SYLLABUS
FOR
BACHELOR OF TECHNOLOGY
IN
ELECTRICAL ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING
UNIVERSITY OF KASHMIR
SRINAGAR

JULY – 2025

(Applicable to Batch 2025 & Onwards)

B.Tech. in Electrical Engineering

Programme Learning Outcomes (PLOs)

1. **Engineering Knowledge**: Apply knowledge of mathematics, science, and electrical engineering fundamentals to solve complex problems in power, control, and energy systems.
2. **Problem Analysis**: Identify and analyze electrical engineering problems using principles of circuit theory, electronics, power systems, and electromagnetic fields.
3. **Design/Development of Solutions**: Design electrical systems and components such as control circuits, machines, and energy systems considering safety, environment, and economic constraints.
4. **Investigation of Complex Problems**: Conduct experiments and investigations to analyze performance characteristics of electrical systems and interpret results using modern methods.
5. **Modern Tool Usage**: Use modern engineering tools such as Python, MATLAB, PSpice, PLCs, SCADA, and simulation software to model and analyze electrical systems.
6. **The Engineer and Society**: Apply contextual knowledge to assess social, health, legal, and cultural issues relevant to electrical system deployment and use.
7. **Environment and Sustainability**: Understand the impact of electrical engineering solutions in environmental and societal contexts and promote sustainable practices.
8. **Ethics**: Apply ethical principles and commit to professional responsibilities in electrical engineering practice.
9. **Individual and Team Work**: Function effectively as an individual and as a team member or leader in multidisciplinary environments.
10. **Communication**: Communicate effectively through technical reports, documentation, presentations, and drawings.
11. **Project Management and Finance**: Apply engineering and management principles for planning and executing electrical engineering projects within budget and time constraints.
12. **Innovation, Entrepreneurship and Life-long Learning**: Exhibit an innovative mindset and entrepreneurial skills for technology development or engage in lifelong learning to adapt to technological changes in electrical engineering and energy systems.

Accreditation Alignment

- The program is designed in accordance with **NEP, AICTE, and NBA guidelines.**
- Program Learning Outcomes (POs) align with **Washington Accord Competencies for Engineering Graduates**.
- 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**	**L**	**E**					**2**	**5**

Digit	**Description**
1	Bachelor's Programme
2 - 4	Programme Code: Electrical Engineering = ELE
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 Examination			
Section	**No of questions**	**Marks**	**Sectional Marks**
A	10	1	10
B	5	4	20
C	2 out of 5 (1 from each unit)	10	20
Total			50

Mid-term			
Section	**No of questions**	**Marks**	**Sectional Marks**
A	10	1	10
B	3	5	15
C	1 out of 2 (from unit 1 & 2)	10	10
Total			35

SCHOOL OF ENGINEERING, UNIVERSITY OF KASHMIR

COURSE STRUCTURE OF B.TECH. PROGRAMME IN ELECTRICAL ENGINEERING

Effective from Session 2025

Semester I							
S.No.	**Course Code**	**Course Title**	**Hours Per Week**				**Credits**
			L	**T**	**P**	**Total**	
3 WEEKS COMPULSORY INDUCTION PROGRAM (UHV-I)							
1	**BELEBPH125**	**Physics (Electromagnetics)**	**3**	**0**	**2**	**5**	**4**
2	**BELEBMT125**	**Mathematics-I (Calculus)**	**3**	**1**	**0**	**4**	**4**
3	**BELEEPP125**	**Programming and Problem Solving Techniques**	**2**	**1**	**2**	**5**	**4**
4	**BELEEEG125**	**Engineering Graphics**	**2**	**1**	**0**	**3**	**3**
5	**BELEHPC125**	**Professional Communication**	**2**	**1**	**0**	**3**	**3**
6	**BELEHUH125**	**Universal Human Values**	**2**	**0**	**0**	**2**	**2**
7	**BELEEEW125**	**Engineering Workshop**	**0**	**0**	**4**	**4**	**2**
8	**Any one of the following (Experiential learning and activity based course)**						
	BELEAYO125	**Yoga**	**0**	**0**	**3**	**3**	**0**
	BELEASP125	**Sports**					
	BELEANC125	**NCC**					
	BELEANS125	**NSS**					
	BELEADM125	**Disaster Management**					
TOTAL			**14**	**4**	**11**	**29**	**22**

