

1st Semester

1st Semester	APPLIED MATHEMATICS-I FOR CV STREAM	M26BMATC101
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Calculus	Understanding the relationship between Cartesian and polar coordinates, knowledge of curves related to various systems and differentiation w.r.t to the specific variables. Familiarity with fundamental knowledge of algebra course.
2	Coordinate Geometry	Cartesian coordinate system, Distance and section formulae, Straight lines and conic sections, Basic graph plotting
3	ODE	Strong knowledge of basic differential equations, separation of variables to solve differential problems. Familiarity with identify the dependent and independent variables.
4	Higher order ODE	Knowledge of factorization and ordinary differential equations. Familiarity with identify the dependent and independent variables.

2. Syllabus

Applied Mathematics-I for CV Stream SEMESTER – I			
Course Code	M26BMATC101	CIE Marks	50
Total Number of Teaching-Learning Hours/Sem (L: T: P:TW:SL)	3:0:2:30	SEE Marks	50
		Total Marks	100
Credits	4	Exam Hours	03
Course Objectives:			
1. Apply the concepts of polar curves and curvature to analyse geometrical profiles, road and railway alignments, bridge curves, and other civil engineering structures involving curved paths. 2. Use series expansions and multivariable calculus to model and optimize engineering systems, analyse functions of several variables, and solve problems related to structural design, fluid flow, and geotechnical engineering. 3. Analyse higher-order differential equations encountered in structural dynamics and vibration problems, including mass-spring systems, to understand the behavior of civil engineering structures under static and dynamic loading			
Module -1			
Polar Curves and Curvature: Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and radius of curvature - Cartesian, parametric, polar and pedal forms.			
Module -2			
Series Expansion, Indeterminate Forms and Multivariable Calculus:			
Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms - L'Hospital's rule. Partial differentiation, total derivative - differentiation of composite functions, Jacobian Applications: Maxima and minima for the function of two variables.			
Module -3			
Ordinary Differential Equations of first Order: Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations - Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right)$ & $\frac{1}{M}\left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right)$. Orthogonal trajectories			
Applications: Law of natural growth and decay.			
Module -4			
Ordinary Differential Equations of Higher Order: Higher-order linear ordinary differential equations with constant coefficients, homogeneous and non-homogeneous equations (e^{ax} , $\sin(ax + b)$, $\cos(ax + b)$, x^n only), Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Applications: Solving governing differential equations of Mass Spring.			
Module -5			

Linear Algebra: Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-elimination method and approximate solution by Gauss-Seidel method. Eigenvalues and Eigenvectors (for smallest eigen value), Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Applications: Traffic flow, Chemical balancing equation.
List of Laboratory experiments (2 hours/week per batch)
1) 2D Engineering Geometry Modeling Using Cartesian and Polar Curves An engineering design team is developing a simple profile for a component and a curved reflector-like surface. The first profile is described in Cartesian coordinates, while the second is described naturally using polar coordinates. Engineers use 2D plots to visualize the geometry before further analysis or fabrication.
2) Engineering Curve Alignment and Intersection Analysis Using Polar Equations In an engineering design problem, two curved profiles meet at a common point. The design engineer needs to determine whether the profiles meet smoothly or at a right angle. Polar equations are convenient for describing the curves because their geometry is naturally expressed using radius r and angle θ.
3) Curvature-Based Design of Smooth Engineering Profiles A civil engineering team is designing a curved component whose profile is approximated by a parabola. At a selected point on the profile, the engineers need to know how sharply the curve bends. The radius of curvature provides a measure of this local bending and can help in component design, path planning, and smooth geometric transitions.
4) Smart Bridge Monitoring using Taylors's and Maclaurin's Series A smart bridge uses sensors to monitor vibrations. For small vibrations, exact computations are expensive, so engineers approximate displacement using Taylor series
5) Drone Battery Optimization using Partial Derivatives and Jacobian. Sky Deliver Pvt. Ltd. is testing delivery drones. Flight time depends on payload and battery temperature. Engineers want to identify which factor most affects flight time and use Jacobian for sensor calibration
6) Modeling and Simulation of Thermal and Vibrational Engineering Systems Using ODEs Engineers frequently model changing physical quantities such as temperature, displacement, velocity, and vibration using ordinary differential equations. In this case study, two engineering situations are considered: cooling of a component using a first-order ODE and vibration of a mechanical system using a second-order ODE. The solutions are obtained numerically and displayed graphically.
7) Modeling and Plotting Chemical Concentration Using First-Order ODEs A chemical engineering company monitors the concentration of a chemical in a reactor. The concentration changes with time according to a first-order differential equation. Engineers solve and plot the ODE to predict the system's behaviour and optimize the reaction process.
8) Smart Traffic Management using Gauss Elimination Method A smart city monitors vehicles entering and leaving three interconnected road junctions. Engineers must determine the traffic volume at each junction to optimize signal timings.
9) Power Grid Voltage Analysis Using the Gauss-Seidel Method. An electrical utility company monitors voltages at interconnected substations. Engineers use iterative techniques to compute unknown voltages in large power grids.
10) Earthquake Resistant Building Analysis using Eigenvalues and Eigenvectors. Structural engineers analyze a two-storey building to study its vibration characteristics during earthquakes. Eigenvalues indicate natural frequencies, while eigenvectors describe vibration modes
Suggested software: Mathematica/MatLab/Python/Scilab
TEXTBOOKS: 1. B. S. Grewal, "Higher Engineering Mathematics", Khanna publishers, 45th Ed.2025. 2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2018. 3. Gilbert Strang, Linear Algebra and its Applications, Cengage Publications, 4th Ed., 2022.

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding the concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE)**

Continuous Internal Evaluation (CIE)						
Components			Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)		3	60%	20	08
2	Alternate Assessment (B)		2	40%	10	---
3	Practical Component (C)	Conduction & Record	1	60%	12	5
		Project Work	1	40%	08	---
	Total Marks				50	20

Final CIE Marks = A + B + C

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

C = Sum of Lab Conduction and project work

Self-Learning (SL): The teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination (SEE) For Theory Course with 3 or 4 credits

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BMATC101.1	Apply the concepts of polar curves, curvature, Taylor and Maclaurin series, multivariable calculus, and ordinary differential equations to model and solve engineering problems involving optimization, growth and decay, and mass-spring systems.
M26BMATC101.2	Analyze and solve systems of linear equations and engineering applications using matrix methods, Gauss elimination, Gauss-Seidel method, eigenvalue techniques, and Rayleigh's power method for applications such as traffic flow and chemical balancing.

M26BMATC101.3	Analyze a real-world engineering problem, develop an appropriate mathematical model using concepts learned in the course, implement the solution using suitable software/tools, and interpret the results.
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CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BMATC101.1	3	3	-	-	-	-	-	-	-	-	-
M26BMATC101.2	3	3	-	-	-	-	-	-	-	-	-
M26BMATC101.3	-	-	-	-	3	-	-	-	-	-	-
M26BMATC101	3	3	-	-	3	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 2: Zero Hunger	Higher-order ODEs can be used to model the growth and distribution of crops in agricultural systems. Crop growth models often involve complex relationships between soil moisture, temperature, fertilizer levels, and plant growth rates. These models can be higher-order due to the interactions between different variables and their rate of change over time.
2	SDG 7: Affordable and Clean Energy	In energy distribution systems, especially those integrating renewable energy sources (e.g., solar, wind), there are often oscillations or instability in the power grid due to fluctuations in energy supply and demand. These systems can be modelled using second-order or higher-order linear ODEs.
3	SDG 11: Sustainable Cities and Communities	Linear algebra is used extensively in urban planning, especially when designing transportation networks, road systems, and building structures. Optimization algorithms are used to ensure that urban areas are both efficient and sustainable, using graph theory and matrix analysis to model connectivity and flow.

1st / 2nd Semester	Basic Science Course (BS) APPLIED PHYSICS FOR CV STREAM	M26BPHYC102 /202
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1. Prerequisites

S/L	Proficiency	Prerequisites
1.	Classical Mechanics and waves	Understanding of simple harmonic motion (SHM) oscillations, DHM and FHM around an equilibrium position, such as a mass-spring system or a pendulum. Understanding of different kinds of sound waves in different fluids.
2.	Material Science	Understanding the mechanical properties such as strength, toughness, hardness, ductility, and brittleness. Fundamental knowledge of how materials deform under various loads.
3.	Basics of Acoustics, Modern Physics	Understanding the process of generation, reception and propagation of sound and vibrations in different materials. Understanding of interaction of light with materials.
4.	Modern Physics and Optics	A strong understanding of basic physics waves, optics, and electromagnetism provide the groundwork for lasers. Understanding the basics of waveguides, ray theory of light guidance is essential. Knowledge of numerical aperture, TIR and propagation of light in different RI medium.
6.	Mathematics	Knowledge of calculus, Linear algebra and trigonometry.

2. Syllabus

Applied Physics for Civil stream			
Course Code	M26BPHYC102/202	CIE Marks	50
Total Number of Teaching-Learning Hours/Sem (L: T: P:TW:SL)	02:02:0: 20:00 = 84 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
- To introduce the fundamental principles of oscillations, shock waves, and elasticity in engineering systems. - To provide an understanding of acoustics and photometry for engineering applications. - To familiarize students with the principles and applications of lasers and optical fiber technology. - To introduce piezoelectric materials and their role in sensors, actuators, and other engineering applications. - To impart the fundamentals of modern material characterization techniques such as X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM).			
Module 1: Oscillations and Shock waves			
Oscillations: Simple Harmonic motion (SHM) and its characteristics, Differential equation for SHM, Springs: Stiffness Factor and its Physical Significance, Series and Parallel combination of Springs (Derivation), Types of Springs and their applications. Theory and differential equation for Damped Oscillations, Types of Damping, Engineering applications of Damped Oscillations, Theory and differential equation for Forced oscillations, Resonance, Sharpness of resonance, Resonance in structures and buildings, Isolation of vibrations in bridges and buildings. Numerical Problems. Shock Waves: Mach number and Mach Angle, Mach Regimes, Definition and Characteristics of Shock waves, Construction and working of Reddy Shock tube, Applications of Shock Waves, Numerical problems.			
Module 2: Elasticity			
Stress-Strain Curve, Stress hardening and softening. Elastic Moduli, Poisson's ratio, Relation between E, G and μ , mention relation between K, E and μ , limiting values of Poisson's ratio. Beams, bending moment and derivation of expression, Cantilever and I section girder and their Engineering Applications, Elastic materials (qualitative). Failures of engineering materials - Ductile fracture, Brittle fracture, Stress concentration, Fatigue and factors affecting fatigue, Numerical problems.			
Module 3: Acoustics and Photometry			
Acoustics: Introduction to acoustics, Types of Acoustics, reverberation and reverberation time, absorption power and absorption coefficient, Requisites for acoustics in auditorium, Sabine's formula (derivation), measurement of absorption coefficient, factors affecting the acoustics and remedial measures, Noise and			

its Measurements, Sound Insulation and its measurements. Impact of Noise in Multi-storied buildings. Numerical.

Photometry: Spectral Quantities, Relation between luminescence, Reflectance and Transmittance, Photometry (cosine law and inverse square law).

Module 4: Lasers and Optical fibre

LASER: Properties of a LASER Beam, Interaction of Radiation with Matter, Einstein's A and B coefficients, LASER action, Population Inversion, Metastable State, Requisites of a LASER System, Semiconductor diode laser, Bridge Deflection, Speed Checker, Laser safety classes, Safety precautions and protective equipment Numerical Problems.

Optical Fiber: Principle and Construction of Optical Fibers, Acceptance angle and NA, Expression for NA, Modes of Propagation, Attenuation and Fiber Losses, Fiber Optic Displacement Sensor, Fiber Optic Temperature Sensor, Numerical Problems.

Module 5: Piezoelectric and Material characterization techniques

Piezoelectric: Introduction, Piezoelectric Coefficients, Mechanical Parameters: Elastic Compliance Constant and Elastic Stiffness Constant, Strain v/s electric field of piezoelectric materials, Dynamic behaviour of piezoelectric materials. Introduction: Quartz, Lead Zirconate Titanate (PZT), Composition and Structure of PZT, Engineering applications of piezoelectric materials.

Material characterization techniques: Principle, construction and working of (i) X-ray Diffractometer (XRD) (ii) Scanning electron microscope (SEM).

Text Books:

1. M.N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, A Textbook of Engineering Physics, Eleventh edition, S Chand and Company Ltd. New Delhi-110055.
2. R. K. Gaur and S. L. Gupta, Engineering Physics, 2010 edition, Dhanpat Rai Publications Ltd., New Delhi-110002.
3. C L Arora and P S Hemne, Physics for degree students- 1st, 2nd and 3rd year, Reprint 2019, S chand and company Ltd.

Reference Books:

1. R Balasubramaniam, Materials Science and Engineering, second edition, Wiley India Pvt. Ltd. Ansari Road, Daryaganj, New Delhi-110002
2. B. P. Singh and Devaraj Singh, Building Science: Lighting and Acoustics, Dhanpat Rai Publications (P) Ltc.,
3. James F. Shackelford and Madanapalli K Muralidhara, Materials Science for Engineers, sixth edition, Pearson Education Asia Pvt. Ltd., New Delhi.
4. B B Loud, Lasers and Non-Linear Optics ,3rd Edition, New Delhi: New Age International Publishers, 2013.
5. M S Vijaya, Piezoelectric materials and devices, CRC Press, Taylor & Francis Group, LLC

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies.
6	Laboratory Learning	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing few experiments.

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE) for Theory Course with 3 credits**

Components		Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
Total Marks				50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Semester End Examination (SEE) For Theory Course with 3 credits.

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice.
3. The questions from Module 2 and 3 will not have any choice.
4. Each of the question will have a maximum of two sub questions.
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks.

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
CO1	Explain key physical concepts oscillations, elasticity, acoustics, lasers, optical fibres, Piezoelectric and their role in engineering applications.
CO2	Apply theoretical principles and mathematical formulations to solve practical and numerical problems in material science and wave-based technologies.
CO3	Analyse the behaviour and performance of structures, materials, and sensors under dynamic conditions in real-world engineering systems.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3										
CO2	3										
CO3		2									
Average of CO's	3	2									

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education.	Builds strong foundational knowledge in physics for engineering applications.
2	SDG 7: Affordable and Clean Energy.	Covers piezoelectric and materials that enable efficient energy and sensing technologies.
3	SDG 9: Industry, Innovation, Infrastructure.	Equips students with skills for innovative design and resilient infrastructure using elasticity, oscillations, and advanced materials.
4	SDG 13: Climate Action.	Promotes sustainable solutions through vibration control, sound insulation, and energy-efficient optical and piezoelectric systems.

1st / 2nd Semester	Professional Core Course (PC) ENGINEERING MECHANICS	M26BECE103/ 203
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1. Prerequisites

S/L	Proficiency	Prerequisites
1	Resultant of coplanar force system	Basic understanding of forces and its characteristics.
2	Equilibrium of coplanar force system and frictional forces	Knowledge of forces and equilibrium concepts.
3	Equilibrium of Non coplanar force system and Analysis of Trusses	Understanding of equilibrium concepts and moments.
4	Centroid and Moment of inertia of plane areas	Integration techniques and geometric properties.
5	Understanding kinematics and kinetics	Basic physics concepts and calculus.

2. Syllabus

ENGINEERING MECHANICS SEMESTER – I/II			
Course Code	M26BECE103/203	CIE Marks	50
Number of Lecture Hours/Week (L: T: TW: SL)	2:2:20: 0= 84 Hours	SEE Marks	50
Total Number of Lecture Hours	50	Total Marks	100
Credits	03	Exam Hours	03
Course objectives - To develop students' ability to analyze the problems involving forces, moments with their applications. - To develop the student's ability to find out the center of gravity and moment of inertia and their applications. - To analyze the member forces in trusses. - To make students to learn the effect of friction on different planes. To make students to learn the concept of kinematics and kinetics.			
Module -1			
Resultant of coplanar force system: Basic dimensions and units, idealizations, classification of force system, principle of transmissibility of a force, composition of forces, resolution of a force, free body diagrams, moment, principle of moments, couple, resultant of coplanar concurrent force system, resultant of coplanar non-concurrent force system, numerical examples.			
Activity: - Free body diagram challenge – draw fbds for real objects like chair, ladder and hanging lamp. - Couple demonstration – demonstrate pure couple using steering wheel, bottle cap or screwdriver. - Rope tug-of-war – study concurrent forces and equilibrium using ropes and a ring.			
Module -2			
Equilibrium of coplanar force system: Equilibrium of coplanar concurrent force system, Lami's theorem, equilibrium of coplanar parallel force system, numerical examples.			
Friction: introduction, laws of coulomb friction, equilibrium of blocks on horizontal plane, equilibrium of blocks on inclined plane, ladder friction, wedge friction numerical examples.			
Activity: - Lami's theorem experiment – verify theorem using three strings, a ring and weights. - Ladder and wedge demonstration – observe friction effects and equilibrium.			
Module -3			
Equilibrium of non-coplanar force system: Types of beams, types of loadings, types of supports, equilibrium of coplanar non-concurrent force system, support reactions of statically determinate beams subjected to various types of loads, numerical examples.			
Analysis of Trusses: Introduction, classification of trusses, analysis of plane perfect trusses by the method of joints and method of sections, numerical examples.			
Activity: - Types of Supports Model – Prepare roller, pin and fixed support models. - Ice Cream Stick Truss – Build Pratt, Howe or Warren trusses and load test them.			
Module -4			

Centroid of Plane areas: Introduction, locating the centroid of rectangle, triangle, circle, semicircle, quadrant and sector of a circle using method of integration, centroid of composite areas and simple built up sections, numerical examples.

Moment of inertia of plane areas: Introduction, rectangular moment of inertia, polar moment of inertia, product of inertia, radius of gyration, parallel axes theorem, perpendicular axis theorem, moment of inertia of rectangular, triangular and circular areas from the method of integration, moment of inertia of composite areas and simple built-up sections, numerical examples.

Activity:

1. Composite section model – prepare an I-section or T-section using cardboard and determine its centroid before calculating moment of inertia.
2. Radius of gyration activity – compare two cardboard sections with the same area but different shapes to observe stiffness.

Module -5

Kinematics:

Linear motion: introduction, displacement, speed, velocity, acceleration, acceleration due to gravity, numerical examples on linear motion

Projectiles: introduction, numerical examples on projectiles.

Kinetics: Introduction, D'Alembert's principle of dynamic equilibrium and its application in-plane motion and connected bodies including pulleys, numerical examples.

Activity:

1. Distance-time graph activity – record motion of a moving object and plot a distance-time graph.
2. Projectile motion with ball – throw a ball horizontally from a table and measure its horizontal range.

Suggested Learning Resources:

TEXT BOOKS

1. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, 2015, Laxmi Publications.
2. Kolhapure B K, Elements of Civil Engineering and Engineering Mechanics, 2014, EBPB

REFERENCE BOOKS

1. Beer F.P. and Johnston E. R., Mechanics for Engineers, Statics and Dynamics, 1987, McGraw Hill.
2. Hibbeler R. C., Engineering Mechanics: Principles of Statics and Dynamics, 2017, Pearson Press.
3. Timoshenko S, Young D. H., Rao J. V., Engineering Mechanics, 5th Edition, 2017, Pearson Press.

VIDEO LINKS

1. NPTEL: Engineering Mechanics-IIT Madras <https://nptel.ac.in/courses/112106180?utm>
2. NPTEL: Engineering Mechanics-IIT Kanpur <https://www.nptel.ac.in/courses/122104015?utm>

3. Teaching-Learning Process Strategies

S/L	TLP Strategies	Description
1	Lectures and Interactive Discussions	Use lectures to introduce fundamental concepts and interactive discussions to clarify doubts.
2	Visual Aids	Utilize diagrams and animations to explain the composition and resolution of forces.
3	Demonstrations	Conduct live demonstrations or simulations of force systems and free body diagrams.
4	Worked Examples	Solve numerical problems step-by-step during class to illustrate the application of theoretical concepts.
6	Assessments	Regular evaluations to assess understanding and proficiency.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE)

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks =(A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Semester End Examination (SEE) For Theory Course with 3 or 4 credits

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BECE103.1	Apply the principles of physics and mathematics in understanding the systems of coplanar forces and determine their resultants.
M26BECE103.2	Illustrate the principles of equilibrium and friction to analyze coplanar force systems.
M26BECE103.3	Analyze statically determinate beams and plane trusses to determine support reactions and member forces.
M26BECE103.4	Locate the centroid and compute the moment of inertia of plane figures.
M26BECE103.5	Illustrate the concept of kinematics and kinetics to deal with the bodies in motion.

CO-PO-PSO Mapping

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
M26BECE103.1	2										
M26BECE103.2	2										
M26BECE103.3		2									
M26BECE103.4	2	2									
M26BECE103.5	2										
M26BECE103	2	2									

6. Mapping to Sustainable Development Goals (SDG):

Relevant SDGs	Relation to SDGs
SDG 4, SDG 9, SDG 11	Develops analytical skills for safe, efficient infrastructure and engineering innovation.
SDG 9, SDG 11, SDG 12	Ensures structural stability, minimizes material wastage, and enhances durability.
SDG 7, SDG 9, SDG 11, SDG 12	Supports efficient structures, renewable energy systems, safety, and resource efficiency.
SDG 9, SDG 11, SDG 12, SDG 13	Optimizes load distribution and material usage in structural design. Designs stronger, lighter structures, reducing embodied carbon and improving resilience.
SDG 9, SDG 11, SDG 12, SDG 13	Enhances the analysis of moving systems for efficient and safe engineering designs. Promotes sustainable transportation, resource-efficient operation, and reduced energy consumption in engineering applications.

1st /2nd Semester	Engineering Science Course (ES) INTRODUCTION TO CIVIL ENGINEERING	M26BESK104A/ 204A
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic Science and Mathematics	Knowledge of basic physics (mechanics, forces) and mathematics (algebra, geometry).
2	Environmental Awareness	Basic knowledge of pollution, sanitation, and sustainable issues.
3	Engineering Drawing and Visualization	Knowledge of sketches, visualization of shapes, sections and projections of buildings.
4	Logical Reasoning and Spatial Ability	Skill to understand space, balance, and visualize structures and forces.

2. Syllabus

Introduction to Civil Engineering SEMESTER – I/II			
Course Code		CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	2:2:0: 20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives: 1. Explore Civil Engineering scope, materials, and building components aligned with Sustainable Development Goals. 2. Apply fundamental concepts of force systems, equilibrium, and free-body diagrams in basic structural analysis. 3. Calculate and locate centroid of simple and built-up sections for structural applications. 4. Calculate moment of inertia of simple and built-up sections for structural applications.			
Module -1			
Introduction: Surveying, Structural Engineering, Geotechnical Engineering, Hydraulics and Water Resources Engineering, Transportation Engineering, Environmental Engineering. Basic Materials of Construction: Bricks, cement, steel, concrete and mortar. Building components: substructure and super-structure components. Introduction to sustainable development goals. Infrastructure: types of infrastructure Activity: Identification and classification of common building materials, structural components, and Civil Engineering disciplines through observation and group discussion.			
Module -2			
Concurrent force systems: Concept of idealization, system of forces, Resolution and composition of forces, Law of Parallelogram of forces, principle of transmissibility, Resultant of concurrent force systems, free body diagram, types of forces, Lami's theorem, equations of equilibrium. Force Board Activity: Experimental determination of the resultant and equilibrium of concurrent force systems using a force board or graphical vector method			
Module -3			
Non-concurrent force systems: Resultant of non-concurrent coplanar force systems, moment of forces, couple, Varignon's theorem, types of loads and supports, equilibrium of non-concurrent coplanar force systems. Moment Balance Activity: Verification of the principle of moments and equilibrium of non-concurrent force systems using a simple balance setup			
Module - 4			
Centroid: Introduction, centre of gravity, centroid, axis of symmetry, locating the centroid of plane lamina and composite figures from first principles and Numerical examples. Paper Cut-Out Activity: Experimental determination of the centroid of plane lamina using the suspension (plumb line) method and comparison with analytical results.			

Module -5

Moment of inertia: Introduction, method of determining the second moment of area of plane sections from first principles, parallel axis and perpendicular axis theorem, radius of gyration, polar moment of inertia, moment of inertia of built-up sections and numerical examples.

Section Comparison Activity: Comparative study of the bending behaviour of different cross-sections to demonstrate the influence of moment of inertia on structural stiffness.

TEXTBOOKS

1. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, 2015, Laxmi Publications.
2. Kolhapure B K, Elements of Civil Engineering and Engineering Mechanics, 2014, EBPB

REFERENCE BOOKS

1. Beer F.P. and Johnston E. R., *Mechanics for Engineers, Statics and Dynamics*, 1987, McGraw Hill.
2. Irving H. Shames, *Engineering Mechanics*, 2019, Prentice-Hall.
3. Timoshenko S, Young D. H., Rao J. V., *Engineering Mechanics*, 5th Edition, 2017, Pearson Press.

VIDEO LINKS

1. <https://www.youtube.com/watch?v=nGfVTNfNwnk&list=PLOSwwFV98rfKXq2KBphJz95rao7q8PpwT>
2. <https://www.youtube.com/watch?v=3YBXteL-qY4>
3. https://www.youtube.com/watch?v=atoP5_DeTPE
4. <https://www.youtube.com/watch?v=ksmsp9OzAsI>
5. <https://www.youtube.com/watch?v=x1ef048b3CE>
6. https://www.youtube.com/watch?v=l_Nck-X49qc
7. https://play.google.com/store/apps/details?id=appinventor.ai_jgarc322.Resultant_Force
8. <https://www.youtube.com/watch?v=RIbceW1DSZg>
9. <https://www.youtube.com/watch?v=R8wKV0UQtlo>
10. https://www.youtube.com/watch?v=0RZHHgL8m_A
11. <https://www.youtube.com/watch?v=Bl5KKnQOWkY>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Interactive Lectures	Use multimedia presentations, models, and physical samples to explain building materials and structural components.
2	Field Visits	Organize visits to construction sites, water treatment plants, and urban infrastructure projects.
3	Group Activities	Facilitate collaborative work on smart city models and environmental impact discussions.
4	Problem Solving Sessions	Introduce conceptual and numerical problem-solving on centroid, force systems, and moment of inertia.
5	ICT Tools and Videos	Use NPTEL lectures, animations and simulations to demonstrate real-time force analysis and building science.
6	Seminars and Presentations	Assign students short presentations on infrastructure, smart cities, and sustainable practices.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE) for Theory Course with 3 credits

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	8
	Total Marks			50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Self-Learning (SL): the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20 marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice.
3. The questions from Module 2 and 3 will not have any choice.
4. Each of the question will have a maximum of two sub questions.
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks.

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BESK104A.1	Apply knowledge of Civil Engineering disciplines, materials, structural elements, and infrastructure for sustainable development practices.
M26BESK104A.2	Assess the resultant and equilibrium of force systems on the rigid bodies.
M26BESK104A.3	Determine and locate the centroid of plane and built-up sections.
M26BESK104A.4	Determine the moment of inertia of plane and built-up sections.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BESK104A.1	3	-	-	-	-	2	3	-	-	-	2
M26BESK104A.2	3	3	-	2	2	-	-	-	-	-	2
M26BESK104A.3	3	3	-	2	-	-	-	-	-	-	2
M26BESK104A.4	3	3	-	2	-	-	-	-	-	-	2
M65BESK104	3	3	-	2	2	2	3	-	-	-	2

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 9: Industry, Innovation and Infrastructure	Students explore fundamental infrastructure design concepts promoting innovation and resilient development.
2	SDG 11: Sustainable Cities and Communities	Incorporates clean city, smart city, and solid waste management topics to improve urban livability.
3	SDG 13: Climate Action	Introduces environment-friendly practices in construction and energy- efficient buildings.

1st/2nd Semester	Engineering Science Course (ES) INTRODUCTION TO ELECTRICAL ENGINEERING	M26BESK104B/ 204B
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic concepts of Circuit Elements	Basic understanding of active and passive elements of a circuit. Familiarity with fundamentals of discrete elements such as resistors, capacitors and inductors.
2	Electrical Circuits	Understanding of voltage, current and their characteristic behavior in electrical circuits and relevant laws.
3	Fundamentals of electromagnetic induction	Faraday's laws of electromagnetic induction, Lenz's law and Fleming's left and right hand rule.
4	Basic knowledge of measuring instruments.	Knowledge of measuring instruments such as ammeter, voltmeter and multimeter etc.

2. Syllabus

INTRODUCTION TO ELECTRICAL ENGINEERING SEMESTER – I/II			
Course Code	M26BESK104B/204B	CIE Marks	50
Total Number of Teaching-Learning Hours/sem(L:T:P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
Credits	03	Total Marks	100
		Exam Hours	03
Course Objectives:			
- To explain electric power generation, transmission and distribution - To explain the laws used in the analysis of DC and AC circuits. - To explain the behaviour of circuit elements in single-phase AC circuits. - To explain the construction and operation of Transformers, AC generators, DC motors and Induction motors. - To introduce concepts of circuit protecting devices, earthing and electricity billing			
Module -1: Electrical Energy Sources & DC circuits			
Introduction to electrical energy sources, Single line diagram approach. Brief introduction to the electrical generation using Thermal, Solar, Hydro, Wind using Block diagram approach. DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series – parallel circuits excited by independent voltage sources. Power and energy, Illustrative examples			
Module -2: Single phase and Three phase AC circuit			
A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, Derivations of average value, RMS value, form factor, peak factor. Voltage and current relationship with phasor diagrams in R, L, and C circuits. Concept of Impedance. Analysis of R-L, R-C, R-L-C Series circuits. Active power, reactive power and apparent power. Concept of power factor and Numerical. Three Phase Circuits: Advantages and limitations; star and delta connection, relationship between line and phase quantities excluding derivation.			
Module -3: Transformers & Three phase synchronous generators			
Transformers: Necessity of transformer, principle of operation, Types and construction of single-phase transformers, EMF equation, losses, variation of losses with respect to load. Efficiency and numerical. Three-phase synchronous generators: Principle of operation and constructional details of salient and non-salient pole generators, synchronous speed, frequency of generated voltage, emf equation, with the concept of winding factor excluding the derivation and calculation of winding factors and numerical.			
Module -4: Motors			

Three-phase induction Motors: Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and slip ring. Slip, its significance and numerical.

DC Motor: Principle of operation, back emf and its significance. Torque equation, types of motors, characteristics and Simple numerical.

Module -5: Domestic Wiring & Electrical Safety

Domestic Wiring: Requirements, Types of wiring: casing, capping. Two way and three way control of load.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, laptops, printers, etc. Definition of “unit” used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits.

Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock

TEXTBOOKS:

1. Fundamentals of Electrical Engineering & Electronics by B L Theraja, S. Chand and Company Pvt. Ltd. Reprint edition, 2022
2. Basic Electrical Engineering D. C. Kulshreshtha McGraw-Hill Education 1st edition, 2019

REFERENCE BOOKS:

1. Electrical Technology E Hughes Pearson International Students 9th edition
2. Principles of Electrical Engineering & Electronics V K Mehta and Rohit Mehta S. Chand and Company Pvt. Ltd.

VIDEO LINKS:

1. <https://youtu.be/OC8Lbyeyh-E>
2. <https://youtu.be/5CHufqAF-p0>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of generation of electrical energy.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	Laboratory Learning	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing few experiments.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE)

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment-Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Self-Learning (SL): If applicable, the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination (SEE) For Theory Course with 3 or 4 credits

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BESK104B.1	Understand the concepts of hydro, thermal, solar & wind energy sources and Electric circuits.
M26BESK104B.2	Apply Ohm's law and Kirchhoff's laws to solve DC & AC circuits
M26BESK104B.3	Illustrate the construction and working principles of DC & AC Machines
M26BESK104B.4	Describe the types of wiring, tariff and safety measures in an electrical system.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BESK104B.1	3	3	-	-	-	-	-	-	-	-	-
M26BESK104B.2	3	3	-	-	-	-	-	-	-	-	-
M26BESK104B.3	3	3	-	-	-	-	-	-	-	-	-
M26BESK104B.4	-	-	-	-	-	3	-	-	-	-	-
M26BESK104B	3	3	-	-	-	3	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 7: Affordable and Clean Energy	Electrical engineers are crucial in designing, installing, and maintaining systems for solar, wind, hydro, and geothermal power. This involves understanding circuits, power electronics, energy conversion, and grid integration.
2	SDG 9: Industry, Innovation, and Infrastructure	Applying basic electrical engineering principles leads to the development of energy-efficient industrial processes, automation, and control systems that reduce resource consumption and waste.
3	SDG 11: Sustainable Cities and Communities	Smart Cities: The development of smart cities heavily relies on electrical engineering for smart infrastructure, energy conservation, efficient waste management, and sustainable urban living. Sustainable Transportation: Electrical engineers are vital in the design and development of electric vehicles (EVs) and their charging infrastructure, reducing reliance on fossil fuels and improving air quality in urban areas.

1st / 2nd Semester	Engineering Science Course (ES) INTRODUCTION TO ELECTRONICS AND COMMUNICATION	M26BESK104C/ 204C
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic knowledge on Physics	A fundamental understanding of physics.
2	Basic knowledge on Mathematics	A fundamental understanding of mathematics.
3	Semiconductor Fundamentals	Basic knowledge of semiconductor physics and semiconductor devices is beneficial.
4	Basic knowledge of analog and digital signals	Elementary electronic components such as resistors, capacitors, inductors, diodes, and transistors.

2. Syllabus

INTRODUCTION TO ELECTRONICS AND COMMUNICATION SEMESTER – I/II			
Course Code	M26BESK104C/204C	CIE Marks	50
Total Number of Teaching-Learning Hours/sem(L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
- To prepare students with fundamental knowledge/ overview in the field of Electronics and Communication Engineering. - To equip students with a basic foundation in electronic engineering required for comprehending the operation and application of electronic circuits, logic design, embedded systems, and communication systems. - Professionalism & Learning Environment: To inculcate in first-year engineering students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.			
Module -1			
Power Supplies – PN Junction Diode: Forward and Reverse Bias Characteristics, DC-powersupply Block diagram, Half-wave rectifier, Full-wave rectifiers, Voltage regulators, switch mode power supplies. Amplifiers – Basics of MOSFET: Construction, Symbol, Types (Enhancement and Depletion), Types of amplifiers, Gain, Input and output resistance, Negative feedback.			
Module -2			
Oscillators –Positive feedback, Ladder network oscillator, Wein bridge oscillator, Multivibrators, Single-stage astable oscillator. (Only Concepts, working, and waveforms. No mathematical derivations) Operational amplifiers –symbol and connections, Operational amplifier parameters, Operational amplifier characteristics, Operational amplifier configurations, Operational amplifier circuits.			
Module -3			
Boolean Algebra and Logic Circuits: Number Base Conversion, Complements, Binary subtraction using 1's and 2's, Basic Theorems and Properties of Boolean Algebra, Canonical and Standard Forms, Digital Logic Gates . Combinational logic: Introduction, Design procedure, Adders and Subtractors.			
Module -4			
Embedded Systems – Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, purpose of embedded system, Elements of an Embedded System, Microprocessor vs Microcontroller, RISC vs CISC.			

