SYLLABUS
FOR
BACHELOR OF TECHNOLOGY
IN
ELECTRONICS & COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
UNIVERSITY OF KASHMIR
SRINAGAR

JULY – 2025
(Applicable to Batch 2025 & Onwards)

UNIVERSITY OF KASHMIR
SCHOOL OF ENGINEERING

B. Tech. Electronics and Communication Engineering

Programme Specific Outcomes

PSO No.	Program Specific Outcome
PSO1	Apply fundamental concepts of electronic devices, circuits, and signal processing to analyze and design analog and digital systems.
PSO2	Design and implement communication systems including wireless, optical, and digital communication with knowledge of modulation, coding, and network protocols.
PSO3	Develop embedded systems and IoT solutions using microcontrollers, sensors, real-time interfaces, and programming tools.
PSO4	Demonstrate the ability to work with VLSI design tools, signal processing techniques, and electronic CAD platforms for system-level implementation.
PSO5	Practice ethical responsibilities and demonstrate awareness of the societal and environmental impact of modern electronics and communication technologies.

Programme Learning Outcomes

PLO No.	Program Learning Outcome
PLO1	**Engineering Knowledge:** Apply knowledge of mathematics, science, and core electronics and communication engineering to solve complex engineering problems.
PLO2	**Problem Analysis:** Identify, formulate, and analyze electronics and communication systems using domain knowledge and engineering principles.
PLO3	**Design/Development of Solutions:** Design analog/digital circuits, communication systems, and embedded platforms that meet desired specifications with appropriate safety, sustainability, and legal constraints.
PLO4	**Investigation of Complex Problems:** Design and conduct experiments using modern tools to investigate problems in signal processing, embedded systems, VLSI, or wireless communication.
PLO5	**Modern Tool Usage:** Use hardware/software tools such as MATLAB, CAD tools, HDL simulators, and microcontroller platforms for electronics and communication system design and simulation.
PLO6	**The Engineer and Society:** Apply contextual knowledge to assess health, safety, legal, and societal issues related to electronic communication technologies.
PLO7	**Environment and Sustainability:** Understand the environmental impact of electronic system design and promote sustainable practices in engineering development.
PLO8	**Ethics:** Apply ethical principles and commit to professional responsibilities in the field of electronics and communication.
PLO9	**Individual and Team Work:** Function effectively as an individual and in teams, including multidisciplinary settings, for solving real-world engineering problems.
PLO10	**Communication:** Communicate effectively in technical formats such as documentation, presentations, and schematic design reports.
PLO11	**Project Management and Finance:** Apply engineering and management principles to handle projects, budgets, and team resources in electronics industries.
PLO12	**Innovation, Entrepreneurship and Life-long Learning:** Exhibit an innovative mindset and entrepreneurial skills for technology development to keep pace with rapid developments in ECE technologies like IoT, 5G, AI , embedded systems, etc.

Accreditation Alignment

1. The program is designed in accordance with **NEP, AICTE, and NBA guidelines.**
2. Program Learning Outcomes (POs) align with **Washington Accord Competencies for Engineering Graduates**.
3. Courses incorporate **UPSC and GATE syllabus alignment** for research and higher education opportunities.

Course Code Formula										
Position:	1	2	3	4	5	6	7	8	9	10
Indicator:	**B**	**E**	**C**	**E**	**B**	**M**	**T**	**2**	**2**	**5**
Digit	**Description**									
1	Bachelor's Programme									
2 - 4	Programme Code: Electronics & Communication Engineering = ECE									
5	Indicator Alphabet in Course Code									
6 - 7	Course Title									
8	Semester(1 to 8)									
9 - 10	Year of Launch									
Indicator Alphabet	**Description**									
H	Humanities & Social Science Course									
B	Basic Science Course									
E	Engineering Science Course									
C	Programme Core Course									
D	Programme Elective Course									
O	Open Elective Course									
L	Laboratory Course									
P	Project/Internship									
Y	Seminar									
A	Audit Course									
Examination Code	**Description**									
MSE	Mid Semester Evaluation									
IA	Internal Assessment									
CIE	Continuous Internal Evaluation = MSE + IA									
SEE	Semester End Evaluation									

Examination Pattern

SEMESTER END EVALUATION(SEE)			
Semester-end Examination(Paper Pattern)			
Section	**No of questions**	**Marks**	**Sectional Marks**
A	10 (2 from each unit)	1	10
B	5 (1 from each unit)	4	20
C	2 out of 5 (1 from each unit)	10	20
Total			50

CONTINUOUS INTERNAL EVALUATION(CIE)			
Mid semester Evaluation(MSE)			
Mid-term Examination (Paper Pattern)			
Section	**No of questions**	**Marks**	**Sectional Marks**
A	10 (5 from each unit)	**1**	**10**
B	3	**5**	**15**
C	1 out of 2 (1 from each unit 1 & 2)	**10**	**10**
Total			**35**

Internal Assessment			
Section	**Type of Assessment**	**Marks**	**Sectional Marks**
1	**Attendance Viva Quiz Presentation Surprise test Open book tests mini project, etc.**	**The Teacher can divide the marks across the assessments**	**15**
Total			**15**

COURSE STRUCTURE OF B.TECH PROGRAM IN ELECTRONICS AND COMMUNICATION ENGINEERING

Effective from Session 2025

Semester - I

S.no.	Course Code	Course Title	Hours Per Week				Credits	Total marks
			L	T	P	Total		
3 WEEKS COMPULSORY INDUCTION PROGRAM (UHV-I)								
1	BECEBPH125	Physics (Electromagnetics,Semiconductors and Optoelectronics)	3	0	2	5	4	200
2	BECEBMT125	Mathematics-I (Calculus)	3	1	0	4	4	100
3	BECEEEW125	Engineering Workshop	0	0	4	4	2	100
4	BECEEPP125	Programming and Problem Solving Techniques	2	1	2	5	4	200
5	BECEEEG125	Engineering Graphics	2	1	0	3	3	100
6	BECEHUH125	Universal Human Values	2	0	0	2	2	100
7	BECEHPC125	Professional Communication	2	1	0	3	3	100
8	Any one of the following (activity based experiential learning and internal exam only)							
	BECEAYO125	Yoga	0	1	2	3	0	100
	BECEASP125	Sports						
	BECEANC125	NCC						
	BECEANS125	NSS						
	BECEADM125	Disaster Management						
TOTAL			14	5	10	29	22	1000

COURSE STRUCTURE OF B.TECH PROGRAM IN ELECTRONICS AND COMMUNICATION ENGINEERING

Effective from Session 2025

Semester-II

S. No.	Course Code	Course Title	Hours Per Week				Credits	Total Marks
			L	T	P	Total		
1	BECEBCH225	Chemistry	3	0	2	5	4	200
2	BECEBMT225	Mathematics-II (Linear Algebra and Differential Equations)	3	1	0	4	4	100
3	BECEBBE225	Biology for Engineers	3	0	0	3	3	100
4	BECEECA225	Computer Aided Drawing	0	0	4	4	2	100
5	BECEEAI225	Introduction to Artificial Intelligence	2	1	2	5	4	200
6	BECEEBE225	Basic Electrical and Electronics Engineering	3	1	2	6	5	200
7	BECEEID225	IDEA Lab Workshop	0	0	2	2	1	100
TOTAL			14	3	12	29	23	1000

Average Course-wise Mapping of Programme Learning Outcomes

Semester I

S. No.	Course Code	Course Title	Average Programme Learning Outcome (PLO) Score												Cumulative Avg
			01	02	03	04	05	06	07	08	09	10	11	12	
1	BECEBPH125	Physics (Electromagnetics,Semiconductors and Optoelectronics)	2.8	2.6	1.4	1.6	1.6	0.2	0.8	0.2	0.0	1.0	0.0	2	1.2
2	BECEBMT125	Mathematics-I (Calculus)	3.0	2.8	1.6	1.6	1.0	0.0	0.6	0.0	0.0	1.0	0.0	2.0	1.1
3	BECEEEW125	Engineering Workshop	3.0	2.8	2.6	1.8	2.8	0.0	0.0	0.0	1.0	1.0	1.0	3.0	1.58
4	BECEEPP125	Programming and Problem Solving Techniques	2.0	1.8	2.6	1.6	2.0	0.0	0.0	0.0	1.0	2.2	1.0	2.0	1.35
5	BECEEEG125	Engineering Graphics	0.0	0.6	0.6	0.0	1.4	1.2	0.2	1.0	2.2	3.0	1.4	2.0	1.13
6	BECEHUH125	Universal Human Values	0.0	1.0	1.0	0.0	0.0	2.6	2.2	3.0	1.0	2.0	1.0	2.0	1.32
7	BECEHPC125	Professional Communication	2.2	2.0	1.8	1.8	2.0	0.5	1.2	0.5	1.0	1.0	1.3	2.0	1.44
8	Any one of the following (Experiential learning and activity based course)														
	BECEAYO125	Yoga	0	1	0.2	0.2	0	1.8	2	2.2	1.2	1.2	0	2	0.98
	BECEASP125	Sports	0	1.2	0.6	0.4	0	1.4	1.4	2	1.6	1.2	0.2	2	1
	BECEANC125	NCC	0.8	1.8	0.8	1.5	0.8	1.8	1.5	2.3	2.3	1.5	1.3	2.3	1.52
	BECEANS125	NSS	0	1	1	1	0	3	2	3	2	2	1	3	1.58
	BECEADM125	Disaster Management	1	2.4	2	1.8	1	3	2.8	2	2.4	2	2.4	2	2.07

Semester II

S. No.	Course Code	Course Title	Average Programme Learning Outcome (PLO) Score												Cumulative Avg
			01	02	03	04	05	06	07	08	09	10	11	12	
1	BECEBCH225	Chemistry	2.6	2.2	1.2	1.6	1.2	0.2	1.0	0.2	0.0	1.0	0.0	2.0	1.10
2	BECEBMT225	Mathematics-II	2.8	2.8	1.8	1.4	1.2	0.2	0.6	0	0	1	0	2	1.15
3	BECEBBE225	Biology for Engineers	2.2	2	2.2	1.2	1.4	1.2	1.6	1	0.4	1	0.6	2.4	1.43
4	BECEECA225	Computer aided Drawing	3	2.6	2.2	2	2	0	0.6	0	1	1	1	2	1.45
5	BECEEAI225	Introduction to Artificial Intelligence	2	2	1.6	1	1.6	1.6	1.2	1.4	0.8	1.2	0.8	3	1.52
6	BECEEBE225	Basic Electrical and Electronics Engineering	1.8	2	2.6	1.4	1.8	1.2	1.2	1.2	2.2	2.2	1.8	3	1.87
7	BECEEID225	IDEA Lab Workshop	2.4	2.6	2.8	2.0	2.8	1.4	1.4	1.0	2.2	2.2	2.2	3.0	2.17

SEMESTER- I
(Detailed Syllabus)

Course Code	**BECEBPH125**		*Semester*			*First*	
Course Title	**Physics (Electromagnetics, Semiconductors and Optoelectronics)**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	3	0	2	5	4	100	100
Prerequisites	*Higher Secondary Physics*					200	

