74283.
9. Design multiplexer using logic gates.
10. D-flip-flop using IC 7474, and verify D-flipflop work as toggle.

11. JK flip-flop using IC 7473.
12. Design T flipflop using JK flipflop.
13. Design 3-bit shift register using D-flip-flop.
14. Realization of 2-bit counter using IC 7473.
15. Realization of 3-bit counter using IC 7474.
16. Realization and testing of CMOS IC characteristics.
17. Realization and testing of TTL IC characteristics.
18. Realization and testing of RAM circuit using IC 7489.

Problem Solving Using Python Lab			
Course Code	**EC182**	**Course Credits**	**3**
Course Category	**LC3**	**Course (U/ P)**	**U**
Course Year (U/ P)	**1U**	**Course Semester (U/ P)**	**2U**
No. of Labs (Hrs/Week)	**1 (2 Hrs)**	**Mid Sem. Exam Hours**	**-**
Total No. of Labs	**10**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	To introduce students to use of Python programming to solve data analytics problems
2.	To elaborate students to statistical analysis using Python programming
3.	To describe various libraries required for data analytics
4.	To elaborate statistical analysis using Python
5.	To study special libraries in Python such as Numpy and Scipy

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Improve problem solving and programming capability.
2.	Learn data analytics through python programming.
3.	Underline the use of package.
4.	Write simple Python programs for solving problems.
5.	Decompose a Python program into functions, lists etc.

List of Experiments

1. To print the largest/smallest of two numbers
2. To read two numbers x and n and print x^n(first write with the use of operator and then write with the help of inbuilt function.
3. To input the value of x and n and print the sum of the series:a. $1 + x + x^2 + x^4 + \cdots + x^n$
4. Write a program to compute distance between two points taking input from the user (PythagoreanTheorem)
5. Write a program to count the numbers of characters in the string and store them in a dictionary datastructure
6. To print factorial of a number with and without using recursion
7. To tell the frequency of the most common word in a file or a given string
8. Write a function to find all duplicates in the list.
9. Write a program to perform addition and multiplication of two square matrices
10. To read from a text file and print each word separated by # symbol, example #vipin # rai

Engineering Physics Lab			
Course Code	**PH104**	**Course Credits**	**1**
Course Category	**LC4**	**Course (U/ P)**	**U**
Course Year (U/ P)	**1U**	**Course Semester (U/ P)**	**2U**
No. of Labs (Hrs/Week)	**1 (2 Hrs)**	**Mid Sem. Exam Hours**	**-**
Total No. of Labs	**10**	**End Sem. Exam Hours**	**3**

List of Experiment

1. Measurement of basic constants: Length, Weight & Time.

2. To Study of force acting on a current carrying conductor in a magnetic field and verify the Lorentz force $F = IBL\,Sin\,\theta$.

3. To study the magnetic field variation of paired coils in a Helmholtz arrangement.

4. To study Interference and diffraction of Light using slits.

5. To calculate the wavelength of sodium light using Fresnel's Bi-prism.

6. To study the interference of light by Fresnel's Bi-prism and find the fringe width. (using laser source)

7. To determine the wavelength of sodium light by Newton's Rings.

8. To determine the Cauchy's constants using Prism and Spectrometer.

9. To find wavelength of Mercury light source by using Plane Transmission Diffraction Grating.

10. To study the Polarization of light and verify Malus's Law.

11. Study of Photoelectric effect and calculation of Planck's Constant.

12. To determine the energy band gap of a given semiconductor material using four Probe method.

13. To find the e/m ratio of electron by Thomson's method.

14. To determine the fill factor of Solar Cell.

15. To determine the specific rotation of sugar using half shade polarimeter.

16. Study of Coupled Pendulum.

Career Skills Lab			
Course Code	**ICTV2**	**Course Credits**	**1**
Course Category	**VACII**	**Course (U/ P)**	**U**
Course Year (U/ P)	**1U**	**Course Semester (U/ P)**	**2U**
No. of Labs (Hrs/Week)	**1 (2 Hrs)**	**Mid Sem. Exam Hours**	**-**
Total No. of Labs	**10**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	To improve students' communication, presentation, and interpersonal skills.
2.	To develop critical thinking, leadership, and team collaboration through interactive sessions.
3.	To expose students to entrepreneurial thinking and startup ecosystems.
4.	To enhance self-awareness, confidence, and time management skills.
5.	To prepare students for interviews, group discussions, and real-world workplace challenges.