Sensors and Interfacing – Instrumentation and control systems, Transducers, Sensors, Actuators, LED, 7-Segment LED Display.

Module -5

Communication Schemes – Modern communication system scheme, Information source, and input transducer, Transmitter, Channel or Medium – Hardwired and Soft wired, Noise, Receiver, Multiplexing, Types of communication systems. Types of modulation (only concepts), Concept of Radio wave propagation (Ground, space, sky)

An Overview of Wireless Systems: Introduction, First- and Second-Generation Cellular Systems, Cellular Communications from 1G to 3G, Road Map for Higher Data Rate Capability in 3G, Wireless 4G Systems.

Text Books

1. Mike Tooley, 'Electronic Circuits, Fundamentals & Applications', 4th Edition, Elsevier, 2015. DOI <https://doi.org/10.4324/9781315737980>. eBook ISBN 9781315737980
2. Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2008 ISBN-978-81-203-0417-84.
3. K V Shibu, 'Introduction to Embedded Systems', 2nd Edition, McGraw Hill Education (India), Private Limited, 2016
4. S L Kakani and Priyanka Punglia, 'Communication Systems', New Age International Publisher, 2017.
5. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, Pearson Education, 2013.
6. Vijay K. Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers (Elsevier), 2nd Edition.

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of basic electronics concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies

4. Assessment Details (both CIE and SEE)
Continuous Internal Evaluation (CIE)

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment-Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

$$\text{Final CIE Marks} = (A) + (B)$$

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.

2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BESK104C/204C.1	Describe the working principles of PN junction diodes, DC power supplies, rectifiers, voltage regulators, switch mode power supplies, amplifier fundamentals, and MOSFET basics.
M26BESK104C/204C.2	Illustrate the principles of oscillators, operational amplifiers configurations used in basic electronic circuits.
M26BESK104C/204C.3	Apply number system concepts, Boolean algebra, and logic gates to implement logic circuits such as adders and subtractors.
M26BESK104C/204C.4	Discuss the fundamentals of communication systems, modulation concepts, radio wave propagation, and the development of wireless communication technologies from 1G to 4G.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BESK104C/204C.1	3	-	-	-	2	-	-	-	2	2	-
M26BESK104C/204C.2	3	3	-	-	2	-	-	-	2	2	-
M26BESK104C/204C.3	3	3	2	-	2	-	-	-	2	-	-
M26BESK104C/204C.4	3	2	-	-	-	-	-	-	-	-	-
M26BESK104C/204C	3	-	2	-	2	-	-	-	2	2	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Learning advanced electronics builds foundational engineering skills.
2	SDG 9: Industry, Innovation and Infrastructure	Embedded systems, communication technologies, amplifiers, digital logic.
3	SDG 11: Sustainable Cities and Communities	Sensors, automation, embedded applications in smart cities

1st/ 2nd Semester	Engineering Science Course (ES) INTRODUCTION TO MECHANICAL ENGINEERING	M26BESK104D/ 204D
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic understanding of Engineering disciplines	Familiarity with different engineering disciplines and their role in society, industry, and technological development.
2	Basic knowledge of Mathematics and Physics	Understanding of fundamental concepts such as force, motion, energy, power, heat, and simple calculations related to engineering systems.
3	Analytical Thinking Skills	Ability to observe, analyze, and solve simple engineering problems using logical reasoning.
4	Visualization Skills	Ability to interpret basic engineering diagrams, machine components, schematic representations, and manufacturing processes.
5	Interest in Engineering Systems and Emerging Technologies	Curiosity to understand the working principles of machines, manufacturing processes, automation, robotics, and future mobility technologies.

2. Syllabus

Introduction to Mechanical Engineering SEMESTER – I/II			
Course Code	M26BESK104D/204D	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
- To develop basic knowledge of Mechanical Engineering, its role in industries, emerging technologies, and conventional and renewable energy sources. - To understand the concepts of different machine tool operations, industrial automation, and advanced manufacturing systems such as CNC machines and Additive Manufacturing (3D Printing). - To understand the working principles and applications of Internal Combustion (IC) engines and future mobility technologies including Electric, Hybrid, and Autonomous Vehicles. - To provide exposure to engineering materials, joining processes and their applications in manufacturing industries. - To acquire a basic understanding of mechatronics, robotics, and their role in industrial automation and modern manufacturing.			
Module -1			
Introduction: Role of Mechanical Engineering in Industries and Society. Emerging trends and technologies in Energy, Manufacturing, Automotive, Aerospace, and Marine sectors. Energy: Introduction and applications of conventional and renewable energy sources including Thermal, Hydel, Nuclear, Solar Photovoltaic (PV), and Wind Energy. Environmental issues such as Global Warming and Carbon Neutrality.			
Module -2			
Machine Tool Operations: Working principle of Lathe and operations such as Turning, Facing and Knurling. Working principle of Drilling Machine and operations including Drilling, Boring and Reaming. Working principle of Milling Machine and operations such as Plain Milling, End Milling and Slot Milling. (<i>No sketches of machine tools; sketches to be used only for explaining the operations</i>). Automation in Industry: Definition, types – Fixed, Programmable and Flexible Automation, basic elements with block diagrams, advantages and industrial applications.			
Module -3			

Introduction to IC Engines: Components and working principles, four-stroke Petrol and Diesel engines, applications of IC engines, and basic performance parameters of IC engines (**Simple numerical problems**).

Future Mobility: Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), components of electric and hybrid vehicles, advantages and limitations of EVs and Hybrid Vehicles, and an introduction to Autonomous Vehicles.

Module -4

Engineering Materials: Types, properties and applications of Ferrous and Non-Ferrous Metals, Ceramics, Glass, Polymers, Graphite, Diamond and Shape Memory Alloys.

Joining Processes: Soldering, Brazing and Welding, definitions, classification of welding processes, Arc Welding, Gas Welding and TIG Welding.

Module -5

Introduction to Mechatronics and Robotics: Open-loop and Closed-loop Mechatronic Systems. Robot Anatomy, Robot Configurations (Cartesian, Cylindrical, Polar and Articulated), applications, advantages and limitations of Industrial Robots.

Introduction to Advanced Manufacturing Systems: Introduction to CNC machines, components of CNC, advantages and applications of CNC, Introduction to Additive Manufacturing (3D Printing), and Introduction to Industry 4.0.

TEXTBOOKS:

1. K. R. Gopala Krishna, Elements of Mechanical Engineering, Subhash Publications, 35th Edition.
2. **R. K. Rajput**, *a Textbook of Elements of Mechanical Engineering*, **Laxmi Publications**, Fourth Edition.

REFERENCE BOOKS:

3. **Jonathan Wickert and Kemper Lewis**, *an Introduction to Mechanical Engineering*, **Cengage Learning**, Fourth Edition.
4. **P. N. Rao**, *Manufacturing Technology: Foundry, Forming and Welding*, **McGraw Hill Education**, Fifth Edition.

VIDEO LINKS:

1. https://www.nptel.ac.in/courses/112104526?utm_source=chatgpt.com
2. <https://mitlibraryblog.wordpress.com/mitm-videos/>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lectures & Presentations	Deliver core concepts and foundational knowledge. - Utilize multimedia (images, diagrams, and animations, videos) to enhance understanding.
2	Interactive Discussions & Q&A	Encourage active participation and clarification of doubts. Facilitate critical thinking and analysis of concepts through student-led discussions
3	Hands-on Activities	Provide laboratory or simulation-based activities to demonstrate real-world applications of mechanics or machine tools.
4	Case Studies	Present real-world engineering challenges and have students analyze potential solutions.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	Project-Based Learning	Encourage research and design thinking through project-based learning activities

4. **Assessment Details (both CIE and SEE)**
Continuous Internal Evaluation (CIE)

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Self-Learning (SL): If applicable, the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. **Course Outcomes (COs) and Mapping with POs/ PSOs**

Course Outcomes (COs)

COs	Description
M26BESK104D/204D.1	Interpret the working principles and applications of conventional and renewable energy sources, with environmental issues such as global warming and carbon neutrality.
M26BESK104D/204D.2	Analyse the working principles and functionalities of various machine tools, industrial automation systems, their control strategies, and industrial applications.
M26BESK104D/204D.3	Evaluate the construction and working principles of Internal Combustion (IC) engines, and the basic concepts, components, and applications of Electric, Hybrid, and Autonomous Vehicles.
M26BESK104D/204D.4	Interpret the properties of engineering materials for selection in engineering applications, and the working principles and applications of welding, brazing, and soldering.
M26BESK104D/204D.5	Analyse the basic concepts of mechatronic systems, robotic systems, CNC machines, Additive Manufacturing (3D Printing), and Industry 4.0 in modern manufacturing.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BESK104D/204D.1	3	-	-	-	-	-	-	-	-	-	-
M26BESK104D/204D.2	3	-	-	-	-	-	-	-	-	-	-
M26BESK104D/204D.3	-	3	-	-	-	-	-	-	-	-	-
M26BESK104D/204D.4	3	-	-	-	-	-	-	-	-	-	-
M26BESK104D/204D.5	3	-	-	-	-	-	-	-	-	-	-
M26BESK104D/204D	3	3	-	-	-	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 7: Affordable and Clean Energy	The course introduces conventional and renewable energy sources, environmental sustainability, and future mobility technologies such as Electric and Hybrid Vehicles, promoting awareness of clean energy solutions, energy efficiency, and sustainable transportation, thereby supporting SDG 7.
2	SDG 9: Industry, Innovation and Infrastructure	Topics such as machine tools, industrial automation, CNC machines, Additive Manufacturing (3D Printing), robotics, and Industry 4.0 foster innovation, enhance manufacturing productivity, and strengthen sustainable industrial infrastructure, contributing to SDG 9.
3	SDG 12: Responsible Consumption and Production	The study of engineering materials, joining processes, advanced manufacturing systems, and automation promotes efficient utilization of resources, sustainable manufacturing practices, waste reduction, and responsible production, aligning with SDG 12.

1st / 2nd Semester	Engineering Science Course (ES) INTRODUCTION TO C PROGRAMMING	M26BESK104E/ 204E
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic computer Skills	Understanding how to use a computer, Functionality of Computer and perform basic Programming.
2	Logical Thinking	Ability to think logically and analytically, which is crucial for understanding algorithms and problem-solving in programming.
3	Understanding of Algorithms	Understanding the logic behind different algorithms (e.g., sorting, searching) can improve the efficiency of the code and its role in solving problems efficiently.
4	Basic Modular Arithmetic	Basic Number Theory: Understanding of integers, Datatypes. Algebra: Proficiency in algebraic manipulations and understanding of congruence relations.
5	Problem-Solving Skills	Ability to break down complex problems into smaller, manageable parts and develop step-by-step solutions

2. Syllabus

INTRODUCTION TO C PROGRAMMING SEMESTER – I/II			
Course Code	M26BESK104E/204E	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
Credits	03	Total Marks	100
		Exam Hours	03
Course Objectives:			
1. To introduce the fundamentals of computers, algorithmic thinking, and structured problem solving.			
2. To build strong foundations in C syntax, control structures, and modular programming.			
3. To develop the ability to design solutions using arrays, pointers, structures, and files.			
4. To cultivate debugging discipline and good programming practices from the very first semester.			
Module -1			
Introduction to computers: Definition, Characteristics of Computer, Stored Program Concept, Applications of Computers, Basic Organization of Computer.			
Computer memory and Processors: Memory Organization, memory Hierarchy, Sequential and random Access, cache memory, Primary Memory.			
Design efficient programs: Program design Tools: Algorithms, Flowcharts, Pseudo codes.			
Programming in C: Introduction to C, Structure of C Program, writing the First C Program, Introduction to C, Files used in a C program, C tokens, Character set in C, keywords, Identifiers, Basic Datatypes in C, variables, constants, Input/output statements in C.			
Textbook 1: Chapter 1.1,1.2, 1.3, 1.6,1.7 , 3.1-3.7 8.4, 9.1-9.4, 9.7-9.14			
Module -2			
Programming in C: Operators in C, Type conversion and typecasting.			
Decision control and Looping statements: Introduction to decision control, Conditional branching statements, iterative statements, nested loops, break and continue statements.			
Textbook 1: Chapter 9.15-9.16, 10.1-10.5			
Module -3			
Functions: Introduction, Using Functions, Function declaration, Function definition, Function call, return statement, passing parameters to functions, scope of variables, recursive functions.			
Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays (Traverse, Searching, Sorting).			
Textbook 1: Chapter 11.1-11.8, 11.10. Chapter 12.1-12.5			
Module -4			
Arrays: Two dimensional arrays, operations on two-dimensional arrays			
Strings: Introduction, string taxonomy, operations on strings, (length, uppercase, lowercase, concatenate, compare, reverse) Miscellaneous string and character functions.			
Textbook 1: Chapter 12.7-12.8 Chapter 13.1, 13.3-13.6,			

Module -5	
Pointers: Concepts, pointer Variable, Accessing Variables through pointers, pointer Declaration and Definition, Initialization Pointer Variables, Pointer and Functions, pointers to pointers, Compatibility. Structures and Unions: Introduction, defining a structure, declaring structure Variables, accessing structure members, structure initialization, copying and comparing structure variables, operation on individuals' members. Textbook 2: Chapter 11, Chapter 13	
Illustrative Mini Project Ideas (Students May Choose Other Relevant Topics)	
<i>Mini projects are to be executed in teams of 2-3 students over the last 3-4 weeks of the semester, with a project report and a live demonstration for evaluation.</i> Mini Project 1: Digital Voltmeter Simulator Simulate a set of voltage readings, classify them into safe/unsafe ranges using functions, and log the readings to a file. Mini Project 2: Ohm's Law Based Circuit Calculator Given any two of voltage, current, and resistance, compute the third for a series of readings stored in an array, and save results to a file. Mini Project 3 Smart Site Alert Simulator Simulate a set of sensor-style readings (e.g., vibration or crack width) in an array, flag any reading beyond a safe limit, and log alerts to a file. Mini Project 4 Concrete Mix Quantity Calculator Given the volume of concrete and mix ratio, use functions to compute the required quantities of cement, sand, and aggregate, and save the report to a file. Mini Project 5: Frequency Unit Converter Utility Build a utility that converts frequency values between Hz, kHz, and MHz using functions and macros, with results logged to a file.	
Textbooks:	
1. Reema Thareja, Computer fundamentals and programming in c, Oxford University, Third edition, 2023 2. Behrouz Forozon, Richard Gilberg, A structured Programming Approach using C, 2nd edition Thomson Learning, 2003.	
Reference Books:	
1. E. Balaguruswamy, Programming in ANSI C, 8th Edition, Tata McGraw-Hill. 2. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Pearson Publishers 2015. 3. Behrouz Forozon, Richard Gilberg, A structured Programming Approach using C, 2nd edition Thomson Learning, 2003.	
VIDEO LINKS:	
https://onlinecourses.nptel.ac.in/noc22_ce54/preview https://mitlibraryblog.wordpress.com/mitm-videos/ https://www.tutorialspoint.com/what-is-an-algorithm-and-flowchart-in-c-language https://www.tutorialspoint.com/cprogramming/c_data_types.htm https://www.tutorialspoint.com/cprogramming/c_operators.htm https://www.ccbp.in/blog/articles/decision-making-statements-in-c https://www.tutorialspoint.com/cprogramming/c_arrays.htm https://www.geeksforgeeks.org/variables-in-c/ https://www.w3schools.com/c/c_arrays.php https://www.programiz.com/c-programming/c-strings https://www.programiz.com/c-programming/c-pointers https://www.scaler.com/topics/c/structures-c/	

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of programming concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.

4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Programming Assignments	Assign programming tasks to reinforce practical skills associated with competencies.

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE) for Theory Course with 3 credits**

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks = (A) + (B)**A** = Average of best two Test marks**B** = Average of two Alternate Assessment marks**Semester End Examination (SEE)**

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BESK104E/204E.1	Apply the basic knowledge of computer hardware, functionalities of a computer to develop Simple C Programs.
M26BESK104/204E.2	Identify the appropriate operators, Branching and Looping constructs of C language to solve the real-world problem.
M26BESK104E/204E.3	Utilizing the Modularity of functions to implement arrays and strings to perform data Manipulation to inscribe the Application.
M26BESK104E/204E.4	Apply pointers, structures, unions in C programming to develop Application that efficiently manage, manipulate the data.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BESK104E/204E.1	3	-	-	-	-	-	-	-	-	-	-
M26BESK104E/204E.2	-	3	-	-	-	-	-	-	-	-	-
M26BESK104E/204E.3	-	3	3	-	-	-	-	-	-	-	-
M26BESK104E/204E.4	-	3	3	-	-	-	-	-	-	-	-
M26BESK104E/204E	3	3	3	-	-	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	The course builds critical computational and analytical thinking skills, empowering students with lifelong learning tools in computer science. Promotes technical education and employability
2	SDG 8: Decent Work and Economic Growth	By equipping students with key programming and problem-solving skills, the course enhances career opportunities in IT and software sectors, contributing to economic growth.
3	SDG 9: Industry, Innovation and Infrastructure	Programming using C form the backbone of modern technology and software infrastructure. The course fosters innovation and prepares students for building efficient, scalable digital systems

1st /2nd Semester	Programming Language Course (PL) BASICS OF JAVA	M26BPLK105A/ 205A
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Foundational Programming Logic	Comfort with variables, control structures, and functions from an earlier programming course (POP/Python).
2	Basic Data Structures Awareness	Familiarity with arrays and the idea of organizing data in memory.
3	Basic Computer Skills	Ability to set up a JDK/IDE, compile, and run programs from the command line or an IDE.
4	Elementary OOP Vocabulary	Awareness of terms like class, object, and method, even if not yet applied.

2. Syllabus

BASICS OF JAVA SEMESTER – I			
Course Code	M26BPLK105A	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
1. To build a strong foundation in object-oriented principles (encapsulation, inheritance, polymorphism, abstraction) using Java. 2. To develop proficiency in exception handling, multithreading, and the Java Collections Framework. 3. To equip students with skills to design robust, reusable Java classes and packages. 4. To introduce students to Java-based GUI and basic client-server (socket) programming.			
Module -1			
Module 1: Java & OOP Foundations:			
Java Buzzwords, JVM/JRE/JDK, bytecode, and the compile-run cycle. Classes and objects: fields, methods, constructors, the 'this' keyword. Data types, operators, arrays, and Java Strings/StringBuilder. Control statements: selection, iteration, and jump statements in Java. Static members, method overloading, and constructor overloading.			
Lab Programs:			
1. Construct and execute a Java program to determine the largest among three user-defined numbers. 2. Construct and execute a Java program that illustrates the concept of constructor overloading. 3. Construct and execute a Java program capable of verifying whether a given string qualifies as a palindrome.			
Text Book 1: Ch 1–2, Ch 3, Ch 4, Ch 5, Ch 6, Ch 7, Ch 18 (Strings) Text Book 2: Ch 2–3, Ch 4, Ch 5, Ch 6–7, Ch 8			
Module -2			
Module 2: Inheritance, Polymorphism, Interfaces & Packages			
Inheritance basics, the 'super' keyword, method overriding, and dynamic method dispatch. Abstract classes and methods; the 'final' keyword. Interfaces: defining, implementing, default and static interface methods. Packages: creating, importing, and access protection (public/private/protected/default). Polymorphism in practice: designing extensible class hierarchies.			
Lab Programs:			
1. Construct and execute a Java program that illustrates single inheritance through the application of the super keyword. 2. Construct and execute a Java program that demonstrates the concept of method overriding. 3. Construct and execute a Java program to implement a Shape interface across two distinct classes.			
Text Book 1: Ch 8 (Inheritance), Ch 9 (Packages and Interfaces) Text Book 2: Ch 8 (extends/overriding), Ch 10 (Interfaces), Ch 11 (Packages)			
Module -3			

Templates & Exception Handling :

Exception hierarchy, try-catch-finally, multiple catch blocks, throw/throws. Creating and using custom (user-defined) exceptions. The Java thread model: creating threads via Thread class and Runnable interface. Thread lifecycle, synchronization, inter-thread communication (wait/notify), avoiding deadlocks. Executor framework basics for managing thread pools.

Lab Programs:

1. Construct and execute a C++ program to determine the maximum of two numbers by implementing a generic function template.
2. Construct and execute a C++ program that illustrates exception handling through the try-catch construct.
3. Construct and execute a C++ program to define a custom exception class derived from the standard std::exception class.

Text Book 1: Ch 10 (Exception Handling), Ch 11 (Multithreaded Programming) | Text Book 2: Ch 13 (Errors and Exceptions), Ch 12 (Multithreaded Programming)

Module -4**Collection hierarchy:**

List, Set, Map interfaces and key implementations (ArrayList, Linked List, HashSet, TreeSet, HashMap, TreeMap). Iterators, Comparable and Comparator for custom sorting. Generics: generic classes and methods, bounded type parameters, wildcards. Autoboxing/unboxing and the java.util utility classes.

Lab Programs:

1. Construct and execute a C++ program to store and present a collection of elements using a vector container.
2. Construct and execute a C++ program to arrange a vector of integers in order by employing the sort() algorithm.
3. Construct and execute a C++ program that illustrates the storage and retrieval of key-value pairs using a map container.

Text Book 1: Ch 14 (Generics), Ch 20 (java.util Part 1: Collections Framework) | Text Book 2: Ch 16 (Java Collections)

Module -5**Java I/O streams:**

Byte vs character streams, reading/writing files, try-with-resources. Serialization basics for persisting Java objects. Introduction to Java Swing: components, layouts, event handling for simple GUIs. Networking basics: Socket and ServerSocket classes for simple client-server communication.

Lab Programs:

1. Construct and execute a C++ program capable of reading from and writing to a file using the fstream class.
2. Construct and execute a C++ program that illustrates the use of a unique_ptr smart pointer for automatic memory management.
3. Construct and execute a C++ program to apply a lambda expression in conjunction with the for each STL algorithm.

Text Book 1: Ch 13 (I/O & Try-with-Resources), Ch 22 (java.io), Swing chapters (~Ch 28–30), Networking (~Ch 24) | Text Book 2: Ch 15 (I/O Files), Ch 14 (Graphics/AWT/Swing)

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 12th Edition, McGraw-Hill.
2. E. Balagurusamy, Programming with Java, 6th Edition, McGraw-Hill Education.

Reference Books:

1. Cay S. Horstmann, Core Java Volume I - Fundamentals, 12th Edition, Pearson.
2. Kathy Sierra and Bert Bates, Head First Java, 2nd Edition, O'Reilly.

Video Link:

1. https://onlinecourses.nptel.ac.in/noc22_cs27/preview

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of programming concepts.

3	Collaborative Learning	Encourage collaborative learning (pair programming, peer code review) for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Programming Assignments	Assign programming/lab tasks and mini-projects to reinforce practical skills associated with competencies.

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE)**

Components		Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
Total Marks				50	20

Final CIE Marks = (A) + (B)**A** = Average of best two Test marks**B** = Average of two Alternate Assessment marks**Semester End Examination (SEE) For Theory Course with 3 or 4 credits**

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BPLK105A.1	Understand and apply the fundamental programming constructs of OOP with Java.
M26BPLK105A.2	Design and implement modular, well-structured programs using the language's core features.
M26BPLK105A.3	Analyze problems and select appropriate data organization techniques to build efficient solutions.
M26BPLK105A.4	Develop complete mini-applications that integrate multiple course concepts to solve real-world problems.
M26BPLK105A.5	Demonstrate professional coding practices including debugging, documentation, and version-appropriate style

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BPLK105A.1	3	-	-	-	-	-	-	-	-	-	-
M26BPLK105A.2	-	3	-	-	-	-	-	-	-	-	-
M26BPLK105A.3	-	-	3	3	-	-	-	-	-	-	-
M26BPLK105A.4	-	-	-	3	-	-	-	-	-	-	-
M26BPLK105A.5	-	-	3	-	-	-	-	-	-	-	-
M26BPLK105A	3	3	3	3	-	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Strengthens rigorous computational thinking and systems-level programming skills as part of a well-rounded technical education.
2	SDG 9: Industry, Innovation and Infrastructure	C++ underpins performance-critical systems, embedded software, and game engines, directly supporting infrastructure innovation.
3	SDG 8: Decent Work and Economic Growth	Proficiency in C++ opens career pathways in systems programming, finance, gaming, and embedded industries.

1st/2nd Semester	Programming Language Course - (PL) INTRODUCTION TO PYTHON PROGRAMMING	M26BPLK105B/ 205B
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic Computer Skills	Understanding how to use files, folders, and applications. Familiarity with installing and using software
2	Logical Thinking and Problem Solving	The ability to understand a problem and solve it step by step. The process of understanding a problem, writing a Python program to solve it, and checking the result.
3	Basic Math Skills	Knowledge of arithmetic operations, percentages, averages, and simple mathematical formulas to perform calculations in Python programs.
4	Elementary Programming Concepts	Basic understanding of variables, data types, operators, input/output, conditional statements, loops, and functions to develop simple Python programs.

2. Syllabus

INTRODUCTION TO PYTHON PROGRAMMING SEMESTER – I			
Course Code	M26BPLK105B/205B	CIE Marks	50
Number of Lecture Hours/Week (L:T: P: S:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
1. Learn the syntax and semantics of the Python programming language. 2. Illustrate the process of structuring the data using lists, tuples. 3. Appraise the need for working with various documents like Excel, PDF, Word and Others. 4. Demonstrate the use of built-in functions to navigate the file system. 5. Implement the Object Oriented Programming concepts in Python.			
Module -1			
Python Basics:			
Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control:			
Boolean Values, Comparison Operators, Boolean Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit().			
Functions:			
def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print() function, Local and Global Scope, The global Statement, Exception Handling.			
Textbook 1: Ch. 1, 2, 3			8 Hours
Lab Programs:			
1. Develop a program to read the student details like Name, USN, and Marks in three subjects. Display the student details, total marks and percentage with suitable messages.			
2. Develop a program to read the name and year of birth of a person. Display whether the person is a senior citizen or not.			
3. Develop a program to generate Fibonacci sequence of length (N). Read N from the console.			
Module -2			
Lists: Dictionaries and Structuring Data:			
The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Strings and Tuples, References,			
Dictionaries and Structuring Data:			
The Dictionary Data Type, Dictionary vs List, The Keys(), values() and items() methods, Pretty Printing, Using Data Structures to Model Real-World Things.			

Textbook 1: Ch. 4, 5 Lab Programs: 1. Design a program that defines a factorial function and uses it to determine the binomial coefficient for the given inputs N and R. 2. Develop a program to read N numbers from the console into a list and calculate the mean, variance, and standard deviation. Display the results with suitable messages. 3. Develop a program to accept a multi-digit number as characters from the console and print the occurrence count of each digit with suitable messages.	8 Hours
Module -3	
Manipulating Strings: Working with Strings, Useful String Methods ,Copying and pasting string with the pyperclip() module. Reading and writing Files: Files and File Paths, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint.format() Function Textbook 1: Ch. 6, 9 Lab Programs: 1. Implement a program that reads a text file, counts the frequency of each distinct word using a dictionary, sorts the words in decreasing order of frequency, and prints the top 10 most frequent words. 2. Develop a program to read the contents of a text file, sort them in ascending order, and write the sorted contents to a separate text file. Use appropriate string, list, and file handling methods. 3. Develop a program to backing Up a given Folder (Folder in a current working directory) into a ZIP File by using relevant modules and suitable methods.	8 Hours
Module -4	
Organizing Files: The shutil Module, walking a Directory Tree, Compressing Files with the zipfile Module, Debugging: Raising Exceptions, Getting the Traceback as a String, Assertions, Logging. Textbook 1: Ch. 10, 11 Lab Programs: 1. Develop a Python program that defines a function DivExp(a, b) to perform division. Use an assertion to validate that a is greater than zero and handle the divide-by-zero condition by raising an appropriate exception. Read the input values from the console and call the function. 2. Construct and execute a Python program to walk a directory tree using os.walk() and list all files with a specific extension. 3. Develop a Python program to simulate the operation of a traffic light. Use an assertion to ensure that the input signal is one of Red, Yellow, or Green. Display the corresponding traffic instruction and handle invalid inputs appropriately.	8 Hours
Module -5	
Classes and objects: Programmer-defined type,Attributes, Rectangles, Instances as return values, Objects are mutable, Copying. Classes and functions: Time, Pure functions, Modifiers, Classes and methods: Printing objects, The __init__ method, The __str__ method, Operator overloading,Polymorphism Textbook 2: Ch. 15, 16, 17 Lab Programs: 1. Develop a Python program to define a class Complex for representing complex numbers. Implement a function to perform the addition of two Complex objects and use it to calculate the sum of N ($N \geq 2$) complex numbers entered by the user. 2. Construct and execute a Python program that demonstrates the use of the __init__ and __str__ methods within a programmer-defined class. 3. Write a Python program using a Student class to read a student's details and marks in three subjects, calculate the total and percentage, and display the score card using appropriate class methods.	8 Hours
TEXT BOOKS 1. Al Sweigart, "Automate the Boring Stuff with Python", 2nd Edition, No Starch Press, 2020. 2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015.	
REFERENCE BOOKS:	

1. Naomi Ceder, The Quick Python Book, 4th Edition
2. Mark Lutz, Learning Python, 5th Edition

Video Links:

1. <https://automatetheboringstuff.com/>
2. <https://greenteapress.com/wp/think-python-2e/>
3. <https://youtube.com/@mitmysorecse2071>

Illustrative Mini Project Ideas (Students May Choose Other Relevant Topics)

Mini projects are to be executed in teams of 2–3 students over the last 3–4 weeks of the semester, with a project report and a live demonstration for evaluation.

1. **Mini Project 1: Personal File Organizer & Backup Utility**
Build a command-line utility that scans a target folder, organizes files into sub-folders by type/extension using the `os` and `shutil` modules, and creates a dated ZIP backup of the organized folder using the `zipfile` module, with a logging-based summary report of every operation performed.
2. **Mini Project 2: Secure Password Locker with Persistent Storage**
Develop a dictionary-based password manager that lets a user add, retrieve, update, and delete account credentials, persisting the data between runs using the `shelve` module, with input validation and try-except blocks to gracefully handle missing or duplicate entries.
3. **Mini Project 3: Student Record Management System (OOP-based)**
Design a Student class with attributes for name, marks, and grade, implement the `__init__` and `__str__` methods for clean object display, and build a program that stores a list of Student objects, computes each student's grade, and saves/loads the records to/from a text file.
4. **Mini Project 4: Text Analyzer & Wiki Formatter**
Create a tool that reads a text file, uses a dictionary to compute word-frequency statistics, pretty-prints the results with the `pprint` module, and reformats selected lines into wiki-style bulleted markup, building directly on the string-manipulation and dictionary techniques from Modules 2 and 3.
5. **Mini Project 5: Debug-Aware Contact Book with Exception Handling**
Build a contact book application that stores contacts as dictionaries within a list, supports adding/searching/deleting entries, and persists data to a file, while using assertions and the logging module to record errors and full tracebacks for invalid input, per the debugging practices covered in Module 4.

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Hands-on Coding	Python is best learned by doing. Provide plenty of opportunities for students to write code, debug, and experiment with Python programs. Use coding exercises, projects, and challenges to reinforce learning.
2	Interactive Learning	Use interactive Python environments like Jupyter Notebooks, REPL (Read-Eval-Print Loop), or IDEs such as PyCharm or Visual Studio Code. These tools allow students to see immediate results and interactively explore concepts.
3	Real-world Examples	Relate Python concepts to real-world applications and examples that resonate with students' interests or future career paths. For example, show how Python is used in data analysis, web development, or artificial intelligence.
4	Incremental Complexity	Start with simple Python concepts and gradually increase the complexity of topics as students gain proficiency. This approach helps build a strong foundation and prevents overwhelming students with advanced topics too soon.
5	Laboratory Learning	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing few experiments.

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE)**

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Semester End Examination (SEE) For Theory Course with 3 or 4 credits

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BPLK105B/205B.1	Apply the fundamentals of Python programming to solve complex problems.
M26BPLK105B/205B.2	Analyse different data structures, concepts of string manipulation used in python programming
M26BPLK105B/205B.3	Interpret the concepts of object oriented programming using Python
M26BPLK105B/205B.4	Develop Solutions to the real world problems using python and justify through formal reasoning with complete experimental documentation.

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BPLK105B/205.1	3	-	-	-	-	-	-	-	-	-	-
M26BPLK105B/205.2	-	3	-	-	-	-	-	-	-	-	-
M26BPLK105B/205.3	-	-	3	-	-	-	-	-	-	-	-
M26BPLK105B/205.4	-	-	-	3	3	-	-	-	-	-	-
M26BPLK105/205B	3	3	3	3	3	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG)

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Python is free, beginner-friendly, and widely used in digital education platforms and coding literacy campaigns.
2	SDG 8: Decent Work and Economic Growth	Python helps in workforce analytics, automation, and developing digital skills that boost employability.
3	SDG 9: Industry, Innovation, and Infrastructure	Python drives innovations in AI, IoT, and automation in industries, enhancing infrastructure management.

1st / 2nd Semester	Programming Language Course (PC) INTRODUCTION TO C++ PROGRAMMING	M26BPLK105C
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Foundational Programming Logic	Comfort with variables, control structures, and functions, typically from POP in C.
2	Basic Understanding of Pointers	Familiarity with the concept of memory addresses and pointer variables.
3	Basic Computer Skills	Ability to compile and run C++ programs using a compiler/IDE (g++, Code::Blocks, VS Code).
4	Elementary OOP Vocabulary	Awareness of terms like class and object, even if not yet applied in code.

