DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY

LUCKNOW, UTTAR PRADESH

EVALUATION SCHEME & SYLLABUS

of

B. TECH.

First Year

ME STREAM

(Mechanical Engineering, Automobile Engineering, Aeronautical Engineering, Industrial Production Engineering, Manufacturing Technology, Mining Engineering)

AS PER AICTE MODEL CURRICULUM & NEP2020

(Effective from the Academic Session: 2026-27)

Dr. A.P.J. Abdul Kalam Technical University, Lucknow- Uttar Pradesh

Bachelor of Technology (ME Stream)

B.TECH. FIRST YEAR, SEMESTER-I

Scheme of Teaching and Examinations (w.e.f. 2026-27)

I Semester												
3- WEEKS STUDENT INDUCTION PROGRAMME IN THE BEGINNING OF THE SESSION AS PER AICTE GUIDELINES												
Sr. No.	**Course Category**	**Course Code**	**Course Title**	**Teaching Department**	**L**	**T**	**P**	**NCrF Hrs.**	**IA (TS/PS) (CT+TA)**	**EA (TE/PE)**	**Total Marks (IA+EA)**	**Credits**
1	BSC	AAS101B/ AAS102B	Physics of Materials/ Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems	AS&H	3	0	0	45	30	70	100	03
2	BSC	AAS103B	Differential Calculus and Linear Algebra	AS&H	3	1	0	60	30	70	100	04
3	ESC	AEE101B/ AEC101B	Fundamentals of Electrical Engineering / Fundamentals of Electronics Engineering	EE/ ECE	2	1	0	45	30	70	100	03
4	ESC	ACS101	Programming Languages	CSE	2	1	0	45	30	70	100	03
5	HSMC	AAS104/ AAS105	Introduction to Indian Knowledge System/ Professional Communication & Technical Writing	AS&H	2	0	0	30	30	70	100	02
6	ESC	AAI101/ AME101B	Introduction to AI & Prompt Engineering/ Fundamentals of Mechanical Engineering	Respective Deptt./ ME	2	0	0	30	30	70	100	02
7	BSC	AAS151/ AAS152B	Applied Physics Lab/ Applied Chemistry for Advanced Metal	AS&H	0	0	2	30	50	50	100	01

			Protection and Sustainable Energy Systems Lab									
8	ESC	AEE151B/ AEC151B	Electrical Engineering Lab / Electronics Engineering Lab	EE /ECE	0	0	2	30	50	50	100	01
9	ESC/ SDC	ACE151B/ AID151	Computer-Aided Engineering Drawing Lab/Innovation & Design Thinking Lab (Project-Based Learning)	CE/ Respective Engg.	0	1	2	45	50	50	100	02
10	BSC/ NCMC	AAS153/ AAC101	Language Lab/ Environment & Sustainability	AS&H	0	0	2	30	50	50	100	-
					2	0	0	30	30	70	100	-
11	NCMC	AGP151	General Proficiency	Respective Deptt.	0	0	2	30	50	—	50	-
				Total	**16**	**04**	**10**	**450**	**330**	**570**	**900**	**21**

AICTE Activity Points (Mandatory)
(i) Students must earn **100** activity points between Semester 1 to 8
(ii) Mandatory requirement for award of degree

Course Category Abbreviations:
BSC *– Basic Science Course;* ***ESC*** *– Engineering Science Course;* ***PSC*** *– Programme Specific Course;* ***AEC*** *– Ability Enhancement Course;* ***NCMC*** *– Non-Credit Mandatory Course;* ***SDC*** *– Skill Development Course;* ***HSMC*** *– Humanities, Social Science & Management Course;* ***AS&H****- Applied Science and Humanities*

UG Programmes Stream-wise Classification

Sr. No.	Stream	Branches
1	**Civil Engineering Stream (CE)**	Civil Engineering, Environmental Engineering
2	**Mechanical Engineering Stream (ME)**	Mechanical Engineering, Automobile Engineering, Aeronautical Engineering, Industrial Production Engineering, Manufacturing Technology, Mining Engineering
3	**Electrical Engineering Stream (EE)**	Electrical Engineering, Electrical & Electronics Engineering, Electrical & Computer Engineering
4	**Electronics Engineering Stream (ECE)**	Electronics Engineering, Electronics and Communication Engineering, Electronics and Communication (Advanced Communication Technology), Electronics Engineering (VLSI Design and Technology), Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Electronics and Computer Engineering
5	**Computer Science & Engineering Stream (CSE)**	Computer Science and Engineering, Computer Science, Computer Engineering, Information Technology, Computer Science and Information Technology, Computer Science & Technology, Computer Science and Design, Computer Science and Engineering (Hindi), Computer Science and Engineering (Artificial Intelligence), Computer Science and Engineering (Artificial Intelligence & Machine Learning), Artificial Intelligence and Machine Learning, Artificial Intelligence (AI) and Data Science, Computer Science and Engineering (Data Science), Computer Science & Engineering (Cyber Security), Computer Science and Engineering (Internet of Things), Cyber Security, Data Science
6	**Textile Engineering Stream (TX)**	Textile Technology, Handloom & Textile Technology, Carpet & Textile Technology
7	**Biotechnology Stream (BT)**	Biotechnology, Biomedical Engineering, Bioinformatics
8	**Chemical Engineering (CH)**	Chemical Engineering, Plastic Engineering, Food Technology
9	**Agricultural Engineering (AG)**	Agricultural Engineering

Dr. A.P.J. Abdul Kalam Technical University, Lucknow- Uttar Pradesh

Bachelor of Technology (ME Stream)

B.TECH. FIRST YEAR, SEMESTER-II

Scheme of Teaching and Examinations (w.e.f. 2026-27)

II Semester												
Sr. No.	**Course Category**	**Course Code**	**Course Title**	**Teaching Department**	**L**	**T**	**P**	**NCrF Hrs.**	**IA (TS/PS) (CT+TA)**	**EA (TE/PE)**	**Total Marks (IA+EA)**	**Credits**
1	BSC	AAS201B/ AAS202B	Physics of Materials/ Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems	AS&H	3	0	0	45	30	70	100	03
2	BSC	AAS203B	Multivariable Calculus and Numerical Methods	AS&H	3	1	0	60	30	70	100	04
3	ESC	AEE201B/ AEC201B	Fundamentals of Electrical Engineering / Fundamentals of Electronics Engineering	Respective Engg. Deptt.	2	1	0	45	30	70	100	03
4	ESC	ACS201	Essentials of Data Structure	CSE	2	1	0	45	30	70	100	03
5	HSMC	AAS204/ AAS205	Introduction to Indian Knowledge System /Professional Communication & Technical Writing	AS&H	2	0	0	30	30	70	100	02
6	ESC	AAI201/ AME201B	Introduction to AI & Prompt Engineering/ Fundamentals of	AS&H/ Respective Engg. Deptt.	2	0	0	30	30	70	100	02

			Mechanical Engineering									
7	BSC	AAS251/ AAS252B	Applied Physics Lab/ Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems Lab	AS&H	0	0	2	30	50	50	100	01
8	ESC	AEE251B/ AEC251B	Electrical Engineering Lab /Electronics Engineering Lab	EE Deptt. / ECE Deptt.	0	0	2	30	50	50	100	01
9	ESC/ SDC	ACE251B/ AID251	Computer-Aided Engineering Drawing Lab/Innovation & Design Thinking Lab (Project-Based Learning)	CE Deptt./ Respective Engg. Deptt.	0	1	2	45	50	50	100	02
10	BSC/ NCMC	AAS253/ AAC201	Language Lab /Environment & Sustainability	AS&H	0	0	2	30	50	50	100	-
					2	0	0	30	30	70	100	-
11	NCMC	AGP251	General Proficiency	Respective Deptt.	0	0	2	30	50	—	50	-
				Total	**16**	**04**	**10**	**450**	**330**	**570**	**900**	**21**

The **Student Induction Programme** (SIP), initiated by the All India Council for Technical Education (AICTE), is designed to help newly admitted students in technical institutions transition smoothly into the higher education environment. It aims to familiarize students with the institutional culture, foster connections with peers and faculty, and provide a foundation for holistic learning. Activities under SIP may include Physical Activities, Creative Arts, Universal Human Values, Literary Events, Proficiency Modules. Lectures shall be by Eminent Personalities, Local Area Visits, Department/Branch Familiarization, and Innovation-related sessions.

AICTE Activity Points Requirement for B.Tech. Programmes

As per AICTE guidelines (refer Chapter 6 – *AICTE Activity Point Program, Model Internship Guidelines*), in addition to academic requirements, students must earn a specified number of Activity Points to be earned is to be eligible for the award of their degree.

- **Regular** students admitted to a 4-year degree program must earn **100 Activity Points**.
- **Lateral** entry students (joining from the second year) must earn **75 Activity Points**.

- **Students** transferred from other universities directly into the fifth semester must earn **50 Activity Points** from the date of entry into AKTU.

These Activity Points are **non-credit** and will not be considered for **the SGPA/CGPA** or be used for **vertical progression**. However, they are mandatory for the **award of the degree**, and the points earned will be reflected on the **eighth semester Grade Card**.

The hours spent for earning the activity points shall not be counted for regular attendance requirements. Students can accumulate these points at any time during their program, including on weekends, holidays, and vacations starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity. If a student fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Consequently, the degree will be awarded only after the Grade Card has been released

Course Code	AAS101B/AAS201B
Title of the Course	Physics of Materials
L-T-P	3-0-0
Total Credits of the Course	03
NCrF Hours	45

Main Focus of the Course Outcomes

Employability	Skill Development	Entrepreneurship
✓	✓	✓

Course Objectives:

1. To understand the foundational concepts and principles of quantum mechanics.
2. To understand the atomic and molecular basis of material properties thereby enabling the evaluation and application of material properties in engineering and technological contexts.
3. To understand the fundamental principles of thermal physics, enabling the analysis of thermal processes and systems.
4. To analyze the electrical and magnetic properties of materials used in machines and devices.
5. To comprehend the principles and applications of photonics.

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Course Content

Unit	Description	Weightage
1.	**Fundamentals of Quantum Mechanics** Inadequacy of classical mechanics, de-Broglie concept of matter waves, Davisson and Germer experiment, wave packet, phase velocity, group velocity, Heisenberg's uncertainty principle and its applications, time-dependent and time-independent Schrodinger wave equations, particle confined in one dimensional box, wave function and its physical interpretation.	20%

2.	**Structure and properties of materials** Atomic structure, types of bonding (ionic, covalent, metallic), crystal structures (BCC, FCC, HCP), lattice parameters, stress and strain, elastic modulus (Young's, Bulk, Shear).	20%
3.	**Thermal Physics** Laws of thermodynamics, heat conduction, convection and radiation, heat capacity, thermal expansion, thermal conductivity, melting and solidification, thermal resistance, enthalpy and entropy, equations of state, Newton's law of cooling.	20%
4.	**Electrical and Magnetic Properties** Band theory of solids, conductors, semiconductors, insulators, dielectric materials, piezoelectricity, ferro-electricity, magnetic materials (diamagnetic, paramagnetic, ferromagnetic), Hall effect, carrier concentration.	20%
5.	**Photonics** **Fiber optics:** Fundamental idea about optical fiber, acceptance angle, acceptance cone, numerical aperture, principle of light propagation in optical fiber, attenuation and attenuation coefficient in fibre. **Laser:** Interaction of radiation with matter (absorption, spontaneous and stimulated emission), principle of laser operation, Einstein's coefficients, Ruby laser, He-Ne laser, laser applications.	20%

Teaching-Learning Methodology

Topics are taught via interactive lectures using blackboard and ICT tools with strong emphasis on material properties relevant to mechanical design. Laboratory demonstrations, case studies, and mini-projects on advanced materials may be included.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Understand the foundational concepts and principles of quantum mechanics.	K2
CO2	Understand the atomic and molecular basis of material properties thereby enabling the evaluation and application of material properties in engineering and technological contexts.	K2
CO3	Understand the fundamental principles of thermal physics, enabling the analysis of thermal processes and systems.	K2

CO4	Understand the electrical and magnetic properties of materials used in machines and devices.	K2
CO5	Comprehend the principles and applications of photonics.	K3

CO-PO Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	2	1	–	1	–	–	1	–	2
CO2	3	3	–	2	1	–	1	–	–	1	–	2
CO3	3	3	2	2	2	–	–	–	1	1	1	3
CO4	3	2	2	2	2	1	1	–	1	1	1	2
CO5	3	2	2	3	2	1	2	1	1	1	1	2

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Assessment (CT + Assignment + Quiz + Attendance)	30%
2.	External Assessment	70%

Suggested Textbooks / Reference Books

1. Materials Science and Engineering: An Introduction – William D. Callister (Wiley)
2. Strength of Materials – R.K. Bansal (Laxmi Publications)
3. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
4. Engineering Physics Theory and Experiments-Srivastava and Yadav (New Age International)
5. Concepts of Modern Physics - Aurthur Beiser (Mc-Graw Hill)

Online Resources

1. NPTEL courses on Materials Science and Engineering Physics
2. MIT Open Course Ware – Structure of Materials
3. ASM International online resources on materials properties

Additional References

Relevant review articles, research papers, and handouts on latest developments are included.

