First Year Curriculum

Admission Year 2026-27

Bachelor of Technology
Mechatronics Engineering

Faculty of Engineering & Technology Parul University

Vadodara, Gujarat, India

Semester 1

a. **Course Name:** Basic Electrical and Electronics Engineering

b. **Course Code:** 03011301PC01

c. **Prerequisite:** Basic knowledge of Physics and Mathematics at the high school level. Additionally, basic concepts of semiconductors and logic circuits will help in grasping electronic circuit analysis and digital system design.

d. **Rationale:** This course provides a fundamental understanding of electrical and electronic systems essential for Mechatronics, Robotics, and Automation Engineering. It covers circuit analysis, electrical machines, power systems, semiconductor devices, and digital electronics, forming the foundation for automation, control, and embedded systems. The practical exposure helps students develop problem solving skills and apply theoretical concepts in real-world engineering applications.

e. Course Learning Objective:

CLOBJ 1	To enable students to analyze DC and AC electrical circuits using fundamental circuit laws and network theorems.
CLOBJ 2	To develop understanding of the construction, operating principles, and applications of transformers and electrical machines.
CLOBJ 3	To familiarize students with power supplies, electrical measurements, and basic instrumentation techniques.
CLOBJ 4	To develop the ability to design and analyze basic electronic circuits using semiconductor devices and operational amplifiers.
CLOBJ 5	To enable students to apply Boolean algebra and implement basic digital logic circuits for solving engineering problems.
CLOBJ 6	To enable students to analyze DC and AC electrical circuits using fundamental circuit laws and network theorems.

f. Course Learning Outcomes:

CLO 1	Analyze DC and AC circuits using circuit theorems.
CLO 2	Explain the working of transformers and electrical machines.
CLO 3	Apply power supplies, measurements, and instrumentation.
CLO 4	Design circuits using semiconductor devices and op-amps.
CLO 5	Implement digital logic circuits and Boolean algebra.

g. Teaching and Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
		P		MSE	CE	P	Theory	P	
		2		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 No	Content	Weightage (%)	Teaching Hrs.
1	**DC and AC circuit analysis** **DC circuit analysis:** Elements and characteristics of electric circuits, ideal and practical sources, independent and dependent electrical sources, Ohm's law, source transformation, Kirchhoff's laws. Mesh analysis, nodal analysis, voltage and current division rules, star-delta conversions, Thevenin's and Norton's theorems, Superposition Theorem. **AC Circuit Analysis:** Generation of sinusoidal AC voltage, average and RMS values, concept of phasor, analysis of series RL, RC and RLC circuits, power triangle, power factor, series resonance and Q factor. Generation of three-phase voltages, advantages of three-phase systems, star and delta connections (balanced only), relation between line and phase quantities.	**20**	**9**
2	**Electrical Machines:** DC Motor: Construction, principle of operation, Different types of DC motors, Voltage equation of a motor, significance of back emf, Speed, Torque, Torque-Speed characteristics, Output Power, Efficiency and applications. Single Phase Transformer: Construction, principle of operation, EMF Equation. Regulation and Efficiency of a Transformer. Induction Machine: Three Phase Induction Motor: Construction and Principle of Operation, Slip and Torque, Speed Characteristics. Stepper motor: Construction, principle and mode of operation.	**20**	**8**

3	**Industrial Electrical Engineering Power supply**Linear power supply, switch mode power supply (SMPS), block diagram of UPS. Measurements And Instrumentation: Functional elements of an instrument, Standards and calibration, Operating Principle, types -Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram-Data acquisition.	**10**	**6**
4	**Semiconductor Devices:** Semiconductor basics, PN Junction diode construction & working, Volt-amp characteristics, Diode current equation, Half wave rectifier, Full wave rectifier: Bridge and center tapped rectifier, Clipper and Clamper. Zener diode and zener diode-based voltage regulator, LED, 555 Timer, Integrated circuits. Operational Amplifiers – Inverting and Non-inverting amplifiers – Instrumentation amplifiers.	**25**	**11**
5	**Number Systems:** Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Boolean theorems, Minterms and Maxterms, Sum of products and products of sums, Karnaugh map Minimization, Logic	**25**	**11**
	gates: NOT, AND, OR, NAND, NOR, EX-OR and EX-NOR, half adder and full adder.		
	Total	**100**	**45**

i. Reference Books:

1. A textbook of Electrical technology Vol2 by B.L.Theraja | S. Chand Publication By B.L.Theraja | S. Chand Publication
2. A Textbook of Applied Electronics By Dr. R.S. Sedha, | S. Chand & Company Limited, | 1
3. Digital Logic and Computer Design By M Morris Mano | Pearson Education;
4. Basic Electrical Engineering By D. P. Kothari and I. J. Nagrath, | Tata McGraw Hill | 3, Pub. Year 2010
5. Basic Electrical Engineering, By Mittle and Mittal | McGraw Education

a. List of Experiments:

Sr No.	Experiment List
1	Verification of Ohm's Law and Kirchhoff's Laws using resistive circuits.
2	Mesh and Nodal Analysis for DC circuit analysis.
3	Thevenin's and Norton's Theorem verification using resistive networks.
4	Superposition Theorem application in a multi-source DC circuit.
5	AC Circuit Analysis of RL, RC, and RLC circuits using phasors and

	resonance.
6	Power Factor Measurement and improvement in AC circuits.
7	Load Test on DC Motors to determine torque-speed characteristics.
8	Transformer Efficiency and Regulation using open-circuit and short-circuit tests.
9	Rectifier Circuits (Half-wave & Full-wave) performance analysis.
10	Logic Gate Implementation and verification using Boolean algebra and K-maps.

a. **Course Name:** Linear Algebra and Calculus
b. **Course Code: 03019101BS02**
c. **Prerequisite:** Elementary Algebra, Matrices, Differentiation and Integration
d. **Rationale**: This syllabus builds essential mathematical tools for engineering applications, covering differential equations, Laplace transforms, and vector calculus.