Course Learning Outcomes (CLOs)	
CLO1	Understand and apply vector calculus and electrostatic principles to solve problems involving electric fields and potentials for various charge distributions.
CLO2	Analyze static magnetic fields using Biot–Savart law, Ampère's law, and Faraday's law; interpret and apply Maxwell's equations in integral and differential forms.
CLO3	Comprehend the foundational experiments and principles of quantum mechanics and demonstrate an understanding of basic quantum computing concepts including qubits and superposition.
CLO4	Interpret energy band theory and analyze the behavior of charge carriers in intrinsic and extrinsic semiconductors under various conditions.
CLO5	Understand the working principles of optoelectronic devices and lasers, and analyze their characteristics and applications in practical systems.
Syllabus	
Units	**Content**
1	**Electrostatics & Electric Fields** Mathematical Foundations: Scalars and vectors, dot product and cross product, vector and scalar triple product of vectors. Vector calculus: gradient, divergence, curl and Laplacian in Cartesian coordinates. Integrals: line, surface, volume; integral theorems: Gauss's theorem, and Stokes' theorem. Problems. Electrostatics and Electric Fields: Coulomb's law, force between point charges; electric field due to discrete and continuous distributions; line, surface and volume charges, divergence and curl of E field, electric flux, Gauss's law in integral and differential forms, and its applications. Electrostatic potential; relation to electric field, potential due to point and distributed sources; Poisson's and Laplace's equations.
2	**Magnetostatics and Magnetic Fields** Magnetostatics and Magnetic Fields: Lorentz force law, Biot–Savart law, field due to straight wire, circular loop; Ampère's law, solenoids, toroids, Ampère's law in differential form and integral form; vector potential, definition, relation to magnetic field; divergence and curl of B field. Problems. Electrodynamics: Electromotive force, Faraday's law in differential form and integral form. Maxwell's equations: Maxwell modification of Ampère's law.
3	**Quantum Mechanics and Quantum Computing** Quantum Mechanics: Black body radiation, Planck's radiation law, Compton scattering, and Photoelectric effect. Ultraviolet catastrophe, and Rayleigh-Jeans law. De-Broglie hypothesis, wave-particle duality, Davisson and Germer experiment. Basic postulates of quantum mechanics. Heisenberg's Uncertainty Principle. Wave function: Properties and physical significance, Schrodinger's equation (Time-dependent and Time-independent forms). Quantum Computing: Differences between Classical & Quantum computing, concept of single qubit: Various physical implementations of qubits (qualitative). Superposition, entanglement, polarization of light, single qubit notation, Bloch sphere notation, single qubit gates.
4	**Solid State and Semiconductor Physics** Band Theory: Electron effective mass, concept of the hole, energy band gap. Metals,

	Insulators and Semi-conductors. Direct and Indirect band gap semiconductors, Intrinsic and Extrinsic semiconductors. Fermi energy level. Charge Carriers in Semiconductors: Equilibrium distribution of electrons and holes, Intrinsic carrier concentration and Fermi energy level position. Doping, n-type and p-type semiconductors. Extrinsic Semiconductor: Equilibrium distribution of electrons and holes. Charge neutrality: Equilibrium electron and hole concentrations, position of Fermi energy level. Carrier Drift: Drift current density, mobility effects, conductivity and resistivity. Carrier Diffusion: Diffusion current density, diffusion length and diffusion constant. Einstein's relation. Hall-effect. Problems.
5	**Optoelectronics and Lasers** Radiative and non-radiative recombination mechanisms in semiconductors, LEDS: Device structure, Materials, Semiconductor photodetectors: Solar cell, PIN and photodiodes and their structure. Lasers: Properties of laser light, main components of laser, population inversion, active medium, optical resonator, pumping, and metastable state. Absorption, spontaneous, and stimulated emission. Einstein coefficients and condition of laser action. Types of lasers: He-Ne laser, Ruby laser, and Semiconductor laser. Applications of lasers.
Experiments	
1	To find the Dielectric constant of different materials.
2	To determine the charge to mass ratio of an electron by Thomson Method.
3	To determine the charge to mass ratio of an electron by Helical Method.
4	Verification of Biot Savart's law.
5	Determination of Magnetic Flux Density at any point along the axis of a circular coil.
6	G M counter Setup.
7	To find the value of Planck's constant using photo cell.
8	Verification of Stefan's Law (electrical method).
9	Determination of Planck's Constant using LEDs.
10	To determine the junction potential of a semiconductor diode.
11	Measurement of bandgap by four probe method.
12	Study the I-V Characteristics of the Given Semiconductor Diode.
13	Study the I-V Characteristics of the Given Bipolar Junction Transistor
14	To find the refractive index of a liquid using a diode LASER on senior optical bench.
15	Determination of wavelength of LASER using Diffraction Grating.

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO 1**	**PLO2**	**PLO3**	**PLO 4**	**PLO5**	**PLO 6**	**PLO7**	**PLO 8**	**PLO 9**	**PLO 10**	**PLO 11**	**PLO 12**	**Avg CLO**
CLO1	3	2	1	1	1	0	0	0	0	1	0	2	0.92
CLO2	3	3	1	2	2	0	0	0	0	1	0	2	1.17
CLO3	3	3	1	2	2	0	1	0	0	1	0	2	1.25
CLO4	3	3	2	2	2	0	1	0	0	1	0	2	1.33
CLO5	2	2	2	1	1	1	2	1	0	1	0	2	1.25
Avg PLO	2.8	2.6	1.4	1.6	1.6	0.2	0.8	0.2	0.0	1.0	0.0	2	1.2

Suggested Reading	
1	David J. Griffiths; Introduction to Electrodynamics, 4th Edition, Pearson.
2	Matthew N. O. Sadiku; Principles of Electromagnetics, 4th Edition, Oxford.
3	Nouredine Zettili; Quantum Mechanics, 2nd Edition, John Wiley.
4	Eleanor G. Rieffel and Wolfgang H. Polak; Quantum Computing, A Gentle Introduction , MIT Press.
5	Charles Kittle; Introduction to Solid State Physics. Wiley India Edition.
6	Karl F. Renk; Basics of Laser Physics, For Students of Science and Engineering, 2nd Edition, Springer

Teaching-Learning Strategies
Interactive lectures integrating theory with coding and simulation sessions. Hands-on laboratory sessions with circuit connections, breadboarding, data acquisition, and simulation exercises (using open-source tools). Case-based learning supported by seminars and discussion of real-world design challenges.

Assessment Methods	
Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (Comprehensive exam).
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks.

Course Code	**BECEBMT125**		*Semester*			*First*	
Course Title	**Mathematics-I (Calculus)**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	3	1	0	4	4	100	NA
Prerequisites	*Higher Secondary Mathematics*					100	

Course Learning Outcomes (CLOs)	
CLO1	Apply foundational mathematical skills to build readiness for advanced calculus topics.
CLO2	Interpret limits, continuity, and differentiability using rigorous definitions and apply derivative techniques to real-world problems.
CLO3	Analyze function behavior and apply differential calculus to solve optimization problems and model dynamic systems.
CLO4	Evaluate definite and indefinite integrals using standard methods and apply them to compute areas, volumes, and physical quantities.
CLO5	Extend calculus to functions of several variables and solve extremum and integration problems using coordinate transformations.
Syllabus	
Units	
1	Review of School-Level Mathematics Sets, functions, graphs of elementary functions; algebraic identities, inequalities; trigonometric identities and equations; coordinate geometry basics; basic limits and derivatives; standard integrals; sequences and series
2	Foundations of Calculus Real-valued functions, domain and range; limits, intuitive and epsilon-delta definitions; continuity and types of discontinuities; differentiability and geometric interpretation; derivative rules — sum, product, quotient, chain; higher-order derivatives; implicit and logarithmic differentiation; applications to rate of change and motion.
3	Applications of Differentiation Mean Value Theorems — Rolle's, Lagrange's, Cauchy's; Taylor and Maclaurin series; monotonicity, concavity, convexity; extrema — first and second derivative tests; curve sketching; indeterminate forms and L'Hospital's Rule; introduction to ordinary differential equations.
4	Techniques and Applications of Integration Definite and indefinite integrals; Riemann sums and integrability; Fundamental Theorem of Calculus; integration techniques — substitution, parts, partial fractions, trigonometric integrals; improper integrals; applications — area under curves, volumes of revolution, arc length, surface area; introduction to Beta and Gamma functions.
5	Multivariable Calculus Functions of several variables; partial derivatives, gradient, directional derivatives; tangent planes and linear approximation; maxima and minima, Lagrange multipliers; double and triple integrals; change of variables — polar, cylindrical, spherical coordinates; applications — area, volume, center of mass.

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**Avg CLO**
CLO1	3	2	1	1	1	0	0	0	0	1	0	2	0.92
CLO2	3	3	1	1	1	0	0	0	0	1	0	2	1
CLO3	3	3	2	2	1	0	1	0	0	1	0	2	1.25
CLO4	3	3	2	2	1	0	1	0	0	1	0	2	1.25
CLO5	3	3	2	2	1	0	1	0	0	1	0	2	1.25
Avg PLO	**3.0**	2.8	1.6	1.6	1.0	0.0	0.6	0.0	0.0	1.0	0.0	2.0	1.1

Suggested Reading	
1	Stewart, Calculus: Early Transcendentals
2	Apostol, Calculus Vol. I and II
3	Thomas, Calculus and Analytic Geometry

Teaching-Learning Strategies
Interactive lectures integrating theory with demo sessions. Case-based learning supported by seminars and discussion of real-world applications.

Assessment Methods	
Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (comprehensive exam aligned to CLOs).
Practical	NA

Course Code	**BECEEEW125**		*Semester*			*First*	
Course Title	**Engineering Workshop**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	0	0	4	4	2	NA	100
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)	
CLO1	Analyzing the different engineering materials, tools, equipment in manufacturing engineering field.
CLO2	Develop basic engineering skills required for the production of various engineering products.
CLO3	Evaluate the processes and identify the quality control in production techniques.
CLO4	Study and practice of basic operations using different types of tools and fixtures in Carpentry and Fitting Shop
CLO5	Introduce various joints, tools, operations and techniques in Sheet-Metal Shop.
CLO6	Recognize and apply basic principles and techniques of Forging Shop.
Syllabus	
Units	
1	Machine Shop: Demonstration of tools and equipment for machining processes. Performing different operations on centre lathe. Performing different operations on CNC Machines (Lathe and Milling)
2	Welding Shop: Demonstration of tools and equipment for welding processes. Prepare different joints as per given dimension by welding technique. Perform visual inspection of welded joints. Carpentry Shop: Demonstration and use of different types of tools, joints, and patterns. Prepare L-joint, T-Joint, Cross joint, Split Pattern and Dove tail joint.
3	Foundry and Casting: Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns. 3D-Printing: Preparation of simple 3D models using 3-D printing.
4	Sheet Metal: Demonstration of tools and equipments for sheet metal operations. Making trays and cones with G.I sheet metal.
5	Fitting: Demonstration of cutting, preparation of stud to cut external threads with help of dies, drilling, countersinking, counter boring and internal thread cutting with taps. Pipe cutting and thread cutting on G.I pipe with pipe dies.
Experiments	
1	To perform various machining operations on centre lathe.
2	To perform different machining operation on CNC machines (Lathe and Milling).
3	To make different joints using welding techniques and carry out the visual inspection of welded joints.
4	f
5	To prepare L-joint, T-Joint, Cross joint, Split Pattern and Dove tail joint in carpentry shop.
6	To prepare Green Sand Moulds for various patterns in sand casting process.
7	To prepare simple 3D models using 3-D printing technique.
8	To make trays and cones using sheet metal operations on G.I sheet metal.