2. Syllabus

INTRODUCTION TO C++ PROGRAMMING SEMESTER – I			
Course Code	M26BPLK105C	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
Credits	03	Total Marks	100
		Exam Hours	03
Course Objectives:			
- To build a strong foundation in object-oriented principles (encapsulation, inheritance, polymorphism) using C++. - To develop skills in operator overloading, templates, and exception handling for robust, reusable code. - To introduce the Standard Template Library (STL) for efficient data management. - To develop an appreciation of resource management (RAII) and modern C++ practices..			
Module -1			
C++ & OOP Foundations			
From C to C++: new features, references, inline functions, default arguments.			
Classes and objects: data members, member functions, access specifiers.			
Constructors (default, parameterized, copy) and destructors.			
Static members and static member functions; the 'this' pointer. Friend functions and friend classes.			
Lab Programs:			
- Construct and execute a C++ program to compute the area of a rectangle by encapsulating the relevant data and logic within a class. - Construct and execute a C++ program that illustrates the sequence in which constructors and destructors are invoked. - Construct and execute a C++ program to interchange the values of two numbers by implementing a friend function.			
Text Book 1: Ch 2 (Beginning with C++), Ch 5 (Classes and Objects), Ch 6 (Constructors and Destructors) Text Book 2: Ch 16 (Classes), Ch 17 (Construction, Cleanup, Copy, and Move)			
Module -2			
Inheritance & Polymorphism			
Types of inheritance: single, multiple, multilevel, hierarchical, hybrid. Function overriding, virtual functions, and pure virtual functions (abstract classes). Runtime polymorphism via virtual function tables; early vs late binding. Operator overloading: unary and binary operators, overloading using friend functions. Virtual destructors and safe polymorphic object destruction.			
Lab Programs:			
- Construct and execute a C++ program that illustrates the concept of single-level inheritance. - Construct and execute a C++ program that demonstrates runtime polymorphism through the implementation of virtual functions. - Construct and execute a C++ program to overload the + operator such that it supports the addition of two complex numbers.			
Text Book 1: Ch 8 (Inheritance: Extending Classes), Ch 9 (Virtual Functions and Polymorphism), Ch 7 (Operator Overloading) Text Book 2: Ch 20 (Derived Classes), Ch 21 (Class Hierarchies), Ch 18–19 (Overloading, Special Operators)			

Module -3
Templates & Exception Handling: Function templates and class templates; template parameters. Template specialization basics. Exception handling: try-catch-throw, exception hierarchies, standard exceptions. Custom exception classes derived from <code>std::exception</code>. Resource Acquisition Is Initialization (RAII) concept and its role in exception safety. Lab Programs: 1. Construct and execute a C++ program to determine the maximum of two numbers by implementing a generic function template. 2. Construct and execute a C++ program that illustrates exception handling through the try-catch construct. 3. Construct and execute a C++ program to define a custom exception class derived from the standard <code>std::exception</code> class. Text Book 1: Ch 12 (Templates), Ch 13 (Exception Handling) Text Book 2: Ch 23 (Templates), Ch 24 (Generic Programming), Ch 13 (Exception Handling) 8 Hours
Module -4
Standard Template Library (STL) STL overview: containers, iterators, algorithms, functions. Sequence containers: vector, list, deque; associative containers: map, set, multimap. Iterators: types and usage; range-based for loops. STL algorithms: sort, find, count, accumulate, transform. Choosing the right container for performance and use-case requirements. Lab Programs: 1. Construct and execute a C++ program to store and present a collection of elements using a vector container. 2. Construct and execute a C++ program to arrange a vector of integers in order by employing the <code>sort()</code> algorithm. 3. Construct and execute a C++ program that illustrates the storage and retrieval of key-value pairs using a map container. Text Book 1: Ch 14 (Introduction to the STL) Text Book 2: Ch 31 (STL Containers), Ch 32 (STL Algorithms), Ch 33 (STL Iterators)
Module -5
File Handling & Modern C++ Practices File streams: <code>ifstream</code>, <code>ofstream</code>, <code>fstream</code>; reading/writing objects to files. Namespaces and their role in avoiding naming conflicts. Introduction to smart pointers (<code>unique_ptr</code>, <code>shared_ptr</code>) for automatic memory management. Lambda expressions basics and their use with STL algorithms. Overview of building a small end-to-end application combining OOP, STL, and file handling. Lab Programs: 1. Construct and execute a C++ program capable of reading from and writing to a file using the <code>fstream</code> class. 2. Construct and execute a C++ program that illustrates the use of a <code>unique_ptr</code> smart pointer for automatic memory management. 3. Construct and execute a C++ program to apply a lambda expression in conjunction with the <code>for_each</code> STL algorithm. Text Book 1: Ch 11 (Working with Files), Ch 16 (New Features of ANSI C++ Standard) Text Book 2: Ch 38 (I/O Streams), Ch 14 (Namespaces), Ch 34 (Memory and Resources — smart pointers), lambda coverage in Ch 11 (Select Operations)
Text Books: 1. E. Balagurusamy, Object Oriented Programming with C++, 8th Edition, McGraw-Hill Education. 2. Bjarne Stroustrup, The C++ Programming Language, 4th Edition, Addison-Wesley. Reference Books: 1. Herbert Schildt, C++: The Complete Reference, 4th Edition, McGraw-Hill. 2. Nicolai M. Josuttis, The C++ Standard Library, 2nd Edition, Addison-Wesley. Video Link: 2. https://onlinecourses.nptel.ac.in/noc22_cs28/preview
Illustrative Mini Project Ideas (Students May Choose Other Relevant Topics)
<i>Mini projects are to be executed in teams of 2–3 students over the last 3–4 weeks of the semester, with a project report and a live demonstration for evaluation.</i> 1. Mini Project 1: Hotel Reservation System

Design a hotel reservation system using classes for Room, Guest, and Booking, storing reservations in a file, with STL containers to manage room availability and a simple search for available rooms by date range.
2. Mini Project 2: Multi-Account Banking System using Inheritance Build a banking system with a base Account class and derived Savings Account/Current Account classes with different interest/overdraft rules, using virtual functions for polymorphic transaction processing and exception handling for invalid transactions.
3. Mini Project 3: Library Management System using STL Implement a library system using a map for ISBN-based book lookup and a vector for tracking issued books per member, supporting issue, return, and overdue-fine calculation, persisted to a file.
4. Mini Project 4: 8-Puzzle Solver Implement a solver for the classic 8-puzzle using a search algorithm (BFS or A*) with STL containers (queue/priority queue, set/map for visited states) to find and display the sequence of moves to reach the goal state.
5. Mini Project 5: Employee Management System with Smart Pointers Create an employee management system using classes for different employee types (via inheritance), managing employee objects using shared_ptr/unique_ptr to demonstrate automatic memory management, with custom exceptions for invalid data and file-based persistence.

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of programming concepts.
3	Collaborative Learning	Encourage collaborative learning (pair programming, peer code review) for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Programming Assignments	Assign programming/lab tasks and mini-projects to reinforce practical skills associated with competencies.
6	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE) for Theory Course with 3 credits

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

$$\text{Final CIE Marks} = (A) + (B)$$

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BPLK105C.1	Understand and apply the fundamental programming constructs of OOP with C++.
M26BPLK105C.2	Design and implement modular, well-structured programs using the language's core features.
M26BPLK105C.3	Analyze problems and select appropriate data organization techniques to build efficient solutions.
M26BPLK105C.4	Develop complete mini-applications that integrate multiple course concepts to solve real-world problems.
M26BPLK105C.5	Demonstrate professional coding practices including debugging, documentation, and version-appropriate style.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BPLK105C.1	3	2	-	-	-	-	-	-	-	-	-
M26BPLK105C.2	-	3	2	-	-	-	-	-	-	-	-
M26BPLK105C.3	-	-	3	2	-	-	-	-	-	-	-
M26BPLK105C.4	-	-	-	2	3	-	-	-	2	-	-
M26BPLK105C.5	-	-	-	-	-	-	-	-	2	2	2
M26BPLK105C	3	2.5	2.5	2	3	-	-	-	2	2	2

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Strengthens rigorous computational thinking and systems-level programming skills as part of a well-rounded technical education.
2	SDG 9: Industry, Innovation and Infrastructure	C++ underpins performance-critical systems, embedded software, and game engines, directly supporting infrastructure innovation.
3	SDG 8: Decent Work and Economic Growth	Proficiency in C++ opens career pathways in systems programming, finance, gaming, and embedded industries.

1st Semester	Programming Language Course (PL) INTRODUCTION TO WEB PROGRAMMING	M26BPLK105D
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic Programming Concepts:	Understanding core programming concepts like variables, loops, and conditional statements will make learning JavaScript and other languages easier.
2	Web Servers and Hosting:	Having a basic understanding of how websites are hosted and served on the internet is beneficial.
3	Problem-Solving and Logical Thinking	Ability to analyze problems and apply logical steps to solve them and Familiarity with algorithmic thinking.
4	Understanding of Markup Language	Basic understanding of what HTML and CSS
5	Developer Tools	Familiarize yourself with browser developer tools, which are essential for debugging and testing web pages.

2. Syllabus

INTRODUCTION TO WEB PROGRAMMING SEMESTER – I			
Course Code	M26BPLK105D	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
Credits	03	Total Marks	100
		Exam Hours	03
Course Objectives:			
1. To use the syntax and semantics of HTML and XHTML 2. To develop different parts of a web page 3. To understand how CSS can enhance the design of a webpage. 4. To create and apply CSS styling to a webpage 5. To get familiarity with the JavaScript language and understand Document Object Model handling of Java Script			
Module -1			
HTML: Understanding elements, physical style elements, DIV and SPAN elements, exploring hyperlink and URLs, Table elements, Images in web page, input element, button, multi choice, submitting forms Textbook1: Ch. 2.1, 3.1,3.2,4.1,5.1.1, 5.1.2,6.1,7.1.1, 8.1.1,8.1.2, 8.1.10, 7.2 8 Hours			
Module -2			
CSS: Syntax of CSS, CSS selectors, CSS in HTML doc, Color property, image property, size property, background property, font family, font size property, font style property, font variant property, font weight property, font property, CSS to text, box model, template layout model, display of an element using CSS, positioning an element, floating element. Textbook 1:Ch 8.1.2, 18.1.3, 18.1.4, 19.1.1, 19.1.2, 19.1.8, 19.1.11,20.1.1,20.1.2, 20.1.5-20.1.8, 20.3, 21.1,21.3,22.1-22.3,25.1 8 Hours			
Module -3			
Table Elements, Formatting a Data Table: Borders, Alignment, and Padding, CSS Structural Pseudo class Selectors, thead and tbody Elements, Cell Spanning, Web Accessibility, CSS display Property with Table Values, a Element, Relative URLs, Navigation Within a Web Page, CSS for Links, Bitmap Image Formats: GIF, JPEG, PNG, img Element, Responsive Images, Positioning Images, Shortcut Icon, iframe Element . Textbook 2 : 5.2 to 5.8, 6.2, 6.3, 6.6., 6.7, 6.9, 6.10, 6.12, 7.2 to 7.4 8 Hours			

Module -4	
XML: Working with basics of XML, XML namespaces, XML schema: simple type, data types, DOM parser, XSLT processor, JAXP, XPath language, XLink language, XPointer language, XML encoding. Textbook1: 28.1-28.7, 29.1,29.2.1,29.2.3, 30.1,30.3,30.4, 32.1-32.3,29.4,29.5	8 Hours
Module -5	
Introduction to JavaScript: Functions, DOM, Forms, and Event Handlers History of JavaScript, Hello World Web Page, Buttons, Functions, Variables, Identifiers, Assignment Statements and Objects, Document Object Model, Client-Side Versus Server-Side, form Element, Controls, Text Control, accessing a Form's Control Values, reset and focus Methods TextBook2: 8.2 to 8.13, 8.15, 8.16	8 Hours
TEXTBOOKS: 1.Dreamtech Press India Pvt. Ltd HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, Second Edition,2019 2.John Dean, Jones & Bartlett Learning, WEB PROGRAMMING with HTML5, CSS and JavaScript, First Edition,2018 REFERENCE BOOKS: 1. S Rattan, Strength of Materials, Second Edition, McGraw Hill, 2011. 2. Ferdinand Beer and Russell Johnston, Mechanics of materials, Tata McGraw Hill, 2003. VIDEO LINKS: 1. https://onlinecourses.swayam2.ac.in/aic20_sp11/preview	

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Learning Objectives	Understand the basic concepts of the internet and the World Wide Web. Differentiate between websites, web pages, web servers, and web browsers. Introduce HTML, CSS, and basic client-server architecture. Understand how data travels on the internet using protocols like HTTP/HTTPS and Develop a simple static web page.
2	Learning Resources	Basic Web Technology or Web Development books., Online Tutorials: W3Schools, MDN Web Docs. Software Tools: Text Editor (VS Code, Notepad++), Browsers (Chrome, Firefox). Hardware Requirements: Computer Lab with internet access
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world Competencies.
5	Outcomes	Create and host a basic webpage. Demonstrate understanding of web browser and server interaction.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE)

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BPLK105D.1	Apply the knowledge of fundamental concepts of HTML, XHTML, CSS and JavaScript
M26BPLK105D.2	Identify complex engineering problems and providing suitable solutions using HTML5 and JavaScript
M26BPLK105D.3	Analyse various attributes, values and types of CSS to design Web components.
M26BPLK105D.4	Investigate the core constructs and event handling mechanisms of JavaScript and CSS for Providing valid solutions.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BPLK105D.1	3	-	-	-	-	-	-	-	-	-	-
M26BPLK105D.2	-	3	-	-	-	-	-	-	-	-	-
M26BPLK105D.3	-	-	3	-	-	-	-	-	-	-	-
M26BPLK105D.4	-	-	-	3	-	-	-	-	-	-	-
M26BPLK105D	3	3	3	3	-	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Provides learners with essential digital and technical skills such as HTML, CSS, JavaScript—empowering them in a technology-driven world.
2	SDG 9: Industry, Innovation, and Infrastructure	Equips students to build digital platforms that can support modern services, innovation, and IT infrastructure development
3	SDG 10: Reduced Inequalities,	Web technologies allow marginalized groups to access opportunities and information, bridging digital and social gaps

1st /2nd Semester	Basic Science Course (BS) APPLIED PHYSICS LAB FOR CV STREAM	M26BPHYLC106/ 206
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1. Prerequisites

S/L	Proficiency	Prerequisites
1.	Classical Mechanics and Waves	Experiments like torsional pendulum, forced oscillations, and spring combinations require knowledge of SHM, resonance, and wave behavior.
2.	Material Science	Young's modulus (bending and cantilever) and moment of inertia experiments demand understanding of stress-strain relations, elasticity, and structural behavior.
3.	Modern Optics	Laser diffraction and Newton's rings experiments involve interference, diffraction, and wave properties of light.
4.	Acoustical Physics	Ultrasonic interferometer understanding connect to wave propagation in media and energy-related phenomena.
5.	Computational and Analytical Skills	Spreadsheet-based simulations and statistical analysis enhance conceptual understanding and data interpretation using mathematical tools.

2. Syllabus

Applied Physics Lab for CV stream			
Course Code	M26BPHYLC106/206	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L: T: P:TW:SL)	0:0:32: 0:00 = 32 Hours	SEE Marks	50
		Total Marks	100
		Exam Hours	03
List of Experiments			
1. Young’s Modulus – Single Cantilever A projecting beam in a building, such as a balcony or canopy, bends when a load is applied at its free end. The amount of bending depends on the stiffness of the material and is important for structural safety and serviceability. Task: Determine the Young’s modulus of the material of the given bar by the single cantilever method.			
2. Rigidity Modulus – Torsional Pendulum Structural members and shafts may undergo twisting when subjected to torsional loads. The ability of a material to resist such twisting is an important consideration in structural applications. Task: Determine the rigidity modulus of the material of the given wire using a torsional pendulum.			
3. Moment of Inertia – Torsional Pendulum Rotating components used in construction machinery, cranes and other equipment must operate smoothly. Their rotational behaviour depends on how their mass is distributed about the axis of rotation. Task: Determine the moment of inertia of the given body using a torsional pendulum.			
4. Effective Spring Constant – Series and Parallel Combinations Vibrations from machinery installed in buildings can be transmitted to the surrounding structure. Springs are commonly used in vibration-isolation systems, and their overall stiffness depends on whether they are connected in series or parallel. Task: Determine the effective spring constant of the given springs in series and parallel combinations.			
5. Frequency Response – Series and Parallel LCR Circuits Buildings increasingly use electrical and electronic systems for lighting, monitoring, security and communication. Such systems may require circuits that respond selectively to particular frequencies. Task: Study the frequency response of the given series and parallel LCR circuits and determine their resonance frequencies.			
3. Wavelength of LASER – Diffraction Grating LASER-based instruments are used in construction and surveying for accurate alignment, levelling and distance measurement. The wavelength of the LASER source is an important parameter in such optical systems. Task: Determine the wavelength of the given LASER using a diffraction grating.			
4. Acceptance Angle and Numerical Aperture of Optical Fiber			

Optical fibers can be used for transmitting signals from monitoring systems installed in bridges, tunnels and other infrastructure. Efficient transmission depends on the amount of light that can enter and propagate through the fiber. Task: Determine the acceptance angle and numerical aperture of the given optical fiber.
5. Particle Size – X-Ray Diffraction Construction materials such as cement, ceramics and mineral-based materials have properties that depend on their microscopic structure. Determining the size of crystalline particles helps in understanding the behaviour of such materials. Task: Determine the particle size of the given material using the principle of X-ray diffraction.
6. Particle Size – SEM The strength, durability and performance of construction materials are influenced by their microstructure. A high-magnification image can reveal the size and distribution of particles present in a material. Task: Determine the particle size of the given material using the principle of Scanning Electron Microscopy (SEM).
7. Young's Modulus – Uniform Bending Beams used in buildings and bridges undergo bending when they carry loads. Excessive deflection can affect the serviceability and safety of a structure, making the elastic property of the beam material an important parameter. Task: Determine the Young's modulus of the material of the given bar by the uniform bending method.
8. Radius of Curvature – Newton's Rings Surveying and levelling instruments use optical components that require accurately manufactured curved surfaces. The radius of curvature of a lens is an important parameter in determining its optical characteristics. Task: Determine the radius of curvature of the given plano-convex lens by setting up Newton's rings.
9. Interactive Physical Simulations Before constructing a civil engineering structure, it is useful to study how a physical system behaves when different conditions are applied. Computer-based simulations allow different parameters to be changed without constructing a physical model for every condition. Task: Investigate the given physical phenomenon using an interactive physical simulation by varying the relevant parameters and analysing their effects.
10. Velocity of Sound in Solids and Liquids – Ultrasonic Interferometer Ultrasonic testing is used for non-destructive assessment of materials and structural components. The velocity of ultrasonic waves through a material provides information about its physical properties. Task: Determine the velocity of sound in the given solids and liquids using an ultrasonic interferometer.
11. Virtual Lab Experiments Scenario: Some laboratory investigations related to Civil Engineering require specialized equipment and controlled experimental conditions. Virtual laboratories allow students to perform such investigations digitally and study the physical principles involved. Task: Perform the given experiment using a virtual laboratory and analyze the observations and results obtained.
12. Study of Motion Using Spreadsheets Scenario: Vehicles travelling on roads continuously change their position and velocity. Understanding the motion of vehicles is important in studying traffic movement, stopping distances and road safety. Task: Study the motion of an object using a spreadsheet and determine its position, velocity and acceleration at different times.

3. Teaching-Learning Process Strategies

1.	Laboratory Learning	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing experiments.
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4. Assessment Details (both CIE and SEE)**CIE for Practical Course:**

- CIE marks for a practical shall be 50 marks.
- The split up of CIE marks for conduction/record/journal and test is to be split in the ratio 60:40.
- Conduction of each experiment/group of experiments in the case of programming labs shall be evaluated for 20 marks.
- The record write-up for the individual experiment shall be evaluated for 10 marks.
- Total marks scored for record writing and conducting the experiment shall be summed up to 30 marks (60% of the maximum marks).
- Two tests, each for 100 marks, shall be conducted, and the final test marks shall be scaled down to 10 marks (20% of the maximum marks).

Test Marks distribution for the Practical Course.

Sl. No.	Description	% Marks	In Marks
1	Write-up, Conduction and Result	60%	60
2	Viva-Voce	40%	40
Total		100%	100

Continuous Internal Evaluation (CIE) for Practical Lab Course with 1 Credits

Sl. No.	Components	Number	Weightage	Max. Marks	Min Marks
1	Conduction & Record (A)	1	60%	30	12
2	Lab IA test (B)	1	20%	10	---
3	Project Work (C)	1	20%	10	---
Total Marks				50	20

$$\text{Final CIE Marks} = A + B + C$$

A = Average of marks for all the experiments

B = Lab Internal Assessment marks

C = Project work marks

SEE for the Practical Course:

- SEE marks for a practical course shall be 50 marks.
- The practical course is evaluated for 100 marks, and the scored marks shall be scaled down to 50 marks.
- A change of experiment is allowed only once, and 20% of the marks allotted to the write-up part will be zero.
- The duration of SEE shall be 3 hours.

Marks distribution for the Practical Course

SL. No.	Description	% Marks	Marks
1	Write-up.	20%	20
2	Conduction and result	60%	60
3	Viva-Voce	20%	20
Total		100%	100

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
CO1	Understand the relation between the working principles and practical measurements in mechanics, electromagnetism, electronics and Optics.
CO2	Apply the working principles of the given experiments and perform the experiments using required apparatus in Optics, mechanics, electromagnetic and electronics.
CO3	Analyse the experimental results through interpretation of graphical/ theoretical data demonstrate and document the same.
CO4	Design and implement a physics-based mini project for an engineering application and write the report.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3										
CO2	3										
CO3								2			
CO4			3								
Average of CO'S	3		3					2			

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Interactive simulations, virtual labs, spreadsheet analysis, and mechanical experiments equip students with practical data skills for sustainable engineering.
2	SDG 7: Affordable and Clean Energy	LCR circuits, diffraction, and fibre optics provide core principles for efficient power grids, renewable energy, and optical communications
3	SDG 9: Industry, Innovation, and Infrastructure	Characterizing Elasticity, Rigidity, Inertia and Nanoparticles properties drive advances in resilient materials, precision manufacturing, and infrastructure.
4	SDG 10: Reduced Inequalities	Utilizing virtual labs and step-based interactive digital simulations democratizes access to high-quality physics practical education, bridging infrastructure gaps for diverse institutions and remote learners.
5	SDG 12: Responsible Consumption and Production	Virtual labs and digital simulations democratize quality physics education, bridging infrastructure gaps for diverse and remote learners.
6	SDG 13: Climate Action	Analysing damping, Spring dynamics, structural bending, and optical efficiency helps design lightweight, energy-efficient systems to lower carbon emissions.

1st /2nd Semester	Ability Enhancement Course (AE) INNOVATION, DESIGN THINKING AND INTERDISCIPLINARY PROJECT WORK	M26BIDTK107/ 207
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic Science knowledge	Understands basic mathematics and science concepts to analyze problems, apply logical thinking, and develop practical engineering solutions
2	Problem-Solving Skills and Computer knowledge	Ability to analyze challenges logically and apply basic problem-solving frameworks. Uses computers, office software, and the internet for research, documentation, presentations, and effective project management.
3	Communication and Collaboration Skills	Communicates ideas clearly through speaking, writing, presentations, and discussions for effective teamwork and project documentation.
4	Teamwork and adaptability	Works effectively with team members, shares responsibilities, respects diverse opinions, and contributes toward achieving common project goals

2. Syllabus

INNOVATION, DESIGN THINKING AND INTERDISCIPLINARY PROJECT WORK SEMESTER I/II			
Course Code	M26BIDTK107	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	32	Total Marks	100
Credits	01	Exam Hours	03

Course Objectives This course will enable students to:

1. Introduce students to the fundamentals of design thinking as a human-centered, iterative approach to innovation and creative problem solving.
2. Develop an understanding of design tools, frameworks, and methodologies that facilitate effective ideation, prototyping, and user-centered design in diverse contexts.
3. Foster critical thinking, analytical reasoning, and empathy, enabling students to identify and frame real-world problems from multiple user perspectives.
4. Enhance collaboration, communication, and creativity through hands-on team-based design projects and real-world scenario applications.
5. Equip students with practical skills in prototyping, testing, and iterative design, preparing them to apply design thinking in academic, social, and entrepreneurial settings.

Course Structure and Weekly Plan

Weeks	Modules & Activities	Key Deliverables
Week 1-3	Orientation, Team Formation & Design Thinking Fundamentals - Introduction to Social Entrepreneurship, Innovation & Interdisciplinary approach. Design Thinking process: (Empathize-Define-Ideate-Prototype-Test), Group discussions: on design thinking process - Ice-breaking, team-building, and theme selection activities - Formation of Student Teams (<i>4-6 Members</i>) and Mentor Allocation	Team list, theme area, and initial idea sketch
Week 4-5	Empathy and Field Exploration - Visits to villages, industries, NGOs, public offices, etc. - Stakeholder interviews, observations, and empathy mapping - Recording interactions in the prescribed activity book	Field visit reflections and stakeholder interaction documentation
Week 6-8	Problem Definition and Framing - Categorization and group discussions on field data - Framing challenge statements using <i>How Might We</i> approach - Framing objectives & expected outcomes. - Affinity Mapping, Problem Tree analysis - How to search for prior work (journals, patents, research project, case studies). Understanding user needs	Clearly defined problem statement, user insights, and literature survey report
Week 9-11	Ideation and Concept Design - Brainstorming {mind mapping, 5W1H (what, who, when, where, why, and	Shortlisted idea, design

	how) SCAMPER}, and idea filtering, - Selection of feasible, eco-friendly, and interdisciplinary ideas - Rough sketches, block diagrams, flowcharts, resource planning - Defining team roles and work breakdown structure	document (flowcharts, sketches), resource plan
Week 12-13	Prototype Development (Stage 1) - Prototyping using ATAL Idea Lab/Makers Space/Thinker CAD/Figma - Development of subsystems/modules, integration, debugging - Peer and mentor reviews	Subsystem demonstrations, prototype development
Week 14	Testing, Validation, and Iteration - User testing and feedback collection - Refinement and iteration of prototypes - Analysis of performance, failures, limitations - Preparation of business/sustainability model	Testing report, feedback form, business model draft, Iteration Summary
Week 15-16	Final Demo, Documentation and Social Pitch - Innovation showcase and social pitch to jury - Final presentation with impact assessment, prototype demo, & sustainability plan/ solution. - Submission of final documentation and reflection journals	Final prototype model, Report, presentation, peer-team reflections
TextBooks 1. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), " Design Thinking: Understand – Improve Apply ", Springer, 2011 2. Yousef Haik and Tamer M. Shahin, " Engineering Design Process ", Cengage Learning, Second Edition, 2011. 3. Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author).		

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Activity based learning & Experiential learning	Students learn by performing hands-on activities, experiments, and practical tasks to apply theoretical concepts in real-world engineering situations.
2	Group Learning	Students collaborate through discussions, brainstorming to analyze problems, generate ideas, and develop innovative engineering solutions
3	Case studies	Students learn through case studies for formulations of problems using field or literature survey and brainstorm to convert ideal into a prototype.
4	Project Based learning	Students work in multidisciplinary teams to design, develop, test, and present innovative solutions for real-world engineering and societal challenges.
5	Use of IDT Framework	Students apply design thinking principles and utilize Atal/Maker Spaces to prototype, test, refine, and validate innovative engineering solutions

4. Assessment Details (both CIE and SEE) (Use the applicable CIE design as per the course)

Component	Marks	Description
Continuous Internal Evaluation (CIE)	50	Based on weekly progress, fieldwork, documentation, and teamwork documented in activity book
Semester End Examination (SEE)	50	Based on prototype demonstration, presentation, and viva

Continuous Internal Evaluation (CIE) – 100 Marks

Sl. No.	CIE Parameter	Marks	Description
1	Orientation, Team formation and Communication skills	10	Participation in orientation, teamwork, and communication activities
2	Empathy & Field Exploration Documentation	15	Quality of stakeholder interviews, empathy mapping, activity book entries
3	Problem Definition, Literature Survey & Framing	15	Clarity of problem statements, user insights, prior work reference

4	Ideation, Mind Mapping & Design	20	Creativity, brainstorming participation, idea filtering, design clarity
5	Prototype Development, Testing & Iteration	25	Quality and creativity of prototype/model, testing, and iteration
6	Teamwork, Journal, and Engagement	15	Peer and mentor evaluation, teamwork, journal updates
Total		100	Minimum to Qualify for SEE: 40/100 (CIE $\geq$ 40)

Semester End Examination (SEE) – 100 Marks

SEE conducted jointly by one Internal and one Internal/External from Industry/External Examiner

S/L	Parameter	Marks	Description
1	Prototype / Solution Demonstration	30	Functionality, creativity, and use of lab tools
2	Final Presentation / Social Pitch	20	Clarity, Storytelling, problem–solution fit, visual aids
3	Business Model/Sustainability Plan	10	Feasibility, scalability, alignment with SDGs
4	Documentation Report / Portfolio	20	Structure, reflections, stakeholder inputs
5	Innovation ,Q& A	20	Individual understanding and creativity
Total		100	

Submission Requirements

1. **Team wise Activity Book (Handwritten)** – All stages documented with mentor signatures
2. **Prototype or Working Model**(Physical or Virtual Model)
3. **Team Wise Final Project Report**(handwritten, Use of MS office or equivalent AI Tools)
4. **Team wise Final Presentation**(PPT/PDF – hard and soft copy)
5. **Poster** (A3 size)

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BIDTK107.1	Empathize with community and industry problems to define meaningful challenges.
M26BIDTK107.2	Apply design thinking and interdisciplinary principles to develop user-centric, innovative solutions.
M26BIDTK107.3	Build and test digital or functional prototypes using the Atal Idea Lab/Tinkering Lab/Makers Space.
M26BIDTK107.4	Demonstrate teamwork, project management, and presentation skills through collaborative work.
M26BIDTK107.5	Pitch socially relevant, sustainable, and scalable solutions with impact analysis.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BIDTK107.1	3						2				
M26BIDTK107.2	3								3		
M26BIDTK107.3		3			3		2				
M26BIDTK107.4	3				3						
M26BIDTK107.5		3				2				3	3
M26BIDTK107	3	3			3	2	2		3	3	3

6. Mapping to Sustainable Development Goals (SDG):

Sl.No	SDG	Justification
1	SDG 4:Quality Education	Promotes experiential, project-based, and lifelong learning through innovation and design thinking.
2	SDG 9:Industry, Innovation, and Infrastructure	Develops innovative solutions, prototypes, and engineering designs for societal and industrial challenges.
3	SDG 17:Partnerships for the Goals	Fosters teamwork, interdisciplinary collaboration, and shared innovation—key to achieving all SDGs.

4	SDG 11: Sustainable Cities and Communities	Enables students to frame user-centered problems and design community-driven and sustainable solutions.
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1st/ 2nd Semester	Ability Enhancement Course (AE) AI AND ITS APPLICATIONS IN CIVIL ENGINEERING	M26BAIC108/ 208
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic computer literacy	opening browsers, creating/saving files, using a mouse/keyboard comfortably
2	High-school level math	averages, percentages, simple graphs (a straight line's slope/intercept helps for Exp. 7, but is re-explained)
3	Basic Programming	Whatever intro-to-programming they've had in 1st year (even just "what is a variable/loop" is enough — Exp. 2 rebuilds this from zero)
4	Spread Sheet	Basic spreadsheet familiarity (typing into cells, sorting)

2. Syllabus

Syllabus

AI AND ITS APPLICATIONS IN CIVIL ENGINEERING			
SEMESTER – II			
Course Code	M26BAIC208	CIE Marks	50
Total Number of Teaching-Learning Hours/Sem (L: T: P:TW:SL)	0:0:28: 0:0 = 28 Hours	SEE Marks	50
		Total Marks	100
Credits	01	Exam Hours	03
Course Objectives:			
1. Build basic programming and data-handling fluency (Python, spreadsheets).			
2. Introduce core AI/ML ideas — data, features, training, prediction, classification — through hands-on, no-code/low-code tools.			
3. Expose students to real (simplified) civil engineering data and images so they see why AI matters in the field.			
4. Build confidence using AI tools (chatbots, image classifiers, pretrained models) responsibly.			
SL NO	Experiments		
PART A – Introduction to Artificial Intelligence and AI Tools			
1	Experiment 1: Introduction to Artificial Intelligence and the Python Development Environment Become familiar with the concepts of Artificial Intelligence, Machine Learning, and Deep Learning, along with their applications in various engineering disciplines. Configure the Google Colab environment, explore Jupyter notebooks, and execute basic Python programs to understand the workflow of AI application development.		
2	Experiment 2: Prompt Engineering and Generative AI for Engineering Applications Explore Generative AI tools and learn prompt engineering techniques such as zero-shot, one-shot, few-shot, role-based, and chain-of-thought prompting. Design and refine prompts for solving engineering problems, generating technical reports, summarizing documents, debugging programs, and assisting in design-related tasks.		
PART B – Python for Artificial Intelligence			
3	Experiment 3: Data Analysis using NumPy and Pandas Develop Python programs to import, manipulate, and analyze engineering datasets using NumPy and Pandas. Perform indexing, filtering, aggregation, descriptive statistics, and feature extraction to prepare data for AI applications.		
4	Experiment 4: Data Preprocessing and Visualization Perform data preprocessing by handling missing values, removing duplicate records, encoding categorical variables, and scaling numerical features. Visualize engineering datasets using Matplotlib to identify trends, distributions, correlations, and patterns for effective decision-making.		
5	Experiment 5: Image Classification using Transfer Learning Develop an image classification model using a pretrained convolutional neural network such as MobileNetV2 or EfficientNet in TensorFlow/Keras. Fine-tune the model on a given image		

	dataset, evaluate its performance, and analyze the effectiveness of transfer learning for engineering applications.
PART C – Machine Learning Applications	
6	Experiment 6: Regression Analysis using Linear Regression Develop a Linear Regression model using Scikit-learn to predict continuous values from a given engineering dataset. Train and evaluate the model using appropriate regression metrics and interpret the relationship between input variables and predicted outputs.
7	Experiment 7: Classification using Decision Tree Construct a Decision Tree classifier to classify engineering data based on multiple input features. Visualize the decision tree, analyze the decision-making process, and evaluate the classification performance using standard evaluation metrics.
8	Experiment 8: Classification using Random Forest Develop a Random Forest classifier using an ensemble of decision trees and compare its performance with the Decision Tree model. Analyze feature importance, prediction accuracy, and the robustness of ensemble learning techniques.
9	Experiment 9: Unsupervised Learning using K-Means Clustering Implement the K-Means clustering algorithm to group similar observations in a multi-feature engineering dataset. Determine the optimal number of clusters, visualize the clustering results, and interpret the identified patterns.
10	Experiment 10: Classification using Support Vector Machine (SVM) Develop a Support Vector Machine classifier using linear and non-linear kernels to solve a classification problem. Compare the performance of SVM with Decision Tree and Random Forest models using suitable evaluation metrics.
11	Experiment 11: Artificial Neural Networks (ANN) Develop a Multilayer Perceptron (MLP) using Scikit-learn or TensorFlow/Keras for solving engineering classification or prediction problems. Train the neural network, analyze the influence of model parameters, and compare its performance with conventional machine learning algorithms.
12	Experiment 12: Reinforcement Learning using Q-Learning Implement a Q-Learning agent in a Grid-World environment to understand the concepts of agent, environment, state, action, reward, and policy. Analyze the learning process through cumulative rewards and discuss applications of Reinforcement Learning in robotics, autonomous systems, smart transportation, and industrial automation.
TEXTBOOK 1. Singh, Ajit. Artificial Intelligence in Civil Engineering: Bridging Bytes and Beams for a Smarter, Sustainable Future. 1st Edition. Independently Published. 2. Samui, Pijush and Kothari, Dwarkadas Pralhaddas. Artificial Intelligence in Civil Engineering: AI in Civil Engineering. 1st Edition (27 Oct 2012). LAP LAMBERT Academic Publishing. REFERENCE BOOKS 1. Plevris, Vagelis; Ahmad, Afaq; Lagaros, Nikos D. (Eds.). Artificial Intelligence and Machine Learning Techniques for Civil Engineering. 1st Edition (2023). IGI Global (Hershey, PA). 2. Bekdaş, Gebrail and Nigdeli, Sinan Melih (Eds.). Artificial Intelligence in Civil Engineering: Recent Advances. Edition Number: 1 (2026). Publisher: Springer Cham (Studies in Systems, Decision and Control, Vol. 643). VIDEO LINKS 1. https://nptel.ac.in/courses/106106212 2. https://onlinecourses.nptel.ac.in/noc25_ge77/preview 3. https://nptel.ac.in/courses/106106198 4. https://onlinecourses.nptel.ac.in/noc25_ce108/preview	

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Demonstration-based learning	Instructor demonstrates each tool (Colab, Teachable Machine, Orange) live on screen before students attempt it independently, reducing setup confusion for first-time AI users.
2	Hands-on / experiential learning	Every session is majority hands-on: students work directly with given datasets/images on their own systems rather than watching passively, reinforcing concepts through doing

3	No-code/low-code scaffolded learning	Concepts are introduced first through no-code tools (Teachable Machine, Orange) before any coding is expected, so students build intuition before syntax
4	ICT-enabled / blended learning	Cloud-based tools (Google Colab, Sheets, web demos) allow learning to continue outside the lab; short video tutorials are assigned for pre-lab preparation
5	Collaborative / peer learning	Students work in pairs or small groups for data-cleaning and classification exercises, encouraging discussion and peer troubleshooting.
6	Problem-based learning (PBL)	Each experiment is framed as a small real-world civil engineering problem (e.g., "is this concrete cracked?") rather than an abstract exercise, motivating engagement
7	Flipped classroom elements	Students watch a short-assigned video (e.g., Teachable Machine intro) before the session, freeing lab time for practice and troubleshooting rather than lecture.
8	Case-study / example-driven teaching	Real (simplified) civil engineering datasets and case examples are used throughout instead of generic/textbook data, connecting AI to the student's future discipline.
9	Continuous formative assessment	Weekly lab records, viva-voce questions, and observation write-ups check understanding incrementally rather than relying on one final exam.
10	Mini-project / capstone-based learning	The final experiments (mini-project) require applying multiple concepts together, encouraging synthesis over rote procedure-following.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE)

Sl. No.	Components	Number	Weightage	Max. Marks	Min Marks
1	Conduction & Record (A)	1	60%	30	12
2	Lab IA test (B)	1	20%	10	---
3	Project Work (C)	1	20%	10	---
Total Marks				50	20

$$\text{Final CIE Marks} = A + B + C$$

A = Average of marks for all the experiments

B = Lab Internal Assessment marks

C = Project work marks

Semester End Examination (SEE)

- SEE marks for a practical course shall be 50 marks.
- The practical course is evaluated for 100 marks, and the scored marks shall be scaled down to 50 marks.
- A change of experiment/program is allowed only once, and 20% of the marks allotted to the procedure/write-up part will be zero.
- The duration of SEE shall be 3 hours.

