First Year Curriculum

Admission Year 2026-27

Bachelor of Technology
EC (VLSI Design and Technology)

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

Semester 1

a. **Course Name:** Foundations of Digital Design and Its Applications
b. **Course Code:** 03019701PC01
c. **Prerequisite:** Number System
d. **Course Learning Outcomes:**

CLO 1	Apply Boolean algebra and Karnaugh Map techniques for simplification and optimization of combinational logic circuits.
CLO 2	Design combinational circuits such as adders, subtractors, multiplexers, decoders, encoders, and comparators for practical applications.
CLO 3	Analyze the operation of sequential circuits including flip-flops, counters, and shift registers used in digital systems.
CLO 4	Develop basic digital design solutions using hardware description concepts/simulation tools for real-world engineering applications.
CLO 5	Demonstrate problem-solving skills and understanding of digital design applications in communication, embedded systems, and computing systems.

e. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
4	**0**	**0**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

f. **Course Content:**

Sr.	**Topics**	**Weightage %**	**Teaching hours**
1	**Module 1 :** Fundamentals of Digital Logic Binary number system and Boolean algebra Logic gates: AND, OR, NOT, NAND, NOR, XOR, XNOR Boolean expressions and simplification (K-map, Quine–McCluskey) Truth tables and combinational logic circuits Parity generator & checker	**20**	**12**
2	**Module 2:** Introduction to Combinational Circuits Designing of MSI Devices: 4-Bit Binary Adder (Serial, Parallel) and Subtractor Designing and analysing 4-bit binary adders (serial and parallel) 4-bit binary subtractors and their working principles	**20**	**8**
3	**Module 3:** Code Conversion Circuits BCD to Gray Code and Gray Code to BCD Converter: Efficient conversion between Binary Coded Decimal and Gray Code for error correction and processing in communication systems.Excess-3 Code Converters: Conversion circuits used in Decimal-to-Binary coded decimal and vice versa.	**25**	**15**
4	**Module 4:** Magnitude Comparators, Decoder/Encoder, and Multiplexers4.1 Magnitude Comparator and Its Applications Designing magnitude comparators Applications in sorting, decision-making, and other digital systems 4.2 Decoder/Encoder, Application of Decoder/Encoder Design and working of decoders and encoders	**25**	**12**

	Applications of decoders and encoders in memory addressing, data encoding, and communication 4.3 Multiplexer/De-Multiplexer, Application of Multiplexer/De-Multiplexer Design of multiplexers and de-multiplexers Practical applications of MUX/DEMUX in data routing, control systems, and communication		
5	**Module 5:** Tri-state Buffer and Propagation Delay5.1 Tri-state Buffer and Its Applications Working and design of tri-state buffers Applications in bus systems, data transfer, and signal isolation 5.2 Propagation Delay for Combinational Circuits Understanding propagation delay in combinational logic circuits Impact of propagation delay on circuit performance and optimization techniques	**15**	**7**

g. Text Book and Reference Book:

1. Modern Digital Electronics By R. P. Jain | Tata McGraw-Hill Education
2. **Digital Design** By M. Morris Man | Prentice Hall of India Pvt. Ltd | 2003
3. Digital Principles and Applications By Albert Paul Malvino , Donald P. Leach and Saha | Tata McGraw-Hill Publishing Company Limited, New Delhi

a. **Course Name:** Linear Algebra and Calculus
b. **Course Code:** 03019101BS02
c. **Prerequisite:** Elementary Algebra, Matrices, Differentiation and Integration
d. **Course Learning Objective:**

CLOBJ 1	Analyze and solve systems of linear equations using matrix methods and understand eigenvalue problems.
CLOBJ 2	Apply first-order ordinary differential equations to model physical phenomena like cooling and electrical circuits.
CLOBJ 3	Understand the principles of partial differentiation for multivariable functions and their applications.
CLOBJ 4	Utilize multiple integration techniques in various coordinate systems to compute geometric properties.
CLOBJ 5	Develop mathematical modeling skills for engineering applications through calculus and linear algebra.

e. **Course Learning Outcomes:**

CLO 1	Understand the concept of eigenvalues and eigenvectors of a matrix.
CLO 2	Formulate first-order differential equation to solve the real-world problem.
CLO 3	Apply partial differentiation to optimize multivariable function.
CLO 4	Evaluate multiple integration in cartesian and polar coordinates.

f. **Teaching & Examination Scheme:**

Teaching Scheme					**Examination Scheme**					
Hours per Week				**Credit**	**Internal Assessment**			**External Assessment**		**Total**
Lecture	**Tutorial**	**Lab**	**Total**		**T**	**CE**	**P**	**T**	**P**	
4	-	-	4	4	20	20	0	60	0	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C.E**. -Continuous Evaluation ***Continuous Evaluation:**It consists of assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

g. **Contents:**

Sr. No.	**Topic**	**Weightage**	**Teaching Hrs.**
1	**Linear Algebra:** Review of Determinant and Matrices, types of matrices, Rank of a matrix, System of Linear equations- homogenous and non-homogenous equations, solving techniques- Gauss Elimination method, Gauss-Jordan method, Consistency and inconsistency of the system, **Eigenvalues and Eigenvector:** Eigenvalues and Eigenvector, Algebraic multiplicity and Geometric multiplicity, Caley-Hamilton theorem, Diagonalization	**30%**	**18**
2	**First Order Ordinary Differential Equations:** Exact and non- exact differential equations, Integrating factor- function of x only and functions of y only, Linear and non-linear differential equations, **Applications:** Newton's Law of cooling, Growth model and RL- Circuit and RC-Circuit	**20%**	**12**

3	**Partial Differentiation:** Functions of several variables, Limit of function, continuity, partial differentiation, chain rule, Implicit functions and their derivatives, Homogeneous functions and Euler's theorem **Applications of Partial Differentiation:** Tangent plane and normal line, Maxima and minima,	**30%**	**18**
4	**Multiple Integration**: Double integration, change of order, change into polar form, triple integrations **Applications:** Area, Volume	**20%**	**12**

h. Text Book and Reference Book:

1. E. Kreyszig, Advanced Engineering Mathematics, Willey India Edition.
2. Howard Anton, Elementary Linear Algebra, Willey India Edition.
3. James Stewart, Calculus: Early Transcendentals, Cengage Learning India
4. Joel Hass, Christopher Heil, Maurice D Weir, Thomas' Calculus, Pearson India

a. **Course Name:** Physics of Semiconductors
b. **Course Code:** 03019201BS01
c. **Prerequisite:** Knowledge of Physics and some basic concepts in Mathematics like differentiation, integration, limit, differential equation, vector calculus up to 12thscience level.
d. **Course Learning Outcomes:**