Course Code	AAS102B /AAS202B
Title of the Course	Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems
Total Credits of the Course	03
NCrF Hours	45

Main Focus of the Course Outcomes

Employability	Skill Development	Entrepreneurship
✓	✓	✓

Course Objectives:

1. To understand the chemistry of metals, alloys, and their failure mechanisms in mechanical systems
2. To apply electrochemical principles to analyze corrosion and implement effective protection strategies
3. To study lubricants, fuels, and their chemical properties relevant to mechanical engineering applications
4. To analyze the chemistry of sustainable energy systems including fuel cells, batteries, and biofuels
5. To introduce the chemistry of surface engineering, coatings, and advanced materials for mechanical applications

Course Content

Unit	Description	Weightage
1.	**Chemistry of Metals and Alloys:** Electronic structure and metallic bonding, properties of engineering metals (iron, aluminium, copper, titanium), alloy formation and phase diagrams, heat treatment chemistry, hardening mechanisms (solid solution, precipitation, work hardening), non-destructive testing (NDT) chemical principles	20%
2.	**Corrosion and Protection:** Electrochemical theory of corrosion, types of corrosion (galvanic, pitting, crevice, intergranular, erosion-corrosion), corrosion in high-temperature environments, oxidation kinetics, passivation, cathodic and anodic	20%

	protection, corrosion inhibitors, organic and inorganic coatings, galvanizing and electroplating	
3.	**Lubricants and Fuels:** Classification and properties of lubricants (viscosity, viscosity index, flash point, pour point), additives (anti-wear, antioxidant, extreme pressure), solid lubricants (MoS2, graphite, PTFE), **Energy Science:** Introduction, Classification, Characteristic of Good fuel, Calorific value, HCV & LCV. Analysis of Coal: Proximate, Ultimate analysis and their significance, Octane and Cetane numbers, biofuels (biodiesel, bioethanol), Biogas manufacturing	20%
4.	**Sustainable Energy Chemistry:** Electrochemical cells and EMF, galvanic and concentration cells, Nernst equation, fuel cells (H2-O2, PEM, SOFC), Li-ion and solid-state batteries, supercapacitors, hydrogen production (electrolysis, steam reforming), photovoltaic chemistry, thermochemical energy storage	20%
5.	**Surface Engineering and Advanced Materials:** Surface energy and wettability, physical and chemical vapor deposition (PVD/CVD), thermal spraying, ceramic coatings, diamond-like carbon (DLC) coatings, Nanomaterials: Properties of Nanomatrials, Applications of nanomaterials, Synthesis methods: Sol-gel and chemical vapour deposition, Carbon nanotubes.	20%

Teaching-Learning Methodology

Topics are taught through interactive lectures using blackboard and ICT tools. Laboratory sessions on corrosion testing, lubricant analysis, fuel calorimetry, and battery characterization are included. Case studies on mechanical failures and sustainable energy applications are integral to the course.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Understand the chemistry of metals and alloys and relate it to mechanical properties and failure	K2

CO2	Apply electrochemical principles to analyze corrosion and implement protection strategies	K3
CO3	Evaluate lubricant and fuel properties and apply chemical knowledge to mechanical systems	K4
CO4	Understand the chemistry of fuel cells, batteries, and sustainable energy systems	K2
CO5	Apply surface chemistry and coating principles to advanced material design for ME	K3

CO-PO Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	–	1	–	–	–	–	2
CO2	3	3	2	2	2	1	2	–	–	1	1	2
CO3	3	3	2	3	3	1	1	–	1	1	–	2
CO4	3	2	2	2	2	1	2	–	–	1	–	2
CO5	3	2	3	2	2	2	3	2	1	1	1	2

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Assessment (CT + Assignment + Quiz + Attendance)	30%
2.	External Assessment	70%

Suggested Textbooks / Reference Books

1. Engineering Chemistry – Jain and Jain
2. Corrosion Engineering – Fontana and Greene
3. Engineering Chemistry – O.G. Palanna
4. Fuels and Combustion – S.P. Sharma and C. Mohan
5. Materials Science and Engineering – William D. Callister

Online Resources

1. NPTEL courses on Engineering Chemistry and Corrosion Science
2. ASM International online resources on metal protection
3. U.S. Department of Energy resources on fuel cells and batteries

Course Code	AAS103B
Title of the Course	Differential Calculus and Linear Algebra
Total Credits of the Course	04
NCrF Hours	60

Main Focus of the Course Outcomes

Employability	Skill Development	Entrepreneurship
✓	✓	✓

Course Objectives:

1. Apply matrix methods to solve engineering problems in machine design and mechanical systems.
2. Use differential calculus to analyze and optimize mechanical engineering systems and processes.
3. Apply multiple integrals to determine area, volume, and engineering quantities in mechanical applications.
4. Understand vector spaces and linear transformations for modeling mechanical systems and engineering analysis.
5. Apply vector calculus concepts to analyze fluid flow, heat transfer, and mechanical field problems.

Course Content

Unit	Description	Weightage
1.	**Matrix Algebra:** Introduction to Matrices, Elementary Transformation, Inverse by E-transformation, Rank of a Matrix by Echelon Form, Solution of system of linear Equations by direct method (Gauss Elimination Method), and Iterative method (Gauss Seidel Method), Eigen Values & Eigen Vectors, Diagonalization, **Applications :** Machine Design, Finite Element Analysis, Dynamics of Mechanical Systems.	20%
2.	**Differential Calculus :** Introduction of Limits, continuity and differentiability for function of two variables, Partial derivatives, Composite functions, Total derivative, Euler's Theorem for homogeneous functions, Taylor's and Maclaurin's expansion for	20%

	function of two variables, Jacobians, properties of Jacobian (without proof), Maxima & Minima for a function of up to two variables. **Applications:** Optimization and Machine Design, Fluid Mechanics, Control Systems, Stress and Strain Analysis.	
3.	**Multiple Integrals**: Evaluation of double and triple integrals, change of order of integration, Change of variable (double -integral).Beta and Gamma functions, Properties of Beta and Gamma function. Dirichlet's Integral. Application of double integrals and triple integral to find area and volume. **Applications:** Area of Irregular Surfaces, Volume of Solids, Fluid Mechanics, Heat Transfer.	20%
4.	**Vector Spaces:** Vector spaces (over the field of real numbers), Subspaces, Spanning set, Linear independence, Basis and Dimension. Linear transformations, Range and Null space, Rank-Nullity theorem, Matrix of a linear transformation. **Applications:** Force & Moment Analysis, Mechanics of Machines, Mechanical Vibrations, CAD.	20%
5.	**Vector Calculus :** Scalar point function, Vector point function, Gradient of a scalar field, Directional derivatives, Divergence and curl of a vector function and their application to solenoidal and irrotational vectors respectively .Integration of Vectors, Stokes Theorem and Gauss Divergence Theorem (Without Proof) . **Applications:** Fluid flow analysis, Aerodynamics, Drone navigation systems.	20%

Course Outcomes

COs	Course Outcome Statement	KL
CO1	Apply matrix algebra to solve engineering problems in machine design and mechanical systems.	K3
CO2	Use differential calculus for optimization and analysis in mechanical engineering.	K3
CO3	Apply multiple integrals to compute area, volume, and engineering quantities.	K3
CO4	Use vector spaces and linear transformations to analyze mechanical systems and CAD models.	K3

CO5	Apply vector calculus to solve problems in fluid flow, aerodynamics, and mechanical engineering.	K3

CO–PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	2	–	–	–	–	–	–	1
CO2	3	3	–	1	2	–	–	–	–	–	–	1
CO3	3	3	1	2	2	–	–	–	–	–	–	1
CO4	3	2	2	2	3	–	–	–	–	–	–	1
CO5	3	3	2	3	2	–	–	–	–	–	–	1

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Assessment (CT + Assignment + Quiz + Attendance)	30%
2.	External Assessment	70%

Text Books:

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
4. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publishing-House, 2002

Reference Books:

1. Peter V.O' Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning,2007.
2. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
3. G.B Thomas, RL Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.
4. James Ward Brown and Ruel V Churchill, Fourier Series and Boundary Value Problems,8th Edition-McGraw-Hill
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.
6. Veerarajan T., Engineering Mathematics for first year, McGraw-Hill, New Delhi, 2008.

7. Charles E Roberts Jr, Ordinary Diffrential Equations, Application, Model and Computing, CRC Press T&F Group.
8. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6th Edition, McGraw-Hill.
9. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, McGraw-Hill.
10. P. Sivaramakrishna Das and C. Vijaya kumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.
11. Advanced Engineering Mathematics By Chandrika Prasad, Reena Garg Khanna Publishing House, Delhi.
12. Laplace Transforms by Schaum’s series, 2005 Edition, Spiegel Publication.
13. Dan Hamilton, Calculus 1 - Differentiation and Integration, Hamilton Education Guides 2018.

Course Code	**AAS203B**
Title of the Course	Multivariable Calculus and Numerical Methods
Total Credits of the Course	04
NCrF Hours	60

Main Focus of the Course Outcomes

Employability	**Skill Development**	**Entrepreneurship**
✓	✓	✓

Course Objectives:

1. Develop the ability to solve ordinary differential equations arising in engineering applications.
2. Introduce Laplace Transform techniques for solving differential equations and analyzing engineering systems.
3. Build an understanding of sequences and infinite series for convergence analysis in mathematical modelling.
4. Develop concepts of complex variable functions, analyticity, and conformal properties for engineering analysis.
5. Apply complex integration and residue theory to evaluate integrals and solve engineering problems.

Course Content:

Unit	**Description**	**Weightage**
1.	**Differential Equations:** Linear differential equation of nth order with constant coefficients, Cauchy-Euler equation, solution of second order linear differential equations with variable coefficient by the method of variation of parameters, change of independent variable, normal form. **Applications :** Spring-mass-damper system modeling, Heat conduction in machine components, Mechanical control system modeling.	20%
2.	**Laplace Transform:** Definition of Laplace Transform, Existence Conditions, Linearity Property, Laplace Transform of some standard functions, I and II Shifting theorems (without proof),	20%

	Change of Scale Property, Laplace transform of derivatives and integrals, Periodic Functions, Unit Step Function, Inverse Laplace Transform, Partial Fraction Method, Convolution theorem (without proof), Application of Laplace transform to solve ordinary differential equation. **Applications:** Transient response analysis of mechanical systems, Modelling of vibration and damping systems, Dynamic response of suspension systems.	
3.	**Sequence and Series:** Definition of a Sequence, Monotonic Sequence, Convergence and Divergent Sequence, Cauchy Sequence, Necessary Condition for Convergence, Tests of Convergence: Comparison Test, Ratio Test, Raabe's Test, Logarithmic Test **Applications:** Convergence analysis of iterative engineering algorithms, Computational fluid dynamics (CFD) simulations, Numerical solutions of engineering equations.	20%
4.	**Complex Variables: Differentiation** Functions of Complex Variables, Limit Continuity and Differentiability, Analytic Function, Cauchy-Riemann Equations (Cartesian and Polar Form), Harmonic Function, Milne-Thomson Method for constructing the Analytic Function. **Applications :** Two-dimensional fluid flow analysis, Stress analysis in elasticity.	20%
5.	**Complex Variables: Integration** Complex integrals, Cauchy-Integral theorem (without proof), Cauchy integral formula (without proof),Taylor's series and Laurent's series, Singularities, Residue of a function, Cauchy Residue Theorem, Evaluation of the Real definite integrals. **Applications:** Evaluation of contour integrals in fluid mechanics, Frequency response analysis in mechanical vibration and control systems.	20%

Course Outcomes:

COs	Course Outcome Statement	KL
CO1	Solve higher-order linear differential equations using analytical methods and apply them to mechanical engineering systems.	**K3**

CO2	Apply Laplace Transform techniques to solve ordinary differential equations and analyze dynamic engineering systems.	**K3**
CO3	Analyze the convergence and divergence of sequences and infinite series using appropriate convergence tests.	**K4**
CO4	Solve analytic functions using Cauchy-Riemann equations and construct analytic functions for engineering applications.	**K3**
CO5	Solve complex integrals and apply residue theory to solve engineering problems involving complex functions.	**K3**

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	–	–	–	–	–	–	1
CO2	3	3	2	2	2	–	–	–	–	–	–	1
CO3	3	3	2	3	2	–	–	–	–	–	–	2
CO4	3	3	2	3	2	–	1	–	–	–	–	2
CO5	3	3	3	3	2	–	1	–	–	–	–	2

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Assessment (CT + Assignment + Quiz + Attendance)	30%
2.	External Assessment	70%

Text Books:

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
4. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publishing-House, 2002

Reference Books:

1. Peter V.O' Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning,2007.
2. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
3. G.B Thomas, RL Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.
4. James Ward Brown and Ruel V Churchill, Fourier Series and

Boundary Value Problems,8th Edition-McGraw-Hill

5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.
6. Veerarajan T., Engineering Mathematics for first year, McGraw-Hill, New Delhi, 2008.
7. Charles E Roberts Jr, Ordinary Diffrential Equations, Application, Model and Computing, CRC Press T&F Group.
8. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6th Edition, McGraw-Hill.
9. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, McGraw-Hill.
10. P. Sivaramakrishna Das and C. Vijaya kumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.
11. Advanced Engineering Mathematics By Chandrika Prasad, Reena Garg Khanna Publishing House, Delhi.
12. Laplace Transforms by Schaum's series, 2005 Edition, Spiegel Publication.
13. Dan Hamilton, Calculus 1 - Differentiation and Integration, Hamilton Education Guides 2018.