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BAIC208.1	Write basic Python scripts to load, clean, and visualize tabular data.
M26BAIC208.2	Explain the difference between regression and classification with civil
M26BAIC208.3	Train a simple no-code ML model (image or tabular) and interpret its accuracy.
M26BAIC208.4	Use pretrained AI models/tools to solve a small vision task (e.g., crack or vehicle detection)
M26BAIC208.5	Use AI chatbots effectively and ethically for study/research support.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BAIC208.1	2	2	-	1	3	-	-	-	-	-	2
M26BAIC208.2	3	3	-	1	1	-	-	-	-	-	2
M26BAIC208.3	2	2	2	2	2	-	-	-	-	-	2
M26BAIC208.4	1	2	2	1	3	1	1	-	-	-	2
M26BAIC208.5	-	1	-	-	2	1	-	3	1	-	2
M26BAIC208	2	2	2	1.25	2.2	1	1	3	1	-	2

6. Mapping to Sustainable Development Goals (SDG)

SDG	Justification
SDG 4 – Quality Education	The course itself builds foundational AI literacy using free, accessible, no-code tools (Colab, Teachable Machine, Orange) — removing cost and coding barriers so every student, regardless of prior programming exposure, can engage with modern AI skills early in their degree.
SDG 9 – Industry, Innovation and Infrastructure	Students are directly exposed to how AI is applied to infrastructure problems — predicting material strength, detecting structural defects, and analyzing traffic — mirroring how the construction and infrastructure industry is adopting AI-driven innovation.
SDG 11 – Sustainable Cities and Communities	Land-use classification from satellite imagery and traffic/vehicle-count analysis directly relate to urban planning, congestion management, and monitoring unplanned urban growth — core concerns of sustainable city development.
SDG 6 – Clean Water and Sanitation	The rainfall data-handling experiment builds the exact data-analysis skill (trend detection, seasonal averaging) used in real hydrological forecasting and water-resource planning, even though the experiment itself uses simplified data.
SDG 13 – Climate Action	Visualizing rainfall and land-use change patterns introduces students to the type of data analysis used in climate-risk assessment and disaster-resilient infrastructure planning.
SDG 3 – Good Health and Well-Being	Crack detection in concrete structures relates to structural safety monitoring early defect detection reduces risk of structural failure and protects public safety.
SDG 12 – Responsible Consumption and Production	The data-cleaning experiment (removing errors, standardizing units, avoiding wasted/incorrect material test data) reflects the broader principle of resource-efficient, error-free engineering decision-making that reduces material waste from faulty specifications.
SDG 17 – Partnerships for the Goals	The AI-chatbot literacy module builds responsible, ethical use of globally available AI tools — a transferable skill relevant to cross-disciplinary and cross-institutional collaboration using shared digital technologies.

1st Semester	Humanities (HS) PROFESSIONAL ENGLISH - I	M26BENGK109
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic knowledge of English grammar and vocabulary	Students should have a foundational understanding of sentence structure, parts of speech, tenses, and commonly used vocabulary.
2	Familiarity with general writing formats	Prior exposure to writing simple paragraphs, letters, or essays at the school level helps ease the transition into structured and formal writing.
3	Ability to comprehend spoken English	Students should be able to follow general English conversations, classroom instructions, and audio content, which will be enhanced further in listening modules.
4	Fundamental computer and internet usage skills	Basic skills such as using a word processor, browsing the web, and using email are essential for completing blog writing, document formatting, and online communication activities.

2. Syllabus

Professional English - I Semester I			
Course Code	M26BENGK109	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	1:0:0:0:0=16	SEE Marks	50
		Total Marks	100
Credits	01	Exam Hours	01
Course Objectives:			
To develop active listening skills by practicing various listening activities, understanding the barriers to effective listening, and applying strategies to enhance comprehension and attention. To build paragraph writing proficiency through structured practice in narrative, descriptive, cause-effect, and comparison formats, focusing on coherence, unity, and the use of transitions. To introduce students to formal and digital communication including email, blog writing, memos, circulars, and notices with emphasis on clarity, tone, and purpose. To equip students with the ability to produce technical documents such as summaries, abstracts, project documentation, reports, and technical proposals aligned with academic and professional standards.			
Module 1: SPEAKING PRACTICE (PHASE-1)			
UNIT I (a): Self-Introduction			
- Importance of professional self-introduction in academic and workplace contexts - Structuring an effective self-introduction (Personal, Academic, Skills, Goals) - Elevator pitch development (30–60 seconds format) - Highlighting strengths, achievements, and areas of interest effectively - Voice modulation, confidence, and body language during introduction - Tailoring self-introduction for academic, networking, and interview contexts			
UNIT I (b): Listening Activities:			
Advantages of active listening; Disadvantages of poor listening; Use of AV modes for awareness of different accents			
Module -2			
UNIT II (a): Just-A-Minute (JAM) Session			
- Introduction to JAM format and evaluation parameters - Idea generation techniques for impromptu speaking - Structuring short spontaneous responses (Opening–Point–Closing) - Fluency building and hesitation control techniques - Handling unfamiliar or abstract topics - Confidence, clarity, and time-management skills			
UNIT (b): Public Speaking Techniques			
A. Foundations of Public Speaking			

• Overcoming stage fear and confidence building • Audience analysis and purpose identification • Structuring a speech (Opening–Body–Closing) • Voice modulation, tone, pace, pauses, articulation • Body language, gestures, posture, and eye contact
B. Professional Speaking Formats
• Extempore speaking techniques • Presentation skills using visual aids • Storytelling for impact • Persuasive speaking methods • Handling Q&A sessions effectively
Module -3
UNIT 3: Paragraph writing: Structure, Construction of a paragraph, Narrative, Descriptive, Comparisons and Contrasts, Cause and Effect, Facts and figures; Use of transitions and connecting devices.
Module -4
UNIT 4: Email writing, Blog writing, Technical and Academic writing basics. Memo, circular, notice. Project documentation, writing of summary, abstract.
Module -5
UNIT 5 (a): Verbal Ability Essentials (Phase 1)
(Note: Only placement-focused areas)
• Sentence Correction (Sub-Verb Agreement, articles, prepositions, idioms and phrases, phrasal verbs) • Tense forms, Clause Analysis • Vocabulary in Context • Cohesive Devices • Synonyms & Antonyms
(b) Reading Comprehension (Beginner & Intermediate Levels):
a) Skimming b) Scanning c) Intensive Reading d) Extensive Reading
REFERENCE BOOKS: 1. Sanjay Kumar & Pushp Lata – Communication Skills (Oxford University Press) 2. N. P. Sudharshana & C. Savitha – English for Engineers (Cambridge University Press) 3. Meenakshi Raman & Sangeeta Sharma – Technical Communication: Principles and Practice (Oxford University Press) 4. Practical English Usage by Michael Swan, Oxford University Press. 5. Technical communication by Gajendra Singh Chauhan, Cengage Learning India Recommended Digital Learning Resources: TED Talks – Public speaking, leadership, and communication models. British Council LearnEnglish – Listening, pronunciation, grammar, and vocabulary practice. Grammarly – Writing support for emails, reports, and academic writing. LinkedIn Learning – Professional communication, presentation skills, and career readiness modules. Cambridge Dictionary (Online) – Pronunciation and vocabulary support.

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Deliver key writing and communication concepts through engaging lectures using examples, concept maps, and structured presentations to establish core understanding.
2	Audio-Visual Aids	Use videos, podcasts, and recorded talks for listening skill development and to model formal/informal communication formats (e.g., email etiquette) and VTU software accessible through MITM library.
3	Collaborative Learning	Promote peer editing, group paragraph construction, and blog-writing teams to foster cooperative skills and knowledge sharing.

4	Real-World Application	Integrate real-life writing tasks like drafting emails, memos, proposals, and project summaries to connect learning with workplace needs.
5	Flipped Classroom Technique	Share writing guides, grammar resources, or sample documents before class; use class time for writing exercises and critique sessions.
6	Hands-on Writing Activities	Practice structured writing tasks in class: paragraph building, report writing, summary/abstract writing, and peer-review sessions.
7	Mini Projects and Portfolios	Assign projects like blog series creation, documentation of a mock project, or technical proposal writing; compile student work into portfolios.
8	Problem-Based Learning (PBL)	Pose real-world communication challenges (e.g., crisis memo, product summary, or report on a lab experiment) to stimulate analytical and creative writing.
9	ICT-Enabled Teaching Tools	Use Google Docs for collaborative editing, Grammarly for feedback, LMS tools for submissions/quizzes, and blogs for publishing content.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

Components		Number	Weightage	Max. Marks
1	Internal Assessment - Tests (A)	3	50%	25
2	Term Work - TW (B)	2	50%	25
Total Marks				50

Final CIE Marks=(A) + (B)

A = Average of best two Test marks

B = Average of two Term Work marks

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BENGK109.1	Develop effective communication skills through active listening, structured writing, and the use of appropriate formats for academic and professional contexts.
M26BENGK109.2	Apply principles of technical writing to prepare clear, concise, and coherent documents such as emails, reports, proposals, summaries, and project documentation.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M26BENGK109.1	3	2	-	-	-	-	-	-	2	3	2	2
M26BENGK109.2	3		2	-	2	-	-	-	2	3	2	2

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	The course promotes essential communication and technical writing skills, improving students' ability to understand, express, and document knowledge effectively.

2	SDG 8: Decent Work and Economic Growth	Effective writing and listening are critical workplace skills, enhancing employability, professionalism, and career growth.
3	SDG 9: Industry, Innovation and Infrastructure	Technical documentation, proposals, and reports are vital for innovation, project development, and building efficient industrial practices.
4	SDG 17: Partnerships for the Goals	Collaborative writing, peer review, and team-based communication activities build skills necessary for effective teamwork and global cooperation.

1st / 2nd Semester	Humanity Science (HS) BIOLOGY FOR ENGINEERS	M26BBEK110/ 210
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic Knowledge of Biology	A basic understanding of high school-level biology concepts can be beneficial. This includes knowledge of cell structure, basic physiology, and fundamental biological processes.
2	Basic Knowledge of Biochemistry	Familiarity with major biological molecules and their application (carbohydrates, proteins, lipids, nucleic acids, vitamins, enzymes, and hormones).
3	Basic Knowledge of Mathematics and Physics	Understanding the human anatomy and physiological systems in comparison with bioengineering principles.
4	Basic Concepts of Design	Understanding of basic design and system thinking, which will help in bioengineering design and nature-bioinspired materials and mechanisms.
5	Engineering Fundamentals	Ability to analyze and apply basic engineering principles to solve biological problems.

2. Syllabus

BIOLOGY FOR ENGINEERS SEMESTER – I/II			
Course Code	M25BBEK110/210	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	1:0:0:0:0 = 16 Hours	SEE Marks	-
		Total Marks	50
Credits	00	Exam Hours	00
Course objectives: - To acquaint the students with fundamental biological principles and their application to bioengineering. - To enable the students to understand the bio-design principles to create novel devices and structures. - To show the students how biological systems can be re-designed as substitute products for natural systems. - To encourage students to create an interdisciplinary view of biological engineering.			
Module -1			
CELL BIOLOGY: Introduction to cell (Types, structure, and major functions of Cells and Cell Organelles) Stem cells and their application. Bio-molecules: Properties and functions of Carbohydrates, Nucleic acids, Proteins, Lipids, Enzymes, Vitamins, and Hormones.			
			3 Hours
Module -2			
BIOMOLECULES AND THEIR APPLICATION: Carbohydrates as Cellulose-based water filters, PHA and PLA as Bio-plastics, Nucleic acids in Vaccines and Diagnosis, Proteins in food production (Plant-based protein, Whey protein, and Meat analogs), Lipids as bio-diesel, and cleaning agents/detergents, Enzymes in Biosensors fabrication, Food processing, Detergent formulation, and Textile processing.			
			3 Hours
Module -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.			
			2 Hours
Module -4			
NATURE-BIOINSPIRED MATERIALS AND MECHANISMS: Echolocation, Photosynthesis. Bird Flying, Lotus Leaf Effect, Plant Burrs, Sharkskin, Kingfisher Beak. Human Blood Substitutes - Hemoglobin-Based Oxygen Carriers (Hbocs) and Perfluorocarbons (Pfc).			
			2 Hours
Module -5			

TRENDS IN BIOENGINEERING: Scaffolds In Muscular, Skeletal Systems and Tissue Engineering, Bio-printing Techniques and Materials. Electrical Tongue and Electrical Nose in Food Science, DNA Origami and Bio-computing, Bio-imaging, and Artificial Intelligence for Disease Diagnosis. Bio-concrete. Bio-remediation. Bio-mining. **2 Hours**

Suggested Learning Resources:

- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and
- Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

Web links and Video Lectures (e-Resources):

- VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource
- <https://nptel.ac.in/courses/121106008>
- <https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists>
- <https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009>
- <https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006>
- <https://www.coursera.org/courses?query=biology>
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- <https://www.classcentral.com/subject/biology>
- <https://www.futurelearn.com/courses/biology-basic-concepts>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Explanation via real-life problems, situation modelling, deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
2	Live Demonstration	Instructions with interactions in classroom lectures (physical/hybrid).
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	ICT Tools	Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
5	Problem-Based Learning (PBL)	Implement PBL to enhance analytical skills and practical application of competencies
6	Multiple Representations	Introduce topics in various representations to reinforce competencies
7	Gamification Tools	Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes
8	Student Seminars	Solo, group /oral presentations.
9	Model Making	Demonstration using working models.

4. Assessment Details (both CIE and SEE)

The weight-age of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

CIE Split UP:

Components		Number	Weight-age	Max. Marks	Min. Marks
(i)	Internal Assessment-Tests (A)	2	50%	25	10
(ii)	Assignments/Quiz/Activity (B)	2	50%	25	10
Total Marks				50	20

Final CIE Marks = (A) + (B)

Average internal assessment shall be the average of the 2 test marks conducted

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M25BBEK210.1	Elucidate the fundamentals of biological concepts employing pertinent health, and engineering applications.
M25BBEK210.2	Assess the biological ideologies for the design and development of novel bioengineering solutions.
M25BBEK210.3	Substantiate and apply the ideologies amid nature-inspired bio-mimetic perceptions for explicit engineering solutions.
M25BBEK210.4	Exploring innovative bio-based solutions for relevant biological complications.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M25BBEK210.1	3	-	-	-	-	-	3	-	-	-	-
M25BBEK210.2	3	-	3	-	-	3	-	-	-	-	-
M25BBEK210.3	3	3	3	-	-	-	3	-	-	-	-
M25BBEK210.4	3	-	3	-	3	-	3	-	-	-	-
M25BBEK210	3	3	3		3	3	3	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 3 – Good Health and Well-being	The syllabus includes stem cells, tissue engineering, bio-imaging, and AI for disease diagnosis, contributing to advanced healthcare and improved health outcomes.
2	SDG 6 –Clean Water and Sanitation	Application of cellulose-based water filters derived from carbohydrates helps in developing sustainable water purification systems for safe and clean water access.
3	SDG 9 – Industry, Innovation & Infrastructure	Modules on bio-inspired design, bio-printing, biosensors, and bio-mimetic promote innovation in sustainable engineering and infrastructure.
4	SDG 12 – Responsible Consumption & Production	Use of bio-plastics (PHA/PLA), bio-diesel from lipids, and enzyme-based green chemistry promotes eco-friendly production and reduced environmental impact.

2nd Semester

2nd Semester	APPLIED MATHEMATICS-II FOR CV STREAM	M26BMATC201
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Integral Calculus	Knowledge of integration w.r.t the specific variables, understanding of curves with fundamental knowledge of geometry for changing the order of integration and also to find area and volume of curves.
2	Vector Calculus	Strong knowledge of calculus, vectors dot and cross product, partial differentiation w.r.t several variables and the concept of integration related to changing of order.
3	Partial Differential equations	Knowledge of partial differentiation w.r.t several variables, basic differential equations. Familiarity with identify the dependent and independent variables.
4	Numerical Methods	Knowledge of factorization to solve algebraic and transcendental equations, familiar with the arithmetic operations.

2. Syllabus

Applied Mathematics-II for CV Stream SEMESTER – II			
Course Code	M26BMATC201	CIE Marks	50
Total Number of Teaching-Learning Hours/Sem (L: T: P:TW:SL)	3:0:2:30	SEE Marks	50
		Total Marks	100
Credits	4	Exam Hours	03
Course Objectives:			
- To, appreciate the importance of Multiple Integrals, vector calculus, PDE and numerical methods in Engineering Problems. - Acquire the knowledge of Multiple Integrals, vector calculus, PDE and numerical methods to apply them in their core domain. - Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.			
Module -1			
Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications: Find Area and Volume by double integral. Problems. Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions (problems only).			
Module -2			
Partial Differential Equations: Formation of PDEs by elimination of arbitrary constants and functions. Solution of non- homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Method of Separation of variables. Application of PDE: One-dimensional heat equation and wave equation-Problems.			
Module -3			
Vector Calculus: Scalar and vector fields. Gradient, directional derivative, divergence and curl - physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential. Vector Integration: Line integrals, Statements of Green's theorem and Stoke's theorem, problems without verification. Application: work done by a force and flux			
Module -4			
Numerical Methods -1 Solution of algebraic and transcendental equations: Regula-Falsi and Newton-Raphson methods (only formulae). Problems. Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.			

Numerical integration: Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules (without proof). Problems.
Module -5
Numerical Methods -2: Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's predictor-corrector method-Problems.
List of Laboratory experiments (2 hours/week per batch)
1) Designing a Smart Roof: Estimating Surface Area and Storage Capacity A smart building has a rooftop of $20\text{ m} \times 10\text{ m}$ with a storage tank of $2\text{ m} \times 2\text{ m} \times 1.5\text{ m}$, requiring accurate estimation of roof area and water-storage capacity. Architects use area and volume calculations to design an efficient rooftop rainwater-harvesting system and maximize water storage.
2) Inside the Reactor: Computing the Volume of a Complex Industrial Vessel An industrial chemical vessel consists of a cylindrical section of radius 2 m and height 5 m , with a conical top of height 1.5 m . Engineers calculate the total volume of the vessel to determine its chemical storage capacity and ensure safe and efficient operation.
3) Reading the Invisible Flow: Analyzing Wind and Air Movement An HVAC system monitors air velocity at different points, such as 2 , 4 , and 6 m/s , inside a building to study airflow distribution. Use vector fields and flow analysis to identify airflow direction, improve ventilation, and maintain indoor air quality.
4) Mapping the Journey: Calculating Work Done Along a Drone Flight Path. A delivery drone flies along a 500 m curved path while experiencing an average wind force of 20 N in the direction of motion. Engineers use line integrals to calculate the total work done by the wind force along the drone's flight path.
5) Finding the Perfect Operating Point: Smart System Optimization. A smart air-conditioning system consumes 5 kW of power at a room temperature of 25°C and 7 kW at 30°C ; engineers need to find the operating condition that minimizes energy consumption. Using optimization techniques, engineers determine the best operating point to reduce power usage while maintaining the required indoor temperature.
6) Weather Forecasting using Newton–Gregory Forward and Backward Interpolation A weather station records temperatures of 28°C , 30°C , 33°C , and 35°C at 9 AM , 11 AM , 1 PM , and 3 PM , but the 12 PM value is missing. Meteorologists use Newton–Gregory forward or backward interpolation to estimate the missing temperature and improve the accuracy of weather forecasts
7) Solar Energy Estimation using Numerical Integration. A solar panel receives sunlight with measured power values of 200 , 500 , 800 , and 600 W/m^2 at different times of the day. Engineers use numerical integration to estimate the total solar energy received and evaluate the panel's energy-generation performance.
8) Rocket Trajectory Prediction using Taylor's and Modified Euler Methods. A small research rocket is launched with an initial velocity of 50 m/s and acceleration of 9.8 m/s^2 ; its height and velocity are calculated at 1-second intervals. Use Taylor's and Modified Euler methods to predict the rocket's trajectory and compare the accuracy of the two numerical methods.
9) Autonomous Drone Navigation using Fourth-Order Runge–Kutta Method. An autonomous drone moves with an initial position of $(0, 0)\text{ m}$ and velocity of $(5, 3)\text{ m/s}$, with its motion described by differential equations. Use the RK4 method to calculate the drone's position at different times and predict its trajectory for safe and accurate navigation
10) Numerical Prediction of Future values using Milne's Method. A smart building records daily electricity consumption of 420 , 450 , 480 , and 510 kWh over four consecutive days. Engineers analyze the past data to predict future energy consumption, helping the building optimize power usage and reduce energy costs.
Suggested software: Mathematica/MatLab/Python/Scilab
TEXTBOOKS: 1. B. S. Grewal, "Higher Engineering Mathematics", Khanna publishers, 45th Ed.2025. 2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2018. 3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8th Ed., 2022.

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding the concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies.

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE)**

Continuous Internal Evaluation (CIE)						
Components			Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)		3	60%	20	08
2	Alternate Assessment (B)		2	40%	10	---
3	Practical Component (C)	Conduction & Record	1	60%	12	5
		Project Work	1	40%	08	---
	Total Marks				50	20

Final CIE Marks = A + B + C**A** = Average of best two Test marks**B** = Average of two Alternate Assessment marks**C** = Sum of Lab Conduction and project work**Semester End Examination (SEE)**

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BMATC201.1	Apply the concepts of partial differential equations and vector calculus to model and solve engineering problems involving heat transfer, wave propagation, work done, and flux.
M26BMATC201.2	Analyze and solve engineering problems using numerical techniques for nonlinear equations, interpolation, numerical integration, and ordinary differential equations, and interpret the accuracy of the computed results..
M26BMATC201.3	Analyze engineering, problems, construct mathematical models, implement computational solutions using appropriate software tools, and critically evaluate and interpret the outcomes.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BMATC201.1	3	3	-	-	-	-	-	-	-	-	-
M26BMATC201.2	3	3	-	-	-	-	-	-	-	-	-
M26BMATC201.3	-	-	-	-	3	-	-	-	-	-	-
M26BMATC201	3	3	-	-	3	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 3: Good Health and Well-Being	In public health, integral calculus is crucial for understanding the total number of people affected by an epidemic over time. Given a model for the rate of change in the number of infected individuals (such as the SIR model), we can integrate the rate of infection to find the total number of infections over a given period.
2	SDG 7: Affordable and Clean Energy	Vector calculus is fundamental to understanding electromagnetic fields, which are central to solar energy, wind energy, and other renewable energy systems. The behaviour of these fields can be described using Maxwell's equations, which are formulated using vector calculus.
3	SDG 11: Sustainable Cities and Communities	Simulating urban development, including traffic patterns, housing growth, and resource usage.

1st / 2nd Semester	Basic Science (BS) APPLIED CHEMISTRY FOR SUSTAINABLE INFRASTRUCTURE	M26BCHEC102/ 202
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic Chemistry	Fundamental understanding of atomic structure, bonding, periodic table, and chemical reactions. Basic concepts of acids, bases, salts, and types of mixtures and solutions. Awareness of laboratory safety and handling of common chemicals.
2	Material Science	Familiarity with metals, alloys, cement, glass, and engineering materials and their physical and chemical properties.
3	Electrochemistry and Corrosion	Basic knowledge of oxidation-reduction reactions, electrochemical cells, electrode potentials, and corrosion phenomena.
4	Environmental and Water Chemistry	Awareness of water quality parameters, pollution, sustainability, and waste management practices.
5	Physics and Energy Concepts	Basic understanding of electricity, energy conversion, photovoltaics, and renewable energy systems.
6	Mathematics	Proficiency in algebra, logarithms, ratios, and solving simple engineering numerical problems
7	Analytical Techniques	Introductory knowledge of titrimetric methods, sensors, and chemical instrumentation.
8	Nanotechnology and Polymers	Preliminary understanding of polymers, nanomaterials, particle size effects, and advanced construction materials.

2. Syllabus

Applied Chemistry for Sustainable Infrastructure SEMESTER – I/II			
Course Code	M26BCHEC102/202	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	2:2:0:20:00 = 84 Hours	SEE Marks	50
Credits	03	Total Marks	100
		Exam Hours	03
Course Objectives: This course will enable students to: - To impart fundamental knowledge of chemistry concepts and advanced materials relevant to civil engineering applications. - To develop an understanding of electrochemical energy systems, corrosion mechanisms, and environmental chemistry for sustainable infrastructure development. - To enable students to analyze the properties and applications of polymers, composites, nanomaterials, cementitious materials, and smart construction materials. - To provide knowledge of analytical techniques and water treatment methods for solving environmental and material-related engineering problems.			
Module-1: Electrochemical Energy Technologies (8hr)			
Electrochemistry: Introduction, electrode potential, concentration cells, numerical problems. Energy storage systems: Introduction to batteries, classification of batteries, construction, working & applications of lithium-ion battery. Energy conversion: Introduction, construction, working, and applications of photovoltaic cells, methanol-oxygen fuel cell. Green fuel: Introduction, production of green hydrogen by electrolysis of water. Self-learning: Construction and working of ion selective electrode.			
Module-2: Corrosion Management and Surface Engineering (8hr)			
Metals and Alloys: Introduction, classification of metals: ferrous and non-ferrous. Composition, properties, applications of iron alloys - cast iron and steel, aluminium alloys-duralumin and magnalumin. Corrosion: Introduction, electrochemical corrosion of steel in concrete, types-differential metal corrosion and differential aeration corrosion. Corrosion control by galvanization and anodization.			

Metal finishing: Introduction, technological importance of metal finishing, electroplating- electroplating of chromium-decorative and hard coating, electroless plating-electroless plating of copper.

Self-learning: Weathering steel in bridges.

Module-3: Sustainable Construction and Smart Materials (8hr)

Cement: Introduction, composition, properties, classification, manufacturing process of cement, process of setting and hardening of cement, additives for cement and testing of cement.

Geopolymer concrete: Introduction, manufacturing process of geopolymer concrete and mechanism of geo-polymerization.

Piezoelectric cement composites: Introduction, composition, properties and its applications in civil engineering.

Self-learning: Chemistry of reinforced concrete from various sources of water (seawater, groundwater, treated water).

Module-4: Advanced Materials for Engineering Applications (8hr)

Polymer: Introduction, methods of polymerization, synthesis, properties and engineering applications of polymethylmethacrylate (PMMA) and chloropolyvinyl chloride (CPVC).

Fibers: Introduction, synthesis, properties and applications of kevlar fibers.

Polymer composites: Preparation, properties, and commercial applications of carbon reinforced composites.

Biodegradable polymers: Introduction, synthesis, properties and applications of polylactic acid (PLA).

Nanomaterials: Introduction, size dependent properties, synthesis of nanomaterial by sol-gel method with example- nano-titanium dioxide.

Self-learning: Preparation, properties, and commercial applications of carbon fiber.

Module-5: Environmental Chemistry and Industrial Analysis (8hr)

Water technology: Introduction, water quality parameters and their significance, determination of temporary, permanent and total hardness by EDTA method, determination of dissolved oxygen by Winkler's method, determination of chemical oxygen demand (COD), numerical problems.

Analytical Techniques: Introduction, potentiometric sensor-principle, instrumentation and its application in the determination of iron. Conductometric sensor-principle, instrumentation and its application in the determination of strong acids

. Colorimetric sensor- principle, instrumentation and estimation of copper.

Self-learning: Sewage treatment (Primary, secondary and tertiary)

TEXTBOOKS:

1. Engineering Chemistry, Satya prakash & Manisha Agrawal, Khanna Book Publishing, Delhi
2. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co.(P)Ltd.
3. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition.
4. Applied Chemistry, Sunita Rattan, Kataria
5. Engineering Chemistry, Baskar, Wiley
5. Chemistry for Environmental Engineering and Science - by Clair Sawyer , Perry Mccarty , Gene Parkin.
6. Industrial chemistry by B K Sharma-GOEL Publishing House, ISBN 8187224002,2000

REFERENCE BOOKS:

1. A Text Book of Engineering Chemistry, R.V.Gadag and Nityananda Shetty, I.K.International Publishing house. 2nd Edition, 2016.
2. "Engineering Chemistry", O.G.Palanna, Tata Mc Graw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
3. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022

VIDEO LINKS:

1. <https://youtu.be/cw6h9bLqXbc?si=9RqZtUvNN2J6tPjs>
2. <https://youtu.be/2y1ck4XagvU?si=3OPmmw3AGKZYTINg>
3. <https://www.youtube.com/watch?v=iEr-K7zLvUM&t=26s>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Deliver concepts related to water chemistry, cementitious materials, corrosion, composites, and environmental chemistry through structured lectures.
2	Demonstration and Laboratory Learning	Conduct experiments on water quality analysis, cement setting tests, corrosion studies, and material characterization.
3	Video/Animation Aids	Use animations to explain nanomaterials, phase behavior, concrete chemistry, and smart construction materials.
4	Collaborative and Peer Learning	Encourage group discussions and peer teaching on sustainable materials and environmental management.
5	Case-Based and Real-World Application	Present case studies on infrastructure failures due to corrosion, sustainable construction materials, and water treatment systems.
6	Flipped Classroom Approach	Share pre-class materials on phase diagrams, advanced materials, and environmental monitoring followed by classroom discussions.
7	Field-Based Learning	Encourage industrial visits and surveys related to water treatment plants, construction materials industries, and waste management facilities.

4. Assessment Details**Continuous Internal Evaluation (CIE)**

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice.
3. The questions from Module 2 and 3 will not have any choice.
4. Each of the question will have a maximum of two sub questions.
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks.

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BCHEC102/202.1	Explain the structure, properties, and applications of advanced engineering materials including polymers, composites, nanomaterials, cementitious materials, and smart construction materials.
M26BCHEC102/202.2	Apply electrochemical principles to analyze batteries, fuel cells, photovoltaic systems, corrosion mechanisms, and suitable corrosion control techniques.
M26BCHEC102/202.3	Evaluate water quality parameters and analytical techniques for environmental monitoring and sustainable resource management.
M26BCHEC102/202.4	Analyze sustainable materials and green technologies for environmentally responsible civil engineering applications.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M25BCHEC102/202.1	3	2	-	-	2	-	-	-	-	-	-
M25BCHEC102/202.2	3	3	-	2	2	-	2	-	-	-	-
M25BCHEC102/202.3	2	3		2	2	2	3	-	-	-	-
M25BCHEC102/202.4	2	2	2		-	2	3	2	-	-	2
M25BCHEC102/202	2.5	2.5	2	2	2	2	2.67	2	-	-	2

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 3: Good Health and Well-Being	Water quality assessment, pollution monitoring, and environmental analysis contribute to public health and well-being.
2	SDG 6: Clean Water and Sanitation	Determination of hardness, dissolved oxygen, COD, and wastewater treatment supports sustainable water management.
3	SDG 7: Affordable and Clean Energy	Study of lithium-ion batteries, photovoltaic cells, fuel cells, and green hydrogen promotes clean energy technologies.
4	SDG 9: Industry, Innovation and Infrastructure	Advanced materials, nanomaterials, composites, smart materials, and corrosion control contribute to sustainable infrastructure development.
5	SDG 11: Sustainable Cities and Communities	Durable construction materials and environmentally friendly technologies support resilient and sustainable urban infrastructure.
6	SDG 12: Responsible Consumption and Production	Biodegradable polymers, green materials, and sustainable resource utilization encourage responsible consumption practices.
7	SDG 13: Climate Action	Green hydrogen production, renewable energy systems, and sustainable construction materials help mitigate climate change impacts.