CLO 1	To conceptualize semiconducting materials on the basis of band theory.
CLO 2	To get familiar with optical fibres and semiconductor based optoelectronic devices useful in fibre optic system.
CLO 3	To conceptualize the foundational principles of quantum Physics and their role in quantum computing.
CLO 4	Formulate and conceptualize various theoretical aspects and the physical phenomena at Low dimensional level (nano)

e. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**2**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

f. **Course Content:**

Sr. No.	**Content**	**Weightage %**	**Teaching hours**
1	**Band theory& Semiconductors** Band structure of solid materials, E-k diagram, Direct and Indirect band gap, Effective mass, Concept of Fermi Energy, Density of state, Fermi Level in Intrinsic and Extrinsic Semiconductors, Ohmic and Schottky Junction.	**25%**	**11**
2	**Optoelectronics** Interaction of radiation with Matter, Absorption, Spontaneous and Stimulated emission, Characteristics of Lasers, Diode Laser, LED, Photodiode and their applications. Principle and Structure of Optical Fiber, Numerical Aperture of fiber, Types of Optical Fibers, Attenuation in Optical Fibers, Applications of Optical Fibers.	**25%**	**11**
3	**Quantum Mechanics & Quantum Computing** Quantum postulates, wave function, Schrodinger's equation time dependent, independent (No derivation), One dimensional potential well, quantum tunneling and its application in soft computing Key Principles of Quantum Computing, Difference between classical and quantum computing, Quantum Computing advantages Challenges and Application.	**30%**	**13**

4	**Low Dimensional Materials** Basic characteristic including synthesis, properties, quantum confinement, classification: Quantum Dot, Quantum well , Quantum Wire and their applications, Novel Materials and their applications	**20%**	**10**

g. List of Practical:

1. I-V characteristics of light emitting diode in forward bias.
2. I-V characteristics of Zener diode in reverse bias.
3. Determination of Velocity of ultrasonic waves in water.
4. Determination of Dielectric constants of Dielectric samples.
5. Measurement of Band gap of semiconductor material.
6. Measurement of Hall coefficient and carrier concentration in semiconductor material.
7. Measurement of Planck's constant using LED.
8. Measurement of wavelength of laser light using diffraction grating.
9. Measurement of Numerical aperture of an optical Fiber.
10. Determination of the size of lycopodium powder particles.
11. Measurement of power loss in an optical fibre.
12. Moment of Inertia of a flywheel.
13. Young's Modulus by bending of beam.

h. Text Book and Reference Book:

i. Physics of Semiconductor Devices (TextBook) By S. M. Sze and K. N. Kwok | John Wiley & Sons
ii. Semiconductor Optoelectronic Devices By P. Bhattacharya | Prentice Hall of India, Pub. Year 1997
iii. Engineering Physics (TextBook) By B.K.Pandey S Chaturvedi and M. Venkanna | - Cengage Publication
iv. Semiconductor Optoelectronics (TextBook) By J. Singh | McGraw-Hill Inc, Pub. Year 1995

a. **Course Name:** Programming for Problem Solving
b. **Course Code:** 03010501ES01
c. **Prerequisite:** Requires Basic Knowledge of Computer
d. **Course Learning Outcomes:**

CLO 1	Recognize the computer's basic principles and organizations.
CLO 2	Understand Concepts of Computer Programming Language.
CLO 3	Develop the algorithm for solving basic Engineering Problems.
CLO 4	Write, Compile and debug program with C Programming.
CLO 5	Analyse the Solved, Complex Computational Program written in C.
CLO 6	Develop simple projects using C Language.

e. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**2**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

f. **Course Content:**

Sr. No.	**Content**	**Weightage %**	**Teaching hours**
1	**Introduction to 'C' Programming** What is C language, History of C language, Application areas of C, Features of C language, structure of C Program, execution flow of program, reading a character, writing a character, formatted input, formatted output functions.	**10%**	**8**
2	**Constants, Variables, Data Types, Operators and Expressions** Constants, Variables, Data Types: Character Set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of Variables, Assigning values to variables, typedef, and Defining symbolic constants. Operators and Expression: Introduction to Operators and its types, Evaluation of expressions, Precedence of arithmetic operators, Type conversions in expressions, Operator precedence and associativity.	**15%**	**5**
3	**Control structures in C** Decision Making & branching: Decision making with If &If .. Else statements, If .. Else statements (Nested …. Ladder), The Switch, The break statement & go to statements, The ternary (?:) Operator Looping: The while statement, & The Do.. While loop, The FOR loop, Jump within loops – Programs	**15%**	**4**

4	**Arrays and Strings** Arrays: Introduction, One-dimensional array, Two-dimensional array, Concept of Multidimensional arrays. Strings: String declaration, storage, Built-in-string functions.	**20%**	**7**
5	**User-Defined Functions, Structure and Unions** User-Defined Functions: Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function, Macros, Pre- processing. Structure and Unions: Introduction, Structure definition, declaring and initializing Structure variables, Accessing Structure members, Copying & Comparison of structures, Arrays of structures, Arrays within structures, Structures within Structures, Structures and functions, Unions	**20%**	**10**
6	**Pointers, Dynamic memory allocation and File Management in C** Pointers: Basics of pointers, pointer to pointer, pointer and array, Pointer to array, array of pointers , functions returning pointers. Dynamic memory allocation: Introduction to Dynamic memory allocation, malloc(), calloc(), free(), realloc(). File Management in C: Introduction and standard file handling functions.	**20%**	**8**
7	**Motion And Power Transmission Devices** Shaft and Axle; Belt Drive; Chain Drive; Friction Drive; Gear Drive; Clutch, Coupling and Brake.	**5%**	**3**
8	**Conventional And Non-Conventional Energy Sources** Introduction and Classification of Energy Sources; Conventional Energy Sources E.g. Solid, Liquid, Gaseous and Nuclear fuels; Calorific Value of Fuels; Non-Conventional Energy Sources E.g. Solar Energy, Wind Energy, Hydro Power, Biomass and Biomass Energy; Comparison of Conventional & Non-Conventional Energy Sources.	**5%**	**3**

g. List of Practical

1. Write a program to print HELLO FRIENDS!
2. Write a program that reads two nos. from key board and gives their addition, subtraction, multiplication, division and modulo.
3. Write a program to calculate area of circle, use Ω as symbolic constants.
4. Write a program to convert days into months and days.
5. Write a program which calculates the summation of three digits from the given 3 digit number.
6. Write a program to demonstrate enumerates data type.
7. Write a program to compute Fahrenheit from centigrade.
8. Write a program to calculate simple interest.
9. Read the price of item in decimal form e.g. 12.50 and separate Rs and Paise from the given value e.g. 12 rupees and 50 paise.

Practical Set 2 (Control Structures)

1. Write a program to find the largest of the three nos. using Nested-If-Else statement.
2. Write a C program to enter a character and to check whether it is a small letter or it is a capital letter or it is a digit or it is a special symbol.
3. Write a program to read marks from keyboard and your program should display equivalent grade according to following table.

Marks	100-80	60-79	35-59	0-34
Grade	Dist	First Class	Second Class	Fail

1. Write a program to read marks of a student from keyboard whether the student id pass (if).

2. Write a program to find the sum of first N odd numbers.
3. Write a program using while loop construct which finds the factorial of a given integer number.
4. Write a C program using do…while and for loop constructs to reverse the digits of the number.
5. Write a program to demonstrate use of Switch- Break Statement.
6. Write a program to find out all the numbers divisible by 5 and 7 between 1 to 100. Check for Armstrong number. A number is Armstrong if sum of cube of every digit is same as the original number. E.g. 153=13+53+33=153
7. Write a program to print the output of bellow series. 1!+2!+3!+4!+.....n!
8. Write a program to print the following outputs using for Loop. (a) 1 (b) * 12 ** 123 ***
9. Write a program to print the following outputs using for Loop. (a) 1 (b) 321 21 21 321 1

Practical Set 3 (Array & Strings)

1. Write a program which sorts 10 numbers into ascending order.
2. Write a program to find maximum element from 1-D array.
3. Write a program to find number of odd and even elements from the 1-D array.
4. Write a program add two 2x2 matrices.
5. Write a program to count number of positive, negative and zero elements from 3x3 matrix.
6. Write a function for the following operations on string: Copy one string to another Comparing two strings Adding a string to the end of another.
7. Write a program to count vowels from a entered String.
8. Write a program which finds whether a string is a palindrome or not.