Semester II							
S. No.	**Course Code**	**Course Title**	**Hours Per Week**				**Credits**
			L	**T**	**P**	**Total**	
1	**BELEBCH225**	**Engineering Chemistry**	**3**	**0**	**2**	**5**	**4**
2	**BELEBMT225**	**Mathematics-II (Linear Algebra, Probability, and Differential Equations)**	**3**	**1**	**0**	**4**	**4**
3	**BELEBBE225**	**Biology for Engineers**	**3**	**0**	**0**	**3**	**3**
4	**BELEEBE225**	**Basic Electrical and Electronics Engineering**	**3**	**1**	**2**	**6**	**5**
5	**BELEEAI225**	**Introduction to Artificial Intelligence**	**2**	**1**	**2**	**5**	**4**
6	**BELEEDT225**	**Design Thinking**	**0**	**0**	**4**	**4**	**2**
7	**BELEAID225**	**IDEA Lab Workshop**	**0**	**0**	**2**	**2**	**0**
TOTAL			**14**	**3**	**12**	**29**	**22**

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	BELEBPH125	Physics (Electromagnetics)	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	BELEBMT125	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	BELEEPP125	Programming and Problem Solving Techniques	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	BELEEEG125	Engineering Graphics	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	BELEHPC125	Professional Communication	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	BELEHUH125	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	BELEEEW125	Engineering Workshop	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)														
	BELEAYO125	Yoga	0	1	0.2	0.2	0	1.8	2	2.2	1.2	1.2	0	2	0.98
	BELEASP125	Sports	0	1.2	0.6	0.4	0	1.4	1.4	2	1.6	1.2	0.2	2	1
	BELEANC125	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
	BELEANS125	NSS	0	1	1	1	0	3	2	3	2	2	1	3	1.58
	BELEADM125	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	BELEBCH225	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	BELEBMT225	Mathematics-II (Linear Algebra, Probability, and Differential Equations)	2.8	2.8	1.8	1.4	1.2	0.2	0.6	0	0	1	0	2	1.15
3	BELEBBE225	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	BELEEBE225	Basic Electrical and Electronics Engineering	3	2.6	2.2	2	2	0	0.6	0	1	1	1	2	1.45
5	BELEEAI225	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	BELEEDT225	Design Thinking	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	BELEEID225	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

Course Code	**BELEBPH125**				*Semester*	*First*	
Course Title	**Physics (Electromagnetics)**					*Max marks*	
Scheme & Credits	*Hours Per Week*				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
	3	0	2	5	4	100	100
Prerequisites	*Nil*					200	

Course Learning Outcomes (CLOs)

CLO1 Develop proficiency in vector calculus and integral theorems essential for analyzing electromagnetic fields.

CLO2 Apply foundational electrostatic principles to determine electric fields, potentials, and capacitance in various configurations.

CLO3 Analyze capacitive behaviours and models.

CLO4 Analyze steady magnetic fields in vacuum and matter using Biot–Savart and Ampère's laws, including magnetic energy and materials

CLO5 Interpret and formulate Maxwell's equations to understand the dynamics of time-varying fields and electromagnetic wave propagation.

Syllabus

Units	Content
1	Mathematical Foundations for Electromagnetism Vector algebra: scalars and vectors, dot product, cross product, scalar triple product; vector calculus: gradient, divergence, curl, Laplacian; coordinate systems: Cartesian, cylindrical, spherical; integrals: line, surface, volume; integral theorems: Gauss's theorem, Stokes' theorem; physical interpretation of fields: field lines, flux, conservative fields, circulation
2	Electrostatics and Electric Fields Coulomb's law: force between point charges; electric field due to discrete and continuous charge distributions: line, surface, volume; electric flux; Gauss's law in integral and differential forms; electric potential: definition, relation to electric field, potential due to point and distributed sources; conductors: electrostatic equilibrium, boundary conditions, induced surface charge
3	Capacitance, Poisson's and Laplace's Equations, and Dielectrics Capacitance: definition, calculation for parallel plate, cylindrical, spherical geometries, energy storage in electric fields; Poisson's and Laplace's equations: derivation and applications; dielectric materials: polarization, bound charges, electric displacement field; boundary conditions in dielectrics; applications: composite and layered dielectric systems
4	Magnetostatics and Magnetic Fields in Matter Magnetic field: Biot–Savart law, field due to straight wire, circular loop; Ampère's law: integral and differential forms, applications to solenoids and toroids; magnetic vector potential: definition and relation to magnetic field; magnetization and bound currents; magnetic field in matter; magnetic materials: paramagnetic, diamagnetic, ferromagnetic; boundary conditions for magnetic materials; energy density in magnetic fields
5	Time-Varying Fields, Maxwell's Equations, and Electromagnetic Waves Faraday's law of induction: motional emf, transformer emf; displacement current; Maxwell's equations: integral and differential forms, physical significance, interconnection; electromagnetic wave equation: derivation and interpretation; energy and momentum in electromagnetic fields: Poynting vector, radiation pressure; electromagnetic waves in vacuum and matter