Course Code	**AEE101B/ AEE201B**
Title of the Course	Fundamentals of Electrical Engineering
Course Category	Engineering Science Course (ESC)
Total Credits	03
NCrF Hours	45

Main Focus of the Course Outcomes

Employability	**Skill Development**	**Entrepreneurship**
✓	✓	✓

Course Objectives:

1. Understand basic electrical quantities and apply Ohm's law and Kirchhoff's laws to DC circuits
2. Analyse single-phase AC circuits and understand power factor in the context of industrial loads
3. Understand three-phase power systems used in industrial motors, drives, and process plants
4. Learn how transformers and electrical machines work and how they are selected for industrial use
5. Apply electrical safety knowledge and understand relevant industrial applications.

Course Content

Unit	**Description**	**Weightage**
1.	**Basic Electrical Quantities and DC Circuits:** Basic concepts of Electric charge, current, voltage, resistance, power, and energy; Ohm's law; series and parallel combination of resistors; Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL); Thevenin's theorem (simple concept and problem). simple mesh and nodal analysis;	20%
2.	**Single-Phase AC Circuits and Power:** AC voltage and current — peak, RMS, average values; phasor representation; R, L, and C circuits and their series and parallel connections; admittance and impedance; active power (P), reactive power (Q), apparent power (S); power factor and its significance; power factor correction using shunt	20%

	capacitors; single-phase power measurement using wattmeter.	
3.	**Unit III – Three-Phase Systems:** Three phase power supply and loads, balanced star and delta connections; phase and line voltages and currents; three-phase power; two-wattmeter method;	10%
4.	**Unit IV – Transformers and Electrical Machines:** Working principle of single-phase transformer; EMF equation; voltage and current ratio; losses and efficiency; concept of step-up and step-down transformer; Equivalent circuit and phasor diagram (no load condition). DC motor — types, working principle, back EMF, torque; three-phase induction motor — rotating magnetic field, slip, torque-speed curve, starting (DOL and star-delta),	30%
5.	**Unit V – Electrical Safety and Emerging applications:** Electrical hazards — shock and fire; earthing and grounding; working principle of fuses and circuit breakers; electrical safety in laboratory; Applications: Working of fluorescent lamps; motor used in water pumps, lathe machines; key components of energy bills;	20%

Teaching-Learning Methodology

Taught using interactive lectures, real equipment demonstrations, and industry-relevant examples. Simple numericals directly related to motor loads, power billing, and transformer selection are the focus of tutorials. Short demonstration videos on VFDs, solar installations, and smart meters connect theory to practice.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Apply Ohm's law and Kirchhoff's laws to solve DC circuit problems in industrial instrumentation	K3
CO2	Analyse single-phase AC circuits and explain power factor significance for industrial loads	K3
CO3	Analyse three-phase circuits and measure three-phase power in industrial motor systems	K3
CO4	Explain fundamental concepts of transformer and machines	K2

CO5	Remember electrical safety knowledge and understand relevant industrial applications.	K2

CO–PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	2	–	–	–	–	–	–	1
CO2	3	3	2	2	2	–	1	–	–	–	–	1
CO3	3	3	2	2	2	–	1	–	–	–	–	1
CO4	3	2	1	1	2	–	–	–	–	–	–	1
CO5	3	2	1	1	1	2	2	2	–	–	–	1

Evaluation Pattern

Sr. No.	Details of Evaluation	Weightage
1.	Internal Assessment – Class Tests (CT) + Teacher's Assessment (Assignment / Quiz / Attendance)	30%
2.	End Semester Theory Examination	70%

Suggested Textbooks / Reference Books

1. Fundamentals of Electric Circuits- Alexander & Sadiku, (McGraw Hill)
2. Electrical & Electronic Technology- Hughes, (Pearson)
3. Basic Electrical Engineering – D.C. Kulshreshtha (McGraw Hill)
4. Fundamentals of Electrical Engineering, 2ed, B. Dwivedi, A. Tripathi, (Wiley & Sons)
5. Electrical Technology Vol. I & II – B.L. Theraja and A.K. Theraja (S. Chand)

Online Resources

1. NPTEL – Basic Electrical Engineering, IIT Bombay
2. Bureau of Energy Efficiency (BEE India) – Industrial Motor and Energy Efficiency modules
3. Siemens Learning Hub – VFD and Motor Drives (free access)

Additional References

Relevant articles, videos, and resources on latest developments in:

1. Variable Frequency Drives: Energy Savings in Industrial Motors
2. Solar Rooftop Systems for Factories and Construction Sites
3. Electric Vehicles in Industry: AGVs, Forklifts, and Electric Trucks

Course Code	**AEC101B / AEC201B**
Title of the Course	Fundamentals of Electronics Engineering
Course Category	Engineering Science Course (ESC)
Total Credits	03
NCrF Hours	45

Main Focus of the Course Outcomes

Employability	**Skill Development**	**Entrepreneurship**
✓	✓	✓

Course Objectives:

1. Understand diode and transistor basics sufficient to read and understand electronic circuit diagrams
2. Understand how sensors convert physical quantities into electrical signals
3. Use op-amp-based signal conditioning circuits to process sensor outputs
4. Understand digital basics and how microcontrollers are used in industrial automation
5. Relate electronics to real industrial systems — PLCs, VFD drive electronics, smart sensors, and Industry 4.0

Course Content

Unit	**Description**	**Weightage**
1.	**Diodes, Rectifiers, and Regulated Power Supplies:** p-n junction diode — basic concept, forward bias, reverse bias; diode as a switch and rectifier; half-wave and full-wave bridge rectifier; filter capacitor; Zener diode voltage regulator; LED and photodiode (what they do); applications: DC power supply for control panels and PLC units, indicator LEDs in machinery, photoelectric sensors in conveyor lines, regulated supply for field instruments	20%
2.	**Transistors and Switching Circuits:** BJT — Construction & VI characteristics of BJT, NPN transistor concept; saturation and cut-off (switch operation); transistor driving a relay; Introduction to FETs, MOSFET as a switch	20%

	(basic idea); transistor/MOSFET in PWM motor speed control; optocoupler — concept and use for isolation; applications: transistor relay driver in industrial control circuits, MOSFET in VFD gate drive (concept), optocoupler isolating PLC output from high-power load, solid-state relay (SSR)	
3.	**Sensors, Transducers, and Signal Conditioning:** Types of sensors — temperature (thermistor, PT100, thermocouple), pressure (strain gauge, piezoresistive), displacement (LVDT concept), proximity (inductive, capacitive, IR); Wheatstone bridge for sensor measurement; op-amp as non-inverting amplifier and comparator for signal conditioning; analog signal (4–20 mA, 0–10V) and why it is used in industry; applications: temperature control in chemical reactors, pressure monitoring in process plants, proximity sensor in textile loom, structural tilt sensor in civil engineering	20%
4.	**Digital Basics and Microcontroller Overview:** Logic levels and digital signals; basic gates — AND, OR, NOT, NAND (truth table only); Boolean expression for simple industrial logic (e.g. motor ON when switch A AND NOT emergency stop); ADC concept — converting sensor analog output to digital; microcontroller overview (Arduino/PLC concept) — inputs, outputs, program logic; display devices — LCD and 7-segment (what they show); applications: digital readout of temperature/pressure on plant display, automated ON/OFF control logic, PLC ladder logic concept	20%
5.	**Industrial Electronics and Smart Systems:** Introduction to PLC (Programmable Logic Controller) — what it does, inputs, outputs, ladder logic concept; Variable Frequency Drive (VFD) electronics — rectifier, DC bus, inverter stage (block diagram only); SCADA and HMI — concept of remote monitoring; wireless sensor networks in industry — concept of industrial IoT (IIoT); smart manufacturing electronics — condition monitoring sensor nodes, vibration sensors on motors;	20%

Teaching-Learning Methodology

Topics are taught using interactive lectures, real industrial equipment demonstrations, and short videos. Every topic is directly linked to an ME, CE, CH, or TX application. No deep semiconductor physics — emphasis is on reading circuit blocks, understanding sensor data sheets, and working with automation electronics.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Explain diode and rectifier circuit operation and identify their role in industrial power supplies	K2
CO2	Explain transistor and optocoupler operation in switching and isolation circuits	K2
CO3	Select appropriate sensors for physical measurement and apply op-amp signal conditioning	K3
CO4	Interpret digital logic and understand microcontroller/PLC role in industrial automation	K2
CO5	Relate PLC, VFD electronics, and IIoT concepts to smart manufacturing and process control	K2

CO–PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	–	–	–	–	–	–	1
CO2	3	2	2	1	2	–	–	–	–	–	–	1
CO3	3	3	2	2	3	–	–	–	–	–	–	1
CO4	3	2	2	2	3	–	–	–	–	–	–	1
CO5	3	2	2	2	3	1	2	–	–	–	–	1

Evaluation Pattern

Sr. No.	Details of Evaluation	Weightage
1.	Internal Assessment – Class Tests (CT) + Teacher's Assessment (Assignment / Quiz / Attendance)	30%
2.	End Semester Theory Examination	70%

Suggested Textbooks / Reference Books

1. Electronics: Fundamentals and Applications – D. Chattopadhyay and P.C. Rakshit
2. Industrial Electronics – G.K. Mithal (Khanna Publishers)
3. Instrumentation and Measurement – A.K. Sawhney (Dhanpat Rai)

Online Resources

1. NPTEL – Basic Electronics and Sensors, IIT Bombay
2. Automation Anywhere / Siemens TIA Portal basics (free online intro)
3. Falstad Circuit Simulator – falstad.com/circuit (free, browser-based)

Additional References

Relevant articles, datasheets, and resources on:

1. PLC Programming Basics: Ladder Logic for Industrial Automation
2. Industrial IoT (IIoT): Sensors, Gateways, and Cloud Monitoring
3. Condition Monitoring of Machines Using Vibration and Current Sensors

Course Code	**ACS101**
Title	Programming Languages
Course Category	Engineering Science Course (ESC)
Credits	03
NCrF Hours	45
Tools	GCC / Code::Blocks / VS Code + Google Colab / Jupyter

Main Focus of the Course Outcomes

Employability	**Skill Development**	**Entrepreneurship**
✓	✓	✓

Course Objectives:

1. Write, compile, and run programs in C and Python
2. Use variables, operators, and control flow to solve simple problems
3. Write and use functions; understand arrays and basic string operations
4. Get familiar with Python built-in data types
5. Apply Python to a small task in an emerging domain — data, automation, or IoT

Course Content

Unit	**Language**	**Topics**	**Weightage**
1.	C	**Programming Basics (C):** 1. Structure of a C program; compilation and execution 2. Data types, variables, constants, operators (arithmetic, relational, logical) 3. Input/output — scanf/printf in C 4. Type conversion; simple expressions *Real connect: C powers embedded systems, microcontrollers, and OS kernels.*	20%
2.	C	**Decision Making and Control Flow (C):** 1. Control Statements 2. Loops — for, while, do-while; break and continue 3. Functions — definition, call, return; call by value	20%

		4. Recursion — factorial and Fibonacci (simple examples only) *Real connect: Control flow is the brain of every program — from traffic signal logic to drone autopilot decision-making.*	
3.	C	**Advanced Programming Concepts (C):** 1. 1D array — declaration, input, output, traversal 2. Simple operations — find max, min, sum, average 3. Strings in C — gets/puts, strlen, strcpy, strcmp 4. Pointer — concept of address and pointer variable (concept only, not deep) 5. Structures, 6. File Handling *Real connect: Arrays store sensor readings, image pixels, and stock prices. Pointers are the foundation of memory management in embedded systems.*	20%
4.	Python	**Python Introduction:** 1. Why Python — where it is used (AI, Data Science, Web, Automation) 2. Python basics — variables, data types, print, input, operators 3. Python control flow — if/else, for loop, while loop 4. Python functions — def, return, default arguments *Real connect: Python is #1 in AI/ML, Data Science, and automation — same syntax, more power, less boilerplate.*	20%
5.	Python	**Python Data Structures and Emerging Applications** 1. Python list, tuple, dictionary, set — basic operations only 2. File handling — read and write a text file; read a CSV (2–3 lines) 3. Introduction to NumPy — array, mean, simple arithmetic (5 lines) 4. Introduction to Matplotlib — plot a simple line graph (5 lines) 5. One mini-demo — IoT sensor simulation	20%

		Real connect: Python lists power NumPy which powers TensorFlow. Matplotlib plots are used in every engineering report and data science notebook. This unit opens the door to AI, IoT, and Data Science using the same Python basics learnt in Unit IV.	