COURSE OUTCOMES	
At the end of the course the students should be able to:	
1.	Communicate effectively in group discussions and public speaking settings.
2.	Demonstrate improved soft skills including confidence, articulation, and critical thinking.
3.	Exhibit professional behaviour in mock interviews and workplace simulations.
4.	To enhance self-awareness, confidence, and time management skills.
5.	To prepare students for interviews, group discussions, and real-world workplace challenges.

List of Experiment

1. Conduct a group discussion session on a general or technical topic to assess communication clarity, confidence, and listening skills.
2. Organize an extempore round where each student speaks for one minute on a surprise topic to improve spontaneous thinking.
3. Conduct a mock HR interview round simulating campus recruitment conditions with personalized verbal feedback.
4. Arrange a session on body language, posture, and presentation skills using mirror practice and peer review.
5. Provide hands-on guidance to create and refine professional resumes and LinkedIn profiles.
6. Conduct a team-building exercise such as a task-based game to encourage leadership, coordination, and time management.
7. Introduce students to startup culture through a short seminar or documentary on entrepreneurship and innovation.

8. Facilitate an elevator pitch activity where each student presents a business idea in under two minutes.
9. Conduct a second round of mock interviews combining technical and HR questions based on student resumes.
10. Organize a second group discussion round to evaluate growth in communication, confidence, and articulation, followed by a detailed feedback session.
11. Conduct a professional email writing and formal communication workshop using real-life workplace scenarios.
12. Arrange a debate session on a trending topic to develop logical reasoning, articulation, and critical thinking.

SEMESTER III

Electronic Devices and Circuits			
Course Code	**ECE 201**	**Course Credits**	**3**
Course Category	**EC/DSC**	**Course (U/P)**	**U**
Course Year (U/P)	**2U**	**Course Semester**	**3U**
No. of Lectures + Tutorials (Hrs/Week)	**03+00**	**Mid Sem. Exam Hours**	**1.5**
No. of Lectures (L+T)	**45**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	Explain the physical operation, characteristics, and modelling assumptions of diodes, BJTs, JFETs, and MOSFETs.
2.	Apply biasing principles and small-signal models to determine the operating conditions of transistor circuits.
3.	Analyze multistage, tuned, and high-frequency amplifiers in terms of gain, impedance, bandwidth, and stability.
4.	Evaluate the influence of negative feedback and oscillator criteria on circuit performance and waveform generation.
5.	Design transistor-based amplifier, oscillator, and power-amplifier stages to satisfy specified electrical requirements.

COURSE OUTCOMES	
At the end of the course, the students should be able to:	
CO1	Describe the construction, operating regions, and equivalent models of major semiconductor devices.
CO2	Calculate Q-points and small-signal parameters for BJT- and FET-based amplifier configurations.
CO3	Compare amplifier coupling methods and assess the frequency response of multistage and tuned circuits.
CO4	Examine feedback topologies and determine the conditions required for stable sinusoidal oscillation.
CO5	Develop and appraise power-amplifier and oscillator circuits for gain, efficiency, distortion, and thermal performance.

UNIT I: Diodes

Review of semiconductors, p-n junction, forward and reverse biased junction, equivalent circuits; Applications - rectifier, clipper, clamper, voltage doubler, transfer characteristics; Zener diode; Power supply, filter, Zener regulator; Special purpose diodes.

Voltage Regulators

Zener voltage regulator, emitter follower regulator, series voltage regulator, IC regulator

Special purpose electronic devices: Principal of operation and Characteristics of Tunnel Diode with the help of energy band diagrams, Varactor Diode, SCR and photo diode

UNIT II: Bipolar Junction transistors

NPN and PNP transistors, input and output characteristics - cut-off, saturation and active regions; CE, CB and CC configurations, small signal model, BJT as amplifier; Biasing circuits; Stability analysis, DC and AC equivalent circuits. Small-signal Analysis:
h-parameter model of BJT, analysis of BJT amplifier circuits, cascaded amplifiers, frequency response of RC coupled amplifier.

UNIT III: Power Amplifiers

DC and AC load lines; Class A operation; Class B operation, push-pull circuit; Biasing circuits, Class C amplifier; Current source, complementary-symmetry amplifiers; distortion, thermal considerations and power dissipation of power amplifiers.