Experiments

1	Measurement of resistance by color coding & Ohm's Law.
2	Measurement of resistance by Wheat Stone bridge.
3	To find the Dielectric constant of different materials.
4	Verification of Biot Savart's law.
5	Determination of Magnetic Flux Density at any point along the axis of a circular coil.
6	Using galvanometer, voltmeter, and ammeter.
7	Simulate magnetic field circulation to validate Stokes' theorem using software.
8	Map equipotential lines and electric fields using software.

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	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	Griffiths, D. J., *Introduction to Electrodynamics*, 5th ed., Cambridge University Press, 2024.
2	Sadiku, M. N. O., *Elements of Electromagnetics*, 7th ed., Oxford University Press, 2019.
3	Ulaby, F. T., *Fundamentals of Applied Electromagnetics*, 8th ed., Pearson, 2020.
4	Hayt, W. H., & Buck, J. A., *Engineering Electromagnetics*, 9th ed., McGraw-Hill Education, 2018.

Teaching-Learning Strategies

Interactive lectures integrating theory with coding and simulation sessions.
Hands-on laboratory sessions 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 Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code	**BELEBMT125**				*Semester*	*First*	
Course Title	**Mathematics-I (Calculus)**					*Max marks*	
Scheme & Credits	*Hours Per Week*				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
	3	1	0	4	4	100	NA
Prerequisites	*Nil*					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	Content
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.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	NA

Course Code	**BELEEPP125**				*Semester*	*First*	
Course Title	**Programming and Problem Solving Techniques**					*Max marks*	
Scheme & Credits	*Hours Per Week*				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
	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	Content
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 fro various problmes 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 demonstarting 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.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code	**BELEEEG125**				*Semester*	*First*	
Course Title	**Engineering Graphics**					*Max marks*	
Scheme & Credits	*Hours Per Week*				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
	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	Content
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 references 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.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	NA

Course Code	**BELEHPC125**				*Semester*	*First*	
Course Title	**Professional Communication**					*Max marks*	
Scheme & Credits	*Hours Per Week*				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
	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 amonmg 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	Content
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	0.6	0.6	0.0	1.4	1.2	0.2	1.0	2.2	3.0	1.4	2.0	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 Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	NA

Course Code	**BELEHUH125**				*Semester*	*First*	
Course Title	**Universal Human Values**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	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 human 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	Content
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	0.0	1.0	1.0	0.0	0.0	2.6	2.2	3.0	1.0	2.0	1.0	2.0	1.32

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.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	NA

Course Code	**BELEEEW125**				*Semester*	*First*	
Course Title	**Engineering Workshop**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	0	0	4	4	2	NA	100
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)

CLO1	Analyzing the different engineering materials, tools, equipments 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	Content
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: Prepartaion of simple 3D models using 3-D printing.
4	Sheet Metal: Demonstration of tools and equipment's 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 technique and carry out the visual inspection of welded joints.
4	To prepare L-joint, T-Joint, Cross joint, Split Pattern and Dove tail joint in carpentry shop.
5	To prepare Green Sand Moulds for various patterns in sand casting process.
6	To prepare simple 3D models using 3-D printing technique.
7	To make trays and cones using sheet metal operations on G.I sheet metal.
8	To prepare stud to cut external threads with help of dies, drilling, countersinking, counter boring and internal thread cutting with taps.
9	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
CLO6	2.0	2.0	2.0	2.0	2.0	0.0	1.0	0.0	1.0	1.0	1	2	1.33
Avg PLO	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

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 gap between theory and real world apllications 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.