1st / 2nd Semester	Engineering Science Course (ES) COMPUTER AIDED ENGINEERING DRAWING-CV STREAM	M26BCEDK103/ 203
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic Geometry and Mathematics	Understanding of geometric shapes, Cartesian coordinate system, algebra, and trigonometry.
2	Fundamentals of Engineering Concepts	Familiarity with engineering terminology and the purpose of engineering drawings.
3	Introduction to Technical Drawing	Awareness of different types of technical drawings and projection methods. Proficiency in free-hand sketching and using drawing instruments.
4	Computer Literacy	Basic knowledge of computer operations and software usage.
5	Visualization Skills	Ability to visualize 3D objects and their 2D representations.
6	Attention to Detail	Precision in creating accurate drawings and following technical standards. Capability to interpret technical drawings and solve related problems.
7	Communication and Learning Abilities	Effective communication of technical information, time management, and adaptability to new tools and techniques.

2. Syllabus

Computer Aided Engineering Drawing			
Course Code	M26BCEDK103/203	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:0:32:20:00 = 84 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
1. To understand fundamentals and conventions to grasp the significance of engineering drawing, BIS conventions, and scales for accurate representation 2. To familiarize with CAD software, coordinate systems, and reference planes for creating precise drawings in 2D and 3D environments. 3. To develop proficiency in using CAD commands and techniques to create various geometric entities and perform essential operations. 4. To understand orthographic projections for points, lines, planes, and solids, and master isometric projection techniques and conversion methods. 5. To apply learned concepts and skills in diverse engineering scenarios, including drawing views in 3D environments, lateral surface development, and creating diagrams and charts.			
Module -1			
Introduction: for CIE only			
Significance of Engineering drawing, BIS Conventions of Engineering Drawing, Free hand sketching of engineering drawing, Scales. Introduction to Computer Aided Drafting software, Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet and curves.			
Orthographic Projections of Points, Lines and Planes:			
Introduction to Orthographic projections: Orthographic projections of points in 1 st and 3 rd			

quadrants. Orthographic projections of lines (Placed in First quadrant only). Orthographic projections of planes viz triangle, square, rectangle, pentagon, hexagon, and circular laminae (Placed in First quadrant only using change of position method). Application on projections of Lines & Planes (For CIE only)
Module -2
Orthographic Projection of Solids: Orthographic projection of right regular solids (Solids Resting on HP only): Prisms & Pyramids (square, pentagon, hexagon), Cylinders, Cones, Cubes & Tetrahedron. Projections of Frustum of cone and pyramids (For practice only, not for CIE and SEE).
Module -3
Isometric Projections: Isometric scale, Isometric projection of hexahedron (cube), right regular prisms, pyramids, cylinders, cones and spheres. Isometric projection of combination of two simple solids. Conversion of simple isometric drawings into orthographic views. Problems on applications of Isometric projections of simple objects / engineering components. Introduction to drawing views using 3D environment (For CIE only).
Module -4
Development of Lateral Surfaces of Solids: Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones resting with base on HP only. Development of lateral surfaces of their frustums and truncations. Problems on applications of development of lateral surfaces like funnels and trays. Problems on applications of development of lateral surfaces of transition pieces connecting circular duct and rectangular duct (For CIE Only)
Module-5
Introduction to Building Plan Layout (For CIE Only): 2D drafting of a simple residential building: Plan, Elevation, and Section. Introduction to symbols in Civil drawings: doors, windows, walls, stairs. Site layout plan and foundation layout basics (simple representation)
Text Books 1. Bhatt, N.D., Engineering Drawing: Plane and Solid Geometry, 53rd edition, Charotar Publishing House Pvt. Limited, 2019. 2. K. R. Gopalakrishna, & Sudhir Gopalakrishna: Textbook Of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017 Reference Books 1. Bhattacharya S. K., Electrical Engineering Drawing, New Age International publishers, second edition 1998, reprint 2005. 2. S.N. Lal, & T Madhusudhan:, Engineering Visualisation, 1st Edition, Cengage, Publication 3. Parthasarathy N. S., Vela Murali, Engineering Drawing, Oxford University Press, 2015.

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Chalk and Talk method	The drawing views are explained using chalk and talk method
2	Videos Demonstration and Simulations	The assembly drawings are explained with the help of videos and simulations.
3	Use of Charts	The use of charts enables better visualization to students.
4	Software	Assign modeling and drafting tasks to reinforce practical skills associated with competencies.

4. Assessment Details (both CIE and SEE)

The weight-age of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

The CIE marks for CAED course offered in the 1st year shall be assessed as follows:

1. The CIE marks awarded in the case of Drawing shall be based on Weekly evaluation of the classwork (sketching and computer display/printouts) with each drawing evaluated as mentioned module wise in the syllabus. The marks of all the drawing sheets are added and scaled do to 30marks
2. One class test similar to SEE will be conducted after completion of the syllabus for 100 marks and scaled down to 20Marks.
3. CIE marks (out of 50) scored by the student is the sum of classwork evaluation and test marks.
4. CIE component should comprise of Continuous evaluation of drawing work of students as and when the Modules are covered based on below detailed weightage.

Module	Max Marks Weightage	Evaluation weightage in marks	
		Computer Display & print out	Preparatory Sketching
Module – 1	20	15	05
Module – 2	25	20	05
Module – 3	20	15	05
Module – 4	20	15	05
Module-5	15	10	05
TOTAL	100	75	25
Consideration of Class work		100 Marks is scaled down to 25 marks	

5. At least one Test covering all the modules is to be conducted for 100 marks and evaluation to be based SEE pattern, and the same is to be scaled down to 25Marks
6. The final CIE = Class work marks + Test marks

Semester End Examination (SEE): SEE marks for the practical course is 50 Marks.

- The duration of SEE is 03 hours. Questions shall be set worth of 3 hours
- SEE shall be conducted jointly by the two examiners appointed by the COE.
- SEE shall be conducted and evaluated for maximum of 100 marks. Marks obtained shall be accounted for SEE final marks, reducing it to 50 marks.
- Two questions from each Modules to be set as per the below table weightage details. The student has to answer one from each module.
- Question paper for each batch of students has to be set before the commencement of Examination of each batch. The answer sheets will have to be jointly evaluated by the two examiners.
- Two questions to be set from each Module
- Student has to answer one question each from Module
- *However, the student may be awarded full marks, if he/she completes solution on computer display without sketch.*

Module	Max Marks Weightage	Evaluation weightage in marks	
		Computer Display & print out	Preparatory Sketching
Module-1	20	15	05
Module-2	30	25	05
Module-3	25	20	05
Module-4	25	20	05
TOTAL	100	80	20

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BCEDK103/203.1	Ability to apply orthographic projection principles to represent points and lines in various quadrants.
M26BCEDK103/203.2	Apply orthographic projection principles to represent regular plane surfaces for different resting positions and orientation within the first quadrant.
M26BCEDK103/203.3	Proficiently apply orthographic projection techniques to represent right regular solids resting on HP.
M26BCEDK103/203.4	Apply isometric scale and projection techniques to visualize and represent various solids facilitating a comprehensive understanding of engineering drawings
M26BCEDK103/203.5	Analyze and create lateral surfaces for solids resting on HP

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BCEDK103/203.1	3	-	-	-	-	-	-	-	-	-	-
M26BCEDK103/203.2	-	3	-	-	-	-	-	-	-	-	-
M26BCEDK103/203.3	-	-	3	-	-	-	-	-	-	-	-
M26BCEDK103/203.4	-	-	-	3	-	-	-	-	-	-	-
M26BCEDK103/203.5	-	-	-	-	2	-	-	-	-	-	-
M26BCEDK103/203	3	3	3	3	2	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Quality Education by providing essential technical and digital skills in engineering drawing and CAD. It promotes inclusive, skill-based learning aligned with modern industry and lifelong learning goals.
2	SDG 9: Industry, Innovation, and Infrastructure	By building foundational skills in technical drawing and CAD, essential for modern engineering design and manufacturing. It fosters innovation and contributes to sustainable industrial development through accurate visualization and digital drafting tools.
3	SDG 12: Responsible Consumption and Production	By teaching precise design and drafting techniques that reduce material wastage and support efficient manufacturing. It encourages sustainable design practices through accurate development of surfaces and optimized use of resources in engineering production.

1st /2nd Semester	Engineering Science Course (ES) INTRODUCTION TO CIVIL ENGINEERING	M26BESK104A/ 204A
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic Science and Mathematics	Knowledge of basic physics (mechanics, forces) and mathematics (algebra, geometry).
2	Environmental Awareness	Basic knowledge of pollution, sanitation, and sustainable issues.
3	Engineering Drawing and Visualization	Knowledge of sketches, visualization of shapes, sections and projections of buildings.
4	Logical Reasoning and Spatial Ability	Skill to understand space, balance, and visualize structures and forces.

2. Syllabus

Introduction to Civil Engineering SEMESTER – I/II			
Course Code		CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	2:2:0: 20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
5. Explore Civil Engineering scope, materials, and building components aligned with Sustainable Development Goals.			
6. Apply fundamental concepts of force systems, equilibrium, and free-body diagrams in basic structural analysis.			
7. Calculate and locate centroid of simple and built-up sections for structural applications.			
8. Calculate moment of inertia of simple and built-up sections for structural applications.			
Module -1			
Introduction: Surveying, Structural Engineering, Geotechnical Engineering, Hydraulics and Water Resources Engineering, Transportation Engineering, Environmental Engineering.			
Basic Materials of Construction: Bricks, cement, steel, concrete and mortar.			
Building components: substructure and super-structure components.			
Introduction to sustainable development goals.			
Infrastructure: types of infrastructure			
Activity: Identification and classification of common building materials, structural components, and Civil Engineering disciplines through observation and group discussion.			
Module -2			
Concurrent force systems: Concept of idealization, system of forces, Resolution and composition of forces, Law of Parallelogram of forces, principle of transmissibility, Resultant of concurrent force systems, free body diagram, types of forces, Lami's theorem, equations of equilibrium.			
Force Board Activity: Experimental determination of the resultant and equilibrium of concurrent force systems using a force board or graphical vector method			
Module -3			
Non-concurrent force systems: Resultant of non-concurrent coplanar force systems, moment of forces, couple, Varignon's theorem, types of loads and supports, equilibrium of non-concurrent coplanar force systems.			
Moment Balance Activity: Verification of the principle of moments and equilibrium of non-concurrent force systems using a simple balance setup			
Module - 4			
Centroid: Introduction, centre of gravity, centroid, axis of symmetry, locating the centroid of plane lamina and composite figures from first principles and Numerical examples.			
Paper Cut-Out Activity: Experimental determination of the centroid of plane lamina using the suspension (plumb line) method and comparison with analytical results.			

Module -5

Moment of inertia: Introduction, method of determining the second moment of area of plane sections from first principles, parallel axis and perpendicular axis theorem, radius of gyration, polar moment of inertia, moment of inertia of built-up sections and numerical examples.

Section Comparison Activity: Comparative study of the bending behaviour of different cross-sections to demonstrate the influence of moment of inertia on structural stiffness.

TEXTBOOKS

3. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, 2015, Laxmi Publications.
4. Kolhapure B K, Elements of Civil Engineering and Engineering Mechanics, 2014, EBPB

REFERENCE BOOKS

1. Beer F.P. and Johnston E. R., *Mechanics for Engineers, Statics and Dynamics*, 1987, McGraw Hill.
2. Irving H. Shames, *Engineering Mechanics*, 2019, Prentice-Hall.
3. Timoshenko S, Young D. H., Rao J. V., *Engineering Mechanics*, 5th Edition, 2017, Pearson Press.

VIDEO LINKS

1. <https://www.youtube.com/watch?v=nGfVTNfNwnk&list=PLOSwwFV98rfKXq2KBphJz95rao7q8PpwT>
2. <https://www.youtube.com/watch?v=3YBXteL-qY4>
3. https://www.youtube.com/watch?v=atoP5_DeTPE
4. <https://www.youtube.com/watch?v=ksmsp9OzAsI>
5. <https://www.youtube.com/watch?v=x1ef048b3CE>
6. https://www.youtube.com/watch?v=l_Nck-X49qc
7. https://play.google.com/store/apps/details?id=appinventor.ai_jgarc322.Resultant_Force
8. <https://www.youtube.com/watch?v=RIbceW1DSZg>
9. <https://www.youtube.com/watch?v=R8wKV0UQtlo>
10. https://www.youtube.com/watch?v=0RZHHgL8m_A
11. <https://www.youtube.com/watch?v=Bl5KKnQOWkY>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Interactive Lectures	Use multimedia presentations, models, and physical samples to explain building materials and structural components.
2	Field Visits	Organize visits to construction sites, water treatment plants, and urban infrastructure projects.
3	Group Activities	Facilitate collaborative work on smart city models and environmental impact discussions.
4	Problem Solving Sessions	Introduce conceptual and numerical problem-solving on centroid, force systems, and moment of inertia.
5	ICT Tools and Videos	Use NPTEL lectures, animations and simulations to demonstrate real-time force analysis and building science.
6	Seminars and Presentations	Assign students short presentations on infrastructure, smart cities, and sustainable practices.

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE)**

Components	Number	Weightage	Max. Marks	Min Marks
1 Internal Assessment - Tests (A)	3	60%	30	12
2 Alternate Assessment (B)	2	40%	20	8
Total Marks			50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Self-Learning (SL): the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20 marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice.
3. The questions from Module 2 and 3 will not have any choice.
4. Each of the question will have a maximum of two sub questions.
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks.

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BESK104A.1	Apply knowledge of Civil Engineering disciplines, materials, structural elements, and infrastructure for sustainable development practices.
M26BESK104A.2	Assess the resultant and equilibrium of force systems on the rigid bodies.
M26BESK104A.3	Determine and locate the centroid of plane and built-up sections.
M26BESK104A.4	Determine the moment of inertia of plane and built-up sections.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BESK104A.1	3	-	-	-	-	2	3	-	-	-	2
M26BESK104A.2	3	3	-	2	2	-	-	-	-	-	2
M26BESK104A.3	3	3	-	2	-	-	-	-	-	-	2
M26BESK104A.4	3	3	-	2	-	-	-	-	-	-	2
M65BESK104	3	3	-	2	2	2	3	-	-	-	2

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 9: Industry, Innovation and Infrastructure	Students explore fundamental infrastructure design concepts promoting innovation and resilient development.
2	SDG 11: Sustainable Cities and Communities	Incorporates clean city, smart city, and solid waste management topics to improve urban livability.
3	SDG 13: Climate Action	Introduces environment-friendly practices in construction and energy- efficient buildings.

1st/2nd Semester	Engineering Science Course (ES) INTRODUCTION TO ELECTRICAL ENGINEERING	M26BESK104B/ 204B
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic concepts of Circuit Elements	Basic understanding of active and passive elements of a circuit. Familiarity with fundamentals of discrete elements such as resistors, capacitors and inductors.
2	Electrical Circuits	Understanding of voltage, current and their characteristic behavior in electrical circuits and relevant laws.
3	Fundamentals of electromagnetic induction	Faraday's laws of electromagnetic induction, Lenz's law and Fleming's left- and right-hand rule.
4	Basic knowledge of measuring instruments.	Knowledge of measuring instruments such as ammeter, voltmeter and multimeter etc.

2. Syllabus

INTRODUCTION TO ELECTRICAL ENGINEERING SEMESTER – I/II			
Course Code	M26BESK104B/204B	CIE Marks	50
Total Number of Teaching-Learning Hours/sem(L:T:P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
6. To explain electric power generation, transmission and distribution 7. To explain the laws used in the analysis of DC and AC circuits. 8. To explain the behaviour of circuit elements in single-phase AC circuits. 9. To explain the construction and operation of Transformers, AC generators, DC motors and Induction motors. 10. To introduce concepts of circuit protecting devices, earthing and electricity billing			
Module -1: Electrical Energy Sources & DC circuits			
Introduction to electrical energy sources, Single line diagram approach. Brief introduction to the electrical generation using Thermal, Solar, Hydro, Wind using Block diagram approach. DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series – parallel circuits excited by independent voltage sources. Power and energy, Illustrative examples			
Module -2: Single phase and Three phase AC circuit			
A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, Derivations of average value, RMS value, form factor, peak factor. Voltage and current relationship with phasor diagrams in R, L, and C circuits. Concept of Impedance. Analysis of R-L, R-C, R-L-C Series circuits. Active power, reactive power and apparent power. Concept of power factor and Numerical. Three Phase Circuits: Advantages and limitations; star and delta connection, relationship between line and phase quantities excluding derivation.			
Module -3: Transformers & Three phase synchronous generators			
Transformers: Necessity of transformer, principle of operation, Types and construction of single-phase transformers, EMF equation, losses, variation of losses with respect to load. Efficiency and numerical. Three-phase synchronous generators: Principle of operation and constructional details of salient and non-salient pole generators, synchronous speed, frequency of generated voltage, emf equation, with the concept of winding factor excluding the derivation and calculation of winding factors and numerical.			
Module -4: Motors			

Three-phase induction Motors: Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and slip ring. Slip, its significance and numerical.

DC Motor: Principle of operation, back emf and its significance. Torque equation, types of motors, characteristics and Simple numerical.

Module -5: Domestic Wiring & Electrical Safety

Domestic Wiring: Requirements, Types of wiring: casing, capping. Two way and three way control of load.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, laptops, printers, etc. Definition of “unit” used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits.

Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock

TEXTBOOKS:

10. Fundamentals of Electrical Engineering & Electronics by B L Theraja, S. Chand and Company Pvt. Ltd. Reprint edition, 2022
11. Basic Electrical Engineering D. C. Kulshreshtha McGraw-Hill Education 1st edition, 2019

REFERENCE BOOKS:

1. Electrical Technology E Hughes Pearson International Students 9th edition
2. Principles of Electrical Engineering & Electronics V K Mehta and Rohit Mehta S. Chand and Company Pvt. Ltd.

VIDEO LINKS:

1. <https://youtu.be/OC8Lbyeyh-E>
2. <https://youtu.be/5CHufqAF-p0>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of generation of electrical energy.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	Laboratory Learning	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing few experiments.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE)

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment-Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Self-Learning (SL): If applicable, the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination (SEE) For Theory Course with 3 or 4 credits

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BESK104B.1	Understand the concepts of hydro, thermal, solar & wind energy sources and Electric circuits.
M26BESK104B.2	Apply Ohm's law and Kirchhoff's laws to solve DC & AC circuits
M26BESK104B.3	Illustrate the construction and working principles of DC & AC Machines
M26BESK104B.4	Describe the types of wiring, tariff and safety measures in an electrical system.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BESK104B.1	3	3	-	-	-	-	-	-	-	-	-
M26BESK104B.2	3	3	-	-	-	-	-	-	-	-	-
M26BESK104B.3	3	3	-	-	-	-	-	-	-	-	-
M26BESK104B.4	-	-	-	-	-	3	-	-	-	-	-
M26BESK104B	3	3	-	-	-	3	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 7: Affordable and Clean Energy	Electrical engineers are crucial in designing, installing, and maintaining systems for solar, wind, hydro, and geothermal power. This involves understanding circuits, power electronics, energy conversion, and grid integration.
2	SDG 9: Industry, Innovation, and Infrastructure	Applying basic electrical engineering principles leads to the development of energy-efficient industrial processes, automation, and control systems that reduce resource consumption and waste.
3	SDG 11: Sustainable Cities and Communities	Smart Cities: The development of smart cities heavily relies on electrical engineering for smart infrastructure, energy conservation, efficient waste management, and sustainable urban living. Sustainable Transportation: Electrical engineers are vital in the design and development of electric vehicles (EVs) and their charging infrastructure, reducing reliance on fossil fuels and improving air quality in urban areas.

1st / 2nd Semester	Engineering Science Course (ES) INTRODUCTION TO ELECTRONICS AND COMMUNICATION	M26BESK104C/ 204C
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic knowledge on Physics	A fundamental understanding of physics.
2	Basic knowledge on Mathematics	A fundamental understanding of mathematics.
3	Semiconductor Fundamentals	Basic knowledge of semiconductor physics and semiconductor devices is beneficial.
4	Basic knowledge of analog and digital signals	Elementary electronic components such as resistors, capacitors, inductors, diodes, and transistors.

2. Syllabus

INTRODUCTION TO ELECTRONICS AND COMMUNICATION SEMESTER – I/II			
Course Code	M26BESK104C/204C	CIE Marks	50
Total Number of Teaching-Learning Hours/sem(L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
1. To prepare students with fundamental knowledge/ overview in the field of Electronics and Communication Engineering. 2. To equip students with a basic foundation in electronic engineering required for comprehending the operation and application of electronic circuits, logic design, embedded systems, and communication systems. 3. Professionalism & Learning Environment: To inculcate in first-year engineering students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.			
Module -1			
Power Supplies – PN Junction Diode: Forward and Reverse Bias Characteristics, DC-powersupply Block diagram, Half-wave rectifier, Full-wave rectifiers, Voltage regulators, switch mode power supplies. Amplifiers – Basics of MOSFET: Construction, Symbol, Types (Enhancement and Depletion), Types of amplifiers, Gain, Input and output resistance, Negative feedback.			
Module -2			
Oscillators –Positive feedback, Ladder network oscillator, Wein bridge oscillator, Multivibrators, Single-stage astable oscillator. (Only Concepts, working, and waveforms. No mathematical derivations) Operational amplifiers –symbol and connections, Operational amplifier parameters, Operational amplifier characteristics, Operational amplifier configurations, Operational amplifier circuits.			
Module -3			
Boolean Algebra and Logic Circuits: Number Base Conversion, Complements, Binary subtraction using 1's and 2's, Basic Theorems and Properties of Boolean Algebra, Canonical and Standard Forms, Digital Logic Gates . Combinational logic: Introduction, Design procedure, Adders and Subtractors.			
Module -4			
Embedded Systems – Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, purpose of embedded system, Elements of an Embedded System, Microprocessor vs Microcontroller, RISC vs CISC.			

Sensors and Interfacing – Instrumentation and control systems, Transducers, Sensors, Actuators, LED, 7-Segment LED Display.
Module -5
Communication Schemes – Modern communication system scheme, Information source, and input transducer, Transmitter, Channel or Medium – Hardwired and Soft wired, Noise, Receiver, Multiplexing, Types of communication systems. Types of modulation (only concepts) , Concept of Radio wave propagation (Ground, space, sky) An Overview of Wireless Systems: Introduction, First- and Second-Generation Cellular Systems, Cellular Communications from 1G to 3G, Road Map for Higher Data Rate Capability in 3G, Wireless 4G Systems.
Text Books 1. Mike Tooley, 'Electronic Circuits, Fundamentals & Applications', 4th Edition, Elsevier, 2015. DOI https://doi.org/10.4324/9781315737980. eBook ISBN 9781315737980 2. Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2008 ISBN-978-81-203-0417-84. 3. K V Shibu, 'Introduction to Embedded Systems', 2nd Edition, McGraw Hill Education (India), Private Limited, 2016 4. S L Kakani and Priyanka Punglia, 'Communication Systems', New Age International Publisher, 2017. 5. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, Pearson Education, 2013. 6. Vijay K. Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers (Elsevier), 2nd Edition.

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of basic electronics concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies

4. Assessment Details (both CIE and SEE)
Continuous Internal Evaluation (CIE)

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment-Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

$$\text{Final CIE Marks} = (A) + (B)$$

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.

2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BESK104C/204C.1	Describe the working principles of PN junction diodes, DC power supplies, rectifiers, voltage regulators, switch mode power supplies, amplifier fundamentals, and MOSFET basics.
M26BESK104C/204C.2	Illustrate the principles of oscillators, operational amplifiers configurations used in basic electronic circuits.
M26BESK104C/204C.3	Apply number system concepts, Boolean algebra, and logic gates to implement logic circuits such as adders and subtractors.
M26BESK104C/204C.4	Discuss the fundamentals of communication systems, modulation concepts, radio wave propagation, and the development of wireless communication technologies from 1G to 4G.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BESK104C/204C.1	3	-	-	-	2	-	-	-	2	2	-
M26BESK104C/204C.2	3	3	-	-	2	-	-	-	2	2	-
M26BESK104C/204C.3	3	3	2	-	2	-	-	-	2	-	-
M26BESK104C/204C.4	3	2	-	-	-	-	-	-	-	-	-
M26BESK104C/204C	3	-	2	-	2	-	-	-	2	2	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Learning advanced electronics builds foundational engineering skills.
2	SDG 9: Industry, Innovation and Infrastructure	Embedded systems, communication technologies, amplifiers, digital logic.
3	SDG 11: Sustainable Cities and Communities	Sensors, automation, embedded applications in smart cities

1st/2nd Semester	Engineering Science Course (ES) INTRODUCTION TO MECHANICAL ENGINEERING	M26BESK104D/ 204D
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic understanding of Engineering disciplines	Familiarity with different engineering disciplines and their role in society, industry, and technological development.
2	Basic knowledge of Mathematics and Physics	Understanding of fundamental concepts such as force, motion, energy, power, heat, and simple calculations related to engineering systems.
3	Analytical Thinking Skills	Ability to observe, analyze, and solve simple engineering problems using logical reasoning.
4	Visualization Skills	Ability to interpret basic engineering diagrams, machine components, schematic representations, and manufacturing processes.
5	Interest in Engineering Systems and Emerging Technologies	Curiosity to understand the working principles of machines, manufacturing processes, automation, robotics, and future mobility technologies.

2. Syllabus

Introduction to Mechanical Engineering SEMESTER – I/II			
Course Code	M26BESK104D/204D	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
1. To develop basic knowledge of Mechanical Engineering, its role in industries, emerging technologies, and conventional and renewable energy sources. 2. To understand the concepts of different machine tool operations, industrial automation, and advanced manufacturing systems such as CNC machines and Additive Manufacturing (3D Printing). 3. To understand the working principles and applications of Internal Combustion (IC) engines and future mobility technologies including Electric, Hybrid, and Autonomous Vehicles. 4. To provide exposure to engineering materials, joining processes and their applications in manufacturing industries. 5. To acquire a basic understanding of mechatronics, robotics, and their role in industrial automation and modern manufacturing.			
Module -1			
Introduction: Role of Mechanical Engineering in Industries and Society. Emerging trends and technologies in Energy, Manufacturing, Automotive, Aerospace, and Marine sectors. Energy: Introduction and applications of conventional and renewable energy sources including Thermal, Hydel, Nuclear, Solar Photovoltaic (PV), and Wind Energy. Environmental issues such as Global Warming and Carbon Neutrality.			
Module -2			
Machine Tool Operations: Working principle of Lathe and operations such as Turning, Facing and Knurling. Working principle of Drilling Machine and operations including Drilling, Boring and Reaming. Working principle of Milling Machine and operations such as Plain Milling, End Milling and Slot Milling. (<i>No sketches of machine tools; sketches to be used only for explaining the operations</i>). Automation in Industry: Definition, types – Fixed, Programmable and Flexible Automation, basic elements with block diagrams, advantages and industrial applications.			
Module -3			

Introduction to IC Engines: Components and working principles, four-stroke Petrol and Diesel engines, applications of IC engines, and basic performance parameters of IC engines (**Simple numerical problems**).

Future Mobility: Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), components of electric and hybrid vehicles, advantages and limitations of EVs and Hybrid Vehicles, and an introduction to Autonomous Vehicles.

Module -4

Engineering Materials: Types, properties and applications of Ferrous and Non-Ferrous Metals, Ceramics, Glass, Polymers, Graphite, Diamond and Shape Memory Alloys.

Joining Processes: Soldering, Brazing and Welding, definitions, classification of welding processes, Arc Welding, Gas Welding and TIG Welding.

Module -5

Introduction to Mechatronics and Robotics: Open-loop and Closed-loop Mechatronic Systems. Robot Anatomy, Robot Configurations (Cartesian, Cylindrical, Polar and Articulated), applications, advantages and limitations of Industrial Robots.

Introduction to Advanced Manufacturing Systems: Introduction to CNC machines, components of CNC, advantages and applications of CNC, Introduction to Additive Manufacturing (3D Printing), and Introduction to Industry 4.0.

TEXTBOOKS:

1. K. R. Gopala Krishna, Elements of Mechanical Engineering, Subhash Publications, 35th Edition.
2. **R. K. Rajput**, *a Textbook of Elements of Mechanical Engineering*, **Laxmi Publications**, Fourth Edition.

REFERENCE BOOKS:

1. **Jonathan Wickert and Kemper Lewis**, *an Introduction to Mechanical Engineering*, **Cengage Learning**, Fourth Edition.
2. **P. N. Rao**, *Manufacturing Technology: Foundry, Forming and Welding*, **McGraw Hill Education**, Fifth Edition.

VIDEO LINKS:

1. https://www.nptel.ac.in/courses/112104526?utm_source=chatgpt.com
2. <https://mitlibraryblog.wordpress.com/mitm-videos/>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lectures & Presentations	Deliver core concepts and foundational knowledge. - Utilize multimedia (images, diagrams, and animations, videos) to enhance understanding.
2	Interactive Discussions & Q&A	Encourage active participation and clarification of doubts. Facilitate critical thinking and analysis of concepts through student-led discussions
3	Hands-on Activities	Provide laboratory or simulation-based activities to demonstrate real-world applications of mechanics or machine tools.
4	Case Studies	Present real-world engineering challenges and have students analyze potential solutions.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	Project-Based Learning	Encourage research and design thinking through project-based learning activities

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE) for Theory Course with 3 credits**

Components		Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
Total Marks				50	20

Final CIE Marks = (A) + (B)**A** = Average of best two Test marks**B** = Average of two Alternate Assessment marks

Self-Learning (SL): If applicable, the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination (SEE) For Theory Course with 3 or 4 credits

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BESK104D/204D.1	Interpret the working principles and applications of conventional and renewable energy sources, with environmental issues such as global warming and carbon neutrality.
M26BESK104D/204D.2	Analyse the working principles and functionalities of various machine tools, industrial automation systems, their control strategies, and industrial applications.
M26BESK104D/204D.3	Evaluate the construction and working principles of Internal Combustion (IC) engines, and the basic concepts, components, and applications of Electric, Hybrid, and Autonomous Vehicles.
M26BESK104D/204D.4	Interpret the properties of engineering materials for selection in engineering applications, and the working principles and applications of welding, brazing, and soldering.
M26BESK104D/204D.5	Analyse the basic concepts of mechatronic systems, robotic systems, CNC machines, Additive Manufacturing (3D Printing), and Industry 4.0 in modern manufacturing.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BESK104D/204D.1	3	-	-	-	-	-	-	-	-	-	-
M26BESK104D/204D.2	3	-	-	-	-	-	-	-	-	-	-
M26BESK104D/204D.3	-	3	-	-	-	-	-	-	-	-	-
M26BESK104D/204D.4	3	-	-	-	-	-	-	-	-	-	-
M26BESK104D/204D.5	3	-	-	-	-	-	-	-	-	-	-
M26BESK104D/204D	3	3	-	-	-	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 7: Affordable and Clean Energy	The course introduces conventional and renewable energy sources, environmental sustainability, and future mobility technologies such as Electric and Hybrid Vehicles, promoting awareness of clean energy solutions, energy efficiency, and sustainable transportation, thereby supporting SDG 7.
2	SDG 9: Industry, Innovation and Infrastructure	Topics such as machine tools, industrial automation, CNC machines, Additive Manufacturing (3D Printing), robotics, and Industry 4.0 foster innovation, enhance manufacturing productivity, and strengthen sustainable industrial infrastructure, contributing to SDG 9.
3	SDG 12: Responsible Consumption and Production	The study of engineering materials, joining processes, advanced manufacturing systems, and automation promotes efficient utilization of resources, sustainable manufacturing practices, waste reduction, and responsible production, aligning with SDG 12.

1st / 2nd Semester	Engineering Science Course (ES) INTRODUCTION TO C PROGRAMMING	M26BESK104E/ 204E
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic computer Skills	Understanding how to use a computer, Functionality of Computer and perform basic Programming.
2	Logical Thinking	Ability to think logically and analytically, which is crucial for understanding algorithms and problem-solving in programming.
3	Understanding of Algorithms	Understanding the logic behind different algorithms (e.g., sorting, searching) can improve the efficiency of the code and its role in solving problems efficiently.
4	Basic Modular Arithmetic	Basic Number Theory: Understanding of integers, Datatypes. Algebra: Proficiency in algebraic manipulations and understanding of congruence relations.
5	Problem-Solving Skills	Ability to break down complex problems into smaller, manageable parts and develop step-by-step solutions

2. Syllabus

INTRODUCTION TO C PROGRAMMING SEMESTER – I/II			
Course Code	M26BESK104E/204E	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
Credits	03	Total Marks	100
		Exam Hours	03
Course Objectives:			
1. To introduce the fundamentals of computers, algorithmic thinking, and structured problem solving. 2. To build strong foundations in C syntax, control structures, and modular programming. 3. To develop the ability to design solutions using arrays, pointers, structures, and files. 4. To cultivate debugging discipline and good programming practices from the very first semester.			
Module -1			
Introduction to computers: Definition, Characteristics of Computer, Stored Program Concept, Applications of Computers, Basic Organization of Computer. Computer memory and Processors: Memory Organization, memory Hierarchy, Sequential and random Access, cache memory, Primary Memory. Design efficient programs: Program design Tools: Algorithms, Flowcharts, Pseudo codes. Programming in C: Introduction to C, Structure of C Program, writing the First C Program, Introduction to C, Files used in a C program, C tokens, Character set in C, keywords, Identifiers, Basic Datatypes in C, variables, constants, Input/output statements in C. Textbook 1: Chapter 1.1,1.2, 1.3, 1.6,1.7 , 3.1-3.7 8.4, 9.1-9.4, 9.7-9.14			
Module -2			
Programming in C: Operators in C, Type conversion and typecasting. Decision control and Looping statements: Introduction to decision control, Conditional branching statements, iterative statements, nested loops, break and continue statements. Textbook 1: Chapter 9.15-9.16, 10.1-10.5			
Module -3			
Functions: Introduction, Using Functions, Function declaration, Function definition, Function call, return statement, passing parameters to functions, scope of variables, recursive functions. Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays (Traverse, Searching, Sorting). Textbook 1: Chapter 11.1-11.8, 11.10. Chapter 12.1-12.5			
Module -4			
Arrays: Two dimensional arrays, operations on two-dimensional arrays Strings: Introduction, string taxonomy, operations on strings, (length, uppercase, lowercase, concatenate, compare, reverse) Miscellaneous string and character functions. Textbook 1: Chapter 12.7-12.8 Chapter 13.1, 13.3-13.6,			

Module -5	
Pointers: Concepts, pointer Variable, Accessing Variables through pointers, pointer Declaration and Definition, Initialization Pointer Variables, Pointer and Functions, pointers to pointers, Compatibility. Structures and Unions: Introduction, defining a structure, declaring structure Variables, accessing structure members, structure initialization, copying and comparing structure variables, operation on individuals' members. Textbook 2: Chapter 11, Chapter 13	
Illustrative Mini Project Ideas (Students May Choose Other Relevant Topics)	
<i>Mini projects are to be executed in teams of 2-3 students over the last 3-4 weeks of the semester, with a project report and a live demonstration for evaluation.</i> Mini Project 1: Digital Voltmeter Simulator Simulate a set of voltage readings, classify them into safe/unsafe ranges using functions, and log the readings to a file. Mini Project 2: Ohm's Law Based Circuit Calculator Given any two of voltage, current, and resistance, compute the third for a series of readings stored in an array, and save results to a file. Mini Project 3 Smart Site Alert Simulator Simulate a set of sensor-style readings (e.g., vibration or crack width) in an array, flag any reading beyond a safe limit, and log alerts to a file. Mini Project 4 Concrete Mix Quantity Calculator Given the volume of concrete and mix ratio, use functions to compute the required quantities of cement, sand, and aggregate, and save the report to a file. Mini Project 5: Frequency Unit Converter Utility Build a utility that converts frequency values between Hz, kHz, and MHz using functions and macros, with results logged to a file.	
Textbooks: 1. Reema Thareja, Computer fundamentals and programming in c, Oxford University, Third edition, 2023 2. Behrouz Forozon, Richard Gilberg, A structured Programming Approach using C, 2nd edition Thomson Learning, 2003. Reference Books: 1. E. Balaguruswamy, Programming in ANSI C, 8th Edition, Tata McGraw-Hill. 2. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Pearson Publishers 2015. 3. Behrouz Forozon, Richard Gilberg, A structured Programming Approach using C, 2nd edition Thomson Learning, 2003. VIDEO LINKS: https://onlinecourses.nptel.ac.in/noc22_ce54/preview https://mitlibraryblog.wordpress.com/mitm-videos/ https://www.tutorialspoint.com/what-is-an-algorithm-and-flowchart-in-c-language https://www.tutorialspoint.com/cprogramming/c_data_types.htm https://www.tutorialspoint.com/cprogramming/c_operators.htm https://www.ccbp.in/blog/articles/decision-making-statements-in-c https://www.tutorialspoint.com/cprogramming/c_arrays.htm https://www.geeksforgeeks.org/variables-in-c/ https://www.w3schools.com/c/c_arrays.php https://www.programiz.com/c-programming/c-strings https://www.programiz.com/c-programming/c-pointers https://www.scaler.com/topics/c/structures-c/	

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of programming concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.