Tutorial Hour — Week-by-Week Practice Problems

One tutorial hour per week. Students write and run programs. Problems below are the minimum set — teacher may add variants.

Week	Language	Tutorial Problems
1	C	1. Print your name and branch. 2. Add two numbers entered by user. 3. Find area of a rectangle.
2	C	1. Swap two numbers. 2. Check if a number is even or odd. 3. Simple calculator (+, −, ×, ÷) using if-else.
3	C	1. Find the largest of three numbers. 2. Grade calculator (marks → A/B/C/D/F). 3. Day name using switch-case.
4	C	1. Print multiplication table of N. 2. Sum of first N natural numbers using loop. 3. Count digits in a number.
5	C	1. Print prime numbers from 1 to 50. 2. Fibonacci series (first 10 terms). 3. Reverse a number.
6	C	1. Factorial using function. 2. Check palindrome number using function. 3. Find GCD of two numbers.
7	C	1. Recursive factorial. 2. Recursive Fibonacci. 3. Sum of digits using recursion.
8	C	1. Input array of N numbers; find max and min. 2. Compute average of array. 3. Linear search in array.
9	C	1. Count vowels in a string. 2. Reverse a string. 3. Check if string is palindrome.
10	C	1. Write a C program to store 5 numbers in an array and print them in reverse order. 2. Write a C program to perform basic string operations such as finding string length, copying and concatenation.
11	Python	1. Hello World in Python. 2. BMI calculator. 3. Temperature converter (°C ↔ °F). Compare C vs Python syntax.

12	Python	1. Grade calculator in Python. 2. Fibonacci using Python loop. 3. Simple calculator using functions in Python.
13	Python	1. List: marks of 5 students — max, min, average. 2. Dictionary: store name and marks of 3 students. 3. Count word frequency in a sentence.
14	Python	1. Write student records to a text file. 2. Read and display the file. 3. Read a small CSV and print rows.
15	Python	1. NumPy: create array, compute mean. 2. Matplotlib: plot a line graph of marks. 3. Mini-demo: simulate 5 IoT temperature readings and plot.

Teaching-Learning Methodology

Lectures are short and concept-focused — every idea is shown with a 3–5 line code example. Tutorial hour is compulsory hands-on coding. Students use GCC/Code::Blocks for C and Google Colab for Python (no installation needed for Python). Live coding and debugging by the teacher are part of every session. Errors are learning opportunities — never skip them.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Write, compile, and run C programs using variables, operators, and I/O	K3
CO2	Use control flow and functions in C to solve simple computational problems	K3
CO3	Work with arrays and strings in C and understand pointer concept	K2
CO4	Implement basic operations using Python built-in data structures.	K3
CO5	Apply Python to read files, plot data, and perform a simple emerging domain task	K3

CO–PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	3	–	–	–	–	–	–	1
CO2	3	3	2	2	3	–	–	–	–	–	–	1
CO3	3	2	1	2	3	–	–	–	–	–	–	1
CO4	3	3	2	2	3	–	–	–	–	–	–	1
CO5	3	3	2	2	3	1	1	–	–	–	–	2

Evaluation Pattern

Sr.	Component	Marks	Weightage
1.	Class Tests (CT) — short questions + write a program (C/Python)	15	15%
2.	Teacher's Assessment (TA) — Tutorial performance + Assignments + Quiz	15	15%
3.	End Semester Examination — theory + program writing (both languages)	70	70%

Suggested Textbooks

1. Problem Solving and Programming in C, Sridhar & Hariharan, Pearson
2. Basic Computer Engineering, 2ed, Sanjay Silakari, Rajesh K. Shukla, Wiley & Sons
3. Python Programming, Sridhar, Indumathi & Hariharan, Pearson
4. Let Us C – Yashavant Kanetkar (BPB) — for C basics
5. Python Crash Course – Eric Matthews (No Starch Press) — for Python units

Online Resources

1. OnlineGDB – onlinegdb.com (free browser-based C and Python compiler)
2. Google Colab – colab.research.google.com (free Python + NumPy + Matplotlib, no install)
3. HackerRank – hackerrank.com (C, Python practice, free, auto-graded)
4. NPTEL – Programming in C, IIT Bombay (free video lectures)

Course Code	**ACS201**
Title of the Course	Essentials of Data Structures
Pre-requisite	ACS101 – Programming Language (C/C++ + Python)
Course Category	Engineering Science Course (ESC)
Credits	02
NCrF Hours	30

Main Focus of the Course Outcomes

Employability	**Skill Development**	**Entrepreneurship**
✓	✓	✓

Course Objectives:

1. Understand data structures and why choosing the right one affects program performance
2. Implement linked list and perform basic insert, delete, and traverse operations
3. Implement stack and queue and apply them to simple real-world problems
4. Apply searching and sorting algorithms and compare their efficiency
5. Understand trees and graphs at a conceptual level with real-world connections

Course Content

Unit	**Language**	**Topics**	**Weightage**
1.	C / Python	**Introduction and Arrays** 1. Data structure — definition, need, classification (linear / non-linear, static / dynamic) 2. Algorithm efficiency — Big O notation: $O(1)$, $O(n)$, $O(\log n)$, $O(n^2)$ — concept only 3. Array — insert, delete, search, traverse in C/Python 4. 2D array — matrix addition and transpose *Real connect:NumPy array (AI/ML), image as 2D matrix, sensor data log as array, spreadsheet rows.*	20%

2.	C/Python	**Linked List** 1. Node — data + pointer; why linked list over array 2. Singly linked list — insert (head, tail, position), delete, traverse 3. Doubly linked list — concept and structure only 4. Circular linked list — concept only *Real connect: Browser back/forward = doubly linked list. Music playlist = circular. Python deque = doubly linked list (used in BFS, LRU cache).*	20%
3.	C/Python	**Stack and Queue** 1. Stack — LIFO; push, pop, peek; implementation using array in C/Python 2. Application: balanced parentheses check; function call stack (concept) 3. Queue — FIFO; enqueue, dequeue; implementation using array in C/ Python 4. Application: print spooler; task scheduling queue, Polish Notation *Real connect: Ctrl+Z = Stack. WhatsApp delivery = Queue. Python error traceback IS a call stack. CPU scheduling = queue.*	20%
4.	C/Python	**Searching and Sorting** 1. Linear search, binary search, comparison 2. Bubble sort and insertion sort, Quick Sort and Selection Sort — trace + C/ Python 3. Merge sort — concept and trace only 4. Python built-in sort() and sorted() *Real connect: Binary search in database index. Python sort() uses Timsort. E-commerce ranking, leaderboard, ML data preprocessing = sorting.*	20%
5.	Trace + Python demo	**Trees and Graphs (Concept Level)** 1. Binary tree — terminology (root, leaf, height, level); properties 2. Binary Search Tree — insert, search; inorder/preorder traversal trace 3. Graph — vertex, edge, directed/undirected; adjacency list representation, insertion	20%

		4. BFS and DFS — trace on a small graph (5–6 nodes) *Real connect: File system = tree. BST in database indexing. Google Maps = weighted graph. Social network = graph. Decision Tree in ML = binary tree.*	

Suggested Assignment / Practice Problems (Unit-wise) but not limited to

No Tutorial hour in ACS201. The following problems are assigned as class assignments and self-practice. 2–3 per unit recommended for internal assessment.

Unit	Trace on Paper	Code (C/Python)
I Arrays	1. Trace insertion at index 2 in [10,20,30,40] 2. Trace deletion of element 30 from [10,20,30,40] 3. What is O(log n)? Give one example	1. Input N numbers; find max, min, average 2. Count even and odd in array 3. Remove duplicates from array
II Linked List	1. Draw linked list after inserting 10, 20, 30 at head 2. Trace deletion of node 20 from [10→20→30→NULL] 3. Difference between singly and doubly linked list	1. Create linked list; insert at head; print 2. Insert node at tail 3. Delete node by value
III Stack & Queue	1. Trace push(5), push(10), pop(), push(15) — what is top? 2. Trace enqueue(A,B), dequeue(), enqueue(C) — what is front? 3. Check '({[]})' balanced — show stack trace	1. Stack using array — push and pop 5 elements 2. Queue using array — enqueue and dequeue 3. Balanced parentheses checker
IV Search& Sort	1. Binary search for 35 in [10,20,30,35,40,50] — show steps 2. Bubble sort trace on [64,34,25,12] 3. Insertion sort trace on [5,3,8,1]	1. Linear search and binary search — compare 2. Bubble sort — count swaps 3. Python: sort a list ascending and descending
V Tree & Graph	1. Draw BST after inserting 50,30,70,20,40 2. Write inorder and preorder of above BST 3.	1. BST insert and inorder in python 2. Graph as adjacency list in Python dict 3. BFS using queue in Python (10–15 lines)

	BFS from A on: A-B, A-C, B-D, C-E	

Teaching-Learning Methodology

Draw first, code later — every data structure is shown visually on the board before any code is written. Trace problems on paper before coding. VisuAlgo animations are used in class for sorting and tree/graph traversal. Python is used for quick 5-line demos where it adds clarity. Assignments include both trace and coding tasks for every unit.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Explain data structure types and Big O; implement array insert, delete, and search in C/Python	K3
CO2	Implement singly linked list operations and relate to real-world applications	K3
CO3	Implement stack and queue using arrays and apply them to solve simple problems	K3
CO4	Apply linear and binary search; trace and implement bubble and insertion sort	K3
CO5	Trace BST insert and traversal; trace BFS/DFS on a small graph	K2

Evaluation Pattern

Sr.	Component	Weightage
1.	Internal Assessment – Class Tests (CT) + Assignments / Quiz (TA)	30%
2.	End Semester Examination — theory + trace problems + short code writing	70%

Suggested Textbooks / Reference Books

1. Data Structures Using C – ReemaThareja (Oxford University Press)

2. Data Structures and Algorithms in Python – Goodrich, Tamassia, Goldwasser(Wiley)
3. Problem Solving with Algorithms and Data Structures using Python – Brad Miller (free: runestone.academy)

Online Resources

1. VisuAlgo – visualgo.net (free animations of every DS and algorithm — use in every class)
2. HackerRank – Data Structures track, hackerrank.com (C++/Python, free, auto-graded)
3. Runestone Academy – runestone.academy (free interactive Python DSA book)
4. LeetCode Easy – leetcode.com (start after this course; industry-standard placement prep)

Course Code	**AAS104/ AAS204**
Title of the Course	Introduction to Indian Knowledge System
Course Category	Engineering Science Course (ESC)
Total Credits	02
NCrF Hours	30

Main Focus of the Course

Employability	**Skill Development**	**Entrepreneurship**
✓	✓	

Course Objectives

1. To introduce the meaning, scope, classification and significance of the Indian Knowledge System (IKS) and its corpus.
2. To develop an understanding of India's contributions to philosophy, mathematics, astronomy and the sciences.
3. To familiarise students with indigenous engineering, technology, metallurgy and architecture.
4. To create awareness of Indian traditions of health, wellness, environment, governance and ethics.
5. To expose students to the contemporary relevance of IKS — digital preservation, AI-enabled study and sustainable applications.

Unit	**Description**	**Weightage (%)**
1	**Foundations of the Indian Knowledge System** Definition, scope, characteristics and significance of IKS; the IKS vision of NEP 2020; the fourteen (Chaturdasha) Vidyasthanas — four Vedas, four Upavedas and six Vedangas; Schools of Indian Philosophy: Orthodox and Heterodox Schools; Oral and Written Knowledge Systems, Knowledge validation (pramanas). Case study: relevance of IKS for a present-day engineer.	20
2	**Indian Mathematics, Astronomy and Scientific Thinking** **Number Systems**: Decimal place-value system, zero and infinity; Bhutasankhya and Katapayadi numeration; Pingala's Chandahshastra and binary representation; Sulbasutras; contributions of	20

	Aryabhata, Brahmagupta, Bhaskara and the Kerala School; Indian astronomy and the Panchanga. **Numerical:** encoding numbers using the Katapayadi scheme/Observing Panchang and Reflecting on the Patterns	
3	**Engineering, Technology and Material Sciences** Metallurgy — Wootz steel, zinc distillation and the Delhi Iron Pillar; town planning and architecture (Harappan, Vastu and Shilpa Shastra); water management — stepwells, tanks and irrigation, textile engineering Case study: materials-science analysis of the Iron Pillar/ Architecture of Stupas	20
4	**Health, Wellness, Environment and Governance** Ayurveda (Charaka and Sushruta), Tridosha; Yoga (Patanjali's Ashtanga) and wellness; environment and sustainability in Indian thought; governance and management — Kautilya's Arthashastra; ethics from the Bhagavad Gita. Case study: Yoga for well-being / Arthashastra management principles/ Learnings from Geeta	20
5	**Contemporary Relevance, AI and Applications of IKS** Digital preservation (CSIR-TKDL, IKS Division) and IPR; Sanskrit and computational linguistics — Panini's Ashtadhyayi, NLP and AI for ancient texts; IKS-inspired sustainable engineering and innovation. Case study: AI/NLP applied to a Sanskrit corpus.	20

Teaching-Learning Methodology	Delivery through interactive lectures, documentaries and IKS Division resources, expert talks, heritage field visits, assignments and a mini-project connecting IKS to a contemporary problem, supported by NPTEL / SWAYAM MOOCs, in line with NEP 2020 and OBE.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Learn the nature, scope and classification of the Indian Knowledge System.	K1

CO2	Understand India's contributions to mathematics and astronomy and relate them to modern concepts.	K2
CO3	Understand indigenous engineering, metallurgical and architectural achievements.	K2
CO4	Interpret Indian traditions of health, wellness, governance and ethics.	K2
CO5	Recognize the contemporary relevance of IKS, including AI-enabled study and sustainability.	K2

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1					2	1	2	1	1		3
CO2	2	1	1		1	1		1				2
CO3	2	2	2		1	2	2	1				2
CO4						2	2	3	1	1		3
CO5	1	1	2		2	3	3	2	1	1	1	3

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1	Internal Continuous Assessment — Class Tests, Assignments, Quizzes, Seminars and Attendance (CT + TA)	30 %
2	End-Semester Examination (Theory)	70 %

Suggested References (latest editions)	
1	Mahadevan, Bhat & Nagendra Pavana, Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning.
2	Kapil Kapoor & Avadhesh Kumar Singh (Eds.), Indian Knowledge Systems, Vols. I & II, D. K. Printworld.
3	Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati.
4	B. V. Subbarayappa, Science in India: Past and Present, Nehru Centre.
Online / e-Resources	
1	IKS Division portals — iksindia.org and iks.aicte-india.org.
2	SWAYAM / NPTEL course on Indian Knowledge Systems; CSIR-TKDL; NDLI; Bharatavani.