e. **Course Learning Objective:**

CLOBJ 1	To develop understanding of matrices, determinants, and techniques for solving systems of linear equations, along with eigenvalues and eigenvectors.
CLOBJ 2	To apply methods for solving first-order ordinary differential equations and model real-life engineering problems such as cooling, growth, and electrical circuits.
CLOBJ 3	To understand functions of multiple variables and apply concepts of partial differentiation in analyzing physical and geometric problems.
CLOBJ 4	To analyze and solve problems involving maxima and minima, tangent planes, and normal lines using partial derivatives.
CLOBJ 5	To evaluate double and triple integrals and apply them to compute areas, volumes, and other engineering quantities.

f. **Course Learning Outcomes:**

CLO 1	Understand the concept of eigenvalues and eigenvectors of a matrix.
CLO 2	Formulate first-order differential equations 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.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**External Evaluation**		**Total**
				T	**CE**	**P**	**Theory**	**P**	
4	**-**	**0**	**4**	**40**	**20**	**0**	**60**		**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **CE**- Continuous Evaluation,

h. **Course Content:**

Sr.	**Topics**	**Weightage**	**Teaching Hours**

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 and applications:** Exact and non-exact differential equations, Integrating factor- function of x only and functions of y only, Linear and nonlinear differential equations, **Applications:** Newton's Law of cooling, Growth model and RL-Circuit and RC-Circuit	20	12
3	**Partial Differentiation and its application** **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

i. Text Book and Reference Book:

1. **Advanced Engineering Mathematics (TextBook)**
   By Erwin Kreyszig | Willey India Education
2. **Elementary Linear Algebra**
   By Howard Anton, Chris Rorres | Willy India Edition | 9th Edition
3. **Calculus with early transcendental functions**
   By James Stewart | Cengage Learning
4. **Thomas' Calculus**
   By Maurice D. Weir, Joel Hass, Frank R. Giordano | Pearson Education

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 12th science level.

d. **Course Learning Objective:**

CLOBJ 1	Understand semiconductor materials using band theory concepts.
CLOBJ 2	Explain principles of optoelectronic devices and optical fibers.
CLOBJ 3	Understand the fundamentals of quantum mechanics and quantum computing.
CLOBJ 4	Analyze low-dimensional and nanomaterials with their applications.
CLOBJ 5	Develop knowledge of semiconductor-based modern technologies.

e. **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.	**Topics**	**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:** 303105102
c. **Prerequisite:** Requires Basic Knowledge of Computer
d. **Rationale**: This course is designed to provide basic ideas of computer programming. This course also helps to understand programming languages. It will help to develop their logical abilities.

e. **Course Learning Objective:**

CLOBJ 1	Recognize and recall fundamental principles and organizations of computers, demonstrating a foundational understanding of computer architecture and design.
CLOBJ 2	Comprehend the concepts of computer programming languages, illustrating a grasp of syntax, semantics, and the essential components of programming languages.
CLOBJ 3	Develop algorithms for solving basic engineering problems, demonstrating the ability to apply theoretical knowledge to practical problem-solving scenarios.
CLOBJ 4	Demonstrate proficiency in the practical application of C programming by writing, compiling, and debugging programs, showcasing the ability to implement and troubleshoot code effectively.
CLOBJ 5	Evaluate and analyse complex computational programs written in C, demonstrating the capacity to assess and understand intricate solutions to computational challenges.
CLOBJ 6	Develop simple projects using the C programming language, showcasing creativity and application of learned principles to produce functional and practical software solutions.

f. **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.

g. **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**

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h. **Course Content:**

Sr.	Topics	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 & goto statements, The ternary (?:) Operator Looping: The while statement, & The Do.. While loop, The FOR loop, Jump within loops – Programs	15	4
4	Arrays and StringsArrays: 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

i. 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

j. List of Practicals

1	Practical Set 1 (Basics) 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
2	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 Grade 100-80 Dist 60-79 First Class 35-59 Second Class 0-34 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 1. Write a program to print the output of bellow series. 1!+2!+3!+4!+. n! 2. Write a program to print the following outputs using for Loop. (a) 1 (b) * 12 ** 123 *** 1. Write a program to print the following outputs using for Loop. (a) 1 (b) 321 21 21 321 1
3	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. 1. Write a program to count vowels from a entered String. 2. Write a program which finds whether a string is a palindrome or not
4	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.
5	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 Team name Batting average
6	Practical Set 6 (Pointers) 1. Write a program to add two numbers using pointers. 2. Write a program to swap two numbers using pointer
7	Practical Set 7 (File Management) 1. Write a program to illustrate reading files contents. 2. Write a program to illustrate the use of fgets( ).

a. **Course Name:** Principles of Communication Skills
b. **Course Code:** 03010001HM01
c. **Prerequisite:** Knowledge of English Language studied till 12th standard
d. **Rationale**: Basic Communication Skills are essential for all Engineers.

e. Course Learning Objective:

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.

f. Course Learning Outcomes:

CLO 1	Identify and explain parts of speech, punctuation marks, tenses, phrases, clauses, determiners, Quantifiers, sentence structures, and basic IPA phonetic symbols for accurate language use.
CLO 2	Demonstrate effective basic conversational exchanges and short extempore speeches using correct pronunciation, appropriate greetings, logical organization of ideas, and improved fluency.
CLO 3	Apply basic reading and listening strategies to comprehend short passages and spoken texts, recognizing appropriate pronunciation, stress, and intonation patterns.
CLO 4	Analyse personal communication performance and evaluate SMARTER goals through self-assessment and reflective practices to monitor language and pronunciation improvement.
CLO 5	Compose structured short picture-based perceptions by developing clear topic sentences, supporting details, and coherent conclusions with grammatical accuracy.