Field Effect Transistors

Operating characteristic, Trans-conductance, JFET as amplifier, biasing circuits; Applications

UNIT IV: Active Filters & Oscillators

Advantages of active filters, classification of filters, response characteristics of butter worth, Chebyshev, causal filters, first order and second order butter worth filters- low pass and high pass types. Band pass & band reject filters. Oscillator principles, types of oscillators - phase shift, Wein bridge & quadrature, square wave, triangular wave and saw tooth wave generators, voltage-controlled oscillator.

Barkhuizen criterion, damped oscillation in LC circuits; Harmonic oscillators- RC phase shift oscillator, transistor phase shift oscillator; Tuned oscillator- Colpitts oscillator, Hartley oscillator; Crystal oscillator

UNIT V: Operational Amplifiers:

The basic operational amplifier & its characteristics, Block diagram representation of OP-AMP, Power supply requirements of an OP-AMP, Evolution of OP-AMP

Text Books

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson.
2. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, Oxford University Press.
3. S. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, McGraw Hill Education.

Reference Books

1. Behzad Razavi, Fundamentals of Microelectronics, Wiley.
2. Richard C. Jaeger and Travis N. Blalock, Microelectronic Circuit Design, McGraw Hill Education.
3. Jacob Millman and Christos C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, McGraw Hill.

Electromagnetic Waves			
Course Code	**ECE 203**	**Course Credits**	**4**
Course Category	**EC/DSC**	**Course (U/P)**	**U**
Course Year (U/P)	**2U**	**Course Semester**	**3U**
No. of Lectures + Tutorials (Hrs/Week)	**03+01**	**Mid Sem. Exam Hours**	**1.5**
No. of Lectures (L+T)	**45 + 15**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	Explain vector-calculus concepts and coordinate systems used to represent electromagnetic fields.
2.	Apply electrostatic and magnetostatic laws to field distributions, material interfaces, capacitance, and inductance problems.
3.	Analyze time-varying fields by formulating Maxwell's equations in integral and differential forms.
4.	Evaluate transmission-line behaviour, impedance matching, reflection, and standing-wave phenomena.
5.	Predict electromagnetic-wave propagation, polarization, reflection, transmission, and dispersion in different media.

COURSE OUTCOMES	
At the end of the course, the students should be able to:	
CO1	Transform vectors and field quantities among rectangular, cylindrical, and spherical coordinate systems.
CO2	Solve electrostatic and magnetostatic boundary-value problems using Coulomb's law, Gauss's law, Biot-Savart law, and Ampere's law.
CO3	Derive field relationships from Maxwell's equations and interpret displacement current, energy flow, and boundary conditions.
CO4	Determine transmission-line parameters, reflection coefficient, standing-wave ratio, and matching solutions using analytical methods and the Smith chart.
CO5	Assess plane-wave propagation at material interfaces and quantify polarization, skin effect, power flow, and dispersive effects.

UNIT I: Vector Analysis and Electrostatics

Vector Analysis: Vector algebra, dot and cross products, coordinate systems, relations among rectangular, cylindrical and spherical coordinate systems, and differential line, surface and volume elements in different coordinate systems. Electrostatics: Coulomb’s law, electric-field intensity, fields due to different charge distributions, electric-flux density, Gauss’s law, divergence theorem, electric potential, relation between E and V, Maxwell’s equations for electrostatic fields, energy density, convection and conduction currents, continuity equation, dielectric materials and boundary conditions, capacitance of parallel-plate, coaxial and spherical capacitors, and Poisson’s and Laplace’s equations.

UNIT II: Magnetostatics and Maxwell’s Equations for Time-Varying Fields

Magnetostatics: Biot-Savart law, Ampere’s circuital law, magnetic-flux density, curl, Stokes’ theorem, Maxwell’s equations for static electromagnetic fields, magnetic scalar and vector potentials, forces due to magnetic fields, Ampere’s force law, inductance and magnetic

energy. Time-Varying Fields: Faraday's law and emf, displacement-current density, Maxwell's equations in integral and differential forms, and retarded potential.