Course Code	**AAS105 / AAS205**
Title of the Course	Professional Communication and Technical Writing
Course Category	HSMC
Total Credits	02
NCrF Hours	30

Main Focus of the Course Outcomes

Employability	**Skill Development**	**Entrepreneurship**
✓	✓	

Course Objectives

1. Explain the principles of professional communication, workplace etiquette, and business correspondence required for professional environments.
2. Apply verbal, non-verbal, presentation, and AI-assisted communication strategies to communicate effectively in academic and profession.
3. Analyze workplace situations by using emotional intelligence, critical thinking, and ethical decision-making based on Indian Knowledge Systems.
4. Demonstrate leadership, teamwork, interpersonal communication, and collaborative problem-solving skills in diverse professional contexts.
5. Integrate mindfulness, yogic principles, and professional ethics to promote effective communication, personal well-being, and lifelong professional growth.

Unit	**Description**	**Weightage (%)**
1	**Professional Communication and Workplace Readiness** • Fundamentals of communication: definition, process, importance of communication barriers to communication, 7 C's of communication • Business Correspondence : Emails, Notices, Agenda, Minutes of Meeting, Technical Report and proposal • Résumé, CV and Cover Letter Writing	20

	• Interview Skills, Professional Networking and branding e,g.,LinkedIn , X, ATS Score • Digital Communication Etiquette : online presence and virtual meetings **Assignments/Activities** • Prepare a professional résumé and cover letter. • Draft business emails and meeting minutes. • Participate in a mock interview.	
2	**Grammar and Vocabulary for Technical Writing** • Parts of Speech and Sentence Structure • Common Grammatical Errors, Subject–Verb Agreement, Tenses, and Articles • Technical Vocabulary, Word Formation, and Precision in Language • Tone, Style, and Clarity in Technical English • Editing and Proofreading Techniques for Technical Writing • Grammar and Vocabulary Enhancement through Practical Writing Exercises **Assignments/Activities** • Edit and proofread a technical paragraph to improve grammar, vocabulary, precision, and clarity.	20
3	**Public – Speaking, Presentation and AI-Assisted Communication** • Public speaking technique: Modes, verbal, and non-verbal communication • Understating non-verbal Communication through the *Natyashastra*: *Angika Abhinaya* (Body Language: Posture, Gestures, Facial Expressions),*Vachika Abhinaya* (Voice Modulation and Speech Delivery) ,*Sattvika Abhinaya* (Expression of Emotions and Authentic Communication) • Presentation Planning and Delivery • Data Visualization and Slide Design • Elevator Pitch • AI Tools for Presentation Design and Speech Practice, prompt writing for effective communication • Ethical Use of AI in Communication **Assignments/Activities** • Deliver an individual presentation. • Prepare an AI-assisted presentation with proper citations. • Record and evaluate an elevator pitch.	20

4	**Emotional Intelligence and Critical Thinking for Workplace Communication** • Emotional Intelligence through the *Bhagavad Gita* :Self-awareness ,Self-regulation ,Empathy, Emotional Balance • Critical Thinking through Indian Values and Logical Traditions: *Nyaya* (Logical Reasoning),*Viveka* (Discrimination and Judgment), • Value-based Decision Making • Ethical Problem Solving • Reflective Thinking in Professional Contexts **Assignments/Activities** • Case study analysis using value-based decision making. • Reflective journal on emotional intelligence. • Group discussion on workplace ethical dilemmas.	20
5	**Leadership, Workplace Well-being, and Mindful Communication** • Leadership definition and types • Leadership Communication: Active Listening, Constructive Feedback, Teamwork, and Collaboration • Mental Health, Stress Management, and Work-Life Balance • Effective Communication through Yogic Practices: **Yama** as Principles of Ethical Communication **Ahimsa** – Respectful and Non-violent Communication, **Satya** – Truthfulness and Transparency, **Asteya** – Integrity and Honesty, **Brahmacharya** – Responsible and Balanced Communication, **Aparigraha** – Freedom from Ego, Bias, and Possessiveness. **Niyama** for Personal and Professional Growth, **Shaucha** – Clarity of Thought and Communication, **Santosha** – Contentment and Positive Workplace Relationships, **Tapas** – Self-discipline and Professional Commitment, **Svadhyaya** – Self-reflection and Continuous Learning ,**Ishvara Pranidhana** – Purpose, Humility, and Service-oriented Leadership • **Storytelling through Panchatantra:** *The Lion and the Rabbit* (Leadership and Strategic Communication), *The Merchant's Iron Balance* (Emotional Intelligence and Strategic Conflict Resolution), *The Two Fish and the Frog* (Leadership,	20

	Vigilance and Decision Making), and *The Merchant and the King's Servant* (Respectful Leadership, Workplace Ethics and Employee Relations).	

Teaching-Learning Methodology	Sessions will be activity-based and interactive, combining short lectures with role-plays, presentations, group discussions, writing tasks and peer review. Audio-visual material, language-lab practice and NPTEL/SWAYAM resources will develop practical communication skills in line with NEP 2020 and OBE.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Communicate effectively in professional settings using appropriate verbal, written, and digital communication skills.	K2
CO2	Apply correct grammar and vocabulary to produce clear technical English.	K3
CO3	Design and Deliver effective presentations by applying public speaking techniques and AI-assisted communication tools ethically.	K4
CO4	Apply emotional intelligence, logical reasoning, and value-based decision-making to solve workplace challenges.	K3
CO5	Demonstrate leadership, teamwork, ethical and mindful communication, stress management, and professional well-being for effective and sustainable workplace success.	K6

CO–PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO11	PO12
CO1	1	–	–	–	1	–	–	–	2	3	2	2	2
CO2	1	1	–	–	1	–	–	–	–	3	2	2	2
CO3	1	2	1	–	2	–	–	2	2	3	2	2	2
CO4	1	3	–	–	–	2	–	3	2	2	2	2	2
CO5	–	2	–	–	–	2	–	3	3	3	3	3	3

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1	Internal Continuous Assessment Class Tests, Assignments, Quizzes, Seminars and Attendance (CT + TA)	30 %
2	End-Semester Examination (Theory)	70 %

Online / e-Resources
Meenakshi Raman & Sangeeta Sharma, Technical Communication: Principles and Practice, Oxford University Press.
Vidushi Sharma , Advanced Soft Skills , Pearson
R. C. Sharma & Krishna Mohan, Business Correspondence and Report Writing, McGraw Hill.
Lesikar & Flatley, Business Communication, McGraw Hill.
NPTEL / SWAYAM courses on Technical / English Communication and Soft Skills.
British Council Learn English and similar e-resources for language practice.
Bhagavad Gita : https://ignca.gov.in/Asi_data/279.pdf
Patanjali. The Yoga Sutras of Patanjali https://archive.org/details/yogasutrasofpata00pata/page/28/mode/2up https://www.ebharatisampat.in/pdfs/ebharati-pdf-1628160725PatanjalaYogaSutra-The-Yoga-Aphorisms-Patanjali-1953.pdf
Natyashastra: https://archive.org/details/natyashastraofbharatmunipart1pradipahindivyakhyababulalshuklashastrichowkambhasanskritseries/page/%E0%A5%A7%E0%A5%AA%E0%A5%AB/mode/2up
Panchatantra : https://ignca.gov.in/Asi_data/2332.pdf https://www.talesofpanchatantra.com/sanskrit-manuscripts https://www.peoplematters.in/blog/organisational-culture/panchatantras-for-leaders-13994
Critical thinking : https://www.alexpcherian.com/2025/08/nyaya-philosophy-art-of-logical-thinking.html https://jiva.org/viveka-proper-discrimination/

Course Context: AI is no longer optional — it is the defining technology of this decade. Every engineer, regardless of branch, will work alongside AI tools in their career. This course demystifies AI for first-year students from all streams: what it is, how it works at a concept level, where it is already changing their field, and — most practically — how to communicate with AI systems effectively through Prompt Engineering. No prior programming or mathematics required. Concept, awareness, and hands-on practice are the goals.

Course Code	**AAI101/AAI201**
Title of the Course	Introduction to AI and Prompt Engineering
Course Category	Engineering Science Course (ESC)
Credits	02
NCrF Hours	30
Tools Used	ChatGPT / Claude / Gemini / Copilot (free tier) — browser based

Main Focus of the Course Outcomes

Employability	Skill Development	Entrepreneurship
✓	✓	✓

Course Objectives:

1. Understand what Artificial Intelligence is, its history, and how it is changing every engineering field
2. Understand key AI concepts — Machine Learning, Deep Learning, and Neural Networks — at a conceptual level
3. Explore how AI is applied across domains — healthcare, agriculture, manufacturing, finance, and education
4. Understand Generative AI — how large language models (LLMs) like ChatGPT and Gemini work
5. Learn and practise Prompt Engineering — the skill of communicating effectively with AI tools to get useful results

Course Content

Unit	Topics	Weightage
1.	**Introduction to Artificial Intelligence** 1. Definition and scope of AI; brief history — from Alan Turing to ChatGPT 1. Types of AI — Narrow AI, General AI, Super AI (concept)	20%

	2. AI vs Machine Learning vs Deep Learning — what is the difference 3. How machines learn — data, patterns, and predictions (concept, no maths) 4. AI today — where it already exists in daily life (Google Maps, Spotify, Netflix, Google Photos, voice assistants) 5. Machine Learning Concepts, Learning Strategies-Supervised, Unsupervised, Reinforcement Learning 6. Data, Data Visualization, Data Pre-processing **Class Activity: Students list 5 AI tools they use every day and discuss how each one 'learns'.** *Branch connect: CE — AI in structural health monitoring; ME — AI in predictive maintenance; EE — smart grid; CSE — AI in compilers; BT — drug discovery; AG — crop yield prediction.*	
2.	**Core AI Concepts** 1. Machine learning: Classification Techniques- K-Nearest Neighbors (KNN), Naïve Bayes, Clustering Technique-K-Means 2. Classification metrics-accuracy, precision, recall, F1 score, MAE. 3. Neural networks — concept of neurons, layers, weights (simple diagram) 4. Deep learning — what makes it 'deep'; why it needs GPUs, CNN 5. Computer vision — how AI sees images (face recognition, medical imaging) 6. Natural Language Processing (NLP) — how AI understands text and speech **Class Activity: Show Google Teachable Machine (teachablemachine.withgoogle.com) — train a simple image classifier in 5 minutes, no code.** *Branch connect: ECE — image sensors + AI; BT — protein structure prediction (AlphaFold); AG — plant disease detection from photos; TX — fabric defect detection.*	20%
3.	**Generative AI and Large Language Models** 1. What is Generative AI — AI that creates text, images, code, audio, video 2. Large Language Models (LLMs) — what they are, how they are trained (concept)	20%