Practical Set 4 (Functions)

1. Write a program to find factorial of a number using recursion.
2. Write a program that used user defined function Swap ( ) and interchange the value of two variable.
3. Write a function to return 1 if the number is prime otherwise return 0.

Practical Set 5 (Structures)

1. Define a structure type, personal that would contain person name, date of joining and salary.
2. Define a structure called cricket that will describe the following information: Player name ATeam name Batting average

Practical Set 6 (Pointers)

1. Write a program to add two numbers using pointers.
2. Write a program to swap two numbers using pointer

Practical Set 7 (File Management)

1. Write a program to illustrate reading files contents.
2. Write a program to illustrate the use of fgets( ).

h. Text Book and Reference Book:

1. Programming in ANSI C (TextBook) By E. Balaguruswamy | Tata McGraw-Hill
2. C Programming: Test Your Skills By Ashok Kamthane
3. Computer Fundamentals By P. K. Sinha and Priti Sinha | BPB Publications | 4th Edition
4. Star C Programming STAR Certification | C Certification Exam
5. Programming with C By Byron Gottfried | Tata McGraw Hill Education
6. C The Complete Reference By Herbert Schildt
7. Let Us C By Yeshavant Kanetkar | BPB Publications.

a. Course Name: Basic Electronics
b. Course Code: 03010601ES02
c. Prerequisite: Knowledge of Physics
d. Course Learning Outcomes:

CLO 1	Describe the construction, working principles, and IV characteristics of PN junction diode with applications.
CLO 2	Illustrate the construction, working principles, and IV characteristics of special purpose diode with applications.
CLO 3	Utilize BJTs as amplifiers and switches in electronic circuits.
CLO 4	Differentiate between linear and switched-mode power supplies (SMPS) and their applications.
CLO 5	Compare sensors and transducers based on their working principles and applications

e. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
4	**3**	**2**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

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f. Course Content:

Sr.	**Topics**	**Weightage e %**	**Teaching hours**
1	**Unit-1Diode Theory and Its Applications :** PN Junction Diode: Construction, Working, and IV Characteristics , Forward and Reverse Bias Operation, Breakdown Mechanisms: Zener and AvalancheBreakdown , Applications: Rectifiers, Clipping and Clamping Circuits	20	8
2	**Unit-2 Special Purpose Diodes :** Construction of Zener diode, Characteristics of Zener diode, Application of Zener Diode as Voltage Regulator, load line, Optoelectronic devices (LED and Photo Diode), Seven Segment Display, Schottky diode and its Application, Varactor Diode and its Application, Understanding Datasheets.	20	8
3	**Unit-3Bipolar Junction Transistors (BJTs):** Construction and Working of NPN & PNP Transistors, BJT Operating Modes: Cutoff, Active, and Saturation, Transistor Configurations: Common Emitter, Common Collector and Common Base Configurations, Transistor Biasing: Fixed Base Biasing and Voltage Divider Transistor Biasing, BJT as an Amplifier and Switch.	25	15
4	**Unit-4 DC Regulated Power Supply :** Voltage Regulator- Basic series and shunt regulator, Types of voltage regulator IC: Fixed and adjustable positive and negative linear voltage regulator, IC linear fixed voltage regulator (78XX, 79XX, LM340 Series), Linear Adjustable Regulator (IC LM317, LM337, and IC 723 IC regulator), DC Regulated Power supply, Switched mode power supply (SMPS)	15	6

5	**Unit-5 Introduction to Sensors and Transducers**: Introduction to sensors and Transducers, Comparison between sensors and Transducers, Applications of Sensors and Transducers, Types of Electronic sensors, Types of Transducers.	20	8

g. List of Practical

1. V-I characteristics PN junction diode Characteristic
2. V-I characteristics Zener Diode characteristics
3. Characteristics of Schottky and Varactor diode
4. Optoelectronic devices characteristics: (a) LED, (b) Photo Diode,
5. Half-Wave Rectifier Circuits with and without Filters
6. Full-Wave Rectifier Circuits with and without Filters
7. Clipping Circuits using Diodes : Series and parallel
8. Clamping using Diodes : Positive and Negative
9. Input & Output Characteristics of a BJT in Common Emitter (CE) Configuration
10. Input-output characteristics of common Base (CB) configuration of Transistor
11. Designing of power supply using IC regulator circuit.
12. Introduction to Sensors and Transducers.

h. Text Book and Reference Book:

1. Electronic Devices & Circuits By Sanjeev Gupta | Dhanpatrai
2. Electronic Devices By Thomas L. Floyd | Pearson, Prentice Hall
3. Linear Electronic Circuits and Devices By James Cox | Delmar Publication
4. Electronic Devices & Circuit Theory By Boylestad
5. Electronic Principles By Albert Malvino & David Bates | Tata McGraw Hill Publication 2010 ISBN: 978-0070634244

a. **Course Name:** Principles of Communication Skills
b. **Course Code:** 03010001HM01
c. **Prerequisite:** Knowledge of English Language studied till 12th standard
d. **Course Learning Outcomes:**

CLOBJ 1	Understand the fundamental grammatical structures including parts of speech, punctuation, tenses, phrases, clauses, determiners, Quantifiers, sentence types, and basic concepts of phonetics (IPA symbols, speech sounds, stress, and intonation) for accurate and effective language use.
CLOBJ 2	Develop basic reading and listening comprehension skills by using appropriate strategies to understand simple texts and spoken content with improved pronunciation awareness.
CLOBJ 3	Organize and express ideas clearly in written form through picture-based perception activities.
CLOBJ 4	Build confidence and fluency in spoken communication through correct pronunciation practice, meeting and greeting activities, extempore speech, and everyday conversational exercises.
CLOBJ 5	Apply goal-setting and self-reflection techniques to monitor personal language learning progress, pronunciation improvement, and overall communication skills development.
CLOBJ 1	Understand the fundamental grammatical structures including parts of speech, punctuation, tenses, phrases, clauses, determiners, Quantifiers, sentence types, and basic concepts of phonetics (IPA symbols, speech sounds, stress, and intonation) for accurate and effective language use.

e. **Teaching Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

f. **Course Content:**

Sr.	**Topics**	**Weightage %**	**Teaching hours**
1	**Parts of Speech, Punctuation** Overview of 8 parts of speech Basic punctuation marks and their usage Importance of grammar in writing	10%	4
2	**Tenses** Types: Present, Past, Future Forms and correct usage Common t ense errors	8%	2
3	**Phrase and Clauses; Types of Sentences (Structure Wise)** Difference between phrases and clauses, Classification of Simple, Compound & Complex, Interchange of Simple to Compound, Simple to Complex, Compound to Complex	10%	4