5	Programming Assignments	Assign programming tasks to reinforce practical skills associated with competencies.
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4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE) for Theory Course with 3 credits**

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks = (A) + (B)**A** = Average of best two Test marks**B** = Average of two Alternate Assessment marks**Semester End Examination (SEE) For Theory Course with 3 or 4 credits**

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BESK104E/204E.1	Apply the basic knowledge of computer hardware, functionalities of a computer to develop Simple C Programs.
M26BESK104/204E.2	Identify the appropriate operators, Branching and Looping constructs of C language to solve the real-world problem.
M26BESK104E/204E.3	Utilizing the Modularity of functions to implement arrays and strings to perform data Manipulation to inscribe the Application.
M26BESK104E/204E.4	Apply pointers, structures, unions in C programming to develop Application that efficiently manage, manipulate the data.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BESK104E/204E.1	3	-	-	-	-	-	-	-	-	-	-
M26BESK104E/204E.2	-	3	-	-	-	-	-	-	-	-	-
M26BESK104E/204E.3	-	3	3	-	-	-	-	-	-	-	-
M26BESK104E/204E.4	-	3	3	-	-	-	-	-	-	-	-
M26BESK104E/204E	3	3	3	-	-	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	The course builds critical computational and analytical thinking skills, empowering students with lifelong learning tools in computer science. Promotes technical education and employability
2	SDG 8: Decent Work and Economic Growth	By equipping students with key programming and problem-solving skills, the course enhances career opportunities in IT and software sectors, contributing to economic growth.

3	SDG 9: Industry, Innovation and Infrastructure	Programming using C form the backbone of modern technology and software infrastructure. The course fosters innovation and prepares students for building efficient, scalable digital systems
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1st/2nd Semester	Emerging Technology Course (ET) INTRODUCTION TO BIOMEDICAL INSTRUMENTATION	M26BETK105A/ 205A
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Mathematics	Understanding of basic arithmetic operations.
2	Basic Electronics	Understanding of semiconductor components and their applications.
3	Basic Electrical	Understanding of Alternating Current, Direct current and their appliances.
4	Computer Knowledge	Basic knowledge of computers, peripherals and its operating system

2. Syllabus

INTRODUCTION TO BIOMEDICAL INSTRUMENTATION SEMESTER – I/II			
Course Code	M26BETK105A/205A	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
1. To understand the fundamental principles of biomedical instrumentation and physiological signal generation. 2. To study the operation and application of biomedical sensors and transducers. 3. To analyze the functioning of diagnostic and monitoring instruments such as ECG, EEG, EMG, and BP monitors. 4. To apply basic signal conditioning methods to biomedical signals. 5. To evaluate safety standards, ethical practices, and regulations in biomedical instrumentation.			
Module -1			
Physiology, Sensory organs and transducers: Cell and its structure, Nervous system: Structure of nervous system, neurons, Cardiovascular system, respiratory system, Kidney, Basic components of a biomedical system Sensory organs: Structure and function of Eye, Ear mechanism of hearing Transducers: Transducer, types of transducers, Piezo-electric, Ultrasonic transducer.			
Module -2			
Electro-physiological Measuring devices: Electrodes, ECG, EEG, EMG, ERG (Block diagram approach and its typical waveforms), Dialysis of Kidney.			
Module -3			
Non-electrical Measuring devices: Measurement of blood pressure, Heart rate, Spirometer, pH of blood, finger-tip oximeter, PPG, ESR, GSR (Block diagram approach, typical waveforms and its measurements).			
Module -4			
Medical Imaging: Introduction to Radiographic and fluoroscopic techniques, X-rays, Computer Tomography, MRI, Ultrasonography, Endoscopy, Thermography, PET (working principle with merits and demerits).			
Module -5			
Assistive/therapeutic Equipment and Electrical safety: Pacemakers, Ventilators, Hearing Aids, Audio meters. Electrical safety: Electrical danger, physiological effect of current.			
TEXTBOOKS:			
1. 'Medical Instrumentation: Application and Design', John G. Webster, Amit J. Nimunkar · 2020 2. R.S. Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing CoLtd., 2003. 3. Leslie Cromwell, Fred J.Weibell, Erich A. Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI. https://kahedu.edu.in/naac/C-3/Additional%20documents/E-content/2651.pdf			
REFERENCE BOOKS:			

1. J. Webster, 'Medical Instrumentation', John Wiley & Sons, 2009.
2. L.A. Geddes and L.E. Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.

VIDEO LINKS:

1. https://onlinecourses.nptel.ac.in/noc25_bt49/preview
2. <https://www.coursera.org/learn/medical-image-processing>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Conceptual Lectures with Visual Aids	Deliver fundamental concepts using presentations, diagrams, animations, and videos for better understanding of physiological systems and instruments.
2	Case Studies and Clinical Application Examples	Analyze real-life medical instrumentation cases from hospitals or published studies.
3	Demonstrations of Medical Devices	Live demos or videos of devices like ECG, pulse oximeters, BP monitors to connect theory with practice.
4	Guest Lectures / Industry Interaction	Invite professionals from hospitals or biomedical industries for expert talks.
5	Quizzes, Group Discussions & Peer Teaching	Encourage active learning through formative assessments and collaborative discussion.
6	Conceptual Lectures with Visual Aids	Deliver fundamental concepts using presentations, diagrams, animations, and videos for better understanding of physiological systems and instruments.

4. Assessment Details (both CIE and SEE)
Continuous Internal Evaluation (CIE)

Components		Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment-Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
Total Marks				50	20

$$\text{Final CIE Marks} = (A) + (B)$$

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BETK105A/205A.1	Describe the basic structure and function of physiological systems relevant to biomedical instrumentation.
M26BETK105A/205A.2	Apply the principles and characteristics of sensors and transducers in biomedical instrumentation.

M26BETK105A/205A.3	Apply signal conditioning techniques for acquisition and processing of biomedical signals.
M26BETK105A/205A.4	Analyze the working of diagnostic and therapeutic devices such as ECG, EEG, EMG, and BP monitors.
M26BETK105A/205A.5	Evaluate safety standards, ethical practices, and emerging trends in biomedical instrumentation and healthcare technology.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BETK105A/205A.1	3	-	-	-	-	-	-	-	-	-	-
M26BETK105A/205A.2	-	3	-	-	-	-	-	-	-	-	-
M26BETK105A/205A.3	-	-	3	3	-	-	-	-	-	-	-
M26BETK105A/205A.4	-	-	-	3	-	-	-	-	-	-	-
M26BETK105A/205A.5	-	-	3	-	-	-	-	-	-	-	-
M26BET105A/205A	3	3	3	3	-	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 3: Good Health and Well-Being	Failure theories ensure mechanical safety , preventing accidents (SDG 3).
2	SDG 7: Affordable and Clean Energy	Understanding torsion and stability of columns is essential for energy transmission systems (e.g., turbine shafts in clean energy) and for the structural integrity of buildings and machinery, aligning with SDG 7
3	SDG 9: Industry, Innovation and Infrastructure,	Stress analysis ensures that buildings and components can handle real-world loads and environmental effects, which is crucial for developing resilient infrastructure (SDG 9)

1st / 2nd Semester	Emerging Technology Course (ET) INTRODUCTION TO EMBEDDED SYSTEMS	M26BETK105B/ 205B
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Physics Fundamentals	Apply fundamental concepts of physics related to electronic devices, semiconductor components, sensors, actuators, and physical principles involved in embedded system applications.
2	Digital Concepts	Demonstrate knowledge of digital electronics concepts including logic gates, digital circuits, memory organization, microcontrollers, and input/output interfaces used in embedded systems.
3	Mathematics	Apply mathematical concepts such as number systems, logical operations, calculations, and analytical methods required for understanding embedded system design, programming, and performance evaluation.
4	Computer Knowledge	Apply basic computer architecture, programming concepts, computer languages, and computational principles to understand microprocessors, microcontrollers, embedded software, and embedded system applications.

2. Syllabus

INTRODUCTION TO EMBEDDED SYSTEMS SEMESTER – I/II			
Course Code	M26BETK105B/205B	CIE Marks	50
Total Number of Teaching-Learning Hours/Sem(L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
1. To understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.			
2. To develop the hardware-software co-design and firmware design approaches.			
3. To provide an overview of various applications and domains of embedded systems			
Module -1			
Basics: Basics of Computer Architecture, Computer Languages, RISC and CISC Architectures.			
Introduction to Embedded Systems: Introduction, Application Domain of Embedded Systems, Desirable Features and General Characteristics, Model of an Embedded System, Microprocessor vs Microcontroller, Example of a Simple Embedded System, Figures of Merit for an Embedded System.			
Module -2			
Embedded systems - The hardware point of view: Microcontroller unit (MCU), a popular 8-bit MCU: General Purpose I/O (GPIO), Clock, Power on Reset, Brown Out Reset, Watchdog Timer, Real-time Clock (RTC), Memory.			
Module -3			
Embedded System Components: Sensors, Actuators, I/O subsystems: LED, 7-segment LED, Optocoupler, Stepper motor, Relay, Push Button Switch, Keyboard. Communication interfaces: onboard interface -I2C, SPI, UART, External interface- USB, Bluetooth, Wi-Fi, ZigBee, GPRS.			
Module -4			
Examples of Embedded Systems: Mobile Phone, Automotive Electronics, Radio Frequency Identification (RFID), Wireless Sensor Networks (WISNET).			
Module -5			
Examples of Embedded Systems: Robotics, Biomedical applications.			
Embedded System Design Concepts: Hardware Software Co- Design, Computational models in embedded systems.			
TEXT BOOKS:			
1. Das, Lyla B, “Embedded systems: An integrated approach” Pearson Education India, 2012			

2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.

REFERENCE BOOKS:

1. Raj Kamal, "Embedded system-architecture, design and programming" 2nd edition.

VIDEO LINKS:

1. <https://nptel.ac.in/courses/108102045>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of embedded system working or protocols or buses.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Higher Order Thinking (HOTS) Questions:	Pose HOTS questions to stimulate critical thinking related to each competency.
5	Problem-Based Learning (PBL)	Implement PBL to enhance analytical skills and practical application of competencies
6	Multiple Representations	Introduce topics in various representations to reinforce competencies
7	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
8	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate a deeper understanding of competencies
9	Student Role-Play Assignments	Assign any embedded components to give seminars associated with competencies.

4. Assessment Details (both CIE and SEE)
Continuous Internal Evaluation (CIE)

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment-Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks = (A) + (B)**A** = Average of best two Test marks**B** = Average of two Alternate Assessment marks

Self-Learning (SL): If applicable, the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BETK105B/205B.1	Describe the basic concepts and design attributes of embedded systems
M26BETK105B/205B.2	Describe the elements of an embedded system like core, sensors, actuators, memory and communication buses and protocols.
M26BETK105B/205B.3	Apply the modelling techniques for designing embedded system firmware.
M26BETK105B/205B.4	Analyze the applications of embedded systems in various domains.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BETK105B/205B.1	3	-	-	-	-	-	-	-	-	-	2
M26BETK105B/205B.2	3	-	-	-	-	-	-	-	-	-	2
M26BETK105B/205B.3	3	3	-	-	-	-	-	-	-	-	2
M26BETK105B/205B.4	3	-	2	-	-	-	-	-	-	-	2
M26BETK105B/205B	3	3	2	-	-	-	-	-	-	-	2

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality education	Focuses on design embedded systems and use of OS.
2	SDG 9: (Industry, Innovation, and Infrastructure)	Embedded systems form the backbone of modern industrial automation, IoT, and smart infrastructure. By learning system design, students contribute to advancements in robotics, automation, and efficient computing solutions.
3	SDG 11: (Sustainable Cities and Communities)	Students are exposed to embedded applications in smart cities, including sensor networks, real-time communication, and automation. These help in the development of smart transportation, environmental monitoring, and public safety systems.

1st/ 2nd Semester	Emerging Technology Course (ET) RENEWABLE SOURCES OF ENERGY	M26BETK205C
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1. Prerequisites

S/L	Proficiency	Prerequisites
1.	Basic Physics	- Understanding of energy, power, and force. - Knowledge of thermodynamics, particularly the laws of energy conservation and conversion.
2.	Basic Chemistry	- Understanding of chemical reactions and processes. - Understanding the materials and reactions involved in energy storage, bioenergy, and fuel cells.
3.	Basic Biology	Basics of plant biology and ecology for bioenergy.
4.	Environmental Science	Basic understanding of Ecology, Pollution & Environmental Impact and Sustainability.
5.	Conventional Sources	Basic knowledge of fossil fuels, coal, hydro & nuclear.

2. Syllabus

RENEWABLE SOURCES OF ENERGY SEMESTER – II			
Course Code	M26BETK205C	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course objectives: - To understand energy scenario, energy sources and their utilization. - To explore society's present needs and future energy demands. - To Study the principles of renewable energy conversion systems. - To exposed to energy conservation methods.			
Module -1			
Introduction: Energy source and its classification, India's production and reserves of commercial energy sources, India's Energy Needs, Energy Pricing in India, Energy Distribution between Developed and Developing Countries, worldwide renewable energy availability, renewable energy availability in India, Advantages & disadvantages of renewable energy, Introduction to Internet of energy (IOE) and its applications.			
Module -2			
Solar Energy: Fundamentals of Solar Radiation; Solar radiation Measurements- Pyrheliometer, Pyrometer, Sunshine Recorder. Solar Thermal Collectors: Flat Plate Collector and Concentrating Collectors, Solar distillation; Solar pond electric power plant. Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system. Case Study.			
Module -3			
Wind Energy: History and evolution of wind energy, availability of wind energy in India, wind velocity and power from wind; limitations of wind energy, energy available in the wind, Basic components of wind energy conversion system (WECS); lift and drag, Classification of WECS. Vertical axis- Savonius and Darrieus types. Case study. Biomass Energy: Introduction; Photosynthesis Process; Biomass Resources; Biomass conversion technologies, Anaerobic Digestion, Bio digester -fixed dome & Floating type; Urban waste to energy conversion. Case study			
Module -4			

Ocean Water Energy: Tides and waves as energy suppliers and their mechanics, Single & double basin system, OTEC - Open & Close cycle, Challenges and future directions in ocean energy , Case Study.

Geo Thermal Energy: Introduction, Types of Hydrothermal resources, Applications.

Module -5

AI based Renewable Energy Systems: Role of AI in achieving energy efficiency, Machine learning, deep learning, reinforcement learning, AI techniques and models in renewable energy, AI applications in renewable energy systems, Challenges and limitations of AI in renewable energy. **Role of AI in renewable energy systems,** Sector-wise use of AI: Solar, wind, and grid management, Challenges, opportunities, and future directions. Standards for AI in renewable energy.

Text Books:

1. Nonconventional Energy sources, G D Rai, Khanna Publication, Fourth Edition,
2. Energy Technology, S.Rao and Dr. B.B. Parulekar, Khanna Publication.
3. Solar energy, Subhas PSukhatme, TataMcGrawHill, 2ndEdition,1996.
4. Artificial Intelligence-based Renewable Energy Systems, Kashif Naseer Qureshi,

Reference Books:

- 1.Principles of Energy conversion, A. W. Culp Jr., McGraw Hill, 1996
- 2.Non-Convention EnergyResources, Shobh Nath Singh, Pearson, 2018

Links

1. <https://www.youtube.com/@mitmysore-mechanicalengine8107>
2. https://www.youtube.com/watch?v=mh51mAUexK4&list=PLwdnzlV3ogoXUifhvYB65ILJCZ74o_fAk

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of RES concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE)

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

$$\text{Final CIE Marks} = (A) + (B)$$

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Semester End Examination (SEE) For Theory Course with 3 or 4 credits

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.

2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BETK205C.1	Make use of the basic physics of energy conversion to identify the environmental aspects of renewable energy resources in comparison with various conventional energy systems, their prospects and limitations.
M26BETK205C.2	Interpret the principles of solar radiation and performance of solar thermal and photovoltaic systems for sustainable energy applications.
M26BETK205C.3	Illustrate the methods of energy conversion using the concept of wind energy and bio mass energy concepts.
M26BETK205C.4	Interpret the different energy generation technologies by identifying the key operating principles of ocean energy and geothermal energy.
M26BETK205C.5	Make use of AI techniques to improve the operation, monitoring, and management of renewable energy systems through suitable case studies.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BETK205C.1	3	-	-	-	-	-	-	-	-	-	-
M26BETK205C.2	3	-	-	-	-	-	-	-	-	-	-
M26BETK205C.3	3	-	-	-	-	-	-	-	-	-	-
M26BETK205C.4	3	-	-	-	-	-	-	-	-	-	-
M26BETK205C.5	3	-	-	-	-	-	-	-	-	-	-
M26BETK205C	3	-	-	-	-	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 7 - Affordable and Clean Energy	Primary SDG. Covers renewable energy technologies, energy efficiency, solar, wind, biomass, geothermal, and sustainable energy access.
2	SDG 11 - Sustainable Cities and Communities	Encourages the use of renewable energy in buildings, transportation, and urban energy systems.
3	SDG 12 - Responsible Consumption and Production	Focuses on efficient utilization of energy resources, conservation, and sustainable energy practices.

1st / 2nd Semester	Emerging Technology (ET) FUNDAMENTALS OF NANO SCIENCE AND NANOTECHNOLOGY	M26BETK105/ 205D
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1. Prerequisites

S/L	Proficiency	Prerequisites
1	Engineering principles	Basic understanding of engineering concepts like design, fabrication, and characterization can be helpful.
2	Basic Chemistry	Atomic Structure: Understanding atoms, molecules, and chemical bonds. Chemical Reactions: Knowledge of how substances interact and change. Organic Chemistry: Familiarity with carbon-based molecules, which are often used in nanotechnology.
3	Basic Physics	Classical Mechanics: Basics of motion, forces, and energy. Electromagnetism: Understanding electric and magnetic fields and their interactions with matter. Quantum Mechanics: Basic principles, as nanotechnology often deals with phenomena at the atomic and molecular levels.
4	Fundamentals of Material Science and Engineering	Solid State Physics: Crystal structures, defects in solids, and electronic properties of materials. Thermodynamics: Basic principles including energy, entropy, and the laws of thermodynamics. Material Properties: Mechanical, electrical, optical, and thermal properties of materials.

2. Syllabus

Fundamentals of Nano science and Nanotechnology SEMESTER – I/II			
Course Code	M26BETK205D	CIE Marks	50
Number of Lecture Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Total Marks	100
Credits	3	Exam Hours	03
Course objectives			
- To provide a comprehensive overview of synthesis and characterization of nanoparticles, nanocomposites and hierarchical materials with nanoscale features. - To provide the engineering students with necessary background for understanding various nanomaterials characterization techniques. - To develop an understanding of the basis of the choice of material for device applications. - To give an insight into complete systems where nanotechnology can be used to improve our everyday life. - To describe the historical development and the future potential of nanotechnology.			
Module -1			
Fundamentals of Nanomaterials and Synthesis			
Introduction to Nanotechnology: Introduction to Nanoscience and Nanotechnology, Historical development and future prospects of nanotechnology, Nanoscale dimensions and classification of nanomaterials, Size-dependent physical, chemical, optical and magnetic properties, Quantum confinement in 0D, 1D, 2D and 3D nanostructures, Surface energy and Surface-to-Volume ratio, Types of nanomaterials.			
Synthesis of Nanomaterials			
Bottom-Up Approaches: Sol-Gel Method, Hydrothermal and Solvothermal Synthesis, Chemical Vapor Deposition (CVD), Chemical Bath Deposition (CBD), SILAR Technique.			

Top-Down Approaches: High Energy Ball Milling, Physical Vapor Deposition (PVD), Magnetron Sputtering, Laser Ablation.
Module -2
Characterization Techniques for Nanomaterials Microscopy Techniques: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM), Scanning Tunneling Microscope (STM), Basic introduction to Field Emission SEM (FESEM). Structural and Optical Characterization: X-Ray Diffraction (XRD), Bragg's Law, Debye-Scherrer Equation and Numerical Problems, UV-Visible Spectroscopy and Optical Band Gap, Fourier Transform Infrared Spectroscopy (FTIR), Introduction to Raman Spectroscopy
Module -3
Carbon and Two-Dimensional Nanomaterials Carbon Nanomaterials: Graphene, Single-Walled Carbon Nanotubes (SWCNT), Multi-Walled Carbon Nanotubes (MWCNT), Fullerenes. Emerging Two-Dimensional Materials: Graphene Oxide (GO), Reduced Graphene Oxide (rGO), Transition Metal Dichalcogenides (MoS ₂ – Introduction). Properties and Applications: Electrical, Mechanical, Thermal, Optical Properties. Applications: Energy Storage, Flexible Electronics, Sensors, Biomedical Applications.
Module -4
Nanotechnology for Sustainable Energy Solar Energy: First, Second and Third Generation Solar Cells, Dye Sensitized Solar Cells (DSSC), Quantum Dot Sensitized Solar Cells (QDSSC), Introduction to Perovskite Solar Cells. Energy Storage: Lithium-ion Batteries, Sodium-ion Batteries (Introduction), Nanomaterials for Cathodes and Anodes, Solid Electrolytes and Battery Separators, Supercapacitors (Introduction). Fuel Cells: Types of Fuel Cells, Proton Exchange Membrane Fuel Cell (PEMFC), Hydrogen Storage Materials, Nanocatalysts for Fuel Cells.
Module -5
Applications of Nanotechnology and Recent Trends Applications of Nanotechnology: Nanomedicine and Drug Delivery, Nano Biotechnology and Biosensors, Nanoelectronics, Nanophotonics, Nano-enabled Agriculture, Water Purification using Nanomaterials, Environmental Remediation, Emerging Trends: Smart Nanomaterials, Nanorobotics (Introduction), Artificial Intelligence in Nanomaterial Design, Safety, Toxicity and Ethical Issues of Nanotechnology, Recent Advances and Industrial Applications of Nanotechnology.
Suggested Learning Resources: Books 1. Nano Materials – A.K. Bandyopadhyay/ New Age Publishers 2. Nanocrystals: Synthesis, Properties and Applications – C.N.R. Rao, P. John Thomas and G. U. Kulkarni, Springer Series in Materials Science 3. Nano Essentials- T. Pradeep/TMH 4. Peter J. F. Harris, Carbon nanotube science: synthesis, properties, and applications. Cambridge University Press, 2011 5. M.A. Shah, K.A. Shah, “Nanotechnology: The Science of Small”, Wiley India, ISBN 13: 9788126538683. Reference Books 1. Introduction to Nanotechnology, C. P. Poole and F. J. Owens, Wiley, 2003 2. Understanding Nanotechnology, Scientific American, 2002 3. Nanotechnology, M. Ratner and D. Ratner, Prentice Hall, 2003 4. Nanotechnology, M. Wildon, K. Kannagara, G. Smith, M. Simmons and B. Raguse, CRC Press Boca Raton, 2002.

3. Teaching-Learning Process Strategies

S/L	TLP Strategies:	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of nano materials concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Higher Order Thinking (HOTS) Questions:	Pose HOTS questions to stimulate critical thinking related to each competency.
5	Multiple Representations	Introduce topics in various representations to reinforce competencies
6	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE) for Theory Course with 3 credits**

Components		Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
Total Marks				50	20

Final CIE Marks = (A) + (B)**A** = Average of best two Test marks**B** = Average of two Alternate Assessment marks**Semester End Examination (SEE) For Theory Course with 3 or 4 credits**

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BETK205D.1	Make use of the fundamental concepts of nanotechnology to synthesize the nanoparticles by various techniques.
M26BETK205D.2	Illustrate the working of basic instruments used in characterization of nanoparticles.
M26BETK205D.3	Apply the concepts of nanotechnology in various engineering discipline.
M26BETK205D.4	Interpret the unique properties of carbon and its various allotropes like diamond, graphite and graphene.
M26BETK205D.5	Analyze the relationship between material properties at the nanoscale and their energy storage and conversion capabilities.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BETK205D.1	3	-	-	-	-	-	-	-	-	-	-
M26BETK205D.2	3	-	-	-	-	-	-	-	-	-	-
M26BETK205D.3	3	-	-	-	-	-	-	-	-	-	-
M26BETK205D.4	3	-	-	-	-	-	-	-	-	-	-

M26BETK205D.5	-	3	-	-	-	-	-	-	-	-	-
M26BETK205D	3	3	-	-	-	-	-	-	-	-	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 7: Affordable and Clean Energy	The course extensively covers nanotechnology applications in sustainable energy, including first, second, and third generation solar cells, dye-sensitized and quantum dot solar cells, perovskite solar cells, lithium-ion and sodium-ion batteries, supercapacitors, hydrogen storage materials, and fuel cell nanocatalysts. These topics directly contribute to improving clean energy generation, storage, and energy efficiency.
2	SDG 9: Industry, Innovation and Infrastructure	The course provides a strong foundation in the synthesis, characterization, and application of advanced nanomaterials using state-of-the-art techniques such as CVD, PVD, sputtering, SEM, TEM, XRD, and AFM. It promotes technological innovation in nanoelectronics, sensors, smart materials, nanophotonics, AI-assisted material design, and industrial nanotechnology, supporting sustainable industrialization and research-driven innovation.
3	SDG 6: Clean Water and Sanitation	The course includes nanomaterial-based water purification and environmental remediation technologies. Advanced nanomaterials such as graphene-based materials and nanocomposites are widely used for removing heavy metals, dyes, pathogens, and organic pollutants from water, contributing to improved access to clean and safe water.

1st / 2nd Semester	Emerging Technology Course (ET) GREEN BUILDINGS	M26BETK105/205E
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Mathematics.	Fundamentals of arithmetic and algebra calculations.
2	Physics.	Fundamentals of heat, light, and building physics.
3	Material Science.	Understanding how materials respond to external loads.
4	Construction Methods and Materials.	Knowledge of construction materials observed in day-to-day life.

2. Syllabus

GREEN BUILDINGS SEMESTER – II			
Course Code	M26BET105/205E	CIE Marks	50
Total Number of Teaching-Learning Hours/Sem (L: T: P:TW:SL)	2:2:0: 20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
- Understand the Definition, Concept & Objectives of the terms cost effective construction and green building. - Apply cost effective Technologies and Methods in Construction. - Understand the Problems due to Global Warming. - Understand green building ratings and sustainable design. - Understand the concept of utilization of solar energy and green composites.			
Module -1			
Introduction to the concept of cost-effective construction			
- Different types of materials, their availability, requirements/properties and application – Stones, Laterite Blocks, Burnt Bricks, Concrete Blocks, Stabilized Mud Blocks, Lime Pozzolana Cement, Fiber Reinforced Cement Components, Fiber Reinforced Polymer Composite, Bamboo. - Recycling of building materials – Bricks, Concrete, Steel, Plastics. - Environmental issues related to quarrying of building materials.			
Module -2			
Environment friendly and cost-effective Building Technologies			
- Alternates for wall construction - Flemish Bond, Rat Trap Bond, Cavity Wall. - Ferro Cement and Ferro Concrete constructions. - Different pre cast members - Wall and Roof Panels, Door and Window frames, Water tanks, Septic Tanks. - Alternate roofing systems - Filler Slab, Composite Beam and Panel Roof. - Pre-engineered and ready to use building elements. - Contributions of agencies - Cost ford, Nirmithi Kendra, Habitat			
Module -3			
Global Warming			
- Definition, Causes and Effect, Contribution of Buildings towards Global Warming, - Carbon Footprint – Global Efforts to reduce carbon Emissions. - Green Buildings – Definition, Features, Necessity, Environmental benefit, Economical benefits, Health and Social benefits, Major Energy efficient areas for buildings. - Embodied Energy in Materials. - Comparison of cost of Green V/s Conventional Building. - Life cycle Assessment of Buildings.			
Module -4			

Green Building rating Systems – BREEAM, LEED, GREEN STAR, GRIHA (Green Rating for Integrated Habitat Assessment) and IGBC for new buildings – Purpose - Key highlights - Point System with Differential weight age.

Green Design – Definition, Principles of sustainable development in building design, Characteristics of Sustainable Buildings, sustainably managed Materials.

Module -5

Utility of Solar Energy in Buildings

Utility of Solar energy in buildings concepts - Passive Cooling and Heating of Buildings, Low Energy Cooling, Case studies of Solar Passive Cooled and Heated Buildings.

Green Composites for Buildings - Concepts of Green Composites,

Water Utilization in Buildings - Low Energy Approaches to Water Management, Management of Solid Wastes, Management of Sullage Water and Sewage.

Green Cover and Built Environment.

TEXTBOOKS

1. Harharalyer G, Green Building Fundamentals, Notion Press
2. Dr. Adv. Harshul Savla, Green Building: Principles & Practices. Notion press.

REFERENCE BOOKS

1. Jimmy C.M. Kao, Wen-Pei Sung, Ran Chen, Green Building, Materials and Civil Engineering, 1st edition, CRC Press.
2. Ross Spiegel, Dru Meadows, Green Building Materials: A Guide to Product Selection and Specification,
3. Sam Kubba, Handbook on green building design and construction, BH publications.

VIDEO LINKS:

1. <https://nptel.ac.in/courses/124106455>
2. <https://nptel.ac.in/courses/105102195>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of Verilog concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies.
6	Site Visits	Visting the sites to understand the concept of green building materials and technologies.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE)

Components	Number	Weightage	Max. Marks	Min Marks
1 Internal Assessment - Tests (A)	3	60%	30	12
2 Alternate Assessment (B)	2	40%	20	---
Total Marks			50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Self-Learning (SL): The teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must

collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs

Course Outcomes (COs)

COs	Description
M26BETK205E.1	Apply the knowledge of science to study environmental issues in building materials and environmentally friendly/alternative building materials and technologies for cost effective and energy efficient construction.
M26BETK205E.2	Illustrate the concept of global warming due to different materials and buildings in construction.
M26BETK205E.3	Exemplify the concept of green building rating systems used in buildings.
M26BETK205E.4	Illustrate the alternate source of energy and effective water & solid waste management used in buildings to meet sustainable environment.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BETK205E.1	3	-	-	-	-	2	-	-	-	-	-
M26BETK205E.2	3	-	-	-	-	2	-	-	-	-	-
M26BETK205E.3	3	2	-	-	-	2	-	-	-	-	-
M26BETK205E.4	3	-	-	-	-	2	-	-	-	-	2
M26BETK205E	3	2	-	-	-	2	-	-	-	-	2

6. Mapping to Sustainable Development Goals (SDG)

Sl. No.	SDG	Justification
1	SDG 3: Good Health and Well-being	Improves indoor air quality, reduces exposure to harmful materials, and promotes healthier living and working environments
2	SDG 6: Clean Water and Sanitation	They will learn about rainwater harvesting, greywater reuse, and better sanitation systems.
3	SDG 7: Affordable and Clean Energy	Focuses on energy efficiency and renewable integration (solar systems)
4	SDG 9: Industry, Innovation and Infrastructure,	By adapting these green technologies can ensure buildings and components can handle real-world loads and environmental effects, which is crucial for developing resilient infrastructure.
5	SDG 11: Sustainable Cities and Communities,	Supports urban resilience, resource-efficient neighbourhoods, and inclusive city planning.
6	SDG 12: Responsible Consumption and Production	The efficient use of materials and adoption of construction practices that minimize waste and environmental impact.
7	SDG 13: Climate Action	Promotes deep decarbonization, greenhouse gas reduction, and climate adaptation resilience
8	SDG 15: Life on Land	Supports biodiversity, ecosystem preservation, sustainable forestry, and green landscapes

1st / 2nd Semester	Emerging Technology Course (ET) SMART BUILDING SERVICES AND SUSTAINABLE SYSTEMS	M26BETK105/ 205F
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1. Prerequisites.