g. Teaching Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**0**	**0**	**20**	**0**	**30**	**50**

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

h. Course Content:

Sr.	Topics	W	T
1	Parts of Speech, Punctuation and Tenses using time line ● Overview of 8 parts of speech ● Basic punctuation marks and their usage ● Types: Present, Past, Future ● Forms and correct usage ● Common tense errors	10	4
2	Introduction to Phonetics-Symbols and Pronunciation ● Introduction to Phonetics and IPA ● English Speech Sounds ● Stress and Intonation	10	4
3	Phrase and Clauses; Types of Sentence (Structure Wise) ● Difference between phrases and clauses ● Classification of Simple, Compound & Complex ● Interchange of Simple to Compound, Simple to Complex, Compound to Complex	8	2
4	Picture Perception ● Observing and interpreting images ● Building a short story or description ● Improving vocabulary and creativity	14	4
5	Determiners and Quantifiers ● Types of determiners ● Order of determiners in a sentence ● Quantifiers with countable and uncountable nouns ● Common errors in the use of determiners and Quantifiers	8	2
6	Meeting and Greeting (Initiating a conversation) ● Basic conversation skill ● Formal and informal greetings ● Common phrases for starting interactions	10	4
7	Reading Comprehension (Level of difficulty-Basic) ● Types – Skimming & Scanning ● Reading short passages ● Identifying main ideas and details ● Answering basic questions	10	2
8	Listening Comprehension ● Listening to short audios/Conversation ● Understanding and responding to key information	8	2
9	Extempore Speech ● Speaking on random topics ● Organizing thoughts quickly	12	4

	● Improving fluency and confidence		
10	Goal Setting and Tracking ● Setting SMARTER goals ● Planning and tracking progress ● Self-assessment and reflection	10	2

i. 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: Engineering Graphics & Design
b. Course Code: 03010901ES02
c. Prerequisite: Zeal to learn the subject.
d. Rationale: Engineering Graphics is the language of communication for Engineers. Engineering Graphics course provides tools and techniques of communication for various fields of Engineering

e. Course Learning Objective:

CLOBJ 1	To develop fundamental knowledge of engineering drawing, including standards, drawing instruments, scales, dimensioning, and BIS practices.
CLOBJ 2	To understand and construct various engineering curves such as conics, spirals, involutes, and cycloids with their practical applications.
CLOBJ 3	To apply principles of projections for points, lines, and planes, and determine true lengths, inclinations, and auxiliary views.
CLOBJ 4	To visualize and draw projections and developments of solids, including sectional views and surface developments used in engineering design.
CLOBJ 5	To interpret and create orthographic and isometric projections and develop basic skills in computer-aided drafting for 2D and 3D modeling.

f. Course Learning Outcomes:

CLO 1	Understand the uses of drawing instruments, accessories, scales and BIS drawing standards in engineering graphics.
CLO 2	Form various engineering curves using basic drafting techniques.

CLO 3	Illustrate the projections of points, lines and planes in different quadrants using orthographic projection techniques.
CLO 4	Draw section of solids and development of surfaces using reference planes.
CLO 5	Draw orthographic and isometric projections of 3D objects using basic principles of projection.
CLO 6	Draft 2D and 3D engineering drawings with aid of basic AutoCAD.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				T	**CE**	**P**	**Theory**	**P**	
2	**-**	**4**	**4**	**40**	**20**	**20**	**60**	**30**	**150**

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

h. Course Content:

Sr.	Topics	W	T
1	**Introduction** Scope of Engineering Drawing in all Branches of Engineering, Uses of Drawing Instruments and Accessories, Introduction to Drawing Standards BIS-SP-46, Representative Fraction, Engineering Scales, Dimensioning Terms and Notations, Types of Lines used in Engineering. Practice recommended by BIS.	10	5
2	**Engineering Curves** Classification of Engineering Curves, Application of Engineering Curves, Constructions of Engineering Curves - Conics, Spirals, Involutes and Cycloids with Tangents and Normals.	15	10
3	**Principles of Projections** Types of Projection, Parallel Projection, One-point Perspective projection. Introduction to principal planes of projections, **Projections of the points:** Projections of the points located in the same quadrant and different quadrants. **Projections of line:** Projections of line with its inclination to one reference plane and with two reference planes. True length and inclination with the reference planes. **Projections of planes:** Projections of planes (polygons, circle and ellipse) with its inclination to one reference plane and with two reference planes, Concept of auxiliary plane method for projections of the plane.	20	10
4	**Projections and Development of Solids** **Projections of Solids:** Classifications of basic Solids, Projections of Solids - Right Regular Prism, Pyramid, Cone, Cylinder, Tetrahedron and Cube; Sectional Views. **Development of Surfaces:** Methods of Development of Lateral Surfaces of Right Regular Solids, Parallel Line Development and Radial Line Development, Applications of Development of Surfaces.	20	10
5	**Orthographic and Isometric Projections** **Orthographic Projections:** Principle of orthographic projections, Conversion of pictorial views into orthographic projections including sectional orthographic projections. **Isometric Projections**: Conversion of orthographic views into isometric projections/views.	20	5
6	**Computer Aided Drafting** Basic User Interface of Drafting Software, Demonstration of basic modelling commands, Preparation of 2D and 3D models using Drafting Software.	15	5

i. Text Book and Reference Book:

1. **A Text Book of Engineering Graphics (TextBook)**
   By P.J.Shah | S.Chand & Company Ltd., New Delhi | 2021st edition
2. **Engineering Drawing**
   By N. D. Bhatt | Charotar Publishing House | 55th edition, Pub. Year 2010
3. **A Text Book of Engineering Drawing**
   By P.S.Gill | S.K. Kataria & Sons | 2013th edition
4. **Engineering Graphics with Auto CAD**
   By James D.Bethune, | Pearson Education | 2020th edition

j. List of Practical

Sr. No.	Practical
1	Demonstration of different drawing instruments, dimensioning systems, symbols and Engineering Scale.
2	Exercise on Projections of Points and Lines.
3	Exercise on Projections of Planes.
4	To draw a sheet involving Projections of Solids and Sections of Solids
5	To draw a sheet involving Development of Surfaces.
6	Practice sheets on Orthographic Projections.
7	Practice sheets on Isometric Projection.
8	Demonstration of Industrial Drawings.
9	To create basic objects (2D sketches) using Computer Aided Drafting tool
10	To create precise drawing (3D modeling), dimensions and editing using Computer Aided Drafting tool

Semester 2

b. Course Name: Differential Equations and Vector Calculus
c. Course Code: 03019102BS02
d. Prerequisite: Differential Calculus, Integral Calculus, Vector Algebra, Differential Equations.
e. Rationale: This syllabus builds essential mathematical tools for engineering applications, covering differential equations, Laplace transforms, and vector calculus.

f. Course Learning Objective:

CLOBJ 1	**Solve higher-order linear differential equations** using standard methods for homogeneous and non-homogeneous cases.
CLOBJ 2	**Apply differential equations to physical problems** such as free, damped, and forced oscillations and RLC circuits.
CLOBJ 3	**Use Laplace transforms** and their properties to solve initial value problems efficiently.
CLOBJ 4	**Expand functions using Fourier series**, including half-range expansions for even and odd functions.
CLOBJ 5	**Apply vector calculus concepts** like gradient, divergence, curl, and line integrals in solving practical problems.

g. 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.

h. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				T	**CE**	**P**	**Theory**	**P**	
4	**-**	**-**	**4**	**40**	**20**	**-**	**-**	**60**	**100**

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

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Second and Higher-Order Ordinary Differential Equations Homogeneous Linear ODE, Homogeneous constant c oefficient 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 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, scalar valued function, Gradient 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

j. Text Book and Reference Book:

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

Course Name: Mechanics of Solids

Course Code: 03010402ES01

Prerequisite: Understanding of Physics, Maths, Units, Force etc.

Rationale: Mechanics of Solids is a conceptual application of principles of mechanics in Engineering. The course provides fundamental knowledge of force systems, stresses, strains, beams, friction, centroid, and moment of inertia which are essential for analyzing and designing engineering structures and mechanical systems.

Course Learning Objective:

CLOBJ 1	Understand the concepts of forces, equilibrium, and rigid body mechanics in engineering applications.
CLOBJ 2	Apply principles of centroid and moment of inertia for engineering structures and components.
CLOBJ 3	Analyze stresses, strains, and elastic behavior of materials under different loading conditions.
CLOBJ 4	Evaluate shear force, bending moment, and stresses developed in beams.
CLOBJ 5	Understand the principles of friction and their applications in engineering systems.

f. Course Learning Outcomes:

CLO 1	Correlate real-life problems of rigid bodies with engineering mechanics and determine the resultant & moment of various force system acting in 2-Dimension & 3- Dimension.
CLO 2	Evaluate centroid of line, area and volume; and Moment of inertia of area.
CLO 3	Understand simple stresses and strains, understand principal stresses and strains.
CLO 4	Analyze the internal and external forces & stresses in a beam, bending stresses, shear stress in beams.
CLO 5	Know basics of friction and its importance through simple applications.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
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:** Forces, equilibrium of rigid bodies, scalars and vectors, system of forces, resultant force, statics of particles, free body diagrams, concurrent and non-concurrent force systems, moments about points and axes, and non-coplanar forces.	15%	6
2	**Centroid and Moment of Inertia:** Centroid and center of gravity, centroid of volumes, Pappus-Guldinus theorem and applications, second moment of area, parallel axis theorem, composite areas, and mass moment of inertia.	15%	6
3	**Stresses and Strains:** Types of stresses and strains, Hooke's law, elastic constants, thermal stresses, eccentric loading, principal stresses and strains, Mohr's circle, maximum shear stress and principal planes.	30%	12
4	**Beams:** Types of beams, loads and supports, reactions, shear force and bending moment diagrams, point of contra-flexure, theory of simple bending, bending stresses, beam of uniform strength, and shear stresses in different beam sections.	30%	12
5	**Friction:** Laws of dry friction, coefficient and angle of friction, friction in ladders and spheres, belt friction, and analysis of flat and V-belts.	10%	4

i. List of Practical:

Sr. No.	Practical
1	Equilibrium of Coplanar-Concurrent Force System (Law of Parallelogram of Forces)
2	Equilibrium of Coplanar-Concurrent Force System (Law of Polygon of Forces)
3	Verification of Principle of Moment using Bell-Crank Lever Apparatus
4	Determination of Centre of Gravity for Different Shapes of Plates
5	Brinell and Rockwell Hardness Test
6	Compression Test on Timber
7	Flexural Test on Timber
8	Tensile Test on Mild Steel

9	Equilibrium of Parallel Force System – Simply Supported Beam
10	Determination of Co-efficient of Static Friction

j. Text Book and Reference Book:

1. Engineering Mechanics: Statics and Dynamics By R.C. Hibbeler | Prentice Hall of India
2. Engineering Mechanics: Statics and Dynamics By S. Rajsekaran | Vikas Publication
3. Engineering Mechanics: Statics and Dynamics By J.A. Desai and B.B. Mistry | Popular Prakashan
4. Engineering Mechanics By S.S. Bhavikatti and K.G. Rajashekarappa | Wiley Eastern Ltd
5. Theory of Structures By R.S. Khurmi | S. Chand & Co. Ltd
6. Theory of Structures By S. Ramamrutham | Dhanpat Rai Publishing Company
7. Engineering Mechanics By J.L. Meriam and L.G. Kraige | John Wiley and Sons, New York,

- **Course Name:** Advanced Communication and Interpersonal Skills
- **Course Code:** 03010002HM01
- **Prerequisite:** Basic Communication Skills are essential for all Engineers
- **Rationale**: Strengthen core language and soft skills through applied grammar, communication tasks, and vocabulary building.