UNIT III: Transmission Lines
Characteristic impedance and propagation constant; general solution of the transmission line; standard voltage and current forms for a line terminated by an impedance; input impedance of a lossless line; reflection coefficient, wavelength and velocity of propagation; distortionless transmission line; standing-wave ratio; quarter-wave line and impedance matching; single- and double-stub matching; Smith chart and its applications; conversion between impedance and reflection coefficient.

UNIT IV: Electromagnetic Waves
Wave propagation in free space, conducting media and perfect dielectric media; skin effect; Poynting vector and Poynting theorem; and wave polarization.

UNIT V: Plane-Wave Reflection and Dispersion
Reflection of waves at normal incidence and at multiple interfaces; wave propagation in a general direction; reflection at oblique incidence; Brewster angle; total reflection and transmission of obliquely incident waves; wave propagation and pulse broadening in dispersive media.

Text Books

1. William H. Hayt Jr. and John A. Buck, Engineering Electromagnetics, McGraw Hill Education.
2. Matthew N. O. Sadiku, Elements of Electromagnetics, Oxford University Press.
3. Simon Ramo, John R. Whinnery, and Theodore Van Duzer, Fields and Waves in Communication Electronics, Wiley.

Reference Books

1. David K. Cheng, Field and Wave Electromagnetics, Pearson.
2. John D. Kraus and Daniel A. Fleisch, Electromagnetics with Applications, McGraw Hill Education.
3. R. K. Shevgaonkar, Electromagnetic Waves, McGraw Hill Education.

Signals and Systems			
Course Code	**ECE 205**	**Course Credits**	**4**
Course Category	**EC/DSC**	**Course (U/P)**	**U**
Course Year (U/P)	**2U**	**Course Semester**	**3U**
No. of Lectures + Tutorials (Hrs/Week)	**03+01**	**Mid Sem. Exam Hours**	**1.5**
No. of Lectures (L+T)	**45 + 15**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	Classify continuous-time and discrete-time signals and systems according to their fundamental properties.
2.	Apply convolution and differential- or difference-equation models to determine linear time-invariant system responses.
3.	Analyze periodic and aperiodic signals through Fourier-series and Fourier-transform representations.
4.	Evaluate continuous-time systems in the complex-frequency domain using Laplace-transform techniques.
5.	Formulate sampled-data and discrete-time system solutions using the sampling theorem and Z-transform.

COURSE OUTCOMES	
At the end of the course, the students should be able to:	
CO1	Identify signal transformations and distinguish systems as linear, time invariant, causal, memoryless, or stable.
CO2	Compute the output of continuous-time and discrete-time LTI systems using convolution and system equations.
CO3	Construct spectral representations and interpret magnitude, phase, bandwidth, and filtering characteristics.
CO4	Solve continuous-time system problems using Laplace transforms, regions of convergence, and block-diagram models.
CO5	Analyze sampling, reconstruction, discrete-time processing, and difference equations using Z-transform methods.

UNIT I: Signals and Systems
Continuous-time and discrete-time signals; transformations of the independent variable; exponential and sinusoidal signals; continuous-time and discrete-time LTI systems and their properties; convolution sum and convolution integral; LTI systems described by differential and difference equations.

UNIT II: Fourier Series and Fourier Transform
Response of LTI systems to complex exponentials; Fourier-series representation of continuous-time periodic signals and its properties; continuous-time and discrete-time Fourier transforms and their properties; systems characterized by linear constant-coefficient differential and difference equations.

UNIT III: Time and Frequency Characterization of Signals and Systems
Magnitude-phase representation of the Fourier transform; magnitude-phase representation of the frequency response of LTI systems; time-domain properties of ideal frequency-

selective filters; time- and frequency-domain aspects of non-ideal filters; first-order and second-order continuous-time and discrete-time systems.

UNIT IV: Laplace Transform
Laplace transform, region of convergence, inverse Laplace transform, analysis and characterization of LTI systems, block-diagram representation, and unilateral Laplace transform.

UNIT V: Sampling and Z-Transform
Signal representation by samples, sampling theorem, impulse-train sampling, sampling of discrete-time signals, discrete-time processing of continuous-time signals, Z-transform, region of convergence, inverse Z-transform, analysis and characterization of LTI systems, block-diagram representation, and unilateral Z-transform.

Text Books

1. Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab, Signals and Systems, Pearson.
2. B. P. Lathi, Linear Systems and Signals, Oxford University Press.
3. Michael J. Roberts, Fundamentals of Signals and Systems, McGraw Hill Education.