4	**Picture Perception**: Observing and interpreting images Building a short story or desc ription Improving vocabulary and creativity	15%	4
5	**Paragraph Development** Structure: topic sentence, development, conclusion	8%	2
6	**Meeting and Greeting (Initiating a conversation)** Basic conversation skills Formal and informal greetings Commo n phrases for starting interactions	7%	2
7	**Reading Comprehension (Basic Level)** Types– Skimming & Scanning Reading short passages Identifying main ideas and details Answering basic questions	12%	4
8	**Listening Comprehension (Basic Level)** Listening to short audios/Conversation Understanding and respo nding to key information	8%	2
9	**Extempore Speech** Speaking on random topics Organizing thoughts quickly Improvi ng fluency and confidence	15%	4
10	**Goal Setting and Tracking** Setting SMART goals Planning and tracking progress Self- assessment and reflection	7%	2

g. Reference Books:

1. English Grammar in Use (TextBook) By Murphy, Raymond | Cambridge University Press, Pub. Year 2019
2. A Practical English Grammar (TextBook) By Thomson & Martinet | Oxford University Press, Pub. Year 1986
3. The St. Martin's Guide to Writing By Rise B. Axelrod & Charles R. | Cooper, Bedford/St. Martin's, Pub. Year 2021
4. Tactics for Listening (Basic) By Jack C. Richards | Oxford University Press, Pub. Year 2011
5. Active Skills for Reading: Book 1 By Neil J. Anderson | Cengage Learning, Pub. Year 2013
6. Speak with Impact By Allison Shapira | HarperCollins Leadership, Pub. Year 2018

a. **Course Name:** Student Induction Program with essence of Indian Knowledge System
b. **Course Code:** 03010001MC01
c. **Prerequisite:** NA
d. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
					CE		Theory	P	
12	0	0	0	-	50	-	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

e. **Course Content:**

Sr.	Topic	Weightage %	Teaching hours
1	**Activities in Mathematics** Exploring 3D Shapes (Cylinder, Cone, Cube, Cuboid) The Geometry of Conic Sections: Properties and Applications Measuring the Height of a Tree or Building Using Trigonometry Techniques for Measuring Top and Bottom Angle Reflections Fundamental Elements of Set Theory Set Theory Tools for Probability Analysis Key Concepts in Combinatorial Mathematics Probability Fundamentals: Key Ideas and Concepts Foundations of Statistical Theory: Key Concepts Explained Principles of Geometric Progressions and Series Matrix Application in Cryptography An experimental approach to measure velocity and acceleration Analyzing Rate of Change and Optimization Utilizing Integration for Problem Solving A B C of Tangrams	25%	12
2	**Activities in Communication Skills** Phase-1: Part of Speech, Articles, Tenses, Basic Sentence Formation Phase-2: Verb, Subject Verb Agreement, Active Passive Voice, Idioms and Phrases Phase-3: Introduction to IKS, Indian ways of Speaking and Listening, Healthy Daily Life: The Indian Way, Indian Achievers and Inovations	25%	12
3	**Activities in Computer Science Computer Basic Architecture:** Introduction to Computer Systems, Von Neumann Architecture, Components of a Computer: CPU, Memory, I/O devices, Data Representation and Number Systems, Registers, ALU, Control Unit, Memory Hierarchy: Cache, RAM, ROM, Secondary Storage **Indian Knowledge System in Context of Computing:** Historical Contributions of Indian Scholars to Mathematics and Computing, Algorithms in Ancient Indian Texts, Concept of Zero and Decimal Number System, Indian Logic and Computation Models, Sanskrit Computational Models and Grammar, Traditional Indian Computing Tools and Techniques, Integration of Traditional Knowledge with Modern Computing **Emerging Technologies in Computer Engineering:** Introduction to Artificial Intelligence and Machine Learning, Internet of Things (IoT), Blockchain Technology, Quantum Computing Basics, Edge Computing and Cloud Computing Advances, Cybersecurity Trends and Challenges, 5G and Networking Innovations, Bioinformatics and Computational Biology, Robotics and Automation in Computing.	25%	12

4	**Activities of Physics** Measurement, Electrostatics, Electromagnetics, Optics, Leaser and Fiber Optics, Vedic Physics and Cosmology	25%	12

Semester-2

a. **Course Name:** Digital Design For VLSI
b. **Course Code:** 03019702PC01
c. **Prerequisite:** Digital Circuit fundamentals and Combinational circuit design skill | 03019701PC01 - Foundations of Digital Design and Its Applications
d. **Course Learning Outcomes:**

CLO 1	Design and implement state machines, counters, and memory elements
CLO 2	Optimize digital circuits for high-speed performance and low-power consumption
CLO 3	Simulate and test their designs using industry-standard tools
CLO 4	Compare different logic families and evaluate their performance parameters such as power consumption, noise margin, fanin/ fan-out, and propagation delay for VLSI applications.
CLO 5	Identify glitches and hazards in digital circuits and apply suitable techniques to eliminate them for reliable and stable system operation.

e. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
4	**3**	**0**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

f. **Course Content:**

Sr.	**Topics**	**Weightage %**	**Teaching hours**
1	**Module 1: Sequential Circuits –** Foundations & Applications1.1 Introduction to Sequential Circuits Difference Between Combinational and Sequential Circuits Concept of Clocking, Setup & Hold Time Synchronous vs. Asynchronous Sequential Circuits 1.2 Latches and Flip-Flops SR Latch and SR Flip-Flop – Industry Use Cases Edge-Triggered Flip-Flops: o D Flip-Flop – Data Storage & Pipeline Registers o T Flip-Flop – Counters & Frequency Division o JK Flip-Flop – Versatile State Storage 1.3 Flip-Flop Excitation & Conversion Flip-Flop Excitation Table Conversion of Flip-Flops (JK ↔ D, T ↔ JK, etc.)	16	7
2	**Module 2: Shift Registers & Data Storage Elements**2.1 Introduction to Data Storage Elements Need for Storage & Serial Data Transfer 2.2 Types of Shift Registers & Their Applications SISO (Serial In Serial Out) – Data Communication SIPO (Serial In Parallel Out) – Data Conversion PISO (Parallel In Serial Out) – UART & Serial Transmission PIPO (Parallel In Parallel Out) – High-Speed	13	6