- **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	Enhance written and spoken expression through structured essay writing, Paragraph development, confident self-introduction, and professional grooming practices.
CLOBJ 5	Develop self-management and personal development skills by applying SWOT analysis, practicing effective time management strategies, and engaging in reflective learning processes.

- **Course Learning Outcomes:**

CLO 1	Remember rules of subject–verb agreement, reported speech, and active–passive voice to produce grammatically correct sentences in real-life contexts.
CLO 2	Understand the usage of appropriate vocabulary including synonyms, antonyms, homonyms, homophones, homographs, and idioms in spoken and written communication.
CLO 3	Apply structured essays, Paragraph, and confident self-introductions using appropriate language, logical organization, professional etiquette, and positive body language.
CLO 4	Analyse intermediate-level reading passages by identifying main ideas, supporting details, tone, and purpose.
CLO 5	Evaluate SWOT analysis and time-management techniques to plan personal goals, prioritize tasks, and improve academic and professional effectiveness.

- **Teaching & Examination Scheme:**

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

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

- **Course Content:**

Sr. No.	Content	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**

Lab (Practical)

Sr.	Content	Weightage	Teaching Hrs.

1	Subject Verb Agreement **b.** Fill-in-the-blank exercises **c.** Sentence correction tasks **d.** Group quiz competition **e.** Role-play using correct subject-verb forms	10%	2
2	Reported Speech ● Dialogue conversion practice ● Pair work: narrate a conversation ● Reporting classroom news ● Role-play followed by reporting	10%	2
3	Active and Passive Voice ● Transform active sentences to passive and vice versa ● Rewrite instructions in passive voice ● Classroom narration using passive structures ● Group activity: change story voice	10%	2
4	Building Vocabulary ● Daily word journal ● Vocabulary flashcards and games ● Synonym-antonym match-up ● Word building through storytelling	10%	4
5	Grooming and Personality Development **a.** Personal grooming checklist task **b.** Group discussion on personality traits **c.** Mock social interaction **d.** Confidence-building exercises	10%	4
6	SWOT Analysis with Self Introduction ● SWOT worksheet filling ● Self-introduction in pairs or groups ● Strength-sharing circle ● Feedback on introductions	10%	4

7	Reading Comprehension (Level of Difficulty – Intermediate) ● Reading passage followed by Q&A ● Find-the-theme activity ● Vocabulary hunt from the passage ● Summarizing a short text	10%	4

8	Paragraph Development ● Paragraph writing using prompts ● Sentence reordering activity ● Peer editing for coherence	10%	2
9	Essay Writing ● Brainstorming and outline creation ● Writing on guided topics ● Peer feedback session ● Editing and final draft submission	10%	4
10	Time Management and Team Building ● Create a weekly schedule ● Prioritization task (urgent vs important) ● Reflection on time use habits	10%	2

- **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.

- **Course Name:** Environmental Science
- **Course Code:** 03010002MC01
- **Prerequisite:** Knowledge of Mathematics up to 12th science level
- **Rationale**: The proposed syllabus of Environmental Science is comprehensive and multidisciplinary, reflecting the interconnectedness of ecological systems, technological development, human behavior, and urban planning. This rationale explains the relevance and importance of each thematic area covered: Environmental Health, Ecology, and Quality of Life; Pollution Prevention; Population Growth and Global Environmental Challenges; Environmental Information Systems and Technological Tools; Smart Cities

- **Course Learning Objective:**

CLOBJ 1	Apply systems thinking to analyse the city as a system, demonstrating application
CLOBJ 2	Evaluate the role of smart citizens and approaches for citizen engagement
CLOBJ 3	Identify sources and stressors of water resources, demonstrating understanding
CLOBJ 4	Analyse the causes, effects, and control measures of population explosion

- **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

- **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**		
				Internal Evaluation	**ESE**	

L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	**Total**

1	**-**	**-**	**0**	**50**	**50**	**-**	**-**	**-**	**100**

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

- **Course Content:**

Sr.	**Topics**	**W**	**T**
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	3
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.	25	4
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	3
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	15	3
	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		

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.	20	2

- **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

e. **Course Name:** Privacy and Security in Online Social Media
f. **Course Code:** 03M10002UE01
g. **Prerequisite:** Basic knowledge of social media, privacy and security.
h. **Rationale:** The course explores the fundamentals of Online Social Networks (OSNs), focusing on data collection, analysis, trust, security, and privacy**.**

i. **Course Learning Objective:**

CLOBJ 1	Understand the fundamentals and evolution of Online Social Networks (OSNs), including their structure, data generation processes, and the role of social media APIs in data extraction.
CLOBJ 2	Apply data collection and analysis techniques to extract, preprocess, and interpret social media data while addressing ethical considerations in real-world scenarios.
CLOBJ 3	Evaluate trust, credibility, and reputation mechanisms in online communities and analyze methods for detecting misinformation, fake news, and improving trustworthiness.
CLOBJ 4	Analyze security and privacy challenges in OSNs, including phishing attacks, data disclosure risks, and techniques for identifying fraudulent entities and fake profiles.
CLOBJ 5	Assess real-world applications and emerging trends in OSNs, including case study analysis, research evaluation, and the role of social networks in law enforcement and future security developments.