9	To prepare stud to cut external threads with help of dies, drilling, countersinking, counter boring and internal thread cutting with taps.
10	To perform pipe cutting and thread cutting operation on G.I pipe with pipe dies.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	1	2	1	1	1	1	1	1	2	1.42
CLO2	2	2	2	2	2	1	1	1	1	1	2	2	1.58
CLO3	2	2	2	2	2	1	2	1	1	1	2	2	1.67
CLO4	2	2	2	2	2	0	1	0	1	1	1	2	1.33
CLO5	2	2	2	2	2	0	1	0	1	1	1	2	1.33
Avg PLO	2.0	2.0	2.0	2.0	2.0	0.0	1.0	0.0	1.0	1.0	1	2	1.33

Suggested Reading

1	Workshop Manufacturing Practices (with Lab Manual), Veeran D.K., Khanna Book Publishing Co., New Delhi, 2023.
2	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3	Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
4	Gowri P. Hariharan and A. Suresh Babu,” Manufacturing Technology – I” Pearson Education, 2008

Teaching-Learning Strategies

Interactive lectures inculcating theoretical and experimental understanding of workshop practices to students.
Demonstration of various machines and workshop techniques in forging, carpentry, Fitting and Sheet metal shops.
Case based learning to bridge the gap between theory and real world applications like cutting, shaping and joining wood and metals components. Hands-on practical sessions for developing welded joints, or performing various machining operations.
Demonstration of tools, machines, and processes to build strong foundational understanding.

Assessment Methods

Theory	NA
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks.

Course Code	**BECEEPP125**		*Semester*			*First*	
Course Title	**Programming and Problem Solving Techniques**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	2	1	2	5	4	100	100
Prerequisites	*Nil*					200	

Course Learning Outcomes (CLOs)	
CLO1	Develop structured algorithms and flowcharts to solve computational problems using standard problem-solving techniques.
CLO2	Construct C programs using appropriate syntax for data types, operators, expressions, and standard input/output functions.
CLO3	Implement control flow and modular programming concepts using decision structures, loops, and user-defined functions.
CLO4	Manipulate arrays, strings, and pointers to perform operations on linear data and manage memory dynamically.
CLO5	Design and use user-defined data types (structures and unions) and apply basic file handling for data storage and retrieval.
Syllabus	
Units	
1	Introduction to Problem Solving and Programming: General problem-solving concepts: problem solving in everyday life and with computers. Planning solutions by organizing the approach through problem analysis, algorithm writing, flowchart creation, pseudocode, and documentation. Overview of programming languages: machine language, assembly language, and high-level languages. Designing flowcharts and algorithms to solve basic computational problems such as number testing, generating numerical series, and sorting operations
2	C Language Basics and Expressions: C language preliminaries and structure of a C program. C character set, identifiers, and keywords. Data types including built-in types and type modifiers. Variable declarations and initialization. Input and output functions: scanf, printf, getchar, and putchar. Operators and their types, expressions. Preprocessor directives: #include, #define, and macros. Use of standard library functions.
3	Control Structures and Functions: Decision-making using conditional logic and control structures such as if, if-else, switch, along with looping constructs like while, for, and do-while. Usage of control transfer statements including break, continue, and goto. Introduction to modular programming through the use of functions, including function declaration, definition, prototypes, and calling mechanisms. Parameter passing techniques: call by value and call by reference.
4	Arrays, Strings, and Pointers: One-dimensional and two-dimensional arrays, basic operations, matrix addition and multiplication. String handling using string.h: Basic functions only. Pointers: declaration, arithmetic, pointer to functions, array of pointers, Introduction to dynamic memory allocation using malloc, calloc, free.
5	Structures, Unions, and File Handling: Structure declaration and initialization, accessing structure members, nested structures, array of structures, pointers to structures; Bit fields in structures; Structure padding and memory

	alignment; Union declaration and initialization, accessing union members; Differences between structures and unions; Introduction to basic file handling;
Experiments	
1	Design a flowchart using draw.io for various problems on searching, testing a number, sorting etc.
2	Write a C program that displays a welcome message, declares variables of different types, takes input for two numbers, performs basic arithmetic operations, and displays the results. Observe the use of #include, #define, and other preprocessor directives.
3	Design a system that accepts marks of five subjects and calculates the total, average, percentage, and assigns a grade based on the percentage (A+, A, B, C, D, F). Perform problem analysis, write the algorithm and pseudocode, and draw the flowchart using draw.io.
4	Draw a flowchart using draw.io that accepts three numbers and displays the largest among them.
5	Use #define to declare constants like PI, and include math.h to calculate area and perform operations like square root using standard library functions.
6	Write a program that accepts a score and assigns a grade using if-else or switch-case, and displays the appropriate message.
7	Write programs using for, while, and do-while loops to print number patterns, multiplication tables, and calculate factorials.
8	Write a menu-driven program using switch and break for performing arithmetic operations. Use continue, goto, and exit() where appropriate to control flow.
9	Write a program using functions to compute sum, difference, product, and average of two numbers. Use proper declaration, definition, and function calling.
10	Implement a recursive function to calculate factorial and generate a Fibonacci series. Demonstrate function calls using call-by-value.
11	Use one-dimensional and two-dimensional arrays to perform matrix addition and multiplication. Display the input and output in matrix form.
12	Write a program to perform basic string operations such as reversing a string, converting uppercase to lowercase, and counting vowels using string.h.
13	Demonstrate the use of pointers for accessing array elements. Perform pointer arithmetic and show how pointer variables store and manipulate addresses.
14	Use malloc, calloc, and free to dynamically allocate memory for an integer array. Accept user input, compute the sum and average, and free the allocated memory.
15	Define a structure to store student details such as roll number, name, and marks in three subjects. Use an array of structures to hold the data for n students. Write separate functions to input the student data, calculate and display the total and average marks for each student, and display the details of the student who has the highest total marks.
16	Understand how structures and unions differ in memory usage and behavior using programs
17	Write a simple c program demonstrating reading text from file and writing text to file.

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**Avg CLO**
CLO1	3	3	2	2	2	0	0	0	1	1	1	3	1.50

CLO2	3	3	2	1	3	0	0	0	1	1	1	3	1.50
CLO3	3	3	3	2	3	0	0	0	1	1	1	3	1.67
CLO4	3	3	3	2	3	0	0	0	1	1	1	3	1.67
CLO5	3	2	3	2	3	0	0	0	1	1	1	3	1.58
Avg PLO	**3.0**	2.8	2.6	1.8	2.8	0.0	0.0	0.0	1.0	1.0	1.0	3.0	1.58

Suggested Reading	
1	Balagurusamy, E. (2019). Programming in ANSI C (8th ed.). McGraw Hill Education.
2	Gottfried, B. S. (2010). Programming with C (2nd ed.). Schaum's Outline Series, McGraw Hill.
3	Thareja, R. (2018). Programming in C (2nd ed.). Oxford University Press.
4	Venugopal, K. R., & Prasad, S. R. (2007). Programming with C. Tata McGraw Hill.
5	Forouzan, B. A., & Gilberg, R. F. (2007). Computer Science: A Structured Programming Approach Using C (3rd ed.). Cengage Learning.
6	Kernighan, B. W., & Ritchie, D. M. (1988). The C Programming Language (2nd ed.). Prentice Hall.
7	Dromey, R. G. (2008). How to Solve It by Computer. Pearson Education.

Teaching-Learning Strategies
Begin with real-life problem scenarios and guide students to develop flowcharts and pseudocode before coding. Use visual tools like draw.io to help students understand logic through diagrams and flowcharts. Encourage peer programming and collaborative debugging during lab sessions. Assign small, structured programming tasks that gradually build from basic to advanced concepts.

Assessment Methods	
Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (comprehensive exam aligned to CLOs).
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (comprehensive exam aligned to CLOs).

Course Code	**BECEEEG125**		***Semester***			***First***	
Course Title	**Engineering Graphics**					***Max marks***	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	2	1	0	3	3	100	NA
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)	
CLO1	To identify and use standard drawing instruments, line types, dimensioning methods, and projection concepts for technical drawing.
CLO2	To construct projections of points, lines, and planes in first and third angle systems, including determining true lengths and traces.
CLO3	To generate accurate projections and sectional views of basic solids (polyhedra, solids of revolution) with given orientations and cutting planes.
CLO4	Apply development techniques (parallel and radial line methods) to create surface patterns of common solids.
CLO5	Create orthographic and isometric projections of simple geometries and solids, interpreting and representing all views with clarity and accuracy.
	Syllabus
	Units
1	Introduction to Engineering Drawing: Drawing instruments and their use, types of lines and their uses, dimensioning and concept of Projection. Projection of Points-Quadrant system – Projections of points in all four quadrants- first and third angle projections.
2	Projection of Lines: True length, Line inclined to both reference planes, Line contained by a profile plane. Projection of Planes Classification of planes, Projection of planes inclined to both reference planes.
3	Projection of Solids: Classification-(Polyhedra and solids of revolution), projection of solids with their axis inclined to one of the principal planes and parallel to another. Section of solids-Section planes-types of sections-sectional plane parallel to one and perpendicular to other.
4	Development of Surfaces: Definitions-Development-Stretchout or Girth line-Method of Pattern development-Parallel line Development.
5	Orthographic Projection: Methods of obtaining orthographic Projections in first angle Projection of simple blocks-View analysis-Laying out a three view drawing-Invisible lines and arcs. Isometric projection: Isometric views of different planes and simple solids.

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**Avg CLO**
CLO1	2	1	2	1	2	0	0	0	1	2	1	2	1.17
CLO2	2	2	2	1	2	0	0	0	1	2	1	2	1.25
CLO3	2	2	3	2	2	0	0	0	1	2	1	2	1.42
CLO4	2	2	3	2	2	0	0	0	1	2	1	2	1.42
CLO5	2	2	3	2	2	0	0	0	1	3	1	2	1.50
Avg PLO	2.0	1.8	2.6	1.6	2.0	0.0	0.0	0.0	1.0	2.2	1.0	2.0	1.35

Suggested Reading	
1	Bhatt, N. D. (2014). Engineering Drawing (53rd ed.). Charotar Publishing House.
2	Agrawal, B., & Agrawal, C. M. (2013). Engineering Drawing (2nd ed.). McGraw-Hill Education India.
3	Shah, M. B., & Rana, B. C. (2009). Engineering Drawing (2nd ed.). Pearson Education.
4	Dhawan, R. K. (2012). A Textbook of Engineering Drawing (Rev. ed.). S. Chand Publishing.