	Processing Universal Shift Register – Versatility in Digital Systems 2.3 Shift Register Counter Johnson Counter (Shift Counter) Ring Counter		
3	**Module 3: Counters – Synchronous and Asynchronous Designs**3.1 Asynchronous (Ripple) Counters Up and Down Counters – Frequency Division Propagation Delay & Its Effect on Large Circuits 3.2 Synchronous Counters Clocked Counters – Stable & Predictable Output Types of Synchronous Counters: o Up/Down Counter – Used in Frequency Control o Ring Counter – Used in FPGA State Machines o Twisted Ring (Johnson) Counter – LED Chasers, Display Controllers o Mod-N Counters – Custom Industry Applications	16	7
4	**Module 4: State Machines & Their Role in Digital Design**4.1 Introduction to Finite State Machines (FSMs) State Diagram and State Table Representation Transition & Output Tables, Excitation Table 4.2 Memory Elements in FSMs Role of Flip-Flops in FSM Implementation 4.3 Mealy vs. Moore FSM Models Mealy Machine – Faster Response (Serial Protocols) Moore Machine – Stable Outputs (Digital Controllers)	16	7
5	**Module 5: Glitches, Hazards & Reliability in Digital Circuits**5.1 Introduction to Digital Circuit Failures Causes of Glitches & Hazards Impact of Timing Issues 5.2 Hazard Classification & Mitigation Static Hazards – Incorrect Logic Transitions Dynamic Hazards – Multiple Transitions Essential Hazards – Asynchronous Circuit Issues 5.3 Techniques for Hazard Elimination Adding Redundant Logic Clock Gating Best Practices	13	6
6	**Module 6: Logic Families – Choosing the Right Technology**6.1 Introduction to Logic Families TTL, CMOS, ECL – Trade-offs in Power, Speed, and Noise Immunity 6.2 Digital IC Specification Terminology Fan-in & Fan-out – Drive Strength Noise Margin – Signal Integrity Propagation Delay – Performance Optimization Tri-state Logic – Bus Systems	13	6
7	**Module 7: Semiconductor Memories & Programmable Logic Devices (PLDs)**7.1 Memory Systems in Digital Design Memory Types: SRAM, DRAM, Flash Memory, EEPROM Memory Expansion Techniques 7.2 Introduction to Programmable Logic Devices (PLDs) Concept of PLDs – Custom Hardware Logic Types of PLDs: o ROM – Lookup Table Implementations o PLA (Programmable Logic Array) – Custom Logic o PAL (Programmable Array Logic) – ASIC Applications o FPGA (Field Programmable Gate Array) – Digital prototyping	13	6

g. Text Book and Reference Book:

1. Fundamentals of Digital Circuits – Anand Kumar
2. Modern Digital Electronics – R. P. Jain
3. Digital Electronics – Anil K. Maini

h. List of Experiment

1. To study and understand the concept of sequential circuits and differentiate them from combinational circuits based on memory elements, clock dependency, and output behaviour.
2. To study, implement, and analyse the working of latches and flip-flops and understand their application as memory elements in digital systems.
3. To study various flip-flop triggering techniques and examine their impact on output response.
4. To perform flip-flop conversions using logic gates and verify their operation. • To implement a JK flip-flop using a D flipflop.
5. Study and Analysis of Asynchronous Sequential Circuits and Their Timing Behaviour.
6. Implementation and Analysis of Frequency Divider Circuits Using Flip- Flops/Counters
7. Registers in Digital Systems: Design and Data Transfer Applications
8. Design and Implementation of Various Counters Using Flip-Flops
9. Finite State Machine Modelling and Implementation Using Verilog HDL
10. Design and Implementation of Random Access Memory (RAM) Using Verilog HDL
11. Analysis and Elimination of Glitches and Hazards in Digital Circuits

a. **Course Name:** Physics for Engineers
b. **Course Code:** 03019202BS01
c. **Prerequisite:** Knowledge of Physics and some basic concepts in Mathematics like differentiation, integration, limit, differential equation, vector calculus up to 12th science level.
d. **Course Learning Outcomes:**

CLO 1	Understand the basic concept of classical mechanics to solve static and dynamic problems.
CLO 2	Understand the basic concept of wave and oscillation.
CLO 3	Formulate and conceptualize various theoretical aspects and the physical phenomena at macro and atomic level.
CLO 4	Understand the theoretical analysis using Python programming.

e. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**2**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

f. **Course Content:**

Sr.	**Topics**	**Weightage %**	**Teaching hours**
1	**Oscillations and waves** Damped and forced oscillations, Resonance, Q factor, Sharpness of resonance, transverse waves on a string, Equations of longitudinal and transverse waves and solutions, Reflection and transmission of waves at a boundary, Impedance matching between two medium.	25%	10
2	**Electrodynamics** Concept of Field, Gradient, Divergence, Curl, Scalar and Vector Potential, Maxwell's equations, concept of displacement current, Derivation of wave equation for plane electromagnetic wave, Poynting theorem, Energy density.	25%	10
3	**Materials: Magnetic And Superconducting Materials** Theory, properties and classification of magnetic materials, soft and hard magnetic materials, ferrites, Applications Superconducting Materials: Meissner effect, penetration depth, type-1 and type-2 superconductors, High temperature superconductors, Applications.	25%	10
4	**Scientific computing** Basic concepts in Python, Loops, conditions and functions, Basics of Numpy, Basics of Scipy, Basics of Matplotlib, Applications in special problems like Laplace, Poisson diffusion and Schrodinger equation.	25%	15

g. List of Practical

1. Basic programming using functions.
2. Using different python packages like numpy, scipy, etc.
3. Creating Plots using Python.
4. Solving Laplace equation in python.
5. Solving Poisson equation in python.
6. Study of Diffusion equation using Spectral method.
7. Study of Wave equation in python.
8. Study of Schrodinger equation using python.
9. Boundary value problem using shooting method.
10. Eigen function and Eigen values for differential equation.

h. Text Book and Reference Book:

1. Scientific Computing Using Python (Text Book) By Abhijeet Kar Gupta | Techno World Publications.
2. A text book of Engg. Physics, By M. N. Avadhanulu | S. CHAND & COMPANY LTD-NEW DELHI | 8
3. Physics for Computer Science Students By Narciso Garcia, Arthur Damask and Steven Schwarz | Springer | Second Edition

a. **Course Name:** Electronic Devices and Circuits
b. **Course Code:** 03019702PC02
c. **Prerequisite:** Electronic Devices, Basic Electrical Theorems, etc.
d. **Course Learning Outcomes:**

CLO 1	Analyze the AC analysis of BJT circuits by applying hybrid equivalent and π models to determine voltage gain, input/output impedance, and current gain.
CLO 2	Understand the principles of operation of FETs, including JFETs and MOSFETs, and their different types (n-channel, p channel).
CLO 3	Evaluate various FET biasing configurations to determine the stability and performance of amplifiers.
CLO 4	Design JFET and MOSFET amplifier circuits to achieve specific gain, bandwidth, and impedance characteristics.
CLO 5	Apply concepts of frequency response to investigate the performance of BJT and FET amplifiers at low and high frequencies.

e. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
4	**3**	**2**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

f. **Course Content:**

Sr. No.	**Content**	**Weightage %**	**Teaching hours**
1	**BJT AC Analysis** Introduction, Amplification in the AC Domain, BJT Transistor Modeling, The re Transistor Model, Common-Emitter Fixed-Bias Configuration, Voltage-Divider Bias, CE Emitter-Bias Configuration, Emitter-Follower Configuration, Common-Base Configuration, Collector Feedback Configuration, Collector DC Feedback Configuration, Effect of RL and RS, Determining the Current Gain, Two-Port Systems Approach, Cascaded Systems, Darlington Connection and Feedback Pair	20	9
2	**Field effect transistors (FET)**Types of FETs, Junction field effect transistors(JFET), Comparison of BJT and FET, Structure & Operation, JFET characteristics, Types of MOSFETs, MOSFET Operation, Applications of FETs	10	5
3	**FET Biasing** Introduction, Fixed-Bias Configuration, Self-Bias Configuration, Voltage-Divider Biasing, Common-Gate Configuration, Special Case VGSQ=0V, Depletion-Type MOSFETs, Enhancement-Type MOSFETs, Combination Networks, Design, p-Channel FETs, Universal JFET Bias Curve	20	7