S/L	Proficiency	Prerequisites
1	Basic knowledge of science and mathematics	Studied in 10+2 level and implementation of the concepts through fundamentals
2	Familiarity with basic engineering drawing	The subject imparts ability to visualize spatial arrangements.
3	General awareness of buildings and infrastructure	Understanding of common utilities in homes/buildings.
4	Basic communication skills	Understand and interpret instructions, manuals, and maintenance records

2. Syllabus

SMART BUILDING SERVICES AND SUSTAINABLE SYSTEMS SEMESTER – I/II			
Course Code	M26BETK105/205F	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L: T: P:TW:SL)	2:2:0: 20:20 = 104 Hours	SEE Marks	50
		Total Marks	100
Credits	03	Exam Hours	03
Course Objectives:			
1. Learn the importance of sanitation, domestic water supply, and fire services.			
2. Understand the concepts of heat, ventilation and air conditioning.			
3. Develop technical and practical knowledge in Building Services.			
Module -1			
Water Supply Services for building:			
Basics of water supply for different building types, Simple water purification techniques, Water-saving methods and practices, Service connections: mains, sump, storage tanks, Simple layout plans for water supply systems in building.			
Plumbing services for building:			
Introduction to plumbing services, Basic plumbing, Types/sizes of pipes and pipe fittings and special setups for multi-storeyed buildings, Common materials, bathroom fixtures, and modern fittings (e.g., taps, mixers, showers)			
Module -2			
Heat Ventilation and Air Conditioning (HVAC):			
Basics of heat transfer and thermal insulating materials, Common methods of thermal insulation for roofs and walls.			
Ventilation: importance, types, and basic systems, Fundamentals of air conditioning and air cooling systems, Principles of Air conditioning, Types of ducting and air distribution methods, Essentials of air-conditioning system.			
Module -3			
Electrical Services for building:			
Basics of electricity and electrical supply (Single & Three-phase), Protective devices in buildings (fuse, MCB, RCCB, etc.), Electrical safety and types of earthing (pipe, plate, chemical), ISI standards and safety norms, Types of electrical wiring and cables used in buildings, Electrical layout planning for residential buildings, Components: Main board, distribution board, Basic principles of lighting and illumination.			
Fire Fighting services for building:			
Classification of buildings based on fire risk and occupancy, Common causes and spread of fire in buildings			
Fire protection systems: active and passive, Fire detection equipment: smoke detectors, heat sensors, alarms			
Fire suppression systems: sprinklers, extinguishers, hydrants, wet & dry risers, Escape route planning: fire stairs, doors, signage, fire safety provisions.			
Module -4			

Solar Energy Systems in Buildings:

Introduction to Solar Energy: Basics of solar radiation and photovoltaic (PV) principle, Solar potential in India, Solar Power Systems: Components of a rooftop solar system, Applications in Buildings: Rooftop solar electricity generation, Solar water heating systems, Solar streetlights and garden lighting, Solar-powered fans and pumps.

Rainwater Harvesting: Introduction to Rainwater Harvesting, Need and Importance of RWH in Modern Context, Basic Components of Rainwater Harvesting System, Types of Rainwater Harvesting Systems, Benefits of Rainwater Harvesting, Limitations and Challenges in Implementation.

Module -5**Engineering Services in Buildings:**

Introduction of Engineering Services, Vertical Transportation Systems: Lifts and escalators – types, safety norms, Cold and hot water supply systems, Electrical Systems: Overview of building wiring, power distribution, Heating Systems: Hot water boilers – types and usage.

Building Maintenance:

Introduction to Building Maintenance: Importance and scope, Types of Maintenance: Preventive: Regular inspections, servicing, Protective: Weatherproofing, anti-corrosion measures, Scheduled: Periodic maintenance routines, Contingency: Emergency repairs and breakdown response, Maintenance Planning: Planning tools and scheduling, Maintenance Information System (MIS), Maintenance Standards and Practices.

Text Books

1. Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
2. E. G. Butcher, Smoke control in Fire-safety Design.
3. Energy Conservation Building Code – 2017 (with amendments up to 2020), Bureau of Energy Efficiency.

Reference Books:

1. National Building Code.
2. O. H. Koenigsberger, “Manual of Tropical Housing and Building”, Longman Group United Kingdom.

3. Teaching-Learning Process Strategies

S/L	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Multiple Representations	Introduce topics in various representations to reinforce competencies
5	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
6	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE)**

	Components	Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
	Total Marks			50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Self-Learning (SL): If applicable, the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The

faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination (SEE)

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

Cos	Description
M26BETK205F.1	Demonstrate the understanding of basic engineering services in buildings including water supply, HVAC, electrical, and solar systems.
M26BETK205F.2	Apply sustainable solutions in buildings through the use of rainwater harvesting, solid waste management, and energy-saving methods.
M26BETK205F.3	Identify and interpret safety systems and maintenance strategies including firefighting systems, accessibility features, and building upkeep procedures.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BETK205F.1	3						2				2
M26BETK205F.2	3					2					
M26BETK205F.3		3									
M26BETK205F	3	3				2	2				2

6. Mapping to Sustainable Development Goals (SDG)

Sl. No.	SDG	Justification
1	SDG 3: Good Health and Well-being	HVAC, Fire safety, Ventilation, Building maintenanc
2	SDG 6: Clean Water and Sanitation	Water supply, Rainwater harvesting, Wastewater systems
3	SDG 7: Affordable and Clean Energy	Solar energy systems, Energy-efficient electrical layout
4	SDG 9: Industry, Innovation and Infrastructure	Engineering services in buildings, Lift systems, Automation in waste management
5	SDG 11: Sustainable Cities and Communities	Solid waste management, Fire safety, Accessibility, HVAC
6	SDG 12: Responsible Consumption and Production	Waste segregation, Composting, Energy-efficient lighting
7	SDG 13: Climate Action	Rainwater harvesting, Solar PV systems, Sustainable HVAC systems

I/ II Semester	Emerging Technology Course (ET) INTRODUCTION TO MACHINE LEARNING	M26BETK105G/ 205G
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Mathematics	Ability to understand simple arithmetic, percentages, averages, graphs, tables and basic equations used in introductory data analysis.
2	Computer Operations	Ability to operate a computer, manage files and folders, use spreadsheets, browse online resources and install or open basic software tools.
3	Programming Awareness	Familiarity with variables, simple logic, step-by-step problem solving and the role of programming in solving computational tasks.
4	Data Interpretation	Ability to read tabular data, identify rows and columns, compare values, observe simple patterns and interpret basic charts or scatterplots.

2. Syllabus

INTRODUCTION TO MACHINE LEARNING SEMESTER – I/ II			
Course Code	M26BETK105G/ 205G	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
Credits	03	Total Marks	100
		Exam Hours	03
Course Objectives:			
1. Introduce the fundamental idea of machine learning and its relationship with data science, artificial intelligence and traditional programming. 2. Enable students to distinguish supervised, unsupervised, semi-supervised and reinforcement learning using simple real-world examples. 3. Develop basic understanding of datasets, features, variables, training data, test data, data preparation and visualization in a machine learning workflow. 4. Introduce beginner-level machine learning algorithms such as regression, clustering, support vector machines, neural networks, decision trees and ensemble models. 5. Develop the ability to interpret basic model behaviour, bias, variance, model optimization and a simple Python-based model-building workflow.			
Module -1			
Foundations and Categories of Machine Learning: Meaning and need of machine learning, machine learning as learning from data, input command versus input data, self-learning, training data and test data, relationship among computer science, data science, artificial intelligence and machine learning, machine learning and data mining, supervised, unsupervised, semi-supervised and reinforcement learning with beginner-level examples. Textbook: Chapters 2 and 3, pp. 7-23.			
Module -2			
Data and the Machine Learning Toolbox: Data as the main input for machine learning, structured and unstructured data, tabular datasets, rows, columns, features, variables, vectors and matrices, basic scatterplots and visualization, beginner machine learning infrastructure, Python, Jupyter Notebook, NumPy, Pandas and Scikit-learn, role of algorithms and visualization in communicating results. Textbook: Chapter 4, pp. 24-33.			
Module -3			
Data Preparation and Regression Analysis: Data scrubbing, incomplete, incorrectly formatted, irrelevant and duplicate data, feature selection, row compression, setting up data for modelling, dependent and independent variables, regression analysis, linear regression and prediction, interpreting simple regression-based prediction problems. Textbook: Chapters 5, 6 and 7, pp. 34-63.			
Module -4			

Unsupervised Learning, Generalization and Classification Models: Clustering and k-means clustering, grouping similar data points, bias and variance, underfitting and overfitting, importance of model generalization, support vector machines as a beginner classification approach, margin, separation and simple classification intuition.
Textbook: Chapters 8, 9 and 10, pp. 64-84.

Module -5

Machine Learning Models and Beginner Implementation: Artificial neural networks overview, decision trees, ensemble modelling, development environment, building a model in Python, model optimization, interpreting model results, beginner-level pathway for continuing machine learning study using Python.
Textbook: Chapters 11 to 16 and Appendix, pp. 85-137 and 145-160.

TEXTBOOKS:

1. Oliver Theobald, Machine Learning for Absolute Beginners: A Plain English Introduction, Second Edition, Scatterplot Press, 2017. ISBN: 9781549617218.

REFERENCE BOOKS:

1. Andreas Lindholm, Niklas Wahlström, Fredrik Lindsten and Thomas B. Schön, Machine Learning: A First Course for Engineers and Scientists, Cambridge University Press, 2022.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani and Jonathan Taylor, An Introduction to Statistical Learning with Applications in Python, Springer, 2023.

VIDEO LINKS:

1. Google Developers, Machine Learning Crash Course: <https://developers.google.com/machine-learning/crash-course>
2. Kaggle Learn, Intro to Machine Learning: <https://www.kaggle.com/learn/intro-to-machine-learning>
3. Scikit-learn Getting Started Guide: https://scikit-learn.org/stable/getting_started.html

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture with Examples	Explain machine learning concepts using simple examples such as spam detection, price prediction, customer grouping and recommendations.
2	Tutorial Practice	Use tutorial hours for interpreting small datasets, identifying input/output variables and selecting suitable beginner-level algorithms.
3	Visual Learning	Use tables, scatterplots, flow diagrams and model workflow diagrams to understand data, features, prediction and model behaviour.
4	Case-Based Learning	Discuss short caselets on regression, clustering, classification, overfitting and model improvement.
5	Tool Demonstration	Demonstrate beginner-level use of Python/Jupyter Notebook, Pandas and Scikit-learn for building simple ML models.
6	Collaborative Presentation	Encourage small groups to explain one algorithm, compare learning categories or present a simple data-driven use case.

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation (CIE) for Theory Course with 3 credits

Components		Number	Weightage	Max. Marks	Min Marks
1	Internal Assessment - Tests (A)	3	60%	30	12
2	Alternate Assessment (B)	2	40%	20	---
				50	20

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Alternate Assessment marks

Self-Learning (SL): The teaching faculty shall motivate students to take up relevant online courses from recognized platforms. There shall not be any assessment of the Self-Learning component. The

faculty must collect certificates from students who successfully complete self-learning activities relevant to the course.

Semester End Examination (SEE)

1. Question paper will contain 8 questions. Each question is set for 20 marks. The medium of the question paper shall be English unless otherwise mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice.
3. The questions from Module 2 and 3 will not have any choice.
4. Each question will have a maximum of two sub-questions.
5. The students have to answer 5 full questions selecting one full question from each module.
6. Marks scored will be proportionally scaled down to 50 marks.

5. Course Outcomes (COs) and Mapping with POs/PSOs

Course Outcomes (COs)

COs	Description
M26BETK205G.1	Explain the fundamentals of machine learning, its relationship with data science and artificial intelligence, and the role of data-driven learning.
M26BETK205G.2	Distinguish supervised, unsupervised, semi-supervised and reinforcement learning using appropriate examples and problem contexts.
M26BETK205G.3	Interpret datasets in terms of features, variables, training data, test data and basic data preparation requirements for machine learning.
M26BETK205G.4	Analyze the purpose and working intuition of beginner-level machine learning models such as regression, clustering, support vector machines, neural networks, decision trees and ensemble models.
M26BETK205G.5	Apply a beginner machine learning workflow to outline model building, evaluation, optimization and communication of results using suitable tools.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BETK205G.1	2	-	-	-	1	-	-	-	-	-	-
M26BETK205G.2	2	2	-	-	1	-	-	-	-	-	-
M26BETK205G.3	2	2	-	-	2	-	-	-	-	-	-
M26BETK205G.4	2	2	1	-	2	-	-	-	-	-	-
M26BETK205G.5	-	2	2	-	3	-	-	-	1	1	1
M26BETK205G	2	2	2	-	3	-	-	-	1	1	1

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Introduces first-year students to foundational machine learning concepts, data literacy, analytical thinking and technology-enabled learning.
2	SDG 8: Decent Work and Economic Growth	Builds early awareness of emerging technology skills that support employability, digital transformation and future-ready technical careers.
3	SDG 9: Industry, Innovation and Infrastructure	Develops understanding of data-driven innovation, intelligent systems and modern computational tools used in industry and research.

1st /2nd Semester	Emerging Technology Course (ET) INTRODUCTION TO AI	M26BETK105H /205H
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1. Prerequisites

S/L	Proficiency	Prerequisites
1.	Basic Computer Literacy	Ability to use computers, operating systems, and common software applications.
2.	Fundamentals of Programming	Basic understanding of programming concepts such as variables, data types, input/output, and logical thinking (any programming language).
3.	Mathematical Foundations	Basic knowledge of algebra, logic, probability, and elementary statistics.
4.	Communication Skills	Ability to read, understand, and communicate technical information in English

2. Syllabus

INTRODUCTION TO AI SEMESTER – I/II			
Course Code	M26BETK105H/205H	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	32:32:0:20:20 = 104 Hours	SEE Marks	50
Credits	03	Total Marks	100
		Exam Hours	03
Course Objectives:			
1. To introduce the fundamentals, history, and core concepts of Artificial Intelligence. 2. To familiarize students with the architecture and working principles of Large Language Models. 3. To develop the ability to create effective prompts for interacting with generative AI applications. 4. To expose students to AI ethics, emerging AI trends, and Power BI for data visualization and analysis. 5. To enable students to utilize AI-powered tools for solving academic and real-world problems.			
Module -1			
Overview of Artificial Intelligence: Introduction, Definitions of AI, Is Automating Intelligence is Possible, Man Vs. Computers, Simulation of Sophisticated and Intelligent Behaviour, Brief History: Brief History of AI, Branches of AI, Natural Language, Automated Reasoning, Visual Perception, Intelligent Agents, Major Components of Intelligent System. (Textbook 1:Chapter 1: 1.1 -1.13)			
			8 hours
Module -2			
Large Language Models : Introduction, Definition, Training, Token in the Language Model, Estimate the Cost of Running SaaS-based and Open Source LLM Models, Open Source LLM Models. Transformer and Transformer Block, Self Attention. The Future of LLM Communication (Textbook2:Chapter1) LearningMaterial: https://drive.google.com/drive/folders/1M8mDMeJiO0NTRJhDE2xnLD9-wB2ioY_G?usp=drive_link			
			8 hours
Module -3			
Prompt Engineering: Introduction to Prompt Engineering, Evolution of Prompt Engineering, Types of Prompts, Working of Prompt Engineering, Comprehending Prompt Engineering's Function in Communication, Advantages of Prompt Engineering,. (Textbook2:Chapter1)			
			8 hours
Module -4			
Trends in AI: AI and Ethical Concerns, Introduction to Power BI, Get Started with Power BI, Power BI concepts, Sign up for Power BI, Power BI data sources, Connect to a SaaS solution to Upload a local CSV file, Connect to Excel data that can be refreshed, Connect to a sample, Create a Report with Visualizations, Explore the Power BI portal. Practical component: Student Performance Analysis Using Power BI. LearningMaterial: https://drive.google.com/drive/folders/1M8mDMeJiO0NTRJhDE2xnLD9-wB2ioY_G?usp=drive_link			
			8 hours
Module -5			
Industrial Applications of AI: Introduction to Claude. Practical Component: Creating a Personalized Study Planner Using Claude AI, introduction to Perplexity. Practical Component To familiarize with			

Perplexity AI and to use it effectively for searching, learning, summarizing, and verifying academic information. introduction to NotebookLM, Use of NotebookLM to Organize, Summarize, and Learn from Study Materials

Learning Material: https://drive.google.com/drive/folders/1M8mDMeJiO0NTRJhDE2xnLD9-wB2ioY_G?usp=drive_link

8 hours

Text Books:

1. Munesh Chandra Trivedi, A Classical Approach to Artificial Intelligence, Second edition.
2. Ajantha Devi Vairamani and AnandNayyar, Prompt Engineering: Empowering Communication, 1st Edition, CRC Press, Taylor & Francis Group, 2024. (DOI:<https://doi.org/10.1201/9781032692319>).

Reference Books:

1. ReemaThareja, Artificial Intelligence: Beyond Classical AI, Pearson Education, 2023.

VIDEO LINKS:

1. <https://nptel.ac.in/courses/106106226>
2. <https://www.youtube.com/watch?v=xXCszgfPN6Y>
3. <https://nptel.ac.in/courses/106101007>

3. Teaching-Learning Process Strategies

S/L	TLP Strategies:	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of concepts.
3	Collaborative Learning	Encourage collaborative learning for improved competency application.
4	Problem-Based Learning (PBL)	Implement PBL to enhance analytical skills and practical application of competencies
5	Multiple Representations	Introduce topics in various representations to reinforce competencies
6	Real-World Application	Discuss practical applications to connect theoretical concepts with real-world competencies.
7	Flipped Class Technique	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

CIE Split up for Emerging Technology Course (ET)

	Components	Number	Weightage	Max. Marks
1	Internal Assessment - Tests (A)	3	50%	25
2	Term Work - TW (B)	2	50%	25
	Total Marks			50

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Term Work marks

Semester End Examination (SEE) For Theory Course with 3 credits

1. Question paper will be containing 8 questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. The questions from Module 1, 4 and 5 will have 100% choice
3. The questions from Module 2 and 3 will not have any choice
4. Each of the question will have a maximum of two sub questions
5. The students have to answer 5 full questions selecting one full question from each module.

Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BETK205H.1	Understand the fundamentals, history, branches, and intelligent systems of Artificial Intelligence.
M26BETK205H.2	Apply the concepts and working of Large Language Models, transformers, tokenization, and self-attention mechanisms.
M26BETK205H.3	Analyze prompt engineering techniques to effectively use generative AI tools for various applications.
M26BETK205H.4	Analyze AI ethics, recent AI trends, and develop interactive reports using Power BI for data visualization.
M26BETK205H.5	Design AI-based solutions using AI tools to support learning, research, and academic tasks.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BETK205H.1	3	2	-	-	-	-	-	2	-	-	2
M26BETK205H.2	3	2	-	1	2	-	-	-	-	-	2
M26BETK205H.3	2	3	2	-	3	-	-	2	1	2	3
M26BETK205H.4	2	3	3	2	3	-	-	3	2	2	2
M26BETK205H.5	2	2	2	1	3	2	-	3	2	2	3
M26BETK205H	2.4	2.4	2.3	1.3	2.8	2	-	2.5	1.6	2	2.4

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Promotes AI-assisted learning using Claude, Perplexity, NotebookLM, and Power BI to enhance personalized, inclusive, and lifelong learning.
2	SDG 8: Decent Work and Economic Growth	Develops AI, data analytics, and prompt engineering skills that improve employability and prepare students for AI-driven industries.
3	SDG 9: Industry, Innovation and Infrastructure	Introduces modern AI technologies, Large Language Models, and data visualization tools that support innovation and digital transformation.

1st/ 2nd Semester	Basic Science Lab (BSL) APPLIED CHEMISTRY LABORATORY FOR SUSTAINABLE INFRASTRUCTURE	M26BCHELC106/ 206
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Analytical Chemistry Techniques	Understanding of acid-base, redox, and complexometric titrations. Familiarity with indicators, titration curves, and stoichiometric calculations.
2	Instrument Handling	Prior experience in handling instruments like pH meters, conductivity meters, potentiometers, viscometers, flame photometers, and colorimeters.
3	Sensor and Digital Interface Usage	Basic knowledge of using electrochemical sensors and optical sensors. Understanding how digital sensors interface with microcontrollers or PC-based data acquisition systems.
4	Chemical Handling and Lab Safety	Knowledge of MSDS (Material Safety Data Sheet), safe handling of acids, bases, and organic solvents. Correct usage of PPE like gloves, goggles, and lab coats.
5	Data Recording and Interpretation	Ability to systematically record observations, tabulate data, calculate molarity/normality, and perform result interpretation with suitable units and significant figures.
6	Fundamentals of Electrochemistry	Understanding of electrochemical cells, electrode potential, plating mechanisms, and corrosion. Required for plating, corrosion rate, and battery acid strength experiments.

2. Syllabus

Applied Chemistry Laboratory for Sustainable Infrastructure SEMESTER – I/II			
Course Code	M26BCHELC106/206	CIE Marks	50
Number of Lecture Hours/Week (L: T: P: S:TW:SL)	(0:0:2:0:0)=32Hrs	SEE Marks	50
		Total Marks	100
Credits	01	Exam Hours	03
Course objectives: This course will enable students to: 1. Familiarize students with chemical analysis techniques relevant to civil engineering materials, water, soil, and environmental samples. 2. Develop practical skills in the use of analytical instruments and sensors such as pH, conductometric, potentiometric, and optical sensors. 3. Enable students to evaluate the quality of construction materials and environmental samples through experimental investigations. 4. Apply chemical principles to solve problems related to sustainable infrastructure, water treatment, corrosion, and environmental monitoring. 5. Promote experimental design, data interpretation, teamwork, and sustainable engineering practices.			
Sl. No	Experiments		
1.	By titration method asses Groundwater Suitability for Concrete Preparation: A construction company is using groundwater to prepare concrete for a building project. Workers notice that the concrete mixture is not behaving as expected, and there is concern that the groundwater contains excessive calcium and magnesium salts. How would you determine the total hardness of the groundwater using complexometric titration with EDTA? What is the significance of the hardness value in concrete preparation.		

2.	Estimate the percentage of CaO to examine the quality of cement in a given sample Determine its CaO content by EDTA titration to assess its quality for construction use. A Building contractor a new batch of cement from a supplier. Since the calcium oxide content of cement strongly influences its setting, strength, and durability, the quality-control engineer wants to verify the composition of the cement before it is used. As a quality-control analyst, determine the percentage of CaO present in the cement sample using the rapid EDTA method and evaluate the cement based on the obtained result.
3.	Determine the chemical oxygen demand (COD) of sewage sample by performing both blank titration and back titration: A sewage treatment plant has received wastewater from a nearby residential area. The treatment operator suspects that the sewage contains a high amount of organic pollutants and wants to assess its quality before further treatment. As a laboratory analyst, how would you determine the Chemical Oxygen Demand (COD) of the given sewage sample and assess its pollution level?.
4.	The alkaline nature of the water is to be assessed by utilizing suitable indicators through volumetric analysis of a given water Sample: A residential community has started using water from a newly developed borewell for domestic purposes. The water quality needs to be assessed because its alkalinity may affect taste, scaling, and the effectiveness of water treatment. Determine the carbonate, hydroxides and bicarbonate content of the given water sample by titration using appropriate indicators.
5.	Study the acid–base behavior of a weak acid used in water treatment by pH sensor: A weak acid is being considered for a water-treatment process, and its effectiveness depends on its dissociation behaviour. Use pH measurement to obtain the pKa and understand the dissociation behaviour of the acid.
6.	Investigate the iron content of a simulated corroded reinforcement sample using potentiometric titration: A reinforced concrete structure has developed visible rust, and the extent of corrosion of the embedded steel needs to be investigated. A simulated rust sample is provided for chemical examination. As a chemist, how would you carry out this exercise using potentiometric titration to estimate the iron content and understand the extent of corrosion?
7.	Compare the flow time of the coating and water using the Ostwald's viscometer to determine its viscosity coefficient: The coating manufacturer suspects that its flow behaviour may have changed during storage. You are assigned to compare the flow time of the coating with water using an Ostwald's viscometer and calculate its viscosity coefficient to assess its uniform application.
8.	Using a conductivity cell estimate the acidity of simulated Industrial Wastewater Sample: A concrete structure near an industrial facility is showing signs of and acidic deterioration wastewater is suspected to be the cause. You are tasked with investigating the wastewater through conductometric analysis and identifying whether its acidity could be responsible for the damage.
Project/Virtual lab(For CIE only – not to be included for SEE)	
1.	Asses water quality through virtual simulation: A water sample of unknown quality is being considered for use. Perform a virtual analysis of its key quality parameters and assess its suitability.
2.	Estimate chloride content using a potentiometric sensor: Groundwater near a reinforced concrete structure may contain excess chloride. Carry out potentiometric analysis to estimate the chloride content and identify its potential corrosion risk.
Reference Books:	
1. <u>Vogel's textbook of qualitative chemical analysis By: Vogel, A. I Mendham, J Denney, R.C Barnes, J.D Thomas, M Siavsankar -6 thedn-Pearson Education Services Pvt.Ltd, 2017.</u> 2. <u>Vogel's Qualitative Inorganic Analysis, 7th Edition, Pearson Learningby Svehla.</u>	

3. Teaching-Learning Process Strategies

S/L	TLP Strategies	Description
1	Pre-Lab Sessions	Lecturer introduces the theoretical background of the experiment, covering chemical principles related to civil engineering applications such as water quality, cement chemistry, soil analysis, corrosion, and environmental monitoring. The sessions include purpose of the experiment, instrument working principles, safety precautions, and expected outcomes. Students are encouraged to ask questions to clarify concepts.
2	Pre-Lab Assignments	Students are assigned relevant laboratory manuals, videos, and articles before the laboratory session. These materials cover concepts such as EDTA titrations, COD analysis, sensor calibration, corrosion chemistry, and environmental assessment to ensure preparedness.
3	Experimentation	Students individually or in teams perform experiments involving civil engineering samples such as groundwater, cement, soil, wastewater, corrosion products, and bituminous materials. Activities include: • Setting up apparatus • Safe handling of chemicals • Operation of analytical instruments (pH meter, potentiometric sensor, conductometric sensor, optical sensor, viscometer, etc.) • Accurate data recording • Performing calculations and interpretation of results.
4	Live Demonstration & Guidance	The lecturer provides continuous guidance by: • Demonstrating proper handling and calibration of instruments • Clarifying procedural and conceptual doubts • Assisting in data interpretation • Ensuring adherence to laboratory safety protocols and good laboratory practices.
5	Lab Reports, conclusion & Inference	Students prepare laboratory reports including: • Objectives of the experiment • Experimental procedure • Data presentation using tables and graphs • Calculations and analysis • Discussion of observations, possible errors, conclusions, engineering significance, and applications in sustainable infrastructure and environmental engineering.
6	Reflection & Peer Discussion	Students discuss findings with peers and faculty members to reinforce concepts, compare results, solve experimental challenges, and relate the experiments to real-world civil engineering applications such as water treatment, infrastructure durability, corrosion prevention, and environmental sustainability.

4. Assessment Details**Continuous Internal Evaluation (CIE)**

Sl. No.	Components	Number	Weightage	Max. Marks	Min Marks
1	Write up, Conduction & Record (A)	1	60%	30	12
2	Lab IA test (B)	1	20%	10	---
3	Project Work (C)	1	20%	10	---
Total Marks				50	20

$$\text{Final CIE Marks} = A + B + C$$

A = Average of marks for all the experiments

B = Lab Internal Assessment marks

C = Project work marks

❖ SEE for the Practical Course:

1. SEE marks for a practical course shall be 50 marks.
2. The practical course is evaluated for 100 marks, and the scored marks shall be scaled down to 50

marks.

- A change of experiment/program is allowed only once, and 20% of the marks allotted to the procedure/write-up part will be zero.
- The duration of SEE shall be 3 hours.

Marks distribution for the Practical Course

SL. No.	Description	% Marks	Marks
1	Write-up, Procedure	20%	20
2	Conduction and result	70%	70
3	Viva-Voce	10%	10
Total		100%	100

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

COs	Description
M26BCHELC106/206.1	Apply fundamental chemical principles to analyze construction materials, soil, water, and environmental samples using appropriate experimental procedures relevant to sustainable infrastructure.
M26BCHELC106/206.2	Operate modern analytical instruments and sensors to determine physicochemical properties and estimate constituents in civil engineering materials and environmental samples.
M26BCHELC106/206.3	Analyze experimental data, interpret results scientifically, and communicate findings through systematic laboratory reports with emphasis on sustainable engineering practices.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BCHELC106/206.1	3	2	-	2	-	-	2	-	-	-	-
M26BCHELC106/206.2	2	2	-	2	3	-	-	-	-	-	-
M26BCHELC106/206.3	2	3	-	3	2	-	2	-	2	-	-
M26BCHELC106/206	2.33	2.33	-	2.33	2.5	-	2	-	2	-	-

Assessment Plan

Continuous Internal Evaluation (CIE)

	CO1	CO2	CO3	Total
Total	17	17	16	50

Semester End Examination (SEE)

	CO1	CO2	CO3	Total
Total	36	36	28	100

6. SGD: Sustainable Development goals with justification

Sl. No.	SDG	Justification
1	SDG 3: Good Health and Well-being	Experiments involving water quality assessment, COD determination, effluent analysis, and environmental monitoring contribute to the protection of human health by identifying pollutants and ensuring safe water resources.
2	SDG 6: Clean Water and Sanitation	Determination of hardness, alkalinity, chloride, acidity, and COD helps in monitoring and improving water quality, supporting sustainable water management and wastewater treatment practices.
3	SDG 7: Affordable and Clean Energy	Synthesis of conducting polymers (like polyaniline) and understanding battery chemistry (acid strength in

		Pb-acid battery) align with clean energy and storage solutions.
4	SDG 9: Industry, Innovation, and Infrastructure	Analysis of cement, sulfate in soil, corrosion products, and use of modern sensors promotes innovation in construction materials, infrastructure durability, and smart monitoring techniques.
5	SDG 11: Sustainable Cities and Communities	Experiments related to corrosion, sulfate attack, water quality, and construction materials aid in developing durable and resilient infrastructure for sustainable urban development.
6	SDG 12: Responsible Consumption and Production	Open-ended experiments involving wastewater analysis, recovery of materials from waste streams, and environmental monitoring promote resource efficiency and sustainable engineering practices.
7	SDG 13: Climate Action	Sustainable assessment of environmental pollutants and promotion of durable infrastructure contribute toward reducing environmental degradation and enhancing climate resilience of civil engineering systems.

1st/2nd Semester	Engineering Science Lab (ESL) C PROGRAMMING LAB	M26BECPL107/ 207
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic Computer Skills	Understanding how to use files, folders, and applications. Familiarity with installing and using software.
2	Logical Thinking and Problem Solving	Ability to break problems into steps. Familiarity with if/then logic or flowcharts is a bonus.
3	Basic Math Skills	Comfort with simple arithmetic (addition, subtraction, multiplication, division). Basic understanding of variables and equations.
4	Typing Skills	Not required, but being comfortable with a keyboard will improve your coding speed and reduce frustration.

2. Syllabus

C PROGRAMMING LAB SEMESTER – I/II			
Course Code	M26BCPL107/207	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T:P:TW:SL)	0:0:32:0:0= 32 Hours	SEE Marks	50
		Total Marks	100
Credits	01	Exam Hours	03
Course Objectives:			
- Develop an in-depth knowledge of functional and logical concepts of C Programming with basic syntax and semantics. - Enhance students' analytical and logical thinking skills, enabling them to translate real-world problems into algorithmic solutions and then into working C code. - Equip students with the foundational skills to design, write, and debug C programs, as well as foster problem-solving abilities through programming			
Scenario-Based Experiments			
1	A particle of mass 5 kg is moving with a velocity of 10 m/s at a height of 20 m above the ground. Assuming the acceleration due to gravity is 9.8 m/s², write a program to calculate the mechanical energy of the particle using the formula: $E = mgh + \frac{1}{2}mv^2$ m= mass of the particle, g= acceleration due to gravity, h= height, v= velocity.		
2	A teacher wants to find the highest marks among three students in a class. Write a program that accepts the marks of three students as input and finds and displays the largest mark among them.		
3	You are hired by the local electricity board to automate their monthly billing process. The board charges 80 paise/unit for the first 200 units, 90 paise/unit for the next 100 units, and Rs. 1/unit beyond 300 units, with a minimum meter charge of Rs. 100 for every consumer. If a consumer's bill exceeds Rs. 400, an additional 15% surcharge is applied on the total amount. Write a C program that reads a consumer's name and units consumed, and prints an itemized electricity bill		
4	A local stationery shop wants a simple billing helper for its counter computer. Write a C program that acts as a calculator: it should read two numbers and an operator symbol (+, -, *, /) chosen by the shopkeeper, perform the requested arithmetic operation, and print the result. The program must handle an invalid operator and division by zero gracefully instead of crashing.		
5	A bank wants to verify whether a customer's account number is the same when read from left to right and right to left. Write a C program to accept an integer from the user and determine whether the given number is a palindrome or not using while construct.		
6	A library has digitized its book records and stored the accession numbers of all books on a shelf. To help the librarian quickly locate a book, write a C program that implements the Linear Search		

	algorithm and reports the position of the searched number or informs the librarian that the book is not available
7	A company has two branches, Branch A and Branch B, that record the number of products sold in different categories over two months. The sales data is stored in two matrices. Write a program that accepts two matrices of the same order and performs the following operations: 1. Matrix Addition: Calculate the combined sales of both branches. 2. Matrix Subtraction: Calculate the difference in sales between Branch A and Branch B. The program should display the resultant matrix for both addition and subtraction.
8	A mathematics learning application wants to help students calculate the factorial of a number. The factorial of a positive integer n is calculated as: $n! = n \times (n - 1) \times (n - 2) \times \dots \times 1$
9	The sports committee of a college has collected the scores of N participants in an athletics event and wants them arranged in ascending order to prepare the final ranking sheet. Write a C program that reads the N scores and sorts them using the Bubble Sort technique, displaying the sorted list of scores
10	A college's online registration portal needs to validate and process usernames entered by students: check whether two usernames are identical, merge a username with a default domain suffix, and determine the length of the username for a database field limit. Write a C program using user-defined functions (with appropriate parameter passing techniques) to compare two strings, concatenate two strings, and find the length of a string, using built-in string library functions.
Textbooks: 1. Reema Thareja, Computer fundamentals and programming in c, Oxford University, Third edition, 2023. 2. Behrouz Forozan, Richard Gilberg, A structured Programming Approach using C, 2nd edition Thomson Learning, 2003. Reference Books: 1. E. Balaguruswamy, Programming in ANSI C, 8th Edition, Tata McGraw-Hill. 2. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Pearson Publishers 2015. 3. Yashwanth Kanetkar, "Let Us C", Second Edition, BPB Publishers, 2021..	

2. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	TLP Strategies	Description
2	Interactive Demonstration	Students observe syntax, logic, and output flow in real-time to build a conceptual foundation.
3	Hands-on Practice	Students apply concepts by solving lab exercises independently on computers. Practice focuses on reinforcing learning by executing the programs.
4	Problem-Based Learning (PBL)	Students are given real-world scenario-based problems (e.g., billing systems, sensor data analysis, file handling) to solve using C, fostering critical thinking and application skills.
5	Incremental Learning Approach	Concepts are taught from simple (variables, loops), modular programming (functions), and structural programming to break down complex problems into smaller, manageable parts.

3. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE)**

Sl. No.	Components	Number	Weightage	Max. Marks	Min Marks
1	Conduction & Record (A)	1	60%	30	12
2	Lab IA test (B)	1	20%	10	---
3	Project Work (C)	1	20%	10	---
Total Marks				50	20

Final CIE Marks = A + B + C

A = Average of marks for all the experiments

B = Lab Internal Assessment marks

C = Project work marks

SEE for the Practical Course

1. SEE marks for a practical course shall be 50 marks.
2. The practical course is evaluated for 100 marks, and the scored marks shall be scaled down to 50 marks.
3. A change of experiment/program is allowed only once, and 20% of the marks allotted to the procedure/write-up part will be zero.
4. The duration of SEE shall be 3 hours.

4. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BECPL107/207.1	Analyze problem statements and formulate appropriate algorithmic solutions using fundamental programming constructs.
M26BECPL107/207.2	Apply control structures and user-defined functions to develop, compile, debug, and execute C programs in a native compiler environment.
M26BECPL107/207.3	Prepare professional laboratory reports documenting problem statements, algorithms, flowcharts, source code, execution logs, outputs, and inferences.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BECPL107/207.1	3	-	-	-	3	-	-	-	-	-	-
M26BECPL107/207.2	3	3	3	-	3	-	-	-	-	-	-
M26BECPL107/207.3	-	2	-	-	3	-	-	-	3	-	-
M26BECPL107/207	3	2.5	3		3				3		

5. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	The course builds critical computational and analytical thinking skills, empowering students with lifelong learning tools in computer science. Promotes technical education and employability
2	SDG 8: Decent Work and Economic Growth	By equipping students with key programming and problem-solving skills, the course enhances career opportunities in IT and software sectors, contributing to economic growth.
3	SDG 9: Industry, Innovation and Infrastructure	Programming using C form the backbone of modern technology and software infrastructure. The course fosters innovation and prepares students for building efficient, scalable digital systems

1st / 2nd Semester	Humanities Science (HS) SAMSKRUTHIKA KANNADA	M26BKSKK108/ 208
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1. Prerequisites

S/L	Proficiency	Prerequisites
1	Knowledge of Kannada Literature	Samskruthika Kannada

2. Syllabus

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ SEMESTER – I/II			
Course Code	25BKSKK108/208	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	0:1:0:0:15 = 100 Hours	SEE Marks	50
		Total Marks	100
Credits	01	Exam Hours	01
Course objectives: ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು: 1.ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಿಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು. 2.ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ವಾಚನದ ಮೂಲಕ ಪರಿಚಯಿಸುವುದು. 3.ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಶಿಕ್ಷಣ, ಕ್ರೀಡೆ, ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ, ಉದ್ಯಮ, ಚಳುವಳಿ ಕ್ಷೇತ್ರದ ಸಾಧಕರ ಪರಿಚಯ ಹಾಗೂ ಪ್ರೇರಣೆ ಆಸಕ್ತಿಯನ್ನು ಸಂಪೂರ್ಣ ಮೂಲಕ ಮೂಡಿಸುವುದು. 4.ತಾಂತ್ರಿಕ ವೃತ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರು ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು. 5.ಕಥೆ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.			
Module -1			
ಘಟಕ-1 ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಮತ್ತು ಭಾಷೆ ಕುರಿತಾದ ಲೇಖನಗಳು:			3 ಘಂಟೆ
1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ. 2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ ಜಿ ವೆಂಕಟಸುಬ್ಬಯ್ಯ 3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ- ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ ಕೇಶವಮೂರ್ತಿ			
Module -2			
ಘಟಕ-2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳು			
3ಘಂಟೆ			
ವಚನಗಳು: ಬಸವಣ್ಣ, ಅಲ್ಲಮಪ್ರಭು, ಅಕ್ಕಮಹಾದೇವಿ,			
ಕಿರ್ತನೆಗಳು: ಪುರಂದರದಾಸ, ಕನಕದಾಸ			
ತತ್ವಪದ: ಶಿವನಾಳ ಶರೀಫ			
ಕವಿತೆಗಳು: ಬಿ.ಎಂ ಶ್ರೀಕಂಠಯ್ಯ, ಎಂ ಗೋವಿಂದ ಪೈ, ಉಯಿಲಗೋಳ ನಾರಾಯಣರಾವ್, ಡಿ ಎಸ್ ಕರ್ಕಿ, ಕೆ ವಿ ಪುಟ್ಟಪ್ಪ, ದ ರಾ ಬೇಂದ್ರೆ, ಪು ತಿ ನರಸಿಂಹಾಚಾರ್, ಸಿದ್ದಯ್ಯ ಪುರಾಣಿಕ, ಕೆ ಎಸ್ ನರಸಿಂಹಸ್ವಾಮಿ, ವಿ ಕೃ ಗೋಕಾಕ್, ಎಂ ಗೋಪಾಲಕೃಷ್ಣ ಅಡಿಗ, ಚನ್ನವೀರ ಕಣವಿ, ಚಂದ್ರಶೇಖರ ಕಂಬಾರ, ಜಿ ಎಸ್ ಶಿವರುದ್ರಪ್ಪ, ಕೆ ಎಸ್ ನಿಸಾರ್ ಅಹಮದ್, ಪಿ. ಲಂಕೇಶ್, ಸಿದ್ದಲಿಂಗಯ್ಯ, ಎಚ್ ಎಸ್ ವೆಂಕಟೇಶಮೂರ್ತಿ, ವೈದೇಹಿ, ಎಚ್ ಎಸ್ ಶಿವಪ್ರಕಾಶ್, ಎಚ್ ಎಲ್ ಪುಷ್ಪ, ಎಲ್ ಹನುಮಂತಯ್ಯ, ಸರಜೂ ಕಾಟಕರ್, ಸ ಉಷಾ, ಬೆಳಗರೆ ಚಾನಕಮ್ಮ			
Module -3			
ಘಟಕ-3 ಜಗತ್ತಿನ ಆಯ್ದ 62 ಸಾಧಕರ ಪರಿಚಯ:			3ಘಂಟೆ
ಲ್ಕಾರಿ ಪೇಜ್ ಸರ್ ಜೇಬ್ರೀನ್, ಜೆಫ್ರಿ ಹಿಂಟನ್, ಗಾಲಿ ಮಾಧವೀಲತಾ, ಬಾನು ಮುಷ್ತಾಕ್, ಸಾಲುಮರದ ತಿಮ್ಮಕ್ಕ, ಸೂಲಗಿತ್ತಿ ನರಸಮ್ಮ, ಸುಧಾ ಮೂರ್ತಿ, ನಾರಾಯಣ ಮೂರ್ತಿ, ಅಜೀಂ ಪ್ರೇಮ್ ಜಿ, ಕಿರಣ್ ಮಜುಮ್ದಾರ್, ಮುಖೇಶ್ ಅಂಬಾನಿ, ಹರಿಪೋಡೆ, ಗೋಪಿನಾಥ್, ರತನ್ ಟಾಟಾ, ಸ್ವಾಮಿ ವಿವೇಕಾನಂದ, ರಾಮಕೃಷ್ಣ ಪರಮಹಂಸ, ಶಾರದಾದೇವಿ, ಬಾಲಗಂಗಾಧರ ತಿಲಕ್, ಸುಭಾಷ್ ಚಂದ್ರ ಬೋಸ್, ಮಹಾತ್ಮ ಗಾಂಧಿ, ಕಿತ್ತೂರು ಚೆನ್ನಮ್ಮ, ನಾಲ್ವಡಿ ಕೃಷ್ಣರಾಜ ಒಡೆಯರ್, ಜಯಚಾಮರಾಜ ಒಡೆಯರ್, ರವೀಂದ್ರನಾಥ ಟಾಕೂರ್, ವಿಕ್ರಮ ಸಾರಾಭಾಯಿ, ಪಂಚಾಕ್ಷರಿ ಗವಾಯಿ, ಸಾವಿತ್ರಿಬಾಯಿ ಪುಲೆ, ವಿಂಟನ್ ಸರ್ಫ, ಟಿ ಎನ್ ಶೇಷನ್, ಎಚ್ ಎಸ್ ದೊರಸ್ವಾಮಿ, ಎಚ್ ನರಸಿಂಹಯ್ಯ, ಕೆಂಗಲ್ ಹನುಮಂತಯ್ಯ, ಬಿ ಆರ್ ಅಂಬೇಡ್ಕರ್, ಎ ಜಿ ಸದಾಶಿವ, ಕಸ್ತೂರಿ ರಂಗನ್, ಯು ಆರ್ ರಾವ್, ಕಲ್ಪನಾ ಚಾವ್ಲಾ, ಸುನೀತಾ ವಿಲಿಯಮ್ಸ್, ಸುನಿಲ್ ಗವಾಸ್ಕರ್, ಸಚಿನ್ ತೆಂಡೂಲ್ಕರ್, ರಾಹುಲ್ ದ್ರಾವಿಡ್, ಕಿರಣ್ ಕುಮಾರ್ (ಡಿಆರ್‌ಡಿಓ), ಡಾ.ರಾಜಕುಮಾರ್, ಡಾ. ವಿಷ್ಣುವರ್ಧನ್, ಡಾ. ಅಂಬರೀಶ್, ಎಂ ಡಿ ನಂಜುಂಡಸ್ವಾಮಿ, ಶಾಂತವೇರಿ ಗೋಪಾಲಗೌಡ, ಲತಾ ಮಂಗೇಶ್ಕರ್, ರಾಜಾರಾಮಣ್ಣ, ಸರ್ವಪಲ್ಲಿ ರಾಧಾಕೃಷ್ಣನ್, ಸಿ ರಾಜಗೋಪಾಲಚಾರಿ, ಸರ್ ಸಿ ವಿ ರಾಮನ್, ಲಾಲ್ ಬಹದ್ದೂರ್ ಶಾಸ್ತ್ರಿ, ಮನಮೋಹನ್ ಸಿಂಗ್, ಧ್ಯಾನ ಚಂದ್, ಪ್ರಕಾಶ್ ಪಡುಕೋಣೆ, ಪದ್ಮಶ್ರೀ ರಾಜಣ್ಣ, ದ್ರೌಪದಿ ಮುರ್ಮು, ನೀರಜ್ ಚೋಪ್ರಾ ಪಿ.ಟಿ ಉಷಾ, ಮಾಲತಿ ಹೊಳ್ಳೆ, ನರೇಂದ್ರ ದಾಮೋದರದಾಸ್ ಮೋದಿ			
Module -4			
ಘಟಕ-4 ತಾಂತ್ರಿಕ ವೃತ್ತಿಗಳ ಪರಿಚಯ			
3ಘಂಟೆ			
1. ಡಾ. ಸರ್ ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ: ವೃತ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ- ಎ.ಎನ್ ಮೂರ್ತಿರಾವ್			

2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ	
Module -5	
ಘಟಕ-5 ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ	3ಘಂಟೆ
1.ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ 2. ಮೆಗಾನ್ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ ಚಿ ಬೋರಲಿಂಗಯ್ಯ	
TEXTBOOKS: ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ	
REFERENCE BOOKS: ಅಧುನಿಕ ಕನ್ನಡ ಕಾವ್ಯಗಳು ಮೈವಿವಿ	

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1		Contents related activities (Activity-based discussions)
2		For active participation of students instruct the students to prepare Flowcharts and Handouts
3		Organizing Group wise discussions
4		Quizzes and Discussions
5		Seminars and assignments
6		Contents related activities (Activity-based discussions)

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation:****CIE Split up for Professional Course (PC)**

Components		Number	Weightage	Max. Marks
1	Internal Assessment - Tests (A)	3	50%	25
2	Term Work - TW (B)	2	50%	25
Total Marks				50

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Term Work marks

Self-Learning (SL): If applicable, the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
CO1	ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಕುರಿತು ಅರಿವು ಮೂಡಿಸುತ್ತದೆ.
CO2	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಕಾವ್ಯಗಳನ್ನು ಮತ್ತು ಕಥೆಗಳನ್ನು ಕಲಿತು ಹೆಚ್ಚಿನ ಓದಿಗೆ ಮತ್ತು ಜ್ಞಾನಕ್ಕೆ ಸ್ಫೂರ್ತಿ ಮೂಡುತ್ತದೆ.
CO3	ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಉದ್ಯಮ ಕ್ಷೇತ್ರದ ಶಿಕ್ಷಣ ಚಳುವಳಿ ಕ್ಷೇತ್ರದ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ ಹಾಗೂ ಅವರು ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ತಿಳಿದು ಕೊಂಡು ಇವರಿಗೂ ಕೌಶಲ ಹೆಚ್ಚಿಸುತ್ತದೆ.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	2	-	2	-
CO2	-	-	-	-	-	-	-	2	-	2	-
CO3	-	-	-	-	-	-	-	2	-	2	-
	-	-	-	-	-	-	-	2	-	2	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	Presenting Seminars	Students will be at ease with all seminar presentation
2	Facing Employment Process	If the student taken any civil service examination and their problem issue

1st / 2nd Semester	Humanities Science (HS) BALAKE KANNADA	M26BKSKK108/ 208
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1. Prerequisites

S/L	Proficiency	Prerequisites
1	Knowledge of Kannada Literature	Balake Kannada

2. Syllabus

ಬಲಕೆ ಕನ್ನಡ SEMESTER – I/II			
Course Code	25BKSKK108/208	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	0:1:0:0:15 = 100 Hours	SEE Marks	50
		Total Marks	100
Credits	01	Exam Hours	01
Course objectives: ಬಲಕೆ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:			
1. ಕನ್ನಡ ಭಾಷೆಯ ಮಹತ್ವವನ್ನು ತಿಳಿಸುವುದು.			
2. ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಬರೆಯುವ, ಓದುವ ಮತ್ತು ಸಂವಹಿಸುವ ಕೌಶಲವನ್ನು ಬೆಳೆಸುವುದು.			
Module -1			
Introduction, Necessity of learning a local language. Methods to learn the Kannada language. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conversation, Listening and Speaking Activities Key to Transcription. ವೈಯಕ್ತಿಕ ಸ್ವಾಮ್ಯ ಸೂಚಕ/ಸಂಬಂಧಿತ ಸಾರ್ವಜನಿಕ ಮತ್ತು ಪ್ರತ್ಯಾಧಿಕ ಪದಗಳು - Personal Pronouns, Possessive Forms, Interrogative words			
Module -2			
ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು ಸಂದೇಶಪ್ರದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು ಕಥಾಭೂತಜಿ ಚಿರಡಿಭಿ ರಜಿ ಚಿರಡಿಭಿ, ಜಗಜ್ಜನುತಜಿ ಜಗಜ್ಜನುತಜಿ ಚಿಟಿಜಿ ಖಜಿಟಿಜಿಜಿಟಿ ಚಿಟಿಜಿ ಗುಣ ಪರಿಚಯ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಗಳು ಸಂಖ್ಯಾವಾಚಕಗಳು Qualitative, Quantitative and Colour Adjectives, Numerals ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ(ಅ ಅದು ಅವು ಅಲ್ಲಿ) Predictive Forms, Locative Case			
Module -3			
ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಲಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು ಆಚಿಣುತಜಿ ಅಚಿಜಿ, ಚಿಟಿಜಿ ಓಣುಟಿಜಿಡಿಚಿಟಿ ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು-Ordinal numerals and Plural markers ನೂಟನ ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು Defective / Negative Verbs and Colour Adjectives			
Module -4			
ಅಪ್ಪಣೆಒಪ್ಪಿಗೆ ನಿರ್ದೇಶನ ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು Permission, Commands, encouraging and Urging words (Imperative words and sentences) ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ಸ್ವತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು Accusative Cases and Potential Forms used in General Communication ಇರು ಮತ್ತುಇರಲ್ಲ ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕಕ್ರಿಯಾ ಪದಗಳು Helping Verbs “iru and iralla”, Corresponding Future and Negation Verbs ಹೋಲಿಕೆ ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕಪದಗಳು Comparitive, Relationship, Identification and Negation Words			
Module -5			
ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳು ವಿವಿಧ ಪ್ರಕಾರಗಳು different types of forms of Tense, Time and Verbs ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೋಂದಿಗೆ ಭೂತ ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲವಾಕ್ಯ Formation of Past, Future and Present Tense Sentences with Verb Forms ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿಕ ಕನ್ನಡ ಪದಗಳು Kannada Vocabulary List Kannada Words in Conversation			

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Activity based	Conversational practices
3	Collaborative Learning	
4	Writing exercises	Writing practices
5	Real-World Application	

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation:**

Components		Number	Weightage	Max. Marks
1	Internal Assessment - Tests (A)	3	50%	25
2	Term Work - TW (B)	2	50%	25
Total Marks				50

Final CIE Marks = (A) + (B)**A** = Average of best two Test marks**B** = Average of two Term Work marks**Semester End Examination:**

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
CO1	To understand the necessity of learning of local language for comfortable life.
CO2	To speak, read and write Kannada language as per requirement.
CO3	To communicate (converse) in Kannada language in their daily life with kannada speakers.

CO-PO-PSO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	2	-	2	-
CO2	-	-	-	-	-	-	-	2	-	2	-
CO3	-	-	-	-	-	-	-	2	-	2	-
	-	-	-	-	-	-	-	2	-	2	-

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	Presenting Seminars	Students will be at ease with all seminar presentation
2	Facing Employment Process	If the student taken any civil service examination and their problem issue

2nd Semester	Humanity Science (HS) PROFESSIONAL ENGLISH - 2	M26BENGK209
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic knowledge of English grammar and vocabulary	Students should have a foundational understanding of sentence structure, parts of speech, tenses, and commonly used vocabulary.
2	Familiarity with general writing formats	Prior exposure to writing simple paragraphs, letters, or essays at the school level helps ease the transition into structured and formal writing.
3	Ability to comprehend spoken English	Students should be able to follow general English conversations, classroom instructions, and audio content, which will be enhanced further in listening modules.
4	Fundamental computer and internet usage skills	Basic skills such as using a word processor, browsing the web, and using email are essential for completing blog writing, document formatting, and online communication activities.

2. Syllabus

Professional English - 2 Semester II			
Course Code	M26BENGK209	CIE Marks	50
Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)	1:0:0:0:0=16	SEE Marks	50
		Total Marks	100
Credits	01	Exam Hours	01
Course Objectives:			
To develop students' active listening skills by introducing them to barriers, techniques, and strategies for effective listening in academic and professional environments. To enhance interpersonal communication abilities through conversation practice, situational dialogues, and the application of care, courtesy, and consideration in social and professional interactions. To improve reading comprehension and analytical skills by training students to identify and overcome reading obstacles, and by applying effective reading strategies. To strengthen verbal communication and presentation skills by addressing Mother Tongue Influence (MTI) and building confidence in oral presentations using appropriate structure and delivery techniques.			
Module -1 SPEAKING PRACTICE (PHASE-2) & PROFESSIONAL SKILLS DEVELOPMENT			
UNIT I: Mock GD & Shadowing Practice			
a) Group Discussion (GD) Skills - GD types: Topic-based, Case-based, Abstract - Entry strategies and initiation techniques - Logical argument building and data referencing - Listening skills and constructive participation - Conflict management (non-personal approach) - Summarization skills - Mock GD practice sessions with evaluation rubrics			
b) Shadowing Practice - Concept of shadowing and its benefits - Pronunciation and fluency improvement exercises - Listening-repeat drills using professional speeches - Accent neutralization basics - Recording and feedback-based improvement			
c) Listening Tests and Practice – International language test formats			
Module -2			

UNIT II:**a) Storytelling & Story Retelling**

- Importance of storytelling in professional communication
- Elements of an effective story (context, characters, conflict, resolution)
- Structuring narratives logically and coherently
- Emotional engagement and audience connection techniques
- Summarization and paraphrasing techniques
- Improvisational storytelling activities
- Peer storytelling practice with feedback

b) Read Aloud (Listen & Speak)

- Pronunciation accuracy and articulation practice
- Voice modulation, stress, rhythm, and intonation
- Listening comprehension and repetition drills
- Fluency development through guided reading
- Audio-based listening and speaking shadowing activities
- Read-aloud evaluation and corrective feedback

c) Basics of Interpersonal skills: Developing skills through conversations and dialogues, Purpose of general conversations: interaction, awareness, building credibility, Tips for improving conversations, application of “the three Cs”: Care, Courtesy and Consideration in conversation

Module -3**UNIT III: Resume Building****a) Resume Fundamentals**

- Purpose and recruiter expectations
- Keyword optimization and ATS-friendly resumes

b) Content Development

- Writing strong career objectives / professional summary
- Academic project presentation
- Internships and work experience description using action verbs
- Skill categorization (technical, soft skills, domain skills)
- Certifications and achievements presentation

c) Personal Branding

- LinkedIn profile alignment with resume
- Portfolio development basics
- Email etiquette and professional communication
- Cover letter fundamentals

d) Reading Skills: Differences between efficient and inefficient readers; Basics steps and tips for improving reading ability, Overcoming common obstacles to effective reading, strategies for effective reading.

Module -4**UNIT IV (a): Verbal Ability Essentials (Phase 2)**

(Note: Only placement-focused areas)

- **Voices – Active & Passive**
- **Speech – Direct & Indirect**
- **Vocabulary practice – Synonyms, Antonyms, Homophones, Idioms, Phrasal Verbs**
- **Sentence Improvement**
- **Para Jumble**
- **Short Essay Writing**
- **Placement-focused grammar: concise email language, formal request structures, common interview sentence patterns**
- **Mock practice - short email to recruiter; short message writing**

b) Overcoming MTI or Mother Tongue Influence: Awareness of numerous deviations from Standard English Usage in Indian English, Techniques for the neutralization of MTI.

Module -5**UNIT V: a) INTERVIEW PREPARATION (PHASE-1)****A. Interview Fundamentals**

- Types of interviews (HR, Technical, Panel, Virtual) - Interview process awareness and employer expectations - Professional grooming and dress etiquette B. Core HR Question Preparation - Self-introduction structuring techniques - Strengths, weaknesses, achievements framing (STAR method); SWOC (Strengths-Weakness-Opportunities-Challenges) Analysis - Career goals and motivation-based answers - Handling difficult interview questions C. Communication & Behavioural Skills - Verbal clarity and structured responses - Active listening during interviews - Non-verbal communication in interviews - Confidence and stress management techniques D. Practice & Evaluation - Mock HR interview sessions - Feedback-based performance improvement - Interview etiquette (before, during, after) - Post-interview follow-up communication b) Oral Presentation and PPTs
REFERENCE BOOKS: - Sanjay Kumar & Pushp Lata – Communication Skills (Oxford University Press) - Stephen E. Lucas – The Art of Public Speaking (McGraw-Hill Education) - Ashraf Rizvi – Effective Technical Communication (McGraw-Hill Education) - Practical English Usage by Michael Swan, Oxford University Press. - Technical communication by Gajendra Singh Chauhan, Cengage Learning India Recommended Digital Learning Resources: TED Talks – Public speaking, leadership, and communication models. British Council LearnEnglish – Listening, pronunciation, grammar, and vocabulary practice. Grammarly – Writing support for emails, reports, and academic writing. LinkedIn Learning – Professional communication, presentation skills, and career readiness modules. Cambridge Dictionary (Online) – Pronunciation and vocabulary support.

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Explain key communication concepts, barriers, and strategies through structured lectures using whiteboard/PowerPoint, supported by real-life examples.
2	Audio & Video Listening Practice	Use podcasts, speeches, news clips, and TED Talks to develop listening comprehension and identify poor vs. effective listening practices.
3	Role Play & Situational conversation	Conduct role plays and dialogues based on workplace and social scenarios to improve interpersonal communication and apply the "Three Cs."
4	Group Discussions & Peer Interaction	Foster interpersonal and reading skills by encouraging student-led discussions, topic sharing, and peer evaluation of listening and reading practices.
5	Reading Circles & Skimming Activities	Conduct group reading activities focused on identifying main ideas, improving vocabulary, and distinguishing efficient from inefficient reading habits.
6	Flipped Classroom	Flipped Classroom
7	Pronunciation Labs & MTI Correction	Use language lab tools and drills (tongue twisters, minimal pairs, phoneme practice) to neutralize MTI and promote standard pronunciation.
8	PPT and Oral Presentation Practice	Conduct mock presentations on various topics to build student confidence, body language, clarity, and coherence in verbal expression.

9	ICT-Enabled Tools	Use digital tools like Google Slides (for PPTs), Grammarly (for writing), YouTube (for listening), and online quizzes (for listening/reading practice).
10	Self and Peer Feedback Sessions	Encourage students to reflect on their performance and provide constructive feedback on each other's listening, speaking, and presentation tasks.

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation:**

	Components	Number	Weightage	Max. Marks
1	Internal Assessment - Tests (A)	3	50%	25
2	Term Work - TW (B)	2	50%	25
	Total Marks			50

Final CIE Marks=(A) + (B)**A** = Average of best two Test marks**B** = Average of two Term Work marks**Semester End Examination:**

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M25BENGK209.1	Apply effective listening, reading, and interpersonal communication strategies in both academic and professional contexts.
M25BENGK209.2	Demonstrate improved verbal communication skills by reducing Mother Tongue Influence (MTI) and delivering structured oral presentations.

CO-PO-PSO Mapping

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M25BENGK209.1	-	-	-	-	-	-	-	-	2	3	2	2
M25BENGK209.2	-	-	-	-	-	-	-	-	2	3	2	2
	-	-	-	-	-	-	-	-	2	3	2	2

6. Mapping to Sustainable Development Goals (SDG):

Sl. No.	SDG	Justification
1	SDG 4: Quality Education	Enhances essential communication skills including listening, reading, speaking, and presentation—key components of a quality, holistic education.
2	SDG 8: Decent Work and Economic Growth	Improves workplace readiness through effective communication, interpersonal skills, and presentation abilities—critical for employment and career advancement.
3	SDG 10: Reduced Inequalities	Reducing MTI and promoting clear, inclusive communication helps students from diverse linguistic backgrounds participate equally in academic and professional spaces.
4	SDG 17: Partnerships for the Goals	Promotes teamwork, collaboration, and respectful dialogue—skills essential for global partnerships and effective communication in multidisciplinary settings.

1st /2nd Semester	Engineering Science Lab (ESL) BASIC CIVIL ENGINEERING LABORATORY	M26BECEL110/ 210
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1. Prerequisites

Sl. No.	Proficiency	Pre-requisites
1	Basic Science	• Basic Knowledge and behaviour of engineering materials. • Familiarity with basic laboratory safety practices and safe handling of materials and equipment.
2	Mathematics:	• Basic arithmetic calculations, unit conversions, and measurement principles. • Understanding of simple geometry, dimensions, areas, and volumes used in civil engineering.
3	Engineering Fundamentals	• Basic understanding of engineering drawing, dimensions, and construction terminology, commonly used construction materials such as cement, aggregates, bricks, blocks, and concrete. • Familiarity with elementary concepts of force, load, stress, and structural behaviour. • Ability to observe, record, and interpret engineering measurements and test results.
4	Material Science.	• Basic knowledge of different types of construction materials and their field applications. • Familiarity with the purpose and operation of basic laboratory and surveying instruments. • Awareness of sustainable construction practices and emerging technologies.

2. Syllabus

BASIC CIVIL ENGINEERING LAB SEMESTER – I/II			
Course Code	M25BECEL110/210	CIE Marks	50
Total Number of Teaching-Learning Hours/Sem (L: T: P:TW:SL)	0:0:2: 0:0 = 32 Hours	SEE Marks	-
		Total Marks	500
Credits	00	Exam Hours	-
Course Objectives 1. Familiarize students with the identification, properties, and testing procedures of common construction materials used in civil engineering. 2. Develop practical skills in performing basic laboratory and field experiments following relevant Indian Standards (IS Codes). 3. Demonstrate the ability to operate surveying instruments and interpret elementary field measurements. 4. Introduce students to emerging technologies and Industry 5.0 applications in Civil Engineering.			
Experiment 1: Identification of various construction materials with their standard dimensions and rates. Present Scenario: The construction industry is increasingly adopting sustainable, high-performance, and standardized construction materials to improve quality, durability, and resource efficiency. Knowledge of material properties and standard dimensions is essential for quality assurance and compliance with IS codes. Application: Selection of appropriate construction materials for different structural components.			
Experiment 2: Tests on Aggregates – Specific Gravity and Water Absorption, Sieve Analysis. Present Scenario: Aggregates constitute nearly 70–80% of concrete volume. With increasing use of manufactured sand, recycled aggregates, and sustainable construction materials, characterization of aggregates has become crucial for producing durable and high-performance concrete. Application: Concrete mix design. and Pavement construction.			
Experiment 3: Tests on Bricks– Dimension and Tolerance, Compressive Strength and water Absorption.			

Present Scenario: Modern construction increasingly utilizes fly ash bricks, AAC blocks, concrete blocks, and eco-friendly masonry units to reduce environmental impact. Performance evaluation ensures structural safety, durability, and energy-efficient buildings.

Application: Selection of masonry units for residential and other buildings.

Experiment 4: Tests on Cement and exposure to various construction chemicals—Types of Cement and its Grade, Field Tests. Various construction chemicals available in the market and its specific application.

Present Scenario: Various types of cement such as OPC, PPC, PSC, Composite Cement, and Low Carbon Cement are widely used depending on project requirements. Rapid field identification of cement quality helps prevent construction failures and ensures durability.

Construction chemicals—including superplasticizers, waterproofing compounds, curing compounds, bonding agents, grouts, repair mortars, corrosion inhibitors, and sealants—are increasingly incorporated to enhance workability, strength, durability, and service life of structures. Familiarity with these materials enables engineers to select appropriate products for specific construction applications while ensuring compliance with quality standards and sustainable construction practices.

Application: Selection of suitable cement for different environmental conditions., Preliminary quality assessment at construction sites and Material acceptance before laboratory testing.

Development of practical skills in selecting and handling modern construction materials used in Industry 5.0-enabled construction practices.

Experiment 5: Tests on Concrete – Beams subjected to two-point load, Compressive Strength Test.

Present Scenario: Concrete remains the most widely used construction material, with increasing emphasis on high-strength, self-compacting, fibre-reinforced, geopolymer, and sustainable concretes. Strength evaluation is fundamental for structural design, safety, and quality assurance.

Application: Structural design verification, Quality control of concrete in buildings, bridges, and pavements., Assessment of flexural and compressive performance, Performance evaluation of sustainable concrete mixes and Acceptance testing of concrete in construction projects.

Experiment 6: Surveying – Exposure to various surveying instruments.

Present Scenario: Surveying has rapidly evolved from conventional methods to digital technologies such as Total Stations, GNSS/GPS, UAVs (Drones), LiDAR, and GIS-based mapping. Engineers require familiarity with both conventional and modern surveying equipment.

Application: Land surveying and boundary demarcation, Route alignment for highways, railways, and canals. Construction layout and setting out.

Experiment 7: Emerging Technologies in Civil Engineering.

Present Scenario: Civil Engineering is undergoing a digital transformation through Industry 5.0, integrating Artificial Intelligence (AI), Internet of Things (IoT), Building Information Modelling (BIM), Digital Twins, robotics, drones, 3D concrete printing, smart sensors, and machine learning for sustainable infrastructure development.

Application: Smart infrastructure monitoring, Structural Health Monitoring (SHM), Predictive maintenance using AI and IoT, Digital construction management using BIM, Drone-based inspection and mapping.

Mini Project work - *Students shall form groups of 3–4 and identify a practical civil engineering problem. The project should integrate concepts learned from laboratory experiments.*

TEXTBOOKS

1. Building Materials by S K Duggal, 5th Edition, New Age International Publishers.
2. Surveying Volume - 1 by B C Punmia, Ashok Kumar Jain and Arun Kumar Jain, 16th Edition, Laxmi Publications.
3. Concrete Technology by M S Shetty and A K Jain, 8th edition, S Chand Publishers.

REFERENCE BOOKS

1. Engineering Materials by S C Rangwala, Charotar House Publishing Pvt. Limited.
2. Concrete Technology by A M Neville and J J Brooks, 2nd edition, S Chand Publishers
3. Manual prepared by Department of Civil Engineering.

VIDEO LINKS

1. <https://nptel.ac.in/courses/105106206>

2. <https://nptel.ac.in/courses/105107122>
3. <https://nptel.ac.in/courses/105107833>

3. Teaching-Learning Process Strategies

Sl. No.	TLP Strategies	Description
1	Lecture Method	Utilize various teaching methods within the lecture format to reinforce competencies.
2	Video/Animation	Incorporate visual aids like videos/animations to enhance understanding of Verilog concepts.
3	Collaborative Learning.	Encourage collaborative learning for improved competency application.
4	Real-World Application.	Discuss practical applications to connect theoretical concepts with real-world competencies.
5	Flipped Class Technique.	Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies
6	Laboratory Learning.	Utilize the facilities available in the laboratories to understand the behavior of the materials by performing few experiments.

4. Assessment Details (both CIE and SEE)**Continuous Internal Evaluation (CIE)**

Sl. No.	Components	Number	Weightage	Max. Marks	Min Marks
1	Conduction & Record (A)	1	60%	30	12
2	Lab IA test (B)	1	20%	10	---
3	Project Work (C)	1	20%	10	---
Total Marks				50	20

$$\text{Final CIE Marks} = A + B + C$$

A = Average of marks for all the experiments

B = Lab Internal Assessment marks

C = Project work marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs**Course Outcomes (COs)**

COs	Description
M26BECCEL110.1	Apply the knowledge of science and engineering fundamentals to Perform standard laboratory tests on cement, aggregates, bricks, concrete by following relevant IS procedures and also exposure to surveying instruments and emerging technologies.
M26BECCEL110.2	Analyse experimental observations to determine engineering properties of construction materials and interpret test results as per IS codes. Also interpret the various surveying instruments and emerging technologies in civil engineering.
M26BECCEL110.3	Document the experimental process and corresponding outcomes.

CO-PO-PSO Mapping

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
M26BECCEL110.1	3	-	-	-	-	-	-	-	-	-	-
M26BECCEL110.2	-	3	-	2	2	-	2	2	-	-	2
M26BECCEL110.3	-	-	-	2	-	-	-	-	2	-	2
M26BECCEL110	3	3	-	2	2	-	2	2	2	-	2

6. Mapping to Sustainable Development Goals (SDG)

Sl. No.	SDG	Justification
1	SDG 4 Quality Education	Provides practical, hands-on learning that develops technical skills, craftsmanship, and employability for students.
2	SDG 8 Decent Work and Economic Growth	Equips students with industry-relevant skills for manufacturing, construction and production, leading to better job prospects.
3	SDG 9 Industry, Innovation, and Infrastructure	Builds a foundation for students to contribute to building sectors, promote innovation in manufacturing, and maintain infrastructure.
4	SDG 11 – Sustainable Cities and Communities	Supports resilient and sustainable infrastructure development.