	3. Popular LLMs — ChatGPT (OpenAI), Gemini (Google), Claude (Anthropic), Llama (Meta) 4. Tokens, context window, temperature — simple explanation 5. Multimodal AI — text + image + voice in one model (GPT-4o, Gemini concept) 6. AI image generation — Stable Diffusion, Midjourney, DALL-E (concept + demo) 7. Limitations of LLMs — hallucination, knowledge cutoff, bias 8. Responsible use — academic integrity, plagiarism, AI-generated content disclosure **Class Activity: Students interact with ChatGPT/Gemini/Claude; observe how different inputs give different outputs; identify one hallucination example.** *Every professional today uses at least one Generative AI tool. Understanding how LLMs work makes students better users and future developers.*	
4.	**AI Applications Across Engineering Domains** 1. AI in Civil Engineering — structural health monitoring, smart cities, traffic optimisation 2. AI in Mechanical Engineering — predictive maintenance, design optimisation, robotics 3. AI in Electrical and Electronics — smart grids, fault detection, VLSI design automation 4. AI in CSE — code generation (GitHub Copilot), cybersecurity, natural language interfaces 5. AI in Biotechnology and Healthcare — drug discovery, medical imaging, genomics, wearables 6. AI in Agricultural Engineering — precision farming, crop monitoring, drone-based spraying, soil analysis 7. AI in Chemical and Textile Engineering — process optimisation, quality control, material design 8. Ethical concerns — bias in AI, data privacy, job displacement, responsible AI **Class Activity: One case study per student group — each group presents a 2-minute real AI application from their own engineering branch.** *This unit ensures every student, regardless of branch, sees AI as directly relevant to their future career.*	20%

5.	**Prompt Engineering** 1. What is a prompt — the instruction you give to an AI model 2. Why prompt quality matters — same AI, very different results with different prompts 3. Principles of good prompting — clarity, context, specificity, role assignment, format instruction 4. Prompting techniques: • Zero-shot prompting — direct question • Few-shot prompting — give examples in the prompt • Chain-of-thought prompting — ask AI to think step by step • Role prompting — 'Act as a civil engineer and...' 5. Prompt for different tasks — summarisation, explanation, code generation, report writing, brainstorming, translation 6. Domain-specific prompting — students write prompts relevant to their own branch (CE, ME, BT, AG, etc.) 7. AI tools for engineers — GitHub Copilot (code), Grammarly (writing), Consensus (research), Wolfram Alpha, Canva AI, Notion AI **Hands-on Practice (every lecture): Students write prompts, compare outputs, refine and improve. Graded prompt assignment: write 5 prompts for an engineering problem from their own branch.** *Prompt Engineering is already a job role (avg. salary $100K+ globally). Every engineer who can communicate well with AI has a significant career advantage.*	20%

Suggested Assignments / Practice Tasks but not limited to

Assignment	Task
Assignment 1 (Unit I)	Research task — no AI tool interaction required. Find 3 real AI applications in your engineering branch. For each: name the product/system, what data it uses, and what it predicts or generates. Submit as a one-page note (250–300 words).
Assignment 2 (Unit II)	Concept-check task. Pick one real ML-based system relevant to your branch (e.g., a recommendation engine, a defect detector, a chatbot). Identify: (a) Is it supervised, unsupervised, or reinforcement learning? (b) What could cause it to overfit or underfit? (c) Sketch a simple diagram

	showing its inputs, a basic neuron/layer concept, and output. Submit as a half-page note (200–250 words) with diagram.
Assignment 3 (Unit III)	Hands-on task — direct AI interaction required. Interact with any free LLM (ChatGPT/Gemini/Claude). Ask it a question related to your branch. Identify one correct and one incorrect (hallucinated) response. Explain why the hallucination occurred (150–200 words), with screenshots of both responses.
Assignment 4 (Unit IV)	Group case study: Each group (3–4 students) picks one AI application in their domain, prepares a 2-minute presentation covering: problem → data → AI solution → impact. Submit slides/notes plus a 1-page group summary handout.
Assignment 5 (Unit V)	Write 5 prompts for an engineering problem from your branch using: (a) Zero-shot (b) Few-shot (c) Chain-of-thought (d) Role prompting (e) Format-specific prompt. Submit the prompt + AI response + your evaluation of the output quality, as a single document (2–3 pages).
Assignment 6 (Unit V)	Use an AI tool to help complete one academic task (summarise a topic, generate a study plan, explain a concept, translate a text). Document the prompt used, output received, and how you verified/corrected it. In a 200–300 word reflection, address: (a) what you changed or verified and why, and (b) one way AI use in this task could raise a bias, privacy, or academic-integrity concern.

Teaching-Learning Methodology

Every lecture begins with a real-world AI example — a news article, a product demo, or a live tool interaction. No heavy mathematics or programming — concepts are taught through analogies, diagrams, videos, and demonstrations. Unit V (Prompt Engineering) is entirely hands-on — students bring their laptops/phones and write prompts live in class. Group activities, branch-specific case studies, and AI tool explorations keep every session engaging. Teachers are encouraged to use AI tools themselves in class to demonstrate live prompting and critical evaluation of AI outputs.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Explain what AI is, its types, and identify AI applications in everyday life and their own engineering domain	K2
CO2	Describe key AI concepts — ML, Deep Learning, NLP, Computer Vision — and relate them to real applications	K2
CO3	Apply the working principles, capabilities, limitations, and responsible use of Generative AI and Large Language Models.	K3
CO4	Apply the concept of Artificial Intelligence across engineering domains and their societal, ethical, and professional implications.	K3
CO5	Design and refine effective prompts using zero-shot, few-shot, chain-of-thought, and role prompting techniques for domain-specific tasks	K3

CO–PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	–	2	–	–	–	–	–	–	1
CO2	3	2	2	1	3	–	–	–	–	–	–	1
CO3	3	3	2	2	3	1	1	3	–	–	–	2
CO4	3	3	2	2	2	2	2	3	1	1	–	2
CO5	3	3	3	2	3	1	–	2	–	2	–	3

Evaluation Pattern

Sr.	Component	Marks	Weightage
1.	Class Tests (CT) — concept questions + short answer	15	15%
2.	Teacher's Assessment (TA) — Assignments + Group Case Study + Prompt Portfolio	15	15%
3.	End Semester Theory Examination — concept + application + prompt writing questions	70	70%

Suggested Textbooks / Reference Books

1. *The Quick Guide to Prompt Engineering*, I. Khan, John Wiley & Sons Inc.

2. AI: Its Nature and Future – Margaret Boden (Oxford University Press) — accessible, non-technical introduction to AI concepts
3. Human Compatible: Artificial Intelligence and the Problem of Control – Stuart Russell (Penguin) — accessible reading
4. The Age of AI – Henry Kissinger, Eric Schmidt, Daniel Huttenlocher — for AI and society context
5. Prompt Engineering for Generative AI – James Phoenix and Mike Taylor (O'Reilly) — practical guide to LLMs and prompting, supports Units IV & V

Online Resources

1. Google Teachable Machine – teachablemachine.withgoogle.com (train AI with no code, free)
2. Elements of AI – elementsofai.com (free, beginner course by University of Helsinki + MinnaLearn)
3. Microsoft AI for Everyone – learn.microsoft.com (free beginner modules)
4. ChatGPT – chat.openai.com / Gemini – gemini.google.com / Claude – claude.ai (free tier for prompt practice)
5. Prompt Engineering Guide – promptingguide.ai (free, comprehensive reference)
6. Ethics of AI – ethics-of-ai.mooc.fi (free, beginner course by University of Helsinki on bias, privacy, and responsible AI)
7. 3Blue1Brown – Neural Networks series (YouTube, free) — visual, no-maths-heavy explanation of how neural networks work

Course Code	AME101B / AME201B
Title of the Course	Fundamentals of Mechanical Engineering
Course Category	Engineering Science Course (ESC)
Total Credits	02
NCrF Hours	30

Main Focus of the Course Outcomes

Employability	Skill Development	Entrepreneurship
✓	✓	✓

Course Objectives:

1. To develop an understanding of engineering mechanics, force systems, equilibrium, friction, and principles of motion.
2. To introduce stress–strain behaviour, beam loading, strain measurement, and mechanical testing of materials.
3. To impart fundamental knowledge of fluid properties, fluid statics, continuity, and Bernoulli's principles.
4. To develop an understanding of thermodynamic laws, processes, and air-standard internal combustion engine cycles.
5. To familiarize students with engineering materials and fundamental casting, forming, powder metallurgy, and joining processes.

Course Content

Unit	Description	Weightage
1.	**Engineering Mechanics:** Basic concept; System of forces; free-body diagrams; equilibrium equations; laws of forces; moment and their applications; frictions and its applications; Newton's second law of motion, D'Alembert's principle.	20%
2.	**Mechanics of Solid:** Stress and strain, elastic constants, Poisson's ratio; shear force and bending moment diagrams; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.	20%
3.	**Fluid Mechanics:** Fluid properties; fluid statics, forces on submerged bodies, stability of floating	20%

	bodies; fluid acceleration; differential equations of continuity; Bernoulli's equation.	
4.	**Thermodynamics:** Thermodynamic systems and processes; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics. Internal Combustion Engines: Air-standard Otto, Diesel and dual cycles.	20%
5.	**Materials & Manufacturing:** Properties of engineering materials; stress-strain diagrams for engineering materials; casting; fundamentals of hot and cold working processes; principles of powder metallurgy. Principles of welding, brazing & soldering.	20%

Teaching-Learning Methodology

Taught using interactive lectures, industrial videos, and process equipment demonstrations wherever available. Concepts are directly linked to industry scenarios in ME & CE contexts. Tutorial sessions use simple case studies — selecting a pump for a mechanical power plants, analysing a beam in a civil structure. Minimal derivations — engineering judgment and application are the goal.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Apply principles of forces, equilibrium, friction, and motion in engineering mechanics problems.	K3
CO2	Explain stress–strain behaviour, beam loading, strain measurement, and mechanical testing methods.	K2
CO3	Apply fluid statics, continuity, and Bernoulli's equation to basic fluid mechanics problems.	K3
CO4	Apply thermodynamic laws, processes, and air-standard engine cycles to engineering systems.	K3
CO5	Explain engineering material properties and fundamental manufacturing and joining processes.	K2

CO–PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	–	–	–	–	–	–	1
CO2	3	2	1	2	2	–	–	–	–	–	–	1
CO3	3	3	2	2	2	–	1	–	–	–	–	1
CO4	3	3	2	2	2	–	2	–	–	–	–	1
CO5	3	2	2	1	2	1	1	–	–	–	–	1

Evaluation Pattern

Sr. No.	Details of Evaluation	Weightage
1.	Internal Assessment – Class Tests (CT) + Teacher's Assessment (Assignment / Quiz / Attendance)	30%
2.	End Semester Theory Examination	70%

Suggested Textbooks / Reference Books

1. Engineering Mechanics – Statics and Dynamics – Irving H. Shames and G. K. Mohana Rao (Pearson Education Publication)
2. Strength of Materials (Mechanics of Solids) – R. K. Rajpoot (S. Chand Publication).
3. Internal Combustion Engines – V Ganesan (McGraw Hill Publication).
4. Manufacturing Technology (Vol. I & II) – P.N. Rao (McGraw Hill Publication).
5. Thermodynamics: An Engineering Approach – Yunus A. Çengel & Michael A. Boles (McGraw Hill Publication).

Online Resources

1. NPTEL – Introduction to Mechanical Engineering, IIT Bombay
2. NPTEL – Fluid Mechanics (relevant modules), IIT Kharagpur
3. Bureau of Energy Efficiency (BEE India) – Pumps and Compressed Air Systems

Additional References

Relevant articles, videos, and resources on:

1. Sustainable Energy Systems: Wind, Hydro, and Thermal Power

Course Code	**AAS151/ASS251**
Title of the Course	**Applied Physics Lab**
Total Credits of the Course	01
NCrF Hours	30

Course Objectives

1. To determine the wavelength of monochromatic light, polychromatic light and specific rotation optical instruments.
2. To determine Planck's constant using photoelectric effect, study of attenuation in optical fibre and verification of Stefan's law.
3. To determine the energy band gap and Hall coefficient of semiconductor materials.
4. To investigate the electrical, magnetic and thermal properties of materials and to verify respective fundamental laws.
5. To verify discrete nature of atomic energy transitions by Franck-Hertz experiment and study the switching characteristics of fundamental logic gates.

List of Experiments (Any ten experiments)

S. No.	Title of Practical	Description/Objective
1.	Diffraction grating	To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
2.	He -Ne Laser	To determine the wavelength of He-Ne laser light using single slit diffraction.
3.	Polarimeter	To determine the specific rotation of cane sugar solution using polarimeter.
4.	Nodal Slide	To determine the focal length of the combination of two lenses separated by a distance and verify the formula for the focal length of combination of lenses.
5.	Planck's constant	To determine Planck's constant using photoelectric effect.
6.	Optical Fiber	To measure attenuation in an optical fiber.
7.	Stefan's Law	To verify Stefan's law by electric method.
8.	Energy Band Gap	To determine the energy band gap of a given semiconductor material.
9.	Hall Effect	To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.