Teaching-Learning Strategies	
Demonstration-based teaching and hands-on sketching to build drawing fundamentals and projection skills. Step-by-step guided exercises for projection of points, lines, planes, and solids. Practice-oriented assignments and 3D visualization tools for surface development, orthographic, and isometric drawings.	
Assessment Methods	
Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (comprehensive exam aligned to CLOs).
Practical	NA

Course Code	**BECEHUH125**		*Semester*			*First*	
Course Title	**Universal Human Values**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	2	0	0	2	2	100	NA
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)	
CLO1	To help the students appreciate the essential complementarily between ‘values’ and ‘skills’
CLO2	To strengthen the commitment to values.
CLO3	To facilitate the development of ethical human conduct and sustainable living.
CLO4	To strengthen the commitment to socially responsible behavior.
CLO5	To provide a much-needed orientational input in value education to the young enquiring minds.
Syllabus	
Units	
1	Introduction to Value Education Purpose and motivation for value education; The process of self-exploration Basic human aspirations; The Qur’an and Sunnah as sources of value
2	Harmony in the Human Being Understanding the human being as a co-existence of Self and Body Needs of Self ('I') and Body – Sukh and Suvidha; Body as an instrument of 'I'; right utilization
3	Harmony in the Family and Society Values in human-human relationship; Difference between intention and competence Justice and mutual fulfillment; Undivided Society and Universal Human Order
4	Harmony in Nature (Existence) Interconnectedness in nature; Four orders of nature: material, plant, animal, human Existence as co-existence; Holistic perception of harmony
5	Ethical Human Conduct Definitiveness of ethical human conduct; Competence in professional ethics Ethical challenges in modern life: consumerism, materialism, individualism; Harmony at all four levels: Self, Family, Society, Nature

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**Avg CLO**
CLO1	0	1	1	0	0	2	2	3	1	2	1	2	1.25
CLO2	0	1	1	0	0	3	2	3	1	2	1	2	1.33
CLO3	0	1	1	0	0	3	3	3	1	2	1	2	1.42
CLO4	0	1	1	0	0	3	2	3	1	2	1	2	1.33
CLO5	0	1	1	0	0	2	2	3	1	2	1	2	1.25
Avg PLO	0	1	1	0	0	2.6	2.2	3	1	2	1	2	1.32

Suggested Reading	
1	R.R. Gaur, R. Sangal and G.P. Bagaria. A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2010.
2	R.R. Gaur. Teacher's Manual for Universal Human Values, AICTE, New Delhi, 2022.
3	F. Schumacher. Small is Beautiful, Harper Perennial, 1973.
4	Derek Bok. Universities and the Moral Life, Harvard University Press, 1982.
5	J. Krishnamurti. Education and the Significance of Life, Krishnamurti Foundation, 2017.
Teaching-Learning Strategies	
Interactive Lectures/Seminars/Discussions/Indirect methods like role modeling and storytelling/Experiential learning through community service and real-world applications.	
Assessment Methods	
Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (comprehensive exam aligned to CLOs).
Practical	NA

Course Code	**BECEHPC125**		*Semester*			*First*	
Course Title	**Professional Communication**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	2	1	0	3	3	100	NA
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)	
CLO1	Prepare students to demonstrate effective verbal and non-verbal communication in professional and social contexts.
CLO2	Enable learners to apply active listening techniques to improve understanding and response in conversations.
CLO3	Foster clear, concise, and coherent written communications suitable for academic and professional environments among students.
CLO4	Prepare students to present ideas confidently using appropriate communication tools (e.g., presentations, reports, digital media).
CLO5	Equip learners to analyze and adapt communication strategies for diverse audiences and intercultural settings.

Syllabus	
Units	
1	Communication Skills: An Introduction Communication: Meaning and Definition of Communication; Process of Communication; Forms/Types of Communication; Barriers to Effective Communication; Ways to Overcome Barriers in Communication. Communication with AI Systems: Understanding AI Communication, Human-AI Interaction, Future of AI and Communication
2	Listening and Reading Listening: Definition and Process of Listening; Types of Listening; Barriers to Listening; Strategies of Effective Listening. Reading: Definition and Process of Reading; Types of Reading; Strategies of Effective Reading. Listening and Reading Practices: (Recorded Lectures, Poems, Interviews, Podcasts and Speeches; Reading Comprehension and Summarization).
3	Written Communication Aspects of Writing; Process of Writing; Avoiding Ambiguity; Basics of Writing; Style/Structures/Format. Letters, Curriculum Vitae (CV) and Resume Writing, e-mails, Minutes of Meeting. Creative Writing, Academic Writing, Content Writing (Blogs and Advertisements); Translation Practices.
4	Oral Communication Human Speech Mechanism; Speech Organs; Production and Classification of Speech Sounds;

	Consonants and Vowels; IPA Transcription of Words. Skills of Effective Speaking; Public Speaking; Oral Presentation and Group Discussion (GD). Creating Podcasts and Podcast Interviews; Conversation Practice and Mock Interviews, Pronunciation Drills.
5	Basic Grammar Parts of Speech; Tenses; Use of Words as Different Grammatical Items; Model Auxiliaries. Lexicography and Vocabulary Building: Homophones and Homonyms; Phrases and Idioms; One Word Substitution and Jargonism.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	0	0	0	0	1	1	0	1	2	3	1	2	0.92
CLO2	0	0	0	0	1	1	0	1	2	3	1	2	0.92
CLO3	0	1	1	0	1	1	0	1	2	3	1	2	1.08
CLO4	0	1	1	0	2	1	0	1	2	3	2	2	1.25
CLO5	0	1	1	0	2	2	1	1	3	3	2	2	1.50
Avg PLO	0	0.6	0.6	0	1.4	1.2	0.2	1	2.2	3	1.4	2	1.13

Suggested Reading

1	Advanced English Grammar by Martin Hewing, CUP, New Delhi, 2010.
2	*Better English Pronunciation by JD O'Connor, CUP, New Delhi, 2015.*
3	Business Communication by Raman Prakash, Oxford
4	*AI for Communication by David J. Gunkel, CRC Press, 2024.*
5	*Effective Listening by Steil, L. K., Barker, L. L., & Watson, K. W. Addison-Wesley.*
6	*Effective Technical Communication by M. Ashraf Rizvi.*
7	*English Pronouncing Dictionary by Daniel Jones, CUP.*
8	*English Pronunciation in Use by Mark Hancock, CUP.*
9	*English Vocabulary in Use (Advanced) McCarthy and O'Dell, CUP.*
10	*Oxford English Grammar by Sydney Greenbaum, Oxford.*
11	*Practical English Usage by Michael Swan, Oxford.*
12	*Study Reading by Glendinning and Holmstron, CUP.*
13	*Study Speaking by Anderson/Maclean/Lynch, CUP.*

14	*Study Writing by Hamp-Lyons and Heasley, CUP.*
15	*The Oxford Essential Guide to Writing by Thomas S. Kane (Oxford).*
Teaching-Learning Strategies	
Interactive Lectures/Language Lab Drills/Seminars/Presentations/Discussions	

Evaluation Scheme	
Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 Marks (External)
Practical	NA

Course Code	**BECEAY0125**		*Semester*			*First*	
Course Title	**YOGA**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	0	0	2	2		NA	100
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)	
CLO1	To make the students understand the importance of sound health and fitness principles as they relate to better health
CLO2	To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
CLO3	To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury.
CLO4	To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.
CLO5	Apply mindfulness and meditation practices to enhance concentration, emotional balance, and stress relief in both individual and group settings.
Syllabus & List of Activities	
1	Introduce yoga: origins, philosophy, health benefits; explain syllabus structure and evaluation. Issue practice mats; register students in batches
2	Conduct group stretching and breath awareness session; observe and correct posture. Explain basic rules of yoga practice: empty stomach, breath control, contraindications
3	Begin with basic asanas: Tadasana, Vajrasana, Trikonasana; correct technique and alignment. Record baseline flexibility and balance (e.g., toe-touch test, tree pose duration)
4	Teach pranayama basics: Anulom-Vilom, Bhramari; supervise guided practice with breath count. Introduce meditation through body scan and breath focus; 10-minute seated session
5	Circuit practice of daily-use asanas (e.g., Bhujangasana, Pawanmuktasana, Ardha Matsyendrasana). Assign students to track daily home practice with a self-check journal
6	Classroom session on wellness and positive lifestyle; group discussion on sleep, diet, screen time. Group activity: create a “My Ideal Daily Routine” chart integrating yoga and wellness
7	Posture-specific sessions for common conditions (e.g., yoga for back pain, obesity). Display and discuss contraindications and modifications for each condition-specific asana
8	Introduction to Shatkarma cleansing techniques: Jal Neti, Kapalabhati (theory + optional demo). Supervised Kapalabhati breathing session; discuss energizing effect and safety precautions
9	Mindfulness walk on campus: focus on breath, body, and surroundings during slow walk. Reflection circle: students share feelings and mental shifts after mindfulness activities
10	Poster-making: yoga for lifestyle diseases (diabetes, hypertension, asthma). Peer explanation session: each group presents poster to class with Q&A

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**Avg CLO**
CLO1	0	1	0	0	0	2	2	2	1	1	0	2	0.92
CLO2	0	1	0	0	0	2	2	2	1	1	0	2	0.92
CLO3	0	1	1	1	0	1	2	2	1	1	0	2	1
CLO4	0	1	0	0	0	2	2	2	1	1	0	2	0.92
CLO5	0	1	0	0	0	2	2	3	2	2	0	2	1.17
Avg PLO	0	1	0.2	0.2	0	1.8	2	2.2	1.2	1.2	0	2	0.98

Suggested Reading	
1	B.K.S. Iyengar – Light on Yoga – 1966 – Allen & Unwin
2	T.K.V. Desikachar – The Heart of Yoga: Developing a Personal Practice – 1995 – Inner Traditions International
3	Leslie Kaminoff & Amy Matthews – Yoga Anatomy – 2014 – Human Kinetics
4	William J. Broad – The Science of Yoga: The Risks and the Rewards – 2012 – Simon & Schuster

Teaching-Learning Strategies
Experiential learning

Evaluation Scheme	
Practical	Activity based experiential learning and internal exam only

Course Code	**BECEBPH125**		*Semester*			*First*	
Course Title	**Sports**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	0	0	2	2		NA	100
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)	
CLO1	Define the meaning, aims, objectives, and changing trends of Physical Education and explain their significance in holistic development.
CLO2	Assess personal fitness and wellness using standardized tests and formulate individualized improvement goals.
CLO3	Demonstrate basic rules, techniques, and motor skills in selected individual and team sports, and apply principles of sportsmanship and fair play.
CLO4	Exhibit team spirit and leadership by organizing and participating in group sports activities and drills.
CLO5	Analyze the meaning and methods of doping, identify prohibited substances, and evaluate the ethical and health implications of performance-enhancing drugs.
Syllabus & List of activities	
1	Introduce Course; Meaning & definition of Physical Education; outline aims, objectives, changing trends; form student teams and assign captains
2	Fun relay challenges (e.g., baton-pass, cone weave) to foster camaraderie and communication
3	Morning PT session – stretching, 1-mile run, sit-ups, push-ups; record individual fitness scores
4	Rotating drills for strength (squats, lunges), endurance (jump rope), flexibility (hamstring stretch) with personal goal setting
5	Classroom Lecture & Discussion on components of physical fitness, health-related fitness, and wellness; small-group brainstorm on positive lifestyle habits
6	Demonstrate & practice basic techniques in badminton (serve, forehand), tennis (rally), and athletics (long jump approach)
7	Teach rules & skills for basketball dribbling/shooting and football passing/dribbling; mini scrimmage matches
8	Role-play scenarios addressing fouls, disputes, and ethical dilemmas; group reflection on team spirit
9	Presentation on Ancient & Modern Olympics, symbols, ideals; quiz on Olympic values and Indian sports awards
10	Written quiz on theory topics; practical skill test stations; collect feedback and award “Best Team Spirit” and participation certificates