j. **Course Learning Outcomes:**

CLO 1	Understand Online Social Networks and Data Collection – Explain the fundamentals of online social networks, data collection methods, and the challenges and opportunities associated with them.
CLO 2	Analyze Trust, Credibility, and Reputation in Social Systems – Evaluate the role of trust and reputation in online communities and develop strategies to detect misinformation and enhance credibility.
CLO 3	Examine Privacy and Security Risks in OSNs – Assess the impact of privacy disclosure, phishing, and fraudulent activities in social media and propose countermeasures.
CLO 4	Apply Data Collection and Analysis Techniques – Utilize social media APIs and data processing methods to extract, clean, and analyze information from online social networks.
CLO 5	Conduct Research on Emerging OSN Topics – Engage in discussions and research on social media security, privacy, and law enforcement applications, contributing to the field through case studies and research papers

k. **Teaching & Examination Scheme:**

Teaching Scheme	**Evaluation Scheme**

L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	**0**	**0**	**3**	40	20	-	60	-	**100**

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

I. Course Content:

Sr.	Topic	Weightage	Teaching Hrs.
1	Introduction to Online Social Networks Definition and Evolution of Online Social Networks (OSNs), Data Collection from Social Networks, Challenges, Opportunities, and Pitfalls in OSNs, social media APIs for Data Extraction.	20	8
2	Data Collection and Analysis in OSNs Techniques for Collecting Data from Online social media, Ethical Considerations in Social Media Data Collection, Data Processing and Cleaning for Analysis, Case Studies on Social Media Data Collection	20	8
3	Trust, Credibility, and Reputation in Social Systems Understanding Trust and Credibility in Online Communities, Reputation Systems and Their Impact on User Behavior, Detecting Misinformation and Fake News in OSNs, Methods for Enhancing Trustworthiness in Social Media	20	8
4	Security, Privacy, and Fraud Detection in OSNs Online Social Media and Its Role in Law Enforcement & Policing, Information Privacy: Disclosure, Revelation, and Its Effects, Phishing Attacks in OSNs and Their Countermeasures, Identifying Fraudulent Entities and Fake Profiles in OSNs.	20	8
5	Research and Practical Applications Review and Discussion of Key Topics (Refresher), Analyzing Real-World OSN Case Studies, Research Paper Discussions on Online Social Networks and Security, Future Trends in OSN Security and privacy	20	8

Reference Books:

1. "Social Media Mining: An Introduction" – Reza Zafarani, Mohammad Ali

Abbasi, Huan Liu: Provides a comprehensive introduction to social media data mining, including machine learning and network analysis techniques.

2. Mining the Social Web" – Matthew A. Russell: Covers data collection, analysis, and visualization techniques using Python and APIs from platforms like Twitter, Facebook, and LinkedIn.
3. Security and Privacy-Preserving Techniques in Social Networks" – Barbara Carminati & Elena Ferrari Explores security challenges, privacy risks, and trust management in online social networks

- **Course Name:** Indian Economy: Some Contemporary Perspectives
- **Course Code:** 06M10102UE02
- **Prerequisite:** Basic understanding of economic principles and macroeconomic concepts is recommended. Familiarity with the Indian economic structure and current affairs will be beneficial but is not mandatory
- **Rationale:** This course is designed to provide students with a comprehensive understanding of the Indian economy's evolution, key reforms, and current challenges.
- **Course Learning Objective:**

CLOBJ 1	Analyze the evolution of the Indian economy since independence, with emphasis on pre- and post-reform phases, including agricultural and industrial reforms in a mixed economy framework.
CLOBJ 2	Evaluate key socio-economic, tax, and financial sector reforms, including financial inclusion initiatives and challenges in the Indian banking system.
CLOBJ 3	Assess India's integration with the global economy, focusing on WTO regulations, structural shocks, recent policy measures, and current economic challenges.

- **Course Learning Outcomes:**

CLO 1	To critically assess the trajectory of India's economic development since independence and explain the impact of major sectoral reforms in agriculture and industry.
CLO 2	To evaluate the effectiveness of financial sector reforms, tax policies, and India's engagement with WTO regulations in promoting inclusive and sustainable economic growth.
CLO 3	To analyze the impact of recent policy shocks and government initiatives on the Indian economy and identify key challenges to future economic stability and growth.

- **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	0	0	3	40	20	0	60	0	100

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

- **Course Content:**

Unit No.	Topic	Weightage	Teaching Hrs.
1.	**Module** 1 Indian economy since independence; analysis of the pre- and post-reform periods of India's economic growth and development; Assessment of agriculture sector reforms; industrial reforms in a mixed economic set up and tracing the contours of liberalization and self-reliance.	40	18
2.	**Module 2** Socio-economic development and tax reforms; Financial sector reforms and financial inclusion; Indian banking sector crisis and recent developments	40	18
3.	**Module 3** India and WTO regulations: Inward and outward analysis; Structural shocks and analysis of recent policy initiatives; Indian economy: Recent outlook and challenges.	20	9

a. **Course Name:** Design, Technology and Innovation
b. **Course Code:** 03M10002UE02
c. **Prerequisite:** Zeal to learn the subject.
d. **Rationale:** Design, Technology, and Innovation (DT&I) subject's lies in equipping students with the skills to be creative problem solvers and innovators in a rapidly evolving world. These subjects foster critical thinking, creative exploration, and the ability to translate ideas into tangible solutions, preparing students for future careers and societal challenges
e. **Course Learning Objective:**

CLOBJ 1	Understand and apply design thinking methodologies, including user-centered design, problem definition, concept generation, and evaluation techniques for developing effective solutions.
CLOBJ 2	Analyze the role of technology in design and innovation, including tools such as CAD, 3D printing, and emerging technologies (AI, IoT, AR/VR), along with engineering, safety, and sustainability considerations.
CLOBJ 3	Evaluate innovation and entrepreneurship processes, including intellectual property, business model development, and collaborative approaches to transform ideas into viable products or services.