10.	Variation of Magnetic Field	To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
11.	B-H Curve	To draw hysteresis curve (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.
12.	Carey Foster's Bridge	To determine resistance per unit length and specific resistance of a given resistance using Carey Foster's Bridge.
13.	Electrochemical Equivalent	To determine the electrochemical equivalent (ECE) of copper.
14.	Coefficient of Viscosity	To determine the coefficient of viscosity of a given liquid.
15.	Surface Tension	To measure surface tension of a liquid (e.g., water, ethanol, and surfactant solutions) at room temperature using capillary rise or stalagmometer.
16.	Compound Pendulum	To determine the value of acceleration due to gravity (g) using compound pendulum.
17.	Moment of Inertia	To determine the moment of inertia of a flywheel about its own axis of rotation.
18.	Young’s Modulus	To determine the Young’s Modulus of a material by Searle's apparatus.
19.	Franck-Hertz Experiment	To determine the first excitation potential of a gas (e.g. Argon) by Franck-Hertz experiment and verify discrete nature of atomic energy transitions.
20.	Solar Cell	To study the characteristics of a solar cell.
21.	Characteristics of Logic Gates	To study the switching characteristics of fundamental logic gates constructed using transistors (BJT/MOSFET), measure propagation delay and power dissipation.

Equipment / Software Required

1. Experimental set-up, inbuilt assembly or specific experiment related apparatus and manuals etc.
2. Light sources, multimeters, rheostat, keys and other required materials.

Teaching-Learning Methodology

Each laboratory session begins with a brief pre-lab discussion connecting the experiment to the corresponding objectives. Students write an aim, apparatus list, procedure, observation table, calculations, result, and inference. Post-lab discussion sessions relate experimental findings to real-world engineering applications. Students maintain a laboratory record book assessed for viva, record, and observation components.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Determine the wavelength of monochromatic light, polychromatic light and specific rotation optical instruments	K3
CO2	Determine Planck's constant using photoelectric effect, study of attenuation in optical fibre and verification of Stefan’s law.	K3
CO3	Determine the energy band gap and Hall coefficient of semiconductor materials.	K3
CO4	Investigate the electrical, magnetic and thermal properties of materials and to verify respective fundamental laws.	K3
CO5	Verify discrete nature of atomic energy transitions by Franck-Hertz experiment and study the switching characteristics of fundamental logic gates.	K3

CO–PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	3	3	–	–	–	1	–	–	1
CO2	3	3	1	3	3	–	1	–	1	–	–	1
CO3	3	3	2	3	3	–	–	–	1	–	–	1
CO4	3	3	2	3	3	1	2	–	1	–	–	1
CO5	3	3	2	3	3	–	–	–	1	–	–	2

Evaluation Pattern

Sr. No.	Component	Marks	Weightage
1.	Day-to-day performance (Observation, Procedure, Conduct)	30	30%
2.	Laboratory Record / File	20	20%
3.	End Semester Practical Examination (Experiment + Viva)	50	50%

Safety and General Instructions

1. Students must follow all laboratory safety guidelines and wear appropriate personal protective equipment (PPE).
2. Electrical experiments must be performed only after instructor approval and under supervision.
3. Handle optical instruments, lasers, and high-voltage equipment with extreme care.
4. Chemicals and solvents (where applicable) must be handled as per MSDS guidelines.
5. Equipment must be switched off and lab bench cleaned after every session.

Suggested Textbooks / Reference Books

1. Practical Physics- K. K. Dey & B. N. Dutta (Kalyani Publishers New Delhi
2. Engineering Physics Practical- S K Gupta (Krishna Prakashan Meerut)
3. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
4. Engineering Physics Theory and Experiments-Srivastava and Yadav (New Age International)

Course Code	**AAS152B/ AAS252B**
Title of the Course	Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems Lab
Course Category	Basic Science Course (BSC)
Total Credits	01
NCrF Hours	30

Main Focus of the Course Outcomes

Employability	**Skill Development**	**Entrepreneurship**
✓	✓	✓

Course Objectives:

1. To determine chemical and physical properties of metals and alloys relevant to mechanical applications
2. To study corrosion of metals in different environments and evaluate protective methods
3. To determine properties of lubricants and fuels relevant to mechanical engineering
4. To characterise electrochemical energy storage devices — batteries and fuel cells
5. To study surface coatings and thin film properties relevant to mechanical systems

List of Experiments (Any 10 Experiments)

Exp.	**Theory Unit**	**Title**	**Description / Objective**
1	Unit I	Determination of Hardness of Metal Specimen	Determine Brinell or Vickers hardness of given metal specimens (mild steel, aluminium, copper); relate to material selection for machine components
2	Unit I	Corrosion of Metals – Weight Loss Method	Determine corrosion rate of mild steel, aluminium, and copper in HCl and H_2SO_4 solutions by weight loss method; express in mpy (mils per

			year); relate to material selection in corrosive environments
3	Unit II	Electrochemical Corrosion – Galvanic Series	Set up galvanic cells with dissimilar metal pairs (Fe-Cu, Fe-Zn, Fe-Al); measure open circuit potential (OCP); verify galvanic series; relate to galvanic corrosion in machine assemblies
4	Unit II	Effectiveness of Corrosion Inhibitor	Study inhibition of mild steel corrosion in HCl using benzotriazole or amine-based inhibitor; calculate inhibition efficiency by weight loss and polarisation methods
5	Unit III	Determination of Viscosity of Lubricating Oil	Measure kinematic viscosity of given lubricating oil samples at 40°C and 100°C using Redwood or Ostwald viscometer; compute viscosity index; assess suitability for engine lubrication
6	Unit III	Flash Point and Fire Point of Lubricating Oil	Determine flash point and fire point of given lubricating oil using Pensky-Martens closed cup or Cleveland open cup apparatus; relate to fire safety in machinery
7	Unit III	Calorific Value of Solid/Liquid Fuel	Determine gross and net calorific value of a given fuel sample (coal/oil) using Bomb calorimeter; relate to fuel efficiency and engine performance
8	Unit IV	EMF of Electrochemical Cell and Nernst Equation	Measure EMF of Daniell cell ($Zn/ZnSO_4$ || $CuSO_4/Cu$) at different concentrations; verify Nernst equation; relate to battery cell potential
9	Unit IV	Charge-Discharge Characteristics of Li-ion / Lead-Acid Battery	Study charge and discharge curves of a small battery cell; measure terminal voltage, capacity, and efficiency; relate to energy storage in EVs and power tools

10	Unit V	Electroplating – Copper Deposition	Electroplate a mild steel specimen with copper from CuSO4 bath; measure thickness of deposit using screw gauge; calculate current efficiency; relate to surface protection of machine parts
11	Unit V	Determination of Dropping Point of Grease	Determine dropping point of given grease samples; classify grease type; relate to selection of lubricating grease for bearings and machine elements
12	Unit IV	Solar Cell – I-V Characteristics	Plot I-V and P-V curves of a small photovoltaic cell; determine open-circuit voltage, short-circuit current, fill factor, and efficiency; relate to photovoltaic chemistry

Equipment / Chemicals Required

1. Hardness tester (Brinell/Vickers), metal specimens
2. Analytical balance, glass beakers, acid solutions
3. Galvanic cell setup with salt bridge and voltmeter
4. Redwood/Ostwald viscometer with thermostat bath
5. Pensky-Martens/Cleveland flash point apparatus
6. Bomb calorimeter
7. Electroplating setup (DC power supply, copper electrodes, CuSO4 bath)
8. Battery charge-discharge test setup with data logger
9. Solar cell module with rheostat and multimeters
10. Dropping point apparatus for grease

Teaching-Learning Methodology

Each laboratory session begins with a 10-minute pre-lab discussion connecting the experiment to the corresponding theory unit. Students record aim, principle, apparatus, chemicals, procedure, observation table, calculations, result, and inference in the laboratory record book. Post-lab discussion relates experimental findings to real-world engineering applications in the respective stream. Students maintain a laboratory record book assessed for viva, record, and day-to-day performance.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Determine metal hardness and corrosion rate in different environments	K3
CO2	Set up galvanic cells, measure OCP, and evaluate corrosion inhibitor efficiency	K3
CO3	Measure viscosity, flash point, and calorific value of lubricants and fuels	K3
CO4	Determine EMF, verify Nernst equation, and study battery charge-discharge characteristics	K3
CO5	Perform electroplating and characterise solar cell I-V behaviour	K3

Co-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	3	3	–	1	–	1	–	–	1
CO2	3	3	2	3	3	1	1	–	1	–	–	1
CO3	3	3	2	3	3	1	2	–	1	–	–	1
CO4	3	2	2	3	3	–	3	–	1	–	–	1
CO5	3	3	2	3	3	1	2	–	1	–	–	1

Evaluation Pattern

Sr.	Component	Marks	Weightage
1.	Day-to-day performance (Observation, Procedure, Conduct)	20	20%
2.	Laboratory Record / File	30	30%
3.	End Semester Practical Examination (Experiment + Viva Voce)	50	50%

Suggested Textbooks / Reference Books

1. Engineering Chemistry – Jain and Jain
2. Corrosion Engineering – Fontana and Greene
3. Fuels and Combustion – S.P. Sharma and C. Mohan

Safety and General Instructions

1. Students must wear lab coat and safety goggles at all times in the chemistry laboratory

2. Handle all acids, alkalis, and oxidising agents with extreme care; use fume hood for volatile chemicals
3. Dispose of chemical waste in designated containers as per lab safety guidelines
4. Do not pipette by mouth; use rubber bulb or mechanical pipette fillers
5. Wash hands thoroughly after every experiment; report any spillage or accident immediately

Course Code	**AEE151B / AEE251B**
Title of the Course	Electrical Engineering Lab
Course Category	Engineering Science Course (ESC)
Total Credits	01
NCrF Hours	30

Main Focus of the Course Outcomes

Employability	**Skill Development**	**Entrepreneurship**
✓	✓	✓

Course Objectives:

1. Verify Ohm's law and Kirchhoff's laws through simple DC circuit experiments
2. Measure AC power, power factor, and demonstrate power factor improvement for industrial loads
3. Set up three-phase circuits and measure three-phase power relevant to industrial motors
4. Study transformer efficiency and induction motor starting and performance
5. Demonstrate working of Fluorescent Lamp, electrical safety and protection equipment, and energy metering.

List of Experiments (Any Ten Experiments)

Exp.	**Title**	**Objective / Description with Application**
1	Electrical Safety Practices in the Laboratory	Demonstrate safe handling of electrical equipment, proper use of insulated tools, earthing, and emergency shutdown procedures. Application: Safe operation of electrical systems in laboratories and workplace
2	Verification of Ohm's Law	Verify the relationship between voltage and current for a resistor and determine its resistance..
3	Verification of KVL and KCL	Verify Kirchhoff's Voltage Law in a series circuit and Kirchhoff's Current Law in a parallel circuit

4	Thevenin's Theorem Verification	Find Thevenin's equivalent of a DC network; verify with different load resistors.
5	Power and Power Factor Measurement	Connect a single-phase inductive load (choke / single-phase motor); measure voltage, current, and active power using a wattmeter; compute power factor.
6	Power Factor Improvement Using Capacitor	Improve power factor of an inductive load by adding capacitors in steps; record reduction in line current.
7	Three-Phase Star Connection – Voltage and Current	Set up a balanced three-phase star resistive load; measure phase and line voltages and currents; verify the √3 relationship. Application: three-phase supply to textile machines, chemical plant drives, and construction site distribution boards.
8	Measurement of Three-Phase Power by Two-Wattmeter Method	Measure the total power of a three-phase balanced load using the two-wattmeter method.
9	No-Load Test on a Single-Phase Transformer	Measure no-load voltage, current, and input power; observe the no-load characteristics of a transformer.
10	Verification of Voltage and Current Ratio of a Single-Phase Transformer	Measure primary and secondary voltages and currents to verify the transformation ratio.
11	Starting of a Three-Phase Induction Motor Using DOL Starter	Start a three-phase induction motor using a DOL starter and observe its operation and direction of rotation.
12	Demonstration of Star-Delta Starter	Observe the starting of a three-phase induction motor using a star-delta starter and compare it with DOL starting..
13	Working of Fluorescent Lamp Circuit	Connect and observe the operation of a fluorescent lamp using a choke and starter.