Evaluation Scheme

Theory	NA
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code	**BELEAYO125**				*Semester*	*First*	
Course Title	**Yoga**					*Max marks*	
	Hours Per Week						
	L	*T*	*P*	*Total*	*Credits*	*Theory*	*Practical*
Scheme & Credits	0	0	3	3	0	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	1.00
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	0.0	1.0	0.2	0.2	0.0	1.8	2.0	2.2	1.2	1.2	0.0	2.0	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	**BELEASP125**				*Semester*	*First*	
Course Title	**Sports**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	0	0	3	3	0	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 & Discussionon 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	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	2	1	1	0	1	2	1	1	1	0	2	1.00
CLO3	0	1	1	1	0	1	1	2	2	1	0	2	1.00
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	0.0	1.2	0.6	0.4	0.0	1.4	1.4	2.0	1.6	1.2	0.2	2.0	1.00

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	**BELEANC125**				*Semester*	*First*	
Course Title	**NCC**					*Max marks*	
	Hours Per Week						
	L	*T*	*P*	*Total*	*Credits*	*Theory*	*Practical*
Scheme & Credits	0	0	3	3	0	NA	100
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)

CLO1	Explain the history, 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 both routine and disaster-response scenarios.
CLO5	Lead community-service and social-interaction initiatives, demonstrating leadership, public-speaking, and problem-solving skills, and 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 and practice basic drill commands (attention, stand-at-ease, stand-easy)
5	Morning PT session: stretching, running, callisthenics; record fitness baselines
6	Circuit-training stations: push-ups, squats, planks; set individual goals
7	Classroom session on small-arms nomenclature and safety rules
8	Hands-on demo of rifle loading/unloading and zero-range protocol (dry-firing)
9	Map-plotting exercise: identify grid references, scales, and symbols. Compass-and-pace navigation drill on campus/locality
10	Field movement drill: low-crawl, rushes, use of cover and concealment
11	First-aid workshop: bandaging, splinting, CPR basics; pair-practice
12	Table-top mock disaster scenario: develop disaster-response plan for floods/earthquakes
13	Leadership skills session: public speaking, group problem-solving
14	Planning and safety briefing for trekking/adventure activities; gear checklist
15	Written quiz on theory topics; practical drill and first-aid skill test
16	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	1.00
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

Evaluation Scheme

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

Course Code	**BELEANS125**				*Semester*	*First*	
Course Title	**NSS**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	0	0	3	3	0	NA	100
Prerequisites	*Nil*					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	3	1.58
Avg PLO	0.0	1.0	1.0	1.0	0.0	3.0	2.0	3.0	2.0	2.0	1.0	3.0	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	**BELEADM125**				*Semester*	*First*	
Course Title	**Disaster Management**					*Max marks*	
	Hours Per Week						
	L	*T*	*P*	*Total*	*Credits*	*Theory*	*Practical*
Scheme & Credits	0	0	3	3	0	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	2.00
CLO5	1	2	2	2	1	3	3	2	2	2	3	2	2.08
Avg PLO	1.0	2.4	2.0	1.8	1.0	3.0	2.8	2.0	2.4	2.0	2.4	2.0	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

Course Code	**BELEBCH225**				*Semester*	*First*	
Course Title	**Engineering Chemistry**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	3	0	2	5	4	100	100
Prerequisites	*Nil*					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 Understaning 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	Content
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 electrode potential, Types of electrodes, Sign of electrode potential, Thermodynamics of reversible electrodes and reversible cells, Effect of electrolyte on electrode potential, Nerst equation, standard electrode potential- chemical series, Eectromotive force of 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 (Do any ten)
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 the demonstrate of 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	0.2	0.0	1.0	0.0	2.0	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 Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code	**BELEBMT225**				*Semester*	*First*	
Course Title	**Mathematics-II (Linear Algebra, Probability and Differential Equations)**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	3	1	0	4	4	100	NA
Prerequisites	*Nil*					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	Content
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	1.00
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	0.0	1.0	0.0	2.0	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 Test, Mini-project, etc)
Semester End Examination (SEE): 50 marks

Practical: NA

Course Code	**BELEEBE125**				*Semester*	*First*	
Course Title	**Biology for Engineers**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	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	Content
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 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	1.50
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	2.0	2.2	1.2	1.4	1.2	1.6	1.0	0.4	1.0	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 Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	NA