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO1**	**PLO2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO 7**	**PLO 8**	**PLO 9**	**PLO1 0**	**PLO11**	**PLO1 2**	**Avg CL O**
CLO1	0	1	0	0	0	2	2	2	1	1	0	2	0.92
CLO2	0	2	1	1	0	1	2	1	1	1	0	2	1
CLO3	0	1	1	1	0	1	1	2	2	1	0	2	1
CLO4	0	1	1	0	0	1	1	2	3	2	1	2	1.17
CLO5	0	1	0	0	0	2	1	3	1	1	0	2	0.92
Avg PLO	0	1.2	0.6	0.4	0	1.4	1.4	2	1.6	1.2	0.2	2	1

Suggested Reading	
1	Deborah L. Wuest & Lavon Williams – Foundations of Physical Education, Exercise Science, and Sport – 2011 – McGraw-Hill
2	David L. Costill, William J. Kenney & Jack Wilmore – Physiology of Sport and Exercise – 2019 – Human Kinetics
3	Peter Brukner & Karim Khan – Clinical Sports Medicine – 2016 – McGraw-Hill
4	Allen Guttmann – The Olympics: A History of the Modern Games – 2002 – University of Illinois Press
Teaching-Learning Strategies	
Experiential learning	
Evaluation Scheme	
Theory	NA
Practical	Activity based experiential learning and internal exam only

Course Code	**BECEANC125**		*Semester*			*First*	
Course Title	**National Cadet Corps (NCC)**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	0	0	2	2		NA	100
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)	
CLO1	Explain the organisational structure, motto, and core values of the National Cadet Corps and demonstrate effective teamwork and unit cohesion through structured team-building activities.
CLO2	Perform basic drill and ceremonial movements, including attention, salute, and marching in formation, and maintain personal fitness standards via regular physical training routines.
CLO3	Apply weapon safety protocols and handling procedures for small arms, and utilise map-reading and navigation techniques (compass use, grid referencing, pacing) in field-craft exercises.
CLO4	Execute field craft and battle-craft manoeuvres (low-crawl, rushes, use of cover), and deliver basic life-saving first-aid and field-hygiene measures in disaster-response scenarios.
CLO5	Lead community-service and social-interaction initiatives, prepare for and participate in NCC camps to foster national integration

Syllabus & List of Activities	
Units	
1	Orientation & Team-Building, Introduction to NCC: history, motto, organisational structure. Basic Drill & Ceremonial, Physical Training (PT). Weapon Safety & Handling, Map Reading & Navigation. Field Craft & Battle Craft, First Aid & Field Hygiene, Disaster Management & Civil Defence. Social Service & Community Interaction, Leadership & Personality Development, NCC Camps & National Integration
2	Introduce NCC: motto, vision, objectives; issue uniforms; form platoons and teams
3	Team-building ; register cadets
4	Demonstrate basic drill commands (attention, stand-at-ease, stand-easy)
5	Practice basic drill commands (attention, stand-at-ease, stand-easy)
6	Morning PT session: stretching, running, callisthenics; record fitness baselines
7	Circuit-training stations: push-ups, squats, planks; set individual goals
8	Classroom session on small-arms nomenclature and safety rules
9	Hands-on demo of rifle loading/unloading and zero-range protocol (dry-firing)

10	Map-plotting exercise: identify grid references, scales, and symbols. Compass‑and-pace navigation drill on campus/locality
11	Field movement drill: low-crawl, rushes, use of cover and concealment
12	First-aid workshop: bandaging, splinting, CPR basics; pair-practice
13	Table-top mock disaster scenario: develop disaster-response plan for floods/earthquakes
14	Leadership skills session: public speaking, group problem-solving
15	Planning and safety briefing for trekking/adventure activities; gear checklist
16	Written quiz on theory topics; practical drill and first-aid skill test
17	Collect feedback; award NCC certificates, badges, and merit-marks

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	0	1	0	0	0	2	1	3	3	2	1	2	1.25
CLO2	0	1	0	1	0	1	1	2	2	1	1	2	1
CLO3	1	2	1	2	1	1	1	2	2	1	1	2	1.42
CLO4	1	2	1	2	1	2	2	2	2	1	1	2	1.58
CLO5	1	2	1	1	1	3	2	3	3	3	2	3	2.08
Avg PLO	0.8	1.8	0.8	1.5	0.8	1.8	1.5	2.3	2.3	1.5	1.3	2.3	1.52

Suggested Reading

1	Directorate General NCC – NCC Training Manual – 2013 – NCC Directorate, New Delhi
2	Ministry of Defence – Drill Regulations (Part I): Ceremonial Drill – 2009 – Government of India Press
3	Michael M. Walker – Map Reading and Navigation for the Armed Forces – 2014 – Naval Institute Press
4	St John's Ambulance Association – First Aid Manual – 2016 – Dorling Kindersley

Teaching-Learning Strategies

Experiential learning

Assessment/Evaluation

Theory	NA
Practical	Activity based, experiential learning and internal exam only

Course Code	**BECEANS125**		*Semester*			*First*	
Course Title	**National Service Scheme (NSS)**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	0	0	2	2		NA	100
Prerequisites	*Higher Secondary Physics*					100	

Course Learning Outcomes (CLOs)	
CLO1	Explain the Philosophy and Structure of NSS
CLO2	Conduct Community Needs Assessments
CLO3	Plan and Execute Service Projects
CLO4	Demonstrate Civic Engagement and Professional Skills
CLO5	Reflect on Personal Growth and Social Impact

Syllabus & List of Activities	
1	Orientation & Team‑Building. Community Mapping & Need Assessment, Social Inclusion & Gender Equity. Health & Hygiene Awareness, Cleanliness & Waste Management. Environment & Tree Plantation. Health Camp & First Aid, Road Safety & Disaster Preparedness, Blood Donation & Voluntary Service
2	Introduce NSS: motto, vision, objectives, Team-building, Register volunteers and form groups
3	Group quiz on NSS symbols and values. Create posters illustrating NSS structure
4	Conduct a mock campus/locality mapping exercise
5	Field visit for initial observations in the adopted area. Draft and finalize a survey questionnaire
6	Facilitate a discussion on social equity and gender sensitivity. Organize a street play or slogan-writing contest
7	Carry out a campus/community clean-up. Host a “My Clean India” poster competition
8	Conduct a workshop on segregation, composting, recycling, Hands-on “best-out-of-waste” Do-it-Yourself (DIY) activity
9	Arrange a guest talk on personal hygiene. Demonstrate proper handwashing and sanitation
10	Hold an eco-awareness rally or drawing competition. Screen a documentary followed by group discussion

11	Plan and execute tree planting in campus/community. Assign each volunteer a sapling to monitor
12	Invite a traffic police officer for a safety session. Conduct a quiz on traffic signs and rules
13	Organize a mock fire or earthquake drill
14	Facilitate a talk on the importance of blood donation. Arrange an interaction with regular donors
15	Visit an old-age home, orphanage, or public space for service
16	Deliver group presentations on all semester activities. Award certificates to active volunteers

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**Avg CLO**
CLO1	0	1	0	0	0	3	2	3	2	2	1	2	1.33
CLO2	0	2	1	1	1	3	2	2	2	2	2	2	1.67
CLO3	0	2	2	1	1	3	2	2	3	2	3	2	1.92
CLO4	0	1	1	1	1	3	2	3	3	3	2	2	1.83
CLO5	0	1	1	1	0	3	2	3	2	2	1	2	1.58
Avg PLO	0	1.2	1	0.9	0.6	3	2	2.5	2.4	2.2	1.9	3	1.58

Suggested Reading	
1	Ministry of Youth Affairs & Sports – National Service Scheme (NSS) Manual – 2018 – Government of India Press
2	Government of India – NSS Programme Guidelines – 2020 – Government of India Press
3	B.K. Mishra & S.C. Ghosh – Community Participation & Rural Development – 2015 – New Age International Publishers
4	K. Singh – Disaster Management: Concepts & Applications – 2017 – Laxmi Publications
Teaching-Learning Strategies	
Experiential learning	
Evaluation Scheme	
Theory	NA
Practical	Activity based experiential learning and internal exam only

Course Code	**BECEADM125**		*Semester*			*First*	
Course Title	**Disaster Management**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	0	0	2	2		NA	100
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)	
CLO1	Identify and explain the key concepts, types, and phases of the disaster-management cycle, including mitigation, preparedness, response, and recovery
CLO2	Conduct hazard and vulnerability assessments for a selected community or campus, and interpret the results to prioritise risks.
CLO3	Design and implement effective preparedness and mitigation strategies, such as early-warning protocols, evacuation plans, and emergency-kit assemblies.
CLO4	Demonstrate practical response skills—search-and-rescue techniques, first aid for disaster-related injuries, and emergency communication procedures.
CLO5	Develop a comprehensive post-disaster recovery and rehabilitation plan, incorporating damage assessment, resource allocation, and psychosocial support measures.
Syllabus & List of Activities	
1	Introduce Disaster Management: definitions, cycle stages; screen a short disaster-management documentary; group discussion
2	Draw and present the disaster-management cycle as a flowchart; explain each phase in mini-presentations
3	Conduct a campus/locality hazard-mapping exercise: identify natural and man-made hazards
4	Draft and apply a simple vulnerability-assessment checklist during a field visit to a selected community site
5	Compile and interpret the community hazard map; prioritise top three risks for the area
6	Workshop on early-warning systems: design alert protocols for one selected hazard (e.g., flood, fire)
7	Hands-on “Build Your Own Emergency Kit” DIY activity: list, assemble, and justify kit contents
8	Develop and sketch a detailed evacuation plan for campus buildings or neighbouring neighbourhood
9	Table-top mock drill planning: assign roles (incident commander, evac-coordinator, medics) and draft SOPs
10	Execute a timed mock evacuation drill; record evacuation times and crowd-flow bottlenecks
11	First-aid for disasters: conduct a practical session on CPR, bandaging crush injuries, and shock management
12	Search-and-rescue basics: demonstrate use of simple tools (ropes, stretchers) and safe victim-extraction methods
13	Visit a local fire station or community relief camp; interact with personnel on roles and resource challenges
14	Plan and run a community-awareness campaign (posters, street play or social media) on key preparedness measures

15	Group presentations: draft a basic post-disaster damage-assessment report and outline a community-rehabilitation plan

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	**1**	2	1	1	1	3	3	2	2	2	2	2	1.83
CLO2	**1**	3	2	2	1	3	3	2	2	2	2	2	2.08
CLO3	**1**	3	3	2	1	3	3	2	3	2	3	2	2.33
CLO4	**1**	2	2	2	1	3	2	2	3	2	2	2	2
CLO5	**1**	2	2	2	1	3	3	2	2	2	3	2	2.08
Avg PLO	**1**	2.4	2	1.8	1	3	2.8	2	2.4	2	2.4	2	2.07