f. **Course Learning Outcomes:**

CLO 1	Apply design thinking methodologies to identify and solve user-centered problems
CLO 2	Demonstrate creative thinking and effective ideation strategies.
CLO 3	Develop low-fidelity and high-fidelity prototypes and understand fabrication challenges.
CLO 4	Incorporate engineering principles into design and innovation.
CLO 5	Communicate ideas visually through sketching and graphical tools
CLO 6	Understand the fundamentals of entrepreneurship and the startup process

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**0**	**3**	**40**	**20**	**0**	**60**	**00**	**100**

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

h. **Course Content**

Unit No.	Topic	Weightage	Teaching Hrs.
1.	**Design Thinking and Methodologies** Introduction to Design Thinking:Understanding the design process, user needs, and problem definition. Design Process:Exploring different design methodologies, including brainstorming, sketching, and prototyping. Human and Culture Centered Design:Focusing on user needs, ergonomics, and user experience. Design for Social and Life style change. Concept Generation and Evaluation:Developing and evaluating design concepts through various techniques.	30	12
2.	**Technology and its Role in Design Technology for Design:** Exploring how technology enables and enhances the design process. Specific Technologies: Relevant areas like CAD and Graphics software, 3D printing, Machining technologies, digital fabrication, and other relevant technology. Innovation in Emerging Technologies and methods like AR/VR, IOT, AI and ML, Supply Chain Management and Project Management. Technology to Solution: Understanding how technology can be leveraged to solve real-world problems. Engineering Aspect of design Electrical, Mechanical, Design, Material, Aspect, Safety and Reliability aspect, Sustainable and Eco friendly materials**.**	35	16
3.	**Innovation and Entrepreneurship** Introduction to Innovation: Understanding the principles of innovation and its role in product development. Role of Innovation in Life and Society Grassroots Innovation: Learning from innovative solutions developed at the community level. Collaborative Innovation: Exploring how different individuals and teams can collaborate to drive innovation. Intellectual Property: Learning about patents, copyrights, and other forms of intellectual property. Business Model Development: Exploring how to develop a business model for a new product or service. Entrepreneurship: Fundamentals of starting a business and the challenges and opportunities of entrepreneurship	35	16

- **Course Name:** Intellectual Property
- **Course Code: 06M10502UE03**
- **Prerequisite:** A basic understanding of business, innovation, or creativity-related fields will be helpful.
- **Rationale:** The course aims to empower future managers, entrepreneurs, and innovators to make informed IP-related decisions..
- **Course Learning Objective:**

CLOBJ 1	Understand the fundamentals of Intellectual Property (IP), including patents, trademarks, and copyright, and their role in the intangible economy.
CLOBJ 2	Analyze the scope, enforcement, and commercial value of IP, including unconventional IP forms and strategies for using IP as a business asset.
CLOBJ 3	Evaluate the role of IP in research, creativity, and policy-making, including its significance in universities, creative industries, and government initiatives for promoting innovation.

- **Course Learning Outcomes:**

CLO 1	To identify different forms of IP, understand their role in value creation, and analyze real-world examples of patents, trademarks, and copyrights.
CLO 2	To evaluate unconventional IPs, assess enforcement mechanisms, and apply business strategies to monetize intellectual assets.
CLO 3	To analyze the role of IP in research institutions and creative industries and assess the importance of policy and education in strengthening the IP framework.

- **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**0**	**-**	**3**	**40**	**20**	**-**	**60**	**-**	**100**

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

- **Course Content:**

Sr. No.	**Content**	**Weightage**	**Teaching Hours**

1	**Module 1** Basics of Intellectual Property; The Intangible Economy; Patents—From ball pens to biologics; Trade Marks—What does red soles and barbie girl mean?; Copyright—Is it right to copy?	**40**	**18**
2	**Module 2** Unconventional IP—The expanding scope; Enforcement of IP—Protecting your rights; IP for Business—A profit making asset class .	**40**	**18**
3	**Module 3** IP, Research, and Universities; IP for the Creative and Entertainment Industries; Governments Role in Fostering IP; Teaching IP—Let everyone learn IP	**20**	**9**

- **Course Name:** Principles of Management
- **Course Code:** 06M10202UE01
- **Prerequisite:** Basic understanding of organizational structure and general awareness of business operations.
- **Rationale:** This course lays the foundational framework for understanding managerial roles and functions in contemporary business settings.

- **Course Learning Objective:**

CLOBJ 1	Understand fundamental management concepts and functions, including planning, forecasting, and the evolution of management thought in a business environment.
CLOBJ 2	Apply managerial processes and techniques, such as decision-making, organizing, staffing, directing, coordination, and management by objectives in organizational settings.
CLOBJ 3	Analyze leadership, communication, and organizational development strategies, including career development, change management, and challenges faced by contemporary businesses.

- **Course Learning Outcomes:**

CLO 1	To describe the core principles of management, analyze historical developments, and apply planning techniques considering environmental factors.
CLO 2	To evaluate various management styles, design effective organizational structures, and apply decision-making and staffing techniques in managerial contexts.
CLO 3	To demonstrate effective leadership and communication strategies, manage organizational change, and critically assess modern-day managerial challenges

- **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**0**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

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

- **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	Module 1:Introduction to Management; Evolution of Management Thought; Planning; Understanding environment of business; Forecasting and Premising.	40	18
2	Module 2Decision-making; Management by Objectives and Styles of Management; Organizing and Directing; Staffing and Coordination	20	9
3	Module 3Career Development Strategy; Leadership styles of Managers; Organizational Communication; Change management; Challenges of Contemporary Business	40	18

a. **Course Name:** Mechatronics Workshop
b. **Course Code: 03011302PC01**
c. **Prerequisite:** Basic understanding of physics, mathematics, mechanical components, and computer basics is helpful, though no prior coding or electronics experience is required for this introductory hands-on workshop.
d. **Rationale:** The Robotics Workshop introduces first-year students to the interdisciplinary nature of Robotics and Automation by blending mechanical systems, electronics, sensors, actuators, and basic programming into practical applications. It serves as a foundation to spark interest, build curiosity, and offer experiential learning early in the academic journey. This workshop bridges theoretical understanding with real-world problem-solving, encouraging teamwork, innovation, and system-level thinking — essential for progressing through advanced Robotics subjects.
e. **Course Learning Objective:**