4	**FET Amplifiers** Introduction, JFET Small-Signal Model, Fixed-Bias Configuration, Self-Bias Configuration, Voltage-Divider Configuration, Common-Gate Configuration, Source- Follower (Common- Drain) Configuration, Depletion-Type MOSFETs, Enhancement-Type MOSFETs, E-MOSFET Drain- Feedback Configuration, E-MOSFET Voltage-Divider Configuration, Designing FET Amplifier Networks, Effect of RL and RSIG, Cascade Configuration	20	9
5	**BJT and JFET Frequency Response** Introduction, Logarithms, Decibels, General Frequency Considerations, Normalization Process, Low-Frequency Analysis—Bode Plot, Low-Frequency Response—BJT Amplifier with RL, Impact of RS on the BJT Low-Frequency Response, Low- Frequency Response—FET Amplifier, Miller Effect Capacitance, High-Frequency Response—BJT Amplifier, High- Frequency Response—FET Amplifier	20	9
6	**Power Amplifiers** Introduction—Definitions and Amplifier Types, Series-Fed Class A Amplifier, Transformer Coupled Class A Amplifier, Class B Amplifier Operation, Class B Amplifier Circuits, Amplifier Distortion, Power Transistor Heat Sinking, Class C and Class D Amplifiers	**10**	**6**

g. Text Book and Reference Book:

1. Electronic Devices and Circuits By Boyestad & Nashelsky
2. Albert Malvino & David, "Electronic Principles", Tata McGraw-Hill, Seventh edition
3. Electronic Devices By Thomas L. Floyd | Pearson, Prentice Hall
4. Albert Malvino & David, "Problems and Solutions in Basic Electronics, McGraw Hill Education

a. **Course Name:** Advanced Communication and Interpersonal Skills
b. **Course Code:** 03010002HM01
c. **Prerequisite:** Basic Communication Skills are essential for all Engineers.
d. Course Learning Objective:

CLOBJ 1	Apply core grammatical principles including subject–verb agreement, reported speech, and active–passive voice to improve accuracy in spoken and written communication.
CLOBJ 2	Expand functional vocabulary and language usage by applying synonyms, antonyms, homonyms, idioms, and contextual word meanings effectively.
CLOBJ 3	Develop effective reading comprehension skills to understand, interpret, and respond to intermediate-level texts and spoken content
CLOBJ 4	To improve students' confidence, grooming, personality development, and professional etiquette for personal and career growth.
CLOBJ 5	Develop self-management and personal development skills by applying SWOT analysis, practicing effective time management strategies, and engaging in reflective learning processes

e. **Course Learning Outcomes:**

CLO 1	Remember the essential rules of English grammar and core vocabulary required for accurate communication.
CLO 2	Understand spoken and written texts at an intermediate level to grasp meaning, ideas, and context.
CLO 3	Apply grammatical structures, vocabulary, and writing skills in essays, self-introductions, and everyday communication.
CLO 4	Analyze personal strengths and weaknesses through SWOT analysis to enhance grooming and personality development.
CLO 5	Analyze communication habits and daily routines to improve time management and professional effectiveness.

f. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	**Total**
1	0	2	2	40	-	20	60	30	150

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

g. **Course Content:**

Unit No.	**Topic**	**Weightage %**	**Teaching hours**
1	**Subject Verb Agreement** Rules of subject-verb matching Singular vs plural forms Common agreement errors.	10%	1

2	**Reported Speech** Direct and indirect speech Changing tenses, pronouns, and time expressions Reporting statements, questions, and commands.	10%	1
3	**Active and Passive Voice** Difference between Active and Passive Rules for converting sentences Usage in real-life contexts.	10%	1
4	**Building Vocabulary** Word meanings and usage Synonyms and antonyms Homonyms, Homophones, Homographs, Idioms	10%	2
5	**Grooming and Personality Development** Importance of dressing and professional etiquette Building confidence and positive body language	10%	2
6	**SWOT Analysis with Self Introduction** Identifying strengths, weaknesses, opportunities, threats Preparing and delivering a confident self-introduction Developing self-awareness and a growth mindset.	10%	2
7	**Reading Comprehension (Intermediate Level)** Understanding written texts Finding main ideas and supporting details Answering questions accurately.	10%	2
8	**Listening Comprehension (Intermediate Level)** Listening for specific information Identifying tone and purpose Responding appropriately.	10%	1
9	**Essay Writing** Structure of an essay: introduction, body, conclusion Organizing ideas logically Using appropriate language and tone.	10%	2
10	**Time Management** Importance of managing time Prioritization Creating schedules.	10%	1

h. Text Book and Reference Book:

1. Technical Communication: Principles And Practice By Sangeetha Sharma, Meenakshi Raman | Oxford University Press | 2nd Edition
2. Personality Development and Soft Skills By Barun K Mitra | Oxford, 2011
3. High School English Grammar and Composition By Wren & Martin | S. Chand Publishing, Pub. Year 2017
4. English Grammar in Use By Raymond Murphy | Cambridge University Press, Pub. Year 2019
5. Communication Skills and Soft Skills By Suresh Kumar | Pearson Publication, 2010

a. **Course Name:** Environmental Science
b. **Course Code:** 03010002MC01
c. **Prerequisite:** Knowledge of Physics, Chemistry and Mathematics up to 12th science level and Biology up to 10th science level.
d. **Course Learning Outcomes:**

CLO 1	Analyze the impact of human activities on environmental sustainability and ecosystems.
CLO 2	Promote awareness about biodiversity conservation and its importance for ecological balance.
CLO 3	Assess the effects of pollution and propose strategies for pollution control and waste management.
CLO 4	Describe the significance of climate change and its global implications on ecosystems and human life.
CLO 5	Develop skills to evaluate and mitigate environmental risks in industrial and urban development.

e. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
1	**0**	**-**	**0**	**-**	**50**	**-**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

f. **Course Content:**

Sr. No.	**Content**	**Weightage %**	**Teaching hours**
1	**FUNDAMENTALS OF ENVIRONMENTAL SCIENCE** Definition, Principles and Scope of Environmental Science. Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Laws of thermodynamics, heat transfer processes, mass and energy transfer across various interfaces, material balance. Meteorological parameters - pressure, temperature, precipitation, humidity, radiation and wind velocity. Interaction between Earth, Man and Environment. Biogeographic provinces of the world and agro- climatic zones of India. Concept of sustainable development goals. Environmental education and awareness. Environmental ethics.	**15%**	**5**
2	**ENVIRONMENTAL POLLUTION AND CONTROL** Air, Noise, Water, Soil, Thermal, Marine, and Radioactive pollution, focusing on sources, types of pollutants, and their impacts on human health, plants, and materials. It includes the measurement techniques and standards for air and water quality, along with pollution control devices and methods. Key topics include criteria air pollutants, noise indices, wastewater treatment, and soil pollution management.	**20%**	**8**