Suggested Reading

1	Michael K. Lindell, Carla S. Prater & Ronald W. Perry – Introduction to Emergency Management – 2006 – Wiley
2	David Alexander – Principles of Emergency Planning and Management – 2014 – Dunedin Academic Press
3	Sudhir K. Jain – Natural Hazards and Disaster Management: Vulnerability and Mitigation – 2010 – Tata McGraw-Hill Education
4	Douglas Paton & David M. Johnston – Disaster Resilience: An Integrated Approach – 2006 – Charles C Thomas Publisher

Teaching-Learning Strategies

Experiential learning

Evaluation Scheme

Theory	NA
Practical	Activity based experiential learning and internal exam only

SEMESTER- II

(Detailed Syllabus)

Course Code	**BECEBCH225**		*Semester*			*Second*	
Course Title	**Engineering Chemistry**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	3	0	2	5	4	100	100
Prerequisites	*Higher Secondary Chemistry*					200	

Course Learning Outcomes (CLOs)	
CLO1	Understand and apply fundamental theories of chemical bonding to predict molecular structures and bonding characteristics.
CLO2	Analyze electrochemical systems using thermodynamic principles to evaluate electrode potentials and cell performance.analysis.
CLO3	Understanding lubrication action and selection of lubricants.
CLO4	Assess corrosion mechanisms and propose effective prevention strategies based on material properties and environmental factors.
CLO5	Interpret spectral data and applications of spectroscopy for molecular identification and structural, & elemental identification and determination.
Syllabus	
Units	
1	Chemical Bonding: Electronic Theory of Valency, Ionic or Electrovalent Bond, Covalent Bond, Coordinate or Dative Bond, Van Der Waals or Intermolecular Forces, Hydrogen Bond, Metallic Bond, Resonance, Valence Bond Theory for Covalence, Hybridization, VSEPR Model and Molecular Shapes, Molecular Orbital Theory, Shapes of Molecular Orbitals, Energy Level Diagram for Molecular Orbitals, Bond Order of a Molecule, Energy level Diagrams for diatomic molecules/ions, Bonding in Heteronuclear Diatomic Molecules.
2	Electro Chemistry: Redox reactions, Electrode potential, measurement of electro potentials, types of electrodes, sign of electrode potential, thermodynamics of reversible electrodes and reversible cells, effect of electrolyte on electro potential, Nernst equation, standard electrode potential- chemical series, electro motive force on Galvanic cells, concentration cells, fuel cells, lead acid cells.
3	Lubricants: Introduction, mechanism of lubrication, hydrodynamic lubrication, boundary lubrication and extreme pressure lubrication, classification of lubricants: liquid, semi solid and solid lubricants, lubricating oils, blended oils, greases, synthetic lubricants. Properties of lubricating oils with special reference to flash point, aniline point, viscosity, and viscosity index
4	Corrosion and its Prevention Introduction, effects of corrosion, dry corrosion and wet corrosion mechanisms, types of corrosion: pitting, crevice, galvanic, stress, factors affecting corrosion: nature of metal and environment, corrosion protection and inhibition: cathodic, anodic, protective coatings.
5	Introduction to Atomic and Molecular Spectroscopy: Principles and application of UV-Visible spectroscopy, Vibrational Spectroscopy, Nuclear magnetic resonance spectroscopy, Atomic absorption spectroscopy, Atomic emission spectroscopy and Inductively coupled plasma emission spectroscopy.
Experiments	
1	Determine the total, permanent, and temporary hardness of water using the EDTA method.
2	Determine the alkalinity of water samples or alkali mixtures using Warder’s method.
3	Estimate the percentage of available chlorine (free chlorine) in bleaching powder or water.
4	Determine the acid value of given lubricating oils.
5	Determine the aniline point of given lubricating oils.

6	Verify Beer-Lambert's law for colored solutions and determine the concentration of an unknown solution.
7	Draw the pH titration curve for a strong acid vs. a strong base.
8	Standardize $KMnO_4$ using sodium oxalate or oxalic acid.
9	Determination of surface tension and viscosity.
10	Thin layer chromatography.
11	Ion exchange column for removal of hardness of water.
12	Determination of chloride content of water.
13	Determination of cell constant and conductance of solutions.
14	Saponification/acid value of an oil.
15	Determination of the partition coefficient of a substance between two immiscible liquids.
16	Adsorption of acetic acid by charcoal.
17	Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	**3**	2	1	1	1	0	0	0	0	1	0	2	0.9
CLO2	**3**	3	1	2	1	0	1	0	0	1	0	2	1.2
CLO3	**2**	2	1	1	1	0	1	0	0	1	0	2	0.9
CLO4	**2**	2	2	2	1	1	2	1	0	1	0	2	1.3
CLO5	**3**	2	1	2	2	0	1	0	0	1	0	2	1.2
Avg PLO	**2.6**	2.2	1.2	1.6	1.2	0.2	1	0.2	0	1	0	2	1.1

Suggested Reading

1	Engineering Chemistry, by Manisha Agrawal
2	University chemistry, by B. H. Mahan
3	Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4	Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5	Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6	Physical Chemistry, by P. W. Atkins
7	Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition

Teaching-Learning Strategies

Interactive lectures integrating theory with applications.
Hands-on laboratory sessions.
Case-based learning supported by seminars and discussion of real-world design challenges.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (comprehensive exam aligned to CLOs).
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks.

Course Code	**BELEBMT225**		*Semester*			*Second*	
Course Title	**Mathematics-II (Linear Algebra and Differential Equations)**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	3	1	0	4	4	100	NA
Prerequisites	*Mathematics - I*					100	

Course Learning Outcomes (CLOs)	
CLO1	Apply fundamental concepts of linear algebra to solve systems of equations and analyze vector spaces using matrix techniques and eigenvalue theory.
CLO2	Evaluate linear transformations and utilize advanced matrix decompositions to study structural properties of matrices and vector spaces.
CLO3	Interpret and analyze probabilistic models and statistical data using foundational concepts, distributions, and inferential techniques.
CLO4	Solve first- and second-order ordinary differential equations analytically and assess the behavior of systems using standard methods.
CLO5	Formulate and analyze advanced ODE systems using matrix approaches, Laplace transforms, and numerical methods for engineering applications.
Syllabus	
Units	
1	Scalars, vectors, and matrix types; basic matrix operations; systems of linear equations and matrix representation; rank, echelon forms, and Gaussian elimination; introduction to vector spaces and subspaces; linear dependence and independence; basis and dimension; norms; orthogonality and orthonormal sets; Gram-Schmidt process; eigenvalues and eigenvectors; diagonalization of matrices.
2	Linear transformations and matrix representation; change of basis and similarity of matrices; characteristic polynomial and Cayley-Hamilton theorem; singular value decomposition (SVD).
3	Basic definitions and axioms of probability; combinatorial probability; conditional probability and independence; Bayes' theorem; discrete and continuous random variables; important probability distributions; expected value, variance, moments; joint distributions and covariance; central limit theorem; hypothesis testing and confidence intervals.
4	First-order ODEs: separable, linear, exact, homogeneous types; existence and uniqueness of solutions; second-order linear ODEs with constant coefficients; homogeneous and nonhomogeneous forms.
5	Higher-order linear differential equations and solution techniques; systems of ODEs and matrix methods for solution and analysis; phase plane analysis for linear systems; introduction to numerical methods for ODEs.

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**Avg CLO**
CLO1	**3**	3	2	1	1	0	0	0	0	1	0	2	1.08
CLO2	**3**	3	2	1	1	0	0	0	0	1	0	2	1.08
CLO3	**2**	2	1	1	1	1	1	0	0	1	0	2	1
CLO4	**3**	3	2	2	1	0	1	0	0	1	0	2	1.25
CLO5	**3**	3	2	2	2	0	1	0	0	1	0	2	1.33
Avg PLO	**2.8**	2.8	1.8	1.4	1.2	0.2	0.6	0	0	1	0	2	1.15

Suggested Reading	
1	Kreyszig, E. Advanced Engineering Mathematics, 10th Edition, Wiley India, 2011.
2	Strang, G. Introduction to Linear Algebra, 5th Edition, Wellesley-Cambridge Press, 2016.
3	Ross, S. M. Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press, 2014.
4	Boyce, W. E., & DiPrima, R. C. Elementary Differential Equations and Boundary Value Problems, 10th Edition, Wiley, 2012.
Teaching-Learning Strategies	
Interactive lectures integrating theory with applications. Case-based learning supported by seminars and discussion of real-world design challenges.	
Evaluation Scheme	
Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (comprehensive exam aligned to CLOs).
Practical	NA

Course Code	**BECEBBE225**		*Semester*			*Second*	
Course Title	**Biology for Engineers**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	3	0	0	3	3	100	NA
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)	
CLO1	Explain the structure and function of cells and biomolecules relevant to engineering applications.
CLO2	Describe the industrial and diagnostic applications of biomolecules in various engineering domains.
CLO3	Relate human anatomical systems to their bioengineering analogs for design inspiration.
CLO4	Identify nature-inspired materials and mechanisms used in innovative engineering solutions.
CLO5	Summarize emerging bioengineering technologies and bioinformatics applications in modern science.
Syllabus	
Units	
1	**CELL BASIC UNIT OF LIFE** Introduction. Structure and functions of a cell. Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules: Properties and functions of enzymes, vitamins and hormones.
2	**APPLICATION OF BIOMOLECULES** Carbohydrates in cellulose-based water filters production, PHA and PLA in bioplastics production, Nucleic acids in vaccines and diagnosis, Proteins in food production, lipids in biodiesel and detergents production, Enzymes in biosensors fabrication, food processing, detergent formulation and textile processing.
3	**ADAPTATION OF ANATOMICAL PRINCIPLES FOR BIOENGINEERING DESIGN** Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as a purification system. Kidney as a filtration system.
4	**NATURE-BIOINSPIRED MATERIALS AND MECHANISMS:** Echolocation, Photosynthesis. Bird flying, Lotus leaf effect, Plant burrs, Shark skin, Kingfisher beak. Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).
5	**TRENDS IN BIOENGINEERING**: Muscular and Skeletal Systems as scaffolds, scaffolds and tissue engineering, Bioprinting techniques and materials. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Bioconcrete. Bioremediation. Biomining. **BIOINFORMATICS:** Introduction and applications.

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**Avg CLO**
CLO1	**3**	2	1	1	1	1	1	1	0	1	0	2	1.17
CLO2	**2**	2	2	1	2	2	2	1	0	1	1	2	1.502
CLO3	**2**	2	3	1	1	1	1	1	0	1	0	2	1.25
CLO4	**2**	2	3	1	1	1	2	1	1	1	1	3	1.58
CLO5	**2**	2	2	2	2	1	2	1	1	1	1	3	1.67
Avg PLO	**2.2**	2	2.2	1.2	1.4	1.2	1.6	1	0.4	1	0.6	2.4	1.43

Suggested Reading	
1	R. Singh and N. R. Rao, Biology for Engineers, Bengaluru, India: Rajendra Singh C and Rathnakar RaoN Publishing, 2023
2	S. Fox and K. Rompolski, Human Physiology, 16th ed. New York, NY, USA: McGraw-Hill, 2022.
3	S. Thyagarajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, W. Thilagaraj, S. Barathi, and M. K. Jaganthan, Biology for Engineers, New Delhi, India: Tata McGraw-Hill, 2012.
4	A. T. Johnson, Biology for Engineers, Boca Raton, FL, USA: CRC Press, Taylor and Francis, 2011.