Reference Books

1. Simon Haykin and Barry Van Veen, Signals and Systems, Wiley.
2. Hwei P. Hsu, Signals and Systems, Schaum's Outline Series, McGraw Hill Education.
3. Alan V. Oppenheim and Ronald W. Schafer, Discrete-Time Signal Processing, Pearson.

Network Theory			
Course Code	**ECE 207**	**Course Credits**	**4**
Course Category	**EC/DSC**	**Course (U/P)**	**U**
Course Year (U/P)	**2U**	**Course Semester**	**3U**
No. of Lectures + Tutorials (Hrs/Week)	**03+01**	**Mid Sem. Exam Hours**	**1.5**
No. of Lectures (L+T)	**45 +15**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	Explain circuit variables, source models, graph-theoretic representations, and fundamental network laws.
2.	Apply nodal, mesh, and network-theorem techniques to solve linear DC and AC circuits.
3.	Analyze interconnected two-port networks using impedance, admittance, hybrid, and transmission parameters.
4.	Evaluate network functions through poles, zeros, realizability conditions, and time- and frequency-domain behaviour.
5.	Synthesize passive RL, RC, and filter networks using Foster, Cauer, constant-k, and m-derived forms.

COURSE OUTCOMES	
At the end of the course, the students should be able to:	
CO1	Formulate circuit equations from Kirchhoff's laws and network graphs for independent and dependent-source networks.
CO2	Solve linear networks using nodal analysis, mesh analysis, and appropriate network theorems.
CO3	Convert between two-port parameter sets and determine the response of cascaded, series, and parallel interconnections.
CO4	Interpret network functions, poles, zeros, stability restrictions, and realizability conditions for passive networks.
CO5	Design elementary network realizations and low-pass or high-pass filter sections to meet specified characteristics.

UNIT I: Circuit Concepts and AC Network Theorems
Circuit Concepts: Independent and dependent sources; signals and waveforms; periodic and singularity voltages; step, ramp, impulse and doublet; loop currents and loop equations; node voltages and node equations. AC Network Theorems: Superposition, Thevenin's, Norton's, maximum power transfer, reciprocity, Millman's, compensation and Tellegen's theorems.

UNIT II: Graph Theory
Graph of a network; definitions; tree, co-tree and link; basic loop and basic cut-set; incidence, cut-set and tie-set matrices; duality; loop and node methods of analysis.

UNIT III: Two-Port Networks
Characterization of LTI two-port networks; Z, Y, ABCD and h-parameters; reciprocity and symmetry; interrelationships among parameters; interconnections of two-port networks; ladder and lattice networks; T and π representations.

UNIT IV: Network Synthesis

Network functions; impedance and admittance functions; transfer functions; relationship between transfer and impulse response; poles and zeros and their restrictions; network functions for two-terminal-pair networks; sinusoidal networks in terms of poles and zeros; realizability conditions for impedance synthesis of RL and RC circuits; synthesis techniques for two-terminal networks; Foster and Cauer forms.

UNIT V: Filter Synthesis

Classification of filters; characteristic impedance and propagation constant of purely reactive networks; ladder networks; T-section, π-section and terminating half-section; pass bands and stop bands; design of constant-k and m-derived filters; composite filters.

Text Books

1. M. E. Van Valkenburg, Network Analysis, Pearson.
2. A. Sudhakar and S. P. Shyammohan, Circuits and Networks: Analysis and Synthesis, McGraw Hill Education.
3. D. Roy Choudhury, Networks and Systems, New Age International.

Reference Books

1. Charles K. Alexander and Matthew N. O. Sadiku, Fundamentals of Electric Circuits, McGraw Hill Education.
2. William H. Hayt Jr., Jack E. Kemmerly, and Steven M. Durbin, Engineering Circuit Analysis, McGraw Hill Education.
3. A. Chakrabarti, Circuit Theory: Analysis and Synthesis, Dhanpat Rai Publishing.