3	**ENVIRONMENT MANAGEMENT AND LEGISLATION** Overview of Environmental Laws in India: Constitutional provisions in India (Article 48A and 51A), Forest Conservation Act, 1980, Water (Prevention and Control of Pollution) Act, 1974 amended 1988 and Rules 1975, Air (Prevention and Control of Pollution) Act, 1981 amended 1987 and Rules 1982, Environmental (Protection) Act, 1986 and Rules 1986, The Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016, The Solid Waste Management Rules, 2016, , Noise Pollution (Regulation 8 and Control) Rules, 2000, Environmental Conventions and Agreements: Stockholm Conference on Human Environment 1972, Montreal Protocol, 1987, Basel Convention (1989, 1992), Earth Summit at Rio de Janeiro, 1992, Agenda-21, Global Environmental Facility (GEF), Convention on Biodiversity (1992), UNFCCC, Kyoto Protocol, 1997, Clean Development Mechanism (CDM), Copenhagen Summit, 2009.	**25%**	**10**
4	**CONTEMPORARY ENVIRONMENTAL ISSUES** Current Environmental Issues in India: Environmental issues related to water resource projects - Narmada dam, Tehri dam etc., Hydro-power projects in Jammu & Kashmir etc.. Water conservation-development of watersheds, Rain water harvesting and ground water recharge. National river conservation plan – Namami Gange and Yamuna Action Plan. Eutrophication and restoration of lakes. Conservation of wetlands, Ramsar sites in India. Climate change - adaptability, energy security, food security and sustainability. Wild life conservation projects: Project tiger, Project Elephant etc., Carbon sequestration and carbon credits. Waste Management – Swachha Bharat Abhiyan. Sustainable Habitat: Green Building, GRIHA Rating Norms. Vehicular emission norms in India. Epidemiological Issues: Fluorosis, Arsenocosis, Goitre, Dengue. Environmental Disasters: Minnamata Disaster, Love Canal Disaster, Bhopal Gas Disaster, 1984.	**10%**	**5**
5	**CLIMATE RESILIENT CITY** Introduction to Climate Resilience – Understanding the need for cities to adapt to climate change. Impact of Climate Change on Cities – Urban heat islands, flooding, pollution, and infrastructure challenges. Sustainable Urban Planning – Role of green spaces, energy-efficient buildings, and smart city concepts. Green Infrastructure – Importance of urban forests, permeable surfaces, and nature-based solutions. Case Studies and Future Trends – Learning from cities like Singapore, Rotterdam, and Copenhagen.	**10%**	**6**

g. Text Book and Reference Book:

1. Textbook of Environmental Studies for Undergraduate Courses' (TextBook) By Erach Bharucha | Universities press
2. Basics of Environmental Studies By U K Khare | Tata McGraw Hi
3. Environmental Studies (TextBook) By Anindita Basak | Drling Kindersley(India)Pvt. Ltd Pearson
4. Environmental Sciences By Daniel B Botkin & Edward A Keller | John Wiley & Sons
5. Air Pollution By M. N. Rao and H. V. N. Rao; | Tata McGraw-Hill Publishing Company
6. Environmental Engineering By Howard S. Peavy, Donald R. Rowe, George Tchobanoglous | McGraw-Hill

a. **Course Name:** Differential Equations and Vector Calculus
b. **Course Code:** 03019102BS02
c. **Prerequisite:** Differential Calculus, Integral Calculus, Vector Algebra, Differential Equations
d. **Course Learning Objective**

CLOBJ 1	Understand second and higher-order ordinary differential equations and their solution techniques.
CLOBJ 2	Apply Laplace transform methods and inverse transforms for solving differential equations arising in engineering applications.
CLOBJ 3	Analyze periodic functions using Fourier series and half-range expansions.
CLOBJ 4	Develop understanding of vector differentiation concepts including gradient, divergence, curl, and Laplacian operators.
CLOBJ 5	Apply vector integration techniques such as line integrals and Green's theorem in mathematical and physical problems.
CLOBJ 6	Formulate and solve engineering and scientific problems using differential equations and vector calculus methods.

e. **Course Learning Outcomes:**

CLO 1	Solve Second and Higher-Order Ordinary Differential Equations
CLO 2	Apply Laplace Transform to Solve Differential Equations.
CLO 3	Apply Fourier series techniques to approximate periodic functions in mathematical and engineering contexts.
CLO 4	Compute and interpret vector differentiation concepts.
CLO 5	Evaluate vector integrals.

f. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
4	**-**	**-**	**4**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

g. **Course Content:**

Sr.	**Topics**	**Weightage %**	**Teaching hours**
1	**Second and Higher-Order Ordinary Differential Equations** Homogeneous Linear ODE, Homogeneous constant coefficient linear ODE, non-homogeneous linear constant coefficient linear ODE, Undetermined coefficient and Variation of Parameter, Applications of higher order linear differential equations in Free oscillations, forced oscillations, Damped oscillations, RLC circuit	**25%**	**15**
2	**Laplace Transformations and Its Applications:** Definition and Laplace transformation of elementary functions, Properties of Laplace Transformations - linearity property, First-Shifting Theorem, Derivative of Laplace transformation, Integration of Laplace transformation, Laplace transformation of Integral, Laplace transformation of derivatives, Inverse Laplace Transformation, Convolution theorem and Application of Laplace Transformation to solve ODE.	**30%**	**18**
3	**Fourier Series** Fourier Series of periodic functions with arbitrary period, Even and Odd functions, Half-Range Fourier Series	**15%**	**9**

4	**Vector Calculus: Vector Differentiation:** Vector-valued functions, smooth curve, vector differentiation, scaler-valued function, Gradiant of scaler valued function, Divergence and curl of vector-valued functions, Laplacian operator, Scalar potential function, **Vector Integration:** Line integral of scaler functions, Line integral of vector valued function, conservative vector field and independent of path, Green's theorem.	**30%**	**18**

h. Text Books:

- Advanced Engineering Mathematics (TextBook) By Erwin Kreyszig | Willey India Education
- D.A. Murray, Introductory Course in Differential Equations. Orient Longman (India).
- Fourier Series and Boundary Value Problems, By James Brown and Ruel Churchill, | McGraw Hill
- Elementary Differential Equations and Boundary Value Problems, By William E Boyce and Richard C. D'Prima | Willey India Edition
- Advanced Engineering Mathematics, By K. A. Stroud and Dexter Booth, | Macmillan Publication

a. **Course Name:** Practical Electronics with Arduino
b. **Course Code:** 03010702ES02
c. **Prerequisite:** Basic Knowledge of Electronics, Basic C programming Skills.
d. **Rationale:** This course equips students with essential embedded-system skills by combining logical programming with hands-on hardware experimentation to create real-world automation projects. It provides a strong foundation for cutting-edge technologies such as robotics, IoT, and smart systems, fostering innovation and workforce-ready technical proficiency.

e. **Course Learning Objective:**

CLOBJ 1	To introduce the fundamentals of microcontrollers, Arduino boards, and embedded system development environments.
CLOBJ 2	To develop programming skills using Arduino IDE, including variables, operators, conditional statements, loops, and functions.
CLOBJ 3	To provide practical knowledge of digital and analog interfacing techniques with LEDs, switches, buzzers, potentiometers, and sensors.
CLOBJ 4	To familiarize students with interfacing and programming of various sensors such as temperature, humidity, ultrasonic, PIR, and IR sensors.
CLOBJ 5	To enable students to interface actuators and display devices including motors, relays, and LCD displays for automation applications.
CLOBJ 6	To enhance problem-solving, innovation, and project development skills through hands- on mini projects and real-world automation applications using Arduino platforms.