Teaching-Learning Strategies
Interactive lectures integrating theory with coding and simulation sessions. Hands-on laboratory sessions with circuit connections, breadboarding, data acquisition, and simulation exercises (using open-source tools). Case-based learning supported by seminars and discussion of real-world design challenges.

Evaluation Scheme	
Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (comprehensive exam aligned to CLOs).
Practical	NA

Course Code	**BECEECA225**		*Semester*			*Second*	
Course Title	**Computer Aided Drawing**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	0	0	4	4	2	NA	100
Prerequisites	*Engineering Graphics*					100	

Course Learning Outcomes (CLOs)	
CLO1	Understand the basic interface and functionality of AutoCAD for 2D drafting and 3D modeling.
CLO2	Learn standard commands for creating and modifying 2D mechanical drawings
CLO3	Gain proficiency in applying dimensioning, layers, and template customization
CLO4	Develop the ability to generate 2D mechanical component and assembly drawings
CLO5	Acquire skills to create and visualize 3D mechanical parts and assemblies
Syllabus	
Units	
1	Introduction to AutoCAD (2D): Importance and prerequisites for CAD tools, Starting AutoCAD: interface, units, grid, limits, Creating a new drawing, Drawing setup and drawing properties, Best practices for 2D drawing generation: Title block integration, Projection view layout, Dimensioning and annotation standards, Basic geometric drawing commands: LINE, CIRCLE, ARC, POLYGON, RECTANGLE, Modify commands: MOVE, COPY, ROTATE, TRIM, EXTEND, OFFSET, MIRROR, FILLET, CHAMFER, Use of layers, linetypes, line weights, Function keys and shortcut keys for productivity, Creating title blocks and borders, Saving and creating template files, Applying and customizing dimension styles.
2	Drawings using AutoCAD: Standard conventions in mechanical drawing, 2D assembly drawing for Hexagonal Headed Bolt and Nut with Washer, Riveted Joints: Lap Joint, Butt Joint
3	Introduction to AutoCAD (3D): Introduction to the 3D workspace, Basic 3D commands: EXTRUDE, PRESSPULL, REVOLVE, SWEEP, LOFT, Boolean operations: UNION, SUBTRACT, INTERSECT, UCS and 3D navigation tools, Parametric drawing tools: Geometric and dimensional constraints.
4	3D Part Modelling and Assembly: Creation of 3D part models, Assembly modelling techniques in 3D, Creating exploded views, Animating part assemblies (introductory), Generating 2D drawings from 3D models (projection views, section views, dimensions)
5	Advanced Assembly Modelling, Assembly constraints and fitment techniques, Exploded views and animation paths.
Experiments	
1	Getting Started with AutoCAD 2D
2	2D Geometrical Sketching and Modifications
3	Creating and Customizing Layers and Dimension Styles
4	Title Block and Template File Creation
5	2D Drawing – Hexagonal Headed Bolt and Nut with Washer
6	Assembly Drawing – Hexagonal Headed Bolt and Nut with Washer

7	Civil Drafting – Floor Plan, Elevation and Section of a Residential Building
8	Introduction to AutoCAD 3D
9	3D Solid Modelling
10	Assembly Modelling and its applications.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	2	1	3	1	1	1	2	1	1	2	1.6
CLO2	3	2	3	2	3	1	1	1	2	1	1	2	1.8
CLO3	3	2	3	2	2	2	2	1	2	2	2	3	2.1
CLO4	3	2	2	2	3	1	1	1	2	1	1	2	1.7
CLO5	3	2	3	2	3	1	1	1	3	1	1	3	2
Avg PLO	3.0	2.0	2.6	1.8	2.8	1.2	1.2	1.0	2.2	1.2	1.2	2.4	2.0

Suggested Reading

1	Sham Tickoo, AutoCAD 2024 for Engineers and Designers, CADCIM Technologies, Latest Edition.
2	N.D. Bhatt, Engineering Drawing, Charotar Publishing House, 53rd Edition.
3	Randy H. Shih, AutoCAD 2023 Tutorial First Level: 2D Fundamentals, SDC Publications.
4	K.L. Narayana, P. Kannaiah, and K. Venkata Reddy, Machine Drawing, New Age International Publishers.

Teaching-Learning Strategies

Interactive demonstrations and hands-on practice for mastering 2D and 3D AutoCAD commands.
Model-based and project-based learning to develop mechanical drawings and assemblies.
Assessments through assignments, quizzes, and final CAD projects to evaluate drafting skills.

Evaluation Scheme

Theory	NA
Practical	Continuous Internal Evaluation (CIE): 35 marks (Mid-Term examination) + 15 marks (Class assessment: quizzes, tutorials). Semester End Examination (SEE): 50 marks.

Course Code	**BECEEAI225**		*Semester*			*Second*	
Course Title	**Introduction to Artificial Intelligence**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	2	1	2	5	4	100	100
Prerequisites	*Programming & Problem solving*					200	

Course Learning Outcomes (CLOs)	
CLO1	Explain the fundamental concepts, history, goals, and types of Artificial Intelligence.
CLO2	Describe major subfields of AI and illustrate their role in real-world applications.
CLO3	Identify and analyze the use of AI in various engineering domains and daily life.
CLO4	Explain the role of intelligent agents, problem-solving strategies, and basic machine learning concepts.
CLO5	Evaluate ethical concerns, societal impacts, and current trends in responsible and emerging AI technologies.
Syllabus	
Units	
1	Introduction to Artificial Intelligence: Definition of AI: what is AI, why it matters; Goals of AI: Building machines that can think, learn, adapt; Brief history of AI: Major milestones from early AI to modern AI (e.g., Turing Test, expert systems, modern AI breakthroughs); Types of AI: Narrow AI, General AI, Super AI-concepts and examples; AI vs Human Intelligence: Key differences;
2	AI Subfields and Everyday AI: Core subfields of AI: Introduction to Machine Learning, Natural Language Processing (chatbots, translation), Robotics (automation in industries), Computer Vision (face recognition, quality inspection); AI in daily life: Smartphones, Recommendation systems (Netflix, Amazon), Chatbots (Siri, Alexa);
3	AI in Engineering Applications: AI in Agriculture: Crop prediction, Precision farming; AI in Manufacturing: Predictive maintenance, Quality control; AI in Smart Cities & Energy: Traffic management, Smart grids, Self-driving cars; AI in Healthcare: Diagnostics, Patient monitoring; AI for Intrusion and threat detection; AI for Safer Infrastructure: Structural health monitoring; Limitations of AI: Where human judgment is crucial (creativity, empathy, ethics);
4	Problem Solving, Intelligent Agents, and Learning: Intelligent agents: Concept, environment, perception-action cycle; Simple problem solving in AI: Search (maze solving, tic-tac-toe); Basic learning concepts: Learning in AI, Supervised vs. Unsupervised learning (conceptual examples like spam detection, product recommendation);
5	Responsible AI-Ethics and Beyond: AI ethics: Bias, fairness, transparency; AI and employment: Automation's impact on jobs, new job roles; AI in security and warfare: Surveillance, autonomous weapons; Responsible AI and standards: XAI (Explainable AI) basics, government & industry guidelines; Emerging trends: Generative AI (e.g., ChatGPT), AI for social good, sustainable AI;
Experiments	
1	Getting started with AI tools: Introduction to AI simulators or platforms (e.g., Google Teachable Machine etc.). Train a simple image classifier (e.g., classify objects using webcam input) using appropriate simulators.

2	Building a basic rule-based chatbot: Use a visual or no-code tool (e.g., Dialogflow, Chatbot.com) to build a chatbot that answers student queries (e.g., college info, timetable). Test chatbot responses and modify rules.
3	AI in image recognition: Use Google Teachable Machine or Edge Impulse (no code) to train a model that recognizes simple gestures or objects (e.g., thumbs up / thumbs down). Discuss accuracy and why it varies.
4	Getting Started with Python: Exploring Basic Syntax, Expressions, Variables, and Output to Build Initial Familiarity in an Interactive Environment
5	Learning to Interact with Python: Handling User Input, Understanding Core Data Types, and Performing Type Conversions in Simple Programs
6	Understanding Python control statements: if, if-else, for etc.
7	Write a Python program using a list to calculate sum and average, and use a dictionary to store and retrieve student marks.
8	Write a Python program to create a pandas DataFrame using a dictionary and display it using print() and .head().
9	Write a Python program using if-else conditions to give simple health advice based on user input like fever or cough.
10	Write a Python program to read a CSV file using pandas, display the top 5 rows, and show column names and data types.
11	Write a Python program to train a simple linear regression model using scikit-learn and predict output for a new input.
12	Write a Python program to plot a simple line graph using matplotlib with labels for x-axis, y-axis, and a title.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	**2**	1	1	0	1	1	0	1	0	1	0	3	0.92
CLO2	**2**	2	2	1	2	1	1	1	1	1	1	3	1.50
CLO3	**2**	3	2	1	2	2	2	1	1	1	1	3	1.75
CLO4	**3**	3	2	2	2	1	1	1	1	1	1	3	1.75
CLO5	**1**	1	1	1	1	3	2	3	1	2	1	3	1.67
Avg PLO	**2**	2	1.6	1	1.6	1.6	1.2	1.4	0.8	1.2	0.8	3	1.52

Suggested Reading

1	Russell, S., & Norvig, P. (2020). Artificial Intelligence: A Modern Approach (4th ed.). Pearson Education.
2	Choudhury, D., & Deb, S. (2021). AI for Engineers: Applications in Mechanical, Civil, Electrical, and Agriculture. Wiley.
3	Joshi, R. C., & Dutta, R. (2022). Artificial Intelligence in Engineering Applications. CRC Press.
4	Google AI. What is AI?. https://ai.google/education
5	IBM. AI in Daily Life. https://www.ibm.com/cloud/learn/what-is-artificial-intelligence
6	Google Teachable Machine. https://teachablemachine.withgoogle.com
7	Balagurusamy, E., Introduction to Python Programming, McGraw-Hill Education, 2020
8	Barry, P., Head First Python, 2nd ed., O'Reilly Media, 2016.

Teaching-Learning Strategies	
Hands-on learning: Let students build simple AI models using tools like Teachable Machine or Dialogflow. Practical experiments like training classifiers or simulating smart traffic lights make AI concepts clear and engaging. Visualization and simulation: Use tools like pathfinding visualizers, user-item matrices in Excel, or image recognition demos to explain complex ideas like search algorithms and recommendation systems. Collaborative learning: Encourage group discussions and roleplays on topics like AI ethics, bias, and automation using tools like Google's What-If Tool to promote critical thinking. Concept mapping and comparison: Use charts and diagrams to compare types of AI, learning methods, or AI vs human intelligence. This helps students organize their understanding visually.	
Assessment Methods	
Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (comprehensive exam aligned to CLOs).
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks.