Course Code	**BELEEBE225**				*Semester*	*First*	
Course Title	**Basic Electrical and Electronics Engineering**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	3	1	2	6	5	100	100
Prerequisites	*Nil*					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	3.0	2.6	2.2	2.0	2.0	0.0	0.6	0.0	1.0	1.0	1.0	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.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code	**BELEEAI225**				*Semester*	*First*	
Course Title	**Introduction to Artificial Intelligence**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	2	1	2	5	4	100	100
Prerequisites	*Nil*					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	Content
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).
4	Getting Started with Python: Exploring Basic Syntax, Expressions, Variables, and Output to Build Initial Familiarity in an Interactive
5	Learning to Interact with Python: Handling User Input, Understanding Core Data Types, and Performing Type Conversions in Simple
6	Undertabding 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	2.0	2.0	1.6	1.0	1.6	1.6	1.2	1.4	0.8	1.2	0.8	3.0	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.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code	**BELEEDT225**				*Semester*	*First*	
Course Title	**Design Thinking**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	0	0	4	4	2	NA	100
Prerequisites	*Nil*					100	

Course Learning Outcomes (CLOs)

CLO1	Apply personal learning styles, memory techniques, and emotional awareness to enhance creativity and peer engagement.
CLO2	Demonstrate understanding of design thinking principles and implement the five-stage innovation process in product development.
CLO3	Develop and test creative solutions for engineering problems using structured problem-solving methodologies.
CLO4	Construct and evaluate engineering product prototypes using design thinking frameworks and iterative testing approaches.
CLO5	Integrate empathy, individual differences, and user feedback to redesign and present customer-centric engineering solutions.

Syllabus

Units	Content
1	Learning process and phases of experiential learning, Kolb's learning styles and interpretation techniques, methods for assessing individual learning preferences, cognitive structure of memory, short-term and long-term memory dynamics, causes and solutions for retention challenges, techniques for memory improvement, emotional intelligence and regulation, types of emotional experiences and their effect on learning, methods to assess and express empathy, role of emotional awareness in group activities.
2	Definition and history of design thinking, relevance of design thinking in engineering and innovation, identifying the need and objectives of design thinking, concept generation and divergent thinking strategies, brainstorming tools and facilitation techniques, stages of design thinking process—Empathize, Define, Ideate, Prototype, Test—with examples from engineering applications.
3	Nature and types of creativity, theories and models of creative thinking, techniques for generating new ideas and transforming them into solutions, systematic problem identification methods, convergent and divergent problem-solving approaches, problem validation, stakeholder mapping, iterative methods for refining ideas, case studies demonstrating innovative thinking in engineering contexts.
4	Engineering design lifecycle, integration of design thinking into product development, stages of product ideation and feasibility analysis, drafting specifications, examples of successful product designs, design aesthetics and usability principles, purpose and formats of prototyping, rapid prototyping tools and techniques, testing procedures for functionality and ergonomics, capturing feedback during prototype trials, role of test groups in iterative improvement.
5	Understanding individual differences in cognition and preferences, influence of diversity on design outcomes, activities to build empathy and collaboration in design teams, interpreting user challenges through design thinking, aligning product features with customer expectations, evaluating parameters of user satisfaction and product experience, feedback loop modeling, refinement strategies, addressing ergonomic and contextual product issues, documentation of redesign outcomes, presentation of final product solving real engineering problems.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	1	1	1	0	1	1	1	1	2	2	1	3	1.25
CLO2	2	2	3	1	2	1	1	1	2	2	2	3	1.83
CLO3	2	3	3	2	2	1	1	1	2	2	2	3	2.00
CLO4	2	2	3	2	2	1	1	1	2	2	2	3	1.92
CLO5	2	2	3	2	2	2	2	2	3	3	2	3	2.33
Avg PLO	1.8	2.0	2.6	1.4	1.8	1.2	1.2	1.2	2.2	2.2	1.8	3.0	1.87

Suggested Reading

1	Developing Thinking Skills. E. Balaguruswamy. 2023.

Teaching-Learning Strategies

Interactive practical sessions.
Case-based learning supported by seminars and discussion of real-world design challenges.

Evaluation Scheme

Theory	NA
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code	**BELEAID225**				*Semester*	*First*	
Course Title	**IDEA Lab Workshop**					*Max marks*	
	Hours Per Week				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
Scheme & Credits	0	0	2	2	0	NA	100
Prerequisites	*Nil*					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	Content
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	2.00
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	2.0	2.8	1.4	1.4	1.0	2.2	2.2	2.2	3.0	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.

Evaluation Scheme

Theory	NA
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.