CLOBJ 1	To provide students with fundamental knowledge of core manufacturing processes such as machining, welding, and handling operations used in modern industries.
CLOBJ 2	To develop practical skills in CNC machines, sensors, actuators, and automation systems through hands-on learning activities.
CLOBJ 3	To introduce students to basic electronics, microcontrollers, and PLC programming for industrial automation applications.
CLOBJ 4	To enhance problem-solving and teamwork abilities by engaging students in real-world manufacturing automation mini-projects.

f. **Course Learning Outcomes:**

CLO 1	Understand core manufacturing processes like machining, welding, and material handling.
CLO 2	Gain hands-on experience with CNC, sensors, actuators, and automation systems.
CLO 3	Learn basic electronics, microcontrollers, and PLC programming.
CLO 4	Work on a real-world manufacturing automation mini-project.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
1	0	4	3	-	50	50	-	50	150

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

h. **Course Content:**

Unit No.	Topic	Weightage	Teaching Hrs.
1.	**Fundamentals of Manufacturing and Engineering Materials** Introduction to Manufacturing & Engineering Materials, Basics of Machining & Traditional Manufacturing Processes, Metal Cutting & Forming Processes, Welding & Joining Processes, Introduction to CNC & Automation in Manufacturing	35%	5
2.	**Basics of Electronics and Automation** Introduction to Electrical and Electronic Components, Power Supply & PCB Basics, Sensors and Actuators in Manufacturing, Microcontrollers in Automation (Arduino), PLCs in Manufacturing Automation	35%	5
3.	**Advanced Manufacturing and Mini Projects** Industrial Robotics and Smart Manufacturing, Material Handling Systems & Conveyors, Mini Project Phase 1 - Concept and Design, Mini Project Phase 2 - Implementation, Final Project Presentation and Career Pathways	35%	5

i. Text Book and Reference Book:

1. Elements of Mechanical Engineering By Sadhu Singh | S. Chand Publisher. | Revised edition, Pub. Year 2013
2. Elements of Mechanical Engineering By S.B.Mathur, S. Domkundwar | Dhanpat Rai & Sons Publications., Pub. Year 2013
3. Fundamental of Mechanical Engineering By G. S. Sawhney | PHI Publication New Delhi. Third edition, Pub. Year 2015
4. Engineering Thermodynamics By P. K. Nag | Tata McGraw-Hill Education | Sixth edition, Pub. Year 2017
5. Thermal Science and Engineering By Dr. D. S. Kumar | S. K. Kataria and sons Publishers. Fourth edition, Pub. Year 2022

j. List of Practical

Sr. No.	Practical
1	Identification of Engineering Materials (Metals, Plastics, Ceramics).
2	Hands-on Practice on Lathe Machine (Basic Turning Operations).
3	Hands-on Experience with Sheet Metal Cutting and Bending.
4	Hands-on Welding Practice (Arc Welding & Soldering).
5	Demonstration of a CNC Machine.
6	Identifying and Testing Basic Electrical & Electronic Components.
7	PCB Design and Soldering a Simple Circuit.
8	Hands-on Work with Sensors (Proximity Sensor for Object Detection).
9	LED Blinking and Sensor-Based Motor Control Using Arduino.
10	Simulating a Simple Pick-and-Place Robotic System.

a. **Course Name:** Elements of Mechanical Engineering
b. **Course Code:** 03010901ES01
c. **Prerequisite:** Knowledge of Physics and Mathematics up to 12th science level
d. **Rationale:** This course introduces the basic principles of Mechanical Engineering to students in various branches of Engineering.
e. **Course Learning Objective:**

CLOBJ 1	To develop a fundamental understanding of thermodynamic principles, laws, systems, and basic energy concepts used in engineering applications.
CLOBJ 2	To analyze the properties and behavior of gases and steam, including gas laws, thermodynamic processes, and steam generation characteristics.
CLOBJ 3	To understand the working principles, performance, and efficiency of heat engines, including internal combustion engines and thermodynamic cycles.
CLOBJ 4	To study energy conversion devices such as boilers, refrigeration systems, and air conditioning systems, along with their components and applications.
CLOBJ 5	To gain knowledge of pumps, compressors, and mechanical power transmission systems, including their working principles, classifications, and practical uses.

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**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				T	**CE**	**P**	**Theory**	**P**	
3	**-**	**2**	**4**	**40**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit, **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 constant pressure and constant volume, Non-flow processes.	**20**	**8**
3	**Heat Engines** Definition and Classification of Heat Engine; **Internal 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, Specific Volume, Dryness Fraction of Steam, Measurement of Dryness Fraction, Calorimeters, and Steam Table.	**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**

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   By P. K. Nag | Tata McGraw-Hill Education | Sixth edition, Pub. Year 2017
5. **Thermal Science and Engineering**
   By Dr. D. S. Kumar | S. K. Kataria and sons Publishers. | Fourth edition, Pub. Year 2022

j. List of Practical

Sr. No.	Practical
1	Case study on Conventional and Non-Conventional Energy Sources.
2	Demonstration of various types of Steam Generators.
3	Demonstration of various types of mountings and accessories.
4	Demonstration of 4-stroke Petrol and Diesel Engines.
5	Demonstration of 2-stroke Petrol and Diesel Engines.

6	Determination of Power and Thermal Efficiency of an IC Engine.

7	Demonstration of Vapor Compression and Vapor Absorption refrigeration cycle.

8	Demonstration of different types of Pumps.
9	Demonstration of different types of Compressors.
10	Demonstration of various Power Transmission Devices.