f. **Course Learning Outcomes:**

CLO 1	Understand the architecture, features, and programming environment of Arduino-based embedded systems.
CLO 2	Develop Arduino programs using variables, operators, loops, conditional statements, functions, and arrays for solving basic engineering problems.
CLO 3	Interface and control digital and analog input/output devices such as LEDs, switches, buzzers, potentiometers, and displays.
CLO 4	Integrate various sensors including DHT11, ultrasonic, PIR, and IR sensors with Arduino for real-time data acquisition and monitoring.
CLO 5	Design and implement actuator-based systems using motors, relays, and display modules for automation applications.
CLO 6	Build and demonstrate mini projects using Arduino to solve practical problems related to smart systems, IoT, and embedded applications.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	**0**	**2**	**3**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	Weightage %	Teaching hours
1	**Introduction to Arduino:** Basics of Microcontrollers and Arduino Overview of Arduino Board (UNO, Mega, Nano) Installing and Setting Up Arduino IDE Writing and Uploading the First Code (Blink LED)	**20 %**	**5**
2	**Arduino Programming Fundamentals:** Basic Structure of an Arduino Sketch Variables, Data Types, and Operators Conditional Statements (if, else) and Loops (for, while) Functions and Arrays in Arduino	**10 %**	**5**
3	**Digital and Analog Interfacing:** Digital Input and Output (Interfacing LEDs, Switches, and Buzzers) Analog Input and Output (Interfacing Potentiometer, LDR, and PWM) Serial Communication (Using Serial Monitor)	**20%**	**5**
4	**Interfacing Sensors with Arduino:** Temperature and Humidity Sensor (DHT11) Ultrasonic Distance Sensor (HC SR04) Motion Detection using PIR Sensor IR Sensor for Object Detection	**20 %**	**5**
5	**Actuators and Display Interfacing:** Interfacing Servo Motor and DC Motor Interfacing 16x2 LCD Display Introduction to Relay Module for Controlling AC Appliances	**20%**	**5**
6	**Mini Project and Real-World Applications:** Building Simple Projects like Automatic Light Control, Smart Door, etc. Project Submission and Assessment	**10%**	**5**
	Total	**100%**	**30**

i. List of Practical

1. Introduction to Arduino IDE
2. Blinking LED – Basic LED ON/OFF using Arduino.
3. Button-Controlled LED – LED control using a push button.
4. Buzzer Alarm System – Using a buzzer for sound alerts.
5. Reading Analog Values – Using a potentiometer with Arduino.
6. LDR-Based Light Control – Automatic LED control based on light intensity.
7. Seven Segment LED – showing numbers as per the diode on /off
8. LCD Display Interface – Showing text on a 16x2 LCD screen.
9. DC Motor Control with Relay – Switching a motor ON/OFF.
10. Interfacing Temperature Sensor (DHT11) – Displaying temperature and humidity.
11. Ultrasonic Distance Measurement – Using HC-SR04 sensor for distance calculation.
12. Motion Detection with PIR Sensor – Automatic light switching.
13. Mini Project: Based on Tinker-CAD software simulation

j. Text Book and Reference Book:

1. Arduino Cookbook By Michael Margolis | O'Really Publication
2. Exploring Arduino By Jeremy Blum | Wiley Publication
3. Beginning Arduino By Michael Patterson | Technology in Action Publication
4. Beginning Arduino (TextBook) By Michael Patterson | Technology in Action Publication
5. Arduino Cookbook, By Michael Margolis, | Shroff/O'Reilly

a. **Course Name:** Elements of Mechanical Engineering
b. **Course Code:** 03010901ES01
c. **Prerequisite:** Knowledge of Physics and Mathematics
d. **Rationale:** This course introduces the basic principles of Mechanical Engineering to students in various branches of Engineering.
e. **Course Learning Objective:**

CLOBJ 1	Understand and describe the basic terminology used in mechanical engineering systems and identify various conventional and non-conventional energy sources.
CLOBJ 2	Apply fundamental thermodynamic concepts to determine the properties of gases and steam used in engineering applications.
CLOBJ 3	Analyze and calculate the power output and efficiency of Internal Combustion (IC) engines using standard performance parameters.
CLOBJ 4	Explain the construction and working principles of steam generators, IC engines, refrigeration systems, air conditioning systems, pumps, and compressors.
CLOBJ 5	Compare and evaluate different power transmission systems and select suitable transmission methods for specific engineering applications.

f. **Course Learning Outcomes:**

CLO 1	Describe basic terminology of mechanical systems and various conventional and non- conventional energy sources.
CLO 2	Estimate the fundamental properties of Gas and Steam.
CLO 3	Calculate the Power and efficiency of the Internal Combustion engine.
CLO 4	Explain the working principle of Steam Generators, IC engines, Refrigeration, Air Conditioning, Pumps, and Compressors.
CLO 5	Differentiate the various power transmission systems and its applications

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	**Total**
3	**-**	**2**	**4**	**20**	**20**	**60**	**60**	**30**	**150**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Introduction:** Prime Movers, Conventional and Non- Conventional Energy Sources and their applications. Basics of Thermodynamics: Basic terminologies, Specific heat, Internal Energy, Enthalpy, Specific Volume. Change of State, Path, Process, Cycle, and Thermodynamic systems, Statement of Zeroth Law, First Law and Second Law of Thermodynamics.	**10%**	**5**
2	**Properties of Gases :** Gas Laws, Gas Constant, and Relation between specific heat at c onstant pressure and constant volume, Non-flow processes.	**20%**	**8**

3	**Heat Engines :** Definition and Classification of Heat Engine, Combustion Engine: Classification, Otto and Diesel Cycle, Two and Four Stroke Petrol and Diesel Engine; Calculation of Power and Efficiency.	**20%**	**10**
4	**Properties of Steam:** Types of Steam and Steam Formation, Specific Enthalpy, Specifi c Volume, Dryness Fraction of Steam, Measurement of Dryness Fraction, Calorimeters, and Steam Table. Interaction and entropy calculations for various thermodynamic processes	**15%**	**7**
5	**Energy Conversion Devices:** Steam Generators: Classification; Cochran, Lancashire, Babcock and Wilcox Boiler, Function of Boiler Mounting and Accessories. Refrigeration and Air Conditioning: Refrigerant, Vapor compression refrigeration system, Vapor absorption refrigeration system, Domestic refrigeration, Window and split air conditioners.	**20%**	**8**
6	**Basics of Pumps and Compressors:** Definition, Classification, Applications, Working Principle and Components of Pumps and Compressors.	**10%**	**4**
7	**Motion and Power Transmission Devices:** Shaft and Axle; Belt Drive, Chain Drive, Friction Drive, Gear Drive, Clutch, Coupling, and Brake.	**5%**	**3**

i. Text Book and Reference Book:

1. Elements of Mechanical Engineering By Sadhu Singh.
2. Elements of Mechanical Engineering, By S.B.Mathur & S. Domkundwar
3. Fundamental of Mechanical Engineering, By G. S. Sawhney
4. Engineering Thermodynamics, By P. K. Nag.
5. Thermal Science and Engineering, By Dr. D. S. Kumar,