Electronic Devices Lab			
Course Code	**ECE 281**	**Course Credits**	**1**
Course Category	**EC/DSC**	**Course (U/P)**	**U**
Course Year (U/P)	**2U**	**Course Semester**	**3U**
No. of Lab (Hrs/Week)	**1(2 Hrs)**	**Mid Sem. Exam Hours**	**-**
No. of Lab Sessions (Sem.)	**10**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	Demonstrate safe and accurate use of laboratory instruments for observing and measuring electronic-circuit variables.
2.	Apply device-characterization procedures to obtain the operating parameters of diodes, BJTs, and FETs.
3.	Construct and troubleshoot biasing, amplifier, feedback, and oscillator circuits on practical hardware or simulation platforms.
4.	Analyze experimental waveforms and frequency-response data to relate measured behaviour to circuit theory.
5.	Evaluate circuit performance and document results using systematic calculations, graphs, and error analysis.

COURSE OUTCOMES	
At the end of the course, the students should be able to:	
CO1	Operate multimeters, function generators, oscilloscopes, and regulated power supplies in accordance with laboratory practice.
CO2	Measure device characteristics and extract parameters such as h-parameters, gain, impedance, and operating point.
CO3	Assemble and test BJT, FET, Darlington, multistage, and tuned-amplifier circuits.
CO4	Interpret the effects of feedback and component variation on bandwidth, stability, and oscillator frequency.
CO5	Validate experimental results against theoretical predictions and prepare technically structured laboratory reports.

List Of Experiments:

1. Verify the configuration of various biasing techniques for BJTs.
2. Determine voltage gain, output impedance and output power of a Darlington-pair compound amplifier.
3. Determine h-parameters of a PNP transistor in common-emitter mode.
4. Determine the frequency response of an IFT amplifier.
5. Determine voltage gain and plot the frequency response of a FET amplifier in common-source mode.
6. Study the effect of negative feedback on voltage gain and bandwidth in a two-stage amplifier.
7. Design and verify Amplifier class A, B, AB by using BJT.

8. Determine the frequency of a Hartley oscillator with changes in the tank-circuit capacitor.
9. Determine the frequency and waveform of a Colpitts oscillator.
10. Determine the frequency and waveform of a crystal oscillator.
11. Determine the frequency and waveform of a phase-shift oscillator.
12. Determine voltage gain and plot the frequency response of single-stage and two-stage RC-coupled and direct-coupled amplifiers.

Network Theory Lab			
Course Code	**ECE 283**	**Course Credits**	**1**
Course Category	**EC/DSC**	**Course (U/P)**	**U**
Course Year (U/P)	**2U**	**Course Semester**	**3U**
No. of Lab (Hrs/Week)	**1 (2 Hrs)**	**Mid Sem. Exam Hours**	**-**
No. of Lab Sessions (Sem.)	**10**	**End Sem. Exam Hours**	**3**

COURSE OBJECTIVES	
1.	Demonstrate correct selection and use of instruments for measuring voltage, current, impedance, phase, and frequency.
2.	Apply experimental procedures to verify circuit laws and classical network theorems in DC and AC networks.
3.	Construct RC, RL, and RLC circuits to investigate transient response, resonance, and frequency-dependent behaviour.
4.	Analyze two-port networks through measured Z, Y, and ABCD parameters and practical interconnections.
5.	Evaluate filter and network performance by comparing observed data with analytical predictions and accepted tolerances.

COURSE OUTCOMES	
At the end of the course, the students should be able to:	
CO1	Configure laboratory sources and instruments to acquire reliable measurements from electrical networks.
CO2	Verify Kirchhoff's laws and Thevenin's, Norton's, superposition, reciprocity, Tellegen's, and maximum-power-transfer theorems.
CO3	Determine transient constants, resonant frequency, bandwidth, and steady-state response of first- and second-order circuits.
CO4	Extract two-port parameters and assess loading effects in series, parallel, and cascade connections.
CO5	Design and test constant-k low-pass and high-pass filter sections and report deviations between theory and experiment.

List Of Experiments:

1. Implement and verify the maximum power transfer and superposition theorems in AC circuits.
2. Implement and verify Thevenin’s and Norton’s theorems in AC circuits.
3. Implement and verify Tellegen’s theorem and reciprocity theorem.
4. Design and test transient response in RC/RL and RLC circuits.
5. Calculate Z, Y and ABCD parameters of a given two-port network.
6. Implement and verify the transfer function of a two-port network.
7. Calculate image and characteristic impedances in T and π networks.
8. Implement and verify series, parallel and cascade interconnections and study the effect of loading on two-port networks.
9. Design and implement constant-k low-pass and high-pass filters in T-sections.