Course Code	**BECEEBE225**		*Semester*			*Second*	
Course Title	**Basic Electrical and Electronics Engineering**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	3	1	2	6	5	100	100
Prerequisites	*Higher Secondary Physics*					200	

Course Learning Outcomes (CLOs)	
CLO1	Analyze and interpret basic circuit laws and network theorems; apply these to design and simulate simple DC circuits.
CLO2	Apply systematic circuit analysis techniques—including nodal, mesh, and superposition methods—to complex, multi-source circuits.
CLO3	Demonstrate proficiency in AC circuit analysis; analyze resonance and transient behavior in RLC circuits.
CLO4	Interpret semiconductor device operation through diode I–V characteristics and design rectification/filtering circuits.
CLO5	Design and analyze analog circuits using transistor biasing.
Syllabus	
Units	**Content**
1	Fundamentals & Basic Circuit Analysis: Introduction to electrical engineering as a discipline (historical context, real-world applications); Definitions of electrical quantities (voltage, current, power, energy, charge, Electric Potential,Resistance, Conductance, Inductance, Capacitance, Reactance,Impedance. Basic terminologies: Nodes, Junctions, Paths,Loops, Branches.etc);Conceptual distinction between linear/non-linear and bilateral/unilateral elements; Electrical Components – Resistors, capacitors, inductors,Memristors (behavior, symbols, units and Modeling);Voltage and Current sources , ideal vs. Practical sources, Independent & Dependent Sources. Batteries (Types,symbols,Parameters and modelling); Power and energy relations. Ohm's law & its Validity, Ohmic and non Ohmic conductors, KVL, KCL – formal treatment and applications; voltage divider, current divider, Y and Δ transformation.
2	Systematic Circuit Analysis & Network Theorems: Formal development of nodal analysis and mesh analysis (algorithmic procedures and matrix formulation); Solving circuits with multiple sources using superposition; Source transformations; Thevenin's and Norton's theorems; Maximum Power Transfer Theorem;
3	AC Circuits (Steady-State): Sinusoidal signals – representation, properties, RMS and average values; Phasor domain analysis; Complex impedance of R, L, and C elements; Steady-state analysis of AC circuits via nodal/mesh methods with phasors; Real, reactive, and apparent power; power triangle, power factor and correction; Series and parallel resonance – derivation of resonant frequency, Q-factor, and bandwidth.
4	Introduction to Electronics and applications of Electronic systems in real life: Introduction to Digital and Analog signals; Review of Charge carriers. Semiconductor Diode: PN-Junction, Forward Bias and Reverse Bias conditions, Ideal-vs-practical diode, I-V characteristics of a PN Junction diode, Shockley equation, Diode models with mathematical formulations and applications. Diode Breakdown,Large signal and Small signal operation of Diode,Special Diodes: Zener Diode ,Photo Diode.Diode applications: OR and AND Gates, Half-Wave Rectification , Centre-tapped Full-Wave rectifier , Bridge rectifier ,zener diode as voltage regulator,photo diode as light sensor.

5	Transistors: Bipolar Junction Transistors (BJTs)—structure, operation, current components, PNP/NPN types, biasing, α and β parameters, operation modes (active, cut-off, saturation), CE, CB, CC configurations, transistor circuit characteristics, Q-point; small-signal operation; Transistor as an amplifier, Transistor as a switch,Transistor as an inverter, Basics of FETs and MOSFETs.
Experiments	
1	Introduction to Safety protocols in lab and practical environments
2	Measure and verify Ohm's Law using a resistive circuit.
3	Analyze voltage and current divider rules through real-time circuit testing.
4	Apply nodal and mesh analysis to solve complex multi-source circuits.
5	Determine Thevenin and Norton equivalents using experimental methods.
6	Investigate phasor relationships in RLC circuits under sinusoidal excitation.
7	Perform power factor correction using capacitors with inductive loads.
8	Plot the I-V characteristics of PN-junction and Zener diodes.
9	Construct and test rectifier circuits and waveform shaping networks.
10	Observe BJT transistor characteristics in common-emitter configuration.
11	Demonstrate switching and amplification using a BJT in different biasing conditions.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	2	2	2	0	0	0	1	1	1	2	1.42
CLO2	3	3	2	2	2	0	0	0	1	1	1	2	1.42
CLO3	3	3	2	2	2	0	1	0	1	1	1	2	1.50
CLO4	3	2	2	2	2	0	1	0	1	1	1	2	1.42
CLO5	3	2	3	2	2	0	1	0	1	1	1	2	1.50
Avg PLO	3	2.6	2.2	2	2	0	0.6	0	1	1	1	2	1.45

Suggested Reading	
1	"Engineering Circuit Analysis" by William H. Hayt, Jack E. Kemmerly, and Steven M. Durbin, McGraw Hill
2	"Basic Electrical Engineering" by D.P. Kothari and I.J. Nagrath, McGraw Hill
3	"Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith,Oxford University Press
4	"Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky, Pearson Education
5	"Network Analysis and Synthesis" by Franklin F. Kuo, Wiley
Teaching-Learning Strategies	
Interactive lectures integrating theory with coding and simulation sessions. Hands-on laboratory sessions with circuit connections, breadboarding, data acquisition, and simulation exercises (using open-source tools). Case-based learning supported by seminars and discussion of real-world design challenges.	
Assessment Methods	
Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks (comprehensive exam aligned to CLOs).
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks.

Course Code	**BECEEID225**		*Semester*			*Second*	
Course Title	**IDEA Lab Workshop**					*Max marks*	
	Hours Per Week						
Scheme & Credits	***L***	***T***	***P***	***Total***	***Credits***	***Theory***	***Practical***
	0	0	2	2	1	NA	100
Prerequisites	*Engineering Workshop*					100	

Course Learning Outcomes (CLOs)	
CLO1	Apply design thinking methodologies to identify user-centric problems and develop innovative, feasible solution concepts through iterative prototyping and validation.
CLO2	Demonstrate the ability to design and assemble basic electronic circuits and embedded systems using microcontrollers and interface them with sensors and actuators for functional prototyping.
CLO3	Create and simulate 2D/3D digital models of components and assemblies using modern CAD tools, ensuring manufacturability and compatibility with digital fabrication systems.
CLO4	Prepare, configure, and operate 3D printers to fabricate physical prototypes from CAD models, including selection of materials, slicing parameters, and post-processing techniques.
CLO5	Integrate design, electronics, and digital fabrication skills to develop and present a complete working prototype using CNC machining or laser cutting, demonstrating a multidisciplinary design approach.
Syllabus	
Units	
1	Design Thinking and Innovation Introduction to design thinking process: empathize, define, ideate, prototype, test. Understanding user needs and problem scoping through empathy maps and journey mapping. Methods of ideation including brainstorming, mind mapping, and SCAMPER. Creation of user personas and storyboarding for solution building. Developing and validating Minimum Viable Products (MVPs). Real-world case studies of innovation using design thinking in engineering.
2	Electronic Prototyping and Embedded Development Overview of electronic components such as sensors, actuators, and microcontrollers. Hands-on prototyping using platforms like Arduino,Designing and simulating circuits using software such as Tinkercad .Interfacing analog and digital sensors, controlling actuators.
3	Software-Based CAD Design and Modeling Introduction to CAD software such as Autodesk Fusion 360, and TinkerCAD. Basic 2D sketching and 3D modeling techniques including extrusion, lofting, filleting, and assembly creation. File export procedures for 3D printing and CNC (STL, DXF, etc.).
4	3D Printing and Additive Manufacturing Principles of 3D printing and additive manufacturing processes. Introduction to FDM, SLA, and SLS technologies. Workflow from CAD to 3D printing using slicing tools like Ultimaker Cura and PrusaSlicer. Material selection including PLA, ABS, and PETG. Printer calibration, print setup, troubleshooting, and G-code basics. Post-processing methods such as support removal, sanding, and finishing for assembly.
5	CNC Fabrication and Integrated Product Development Basics of CNC machining and laser cutting technologies. Introduction to CAM tools such as Fusion 360 CAM and VCarve for generating toolpaths. Safety procedures and operational steps for CNC mills, routers, and laser cutters.

Experiments	
1	Students will engage with real users or use provided case studies to create empathy maps, identify core user needs, and frame well-defined problem statements.
2	Using the SCAMPER technique, Students need to brainstorm multiple solutions and develop storyboards to visualize the user experience for a proposed Minimum Viable Product (MVP).
3	Students need to prototype a working circuit such as a temperature-controlled fan or motion-triggered LED system using Arduino, sensors, and actuators.
4	Students need to design, simulate, and test digital circuits using Tinkercad Circuits, implementing sensor inputs and logical actuator outputs virtually.
5	Students need to model a basic 3D component such as a mechanical enclosure or sensor holder, applying extrusion, filleting, and assembly techniques.
6	Students need to export their 3D designs in STL/DXF formats and verify their readiness for fabrication through 3D printing or CNC machining.
7	Students need to prepare and slice a 3D model, configure print parameters (layer height, infill, supports), and produce a physical part using a 3D printer.
8	After printing, Students need to remove supports, sand and finish parts, and assemble components into a functional prototype if required.
9	Students need to create toolpaths for a 2D or 3D part, simulate machining operations, and prepare G-code for CNC or laser cutting machines.
10	Students need to fabricate their designed part using a CNC machine or laser cutter, applying correct safety practices, material setup, and quality checks.

CLO-PLO Mapping Matrix													
CLO/PLO	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**	**Avg CLO**
CLO1	2	3	3	2	2	2	2	1	2	2	2	3	2.17
CLO2	3	3	3	2	3	1	1	1	2	2	2	3	2.17
CLO3	2	2	3	2	3	1	1	1	2	2	2	3	2
CLO4	2	2	2	2	3	1	1	1	2	2	2	3	1.92
CLO5	3	3	3	2	3	2	2	1	3	3	3	3	2.58
Avg PLO	2.4	2.6	2.8	2	2.8	1.4	1.4	1	2.2	2.2	2.2	3	2.17

Suggested Reading	
1	“The Design of Everyday Things” by Don Norman Publisher: Basic Books
2	“Getting Started with Arduino” by Massimo Banzi and Michael Shiloh Publisher: Maker Media
3	“Fusion 360 for Makers: Design Your Own Digital Models for 3D Printing and CNC Fabrication” by Lydia Sloan Cline Publisher: Make Community

4	“3D Printing: A Beginner’s Guide” by Cameron Coward Publisher: Que Publishing
5	“CNC Machining Handbook: Building, Programming, and Implementation” by Alan Overby Publisher: McGraw-Hill Education
Teaching-Learning Strategies	
Interactive lectures integrating theory with coding and simulation sessions. Hands-on laboratory sessions with circuit connections, breadboarding, data acquisition, and simulation exercises (using open-source tools). Case-based learning supported by seminars and discussion of real-world design challenges.	
Assessment Methods	
Theory	NA
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-Term examination) + 15 Marks (Class assessment: Attendance, Viva, Quiz, Presentation, Surprise test, Open book tests, mini project, etc.). Semester End Examination (SEE): 50 marks.