14	Demonstration of Fuse, MCB and Earthing	Demonstrate the operation of a fuse and MCB and verify proper earthing of electrical equipment.
15	Study of Domestic Energy Meter and Energy Bill	Observe the operation of a single-phase energy meter and identify the major components of a domestic electricity bill

Equipment / Instruments Required

- DC Regulated Power Supply
- Single-Phase and Three-Phase AC Supply
- Electrical Circuit Trainer/Breadboard
- AC/DC Ammeters and Voltmeters
- Two Single-Phase Wattmeters
- Resistor Kit and Rheostat
- Capacitor Bank and Choke Coil (Inductive Load)
- Single-Phase Transformer
- Three-Phase Squirrel Cage Induction Motor
- Direct-On-Line (DOL) Starter
- Star-Delta Starter (Demonstration Setup)
- Single-Phase Energy Meter
- Fluorescent Lamp with Choke (Ballast) and Starter
- Fuse, MCB and Earthing Demonstration Kit
- Earth Continuity Tester
- Connecting Wires, Switches and Terminal Blocks
- Safety Equipment (Insulated Gloves, Safety Goggles, Fire Extinguisher and First Aid Kit)

Teaching-Learning Methodology

Each 2-hour session begins with a 10-minute pre-lab briefing linking the experiment to its theory unit and a real engineering application. Students record aim, circuit diagram, apparatus, procedure, observation table, sample calculations, result, and inference in their lab record book. A 10-minute post-lab discussion relates the experiment to emerging technologies in the stream. Continuous assessment of observation quality and conduct is maintained.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Verify Ohm's law, KVL, KCL, and Thevenin's theorem in DC circuit experiments with industrial context	K3

CO2	Measure AC power, power factor, and demonstrate power factor improvement for laboratory setup	K3
CO3	Set up three-phase circuits and measure power using the two-wattmeter method	K3
CO4	Evaluate transformer efficiency and demonstrate induction motor starting.	K3
CO5	Demonstrate electrical safety practices, conduct energy metering and demonstrate working of Fluorescent Lamp and protection equipment.	K2

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	–	–	–	1	–	–	1
CO2	3	3	2	3	3	–	1	–	1	–	–	1
CO3	3	3	2	3	3	–	1	–	1	–	–	1
CO4	3	2	2	3	3	–	1	–	1	–	–	1
CO5	3	2	1	2	3	2	2	3	1	–	–	1

Evaluation Pattern

Sr.	Component	Marks	Weightage
1.	Day-to-day performance (Observation, Circuit, Conduct)	20	20%
2.	Laboratory Record / File	30	30%
3.	End Semester Practical Examination (Experiment + Viva Voce)	50	50%

Safety Instructions

1. No circuit should be energised without the instructor's approval
2. Always switch OFF supply before making or changing any connection
3. Three-phase experiments must be performed under direct instructor supervision
4. Never exceed the rated range of any measuring instrument
5. Switch off all equipment and tidy the lab bench after every session

Course Code	AEC151B / AEC251B
Title of the Course	Electronics Engineering Lab
Course Category	Engineering Science Course (ESC)
Total Credits	01
NCrF Hours	30

Main Focus of the Course Outcomes

Employability	Skill Development	Entrepreneurship
✓	✓	✓

Course Objectives:

1. Set up diode rectifier and regulated power supply for an electronic control circuit
2. Use transistor as a switch to drive relay and control a real actuator
3. Calibrate a physical sensor (temperature, light) and condition its output using an op-amp
4. Verify logic gate truth tables and understand basic digital control logic
5. Demonstrate industrial electronics — sensor-to-display chain, relay control, and an IIoT demo

List of Experiments (Any Ten Experiments)

Exp.	Title	Objective / Description with Application
1	Diode Characteristics and Rectifier	Plot forward V-I characteristic of a silicon diode; set up a full-wave bridge rectifier; observe output with and without filter capacitor. Application: DC supply for industrial sensor transmitter or PLC input module.
2	Zener Diode Voltage Regulator	Set up a Zener voltage regulator; vary supply and load; measure regulation. Application: regulated 5V / 12V supply for field instrument transmitter circuits in process plant.

3	BJT as a Switch – Relay Driver for Actuator Control	Use NPN BJT to drive a relay coil; connect relay to switch a lamp or motor ON/OFF using a small control signal. Application: PLC transistor output driving a solenoid valve in chemical plant or a conveyor belt relay in textile mill.
4	Optocoupler – Isolation between Control and Power Circuit	Demonstrate an optocoupler (PC817) isolating a low-voltage control signal from a higher-voltage load circuit; observe LED-phototransistor action. Application: PLC output isolation, VFD signal isolation in industrial drives.
5	Thermistor / LDR Sensor Characteristics and Bridge Circuit	Measure resistance-temperature (thermistor) or resistance-light (LDR) characteristics; set up a Wheatstone bridge; observe bridge output voltage change with sensor input. Application: temperature sensing in chemical reactor or light sensing in greenhouse.
6	Op-Amp Signal Amplifier for Sensor Output	Connect thermistor bridge output to a non-inverting op-amp amplifier (IC 741); measure amplified output voltage for different temperatures. Application: amplifying 4–20 mA sensor signal for PLC analog input in process control.
7	Op-Amp Comparator – Threshold Alarm	Set up an op-amp comparator with a sensor (thermistor or LDR) on one input and an adjustable reference on the other; observe alarm LED triggering when threshold is crossed. Application: over-temperature alarm in chemical

		reactor, level alarm in storage tank.
8	Logic Gate Truth Table Verification	Verify truth tables of AND, OR, NOT, NAND gates using a logic trainer; implement a simple industrial logic: Motor ON = Switch_A AND (NOT Emergency_Stop). Application: basic PLC ladder logic equivalent in discrete gate form.
9	7-Segment Display Driver – Digital Readout	Drive a 7-segment display using a BCD decoder IC (7447) and DIP switches to display digits 0–9; understand how a digital readout shows sensor data. Application: digital temperature/pressure display on process plant HMI.
10	Complete Sensor-to-Display Chain	Connect a thermistor sensor → Wheatstone bridge → op-amp amplifier → op-amp comparator (alarm) → digital display (or LED bar graph); demonstrate the full signal chain. Application: temperature monitoring and alarm system in a manufacturing plant or textile drying oven.
11	IIoT Demo – Sensor Data on Cloud Dashboard (Arduino/NodeMCU)	Connect a temperature or soil moisture sensor to a NodeMCU; display readings on serial monitor; (if Wi-Fi available) push data to a free IoT platform (ThingSpeak / Blynk). Application: remote condition monitoring of machines in Industry 4.0 factory.

Equipment / Instruments Required

1. DC regulated power supply and digital multimeters
2. Breadboard and component kit (diodes, Zener, NPN BJT, IC 741, optocoupler PC817)

3. Thermistor, LDR, and Wheatstone bridge setup
4. Relay (5V), indicator LED, small lamp for relay switching
5. Digital logic trainer (ICs 7408, 7432, 7404, 7400)
6. 7-segment display with BCD decoder IC 7447 and DIP switches
7. Arduino / NodeMCU + temperature or moisture sensor + USB cable
8. Laptop with Falstad Circuit Simulator / Tinkercad (browser-based, free)

Teaching-Learning Methodology

Each 2-hour session begins with a 10-minute pre-lab discussion linking the experiment to its theory concept and a real product or industry application. Students build circuits on a breadboard, take measurements, and record observations, calculations, result, and inference. Post-lab discussion highlights how the experiment relates to a real device (phone charger, PLC output, biosensor, IoT node). Simulation (Falstad/Tinkercad) is used alongside hardware wherever possible.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Set up diode rectifier and Zener voltage regulator circuits for industrial instrument supply	K3
CO2	Use BJT and optocoupler to switch relays and isolate control circuits from power circuits	K3
CO3	Calibrate sensors, set up bridge circuits, and apply op-amp amplification and comparator alarm	K3
CO4	Verify logic gate truth tables and demonstrate digital control logic and 7-segment display	K3
CO5	Demonstrate a complete sensor-to-display signal chain and an IIoT sensor monitoring demo	K3

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	–	–	–	1	–	–	1
CO2	3	3	2	3	3	–	–	–	1	–	–	1
CO3	3	3	2	3	3	–	–	–	1	–	–	1
CO4	3	2	2	3	3	–	–	–	1	–	–	1
CO5	3	3	3	3	3	1	1	–	2	1	–	2

Evaluation Pattern

Sr.	Component	Marks	Weightage
1.	Day-to-day performance (Circuit building, Observation, Conduct)	20	20%
2.	Laboratory Record / File	30	30%
3.	End Semester Practical Examination (Experiment + Viva Voce)	50	50%

Safety Instructions

1. Always build the circuit with power OFF; energise only after instructor check
2. Do not apply voltage exceeding IC or component ratings — check datasheet
3. Handle CRO probes and signal generator outputs carefully
4. Do not connect 230V AC load directly — use relay output with instructor supervision only
5. Switch off all instruments and tidy the breadboard and bench after every session

Course Code	**ACE151B / ACE251B**
Title of the Course	Computer Aided Engineering Drawing Lab
Course Category	Engineering Science Course (ESC)
Total Credits	02
NCrF Hours	45

Main Focus of the Course Outcomes

Employability	Skill Development	Entrepreneurship
✓	✓	✓

Course Objectives

1. To familiarise the student with the principles, conventions and standards of engineering drawing, so that a drawing can be read and prepared without ambiguity.
2. To develop the ability to visualise a three-dimensional object and to represent it through orthographic, sectional and pictorial views.
3. To develop working competence in a CAD package for two-dimensional drafting and for basic three-dimensional modelling.
4. To develop the ability to prepare drawings of the components, systems and layouts that occur in the Mechanical Engineering Stream (ME), rather than generic examples.
5. To introduce limits, fits, tolerances and surface texture symbols, and to expose students to solid modelling and its downstream use in CAM and additive manufacturing.

List of Experiments / Exercises		
Exp. No.	**Title and Brief Description**	**Hours**
1	**Drawing standards, sheet layout and the CAD environment** Sheet sizes, borders, title block, lines, lettering and dimensioning as per BIS conventions (SP 46 : 2003 (BIS) Engineering Drawing Practice for Schools and Colleges; IS 10711 (sheet sizes and layout); IS 9609 (lettering); IS 10714 (line conventions); IS 11669 (preparation of general	3

	engineering drawings); ISO 128 series.). Familiarisation with the CAD interface: coordinate entry, units, limits, object snap, layers, line types and file management. Students set up a standard A3/A4 template with a title block that will be reused throughout the semester.	
2	**Geometric constructions and engineering curves** Construction of polygons, tangents, plain and diagonal scales; conic sections (ellipse, parabola, hyperbola) and one roulette (cycloid or involute) using CAD draw and modify commands (LINE, ARC, OFFSET, TRIM, ARRAY, MIRROR). Stream context: involute of a circle (gear tooth profile), cycloid (cam and rolling contact) and helix (screw thread and spring).	3
3	**Orthographic projection of points and straight lines** Projections of points in the four quadrants; projections of lines inclined to one and both reference planes; true length and true inclination by rotation/trapezoidal method. Principal planes handled on separate CAD layers.	3
4	**Orthographic projection of planes and simple solids** First angle projection of planes and of prisms, pyramids, cylinders and cones resting in given positions; front, top and side views. Third angle convention introduced for comparison, since it is common in imported drawings.	3
5	**Sections of solids and true shape of section** Solids cut by section planes perpendicular to one reference plane and inclined to the other; sectional views, cutting plane line, hatching conventions and true shape of the section obtained by auxiliary projection.	3
6	**Development of lateral surfaces** Parallel line and radial line development of cube, prism, cylinder, cone and truncated solids. Stream context: development of a sheet metal transition piece, a funnel and an elbow, of the kind fabricated in a sheet metal shop.	3
7	**Isometric projection and reading of orthographic views** Isometric scale, isometric axes and isometric drawing aids in CAD; conversion of given orthographic views into an isometric view, and the reverse exercise of reading a pictorial view and producing orthographic views. Missing line and missing view problems for visualisation practice.	3
8	**Machine component drawing with tolerancing conventions** Orthographic and sectional views of a machine component (bearing bracket, stuffing box or a simple housing).	4

	Conventional representation of external and internal screw threads, fasteners, keys, splines and springs. Indication of limits and fits as per IS 919, geometrical tolerances as per ISO 1101, and surface texture symbols as per IS 10719, with a short discussion on why a shop drawing is incomplete without them.	
9	**Assembly drawing from part drawings** Given the detail drawings, students prepare the assembly drawing of a knuckle joint, cotter joint, flanged coupling or screw jack with sectional front view, item balloons, a parts list/bill of materials and only the overall, fit and installation dimensions. One reverse exercise: given an assembly, extract the detail drawing of one part.	4
10	**3D solid modelling and drawing derivation** Feature based modelling of a component (V belt pulley, flange, connecting rod or a bracket) using extrude, revolve, sweep, fillet, chamfer, hole and pattern features; a simple two-part assembly with mates; automatic generation of the orthographic and sectional drawing views with a bill of materials from the model.	4
11	**Sheet composition, plotting and CAD data exchange** Composition of a complete drawing sheet with title block, revision table and multiple scaled views; plotting to scale; export to PDF and DXF for a laser/waterjet job and to STL/STEP for 3D printing and for exchange with a different CAD package. Discussion of why STEP is preferred over native formats for archival.	3
12	**Mini project with an introduction to parametric and AI assisted design** In groups of two or three, students prepare a complete drawing set (detail drawings plus an assembly drawing with BOM) of a small mechanism or sub assembly, together with its 3D model. The session includes a demonstration of design tables/parametric configurations, topology optimisation and generative design, and of the CAD–CAM chain up to tool path or slicer output. Evaluation by presentation and viva voce.	6
	Internal assessment, viva voce and end semester practical examination	**03**
	Total	**45**

Teaching–Learning Methodology
Each weekly session begins with a short tutorial (1 hour) on the drawing principle or standard involved, followed by two hours of hands-on CAD work at the terminal. Experiments 1 to 7 build the common graphics foundation. Experiments 8 to 12 are specific to the Mechanical Engineering Stream (ME) and are conducted by, or in consultation with, the parent department. Every student maintains a CAD drawing portfolio (soft copy plus a plotted file) which is submitted for internal assessment. Sheets are checked for correctness of projection and for conformity to standards a geometrically correct but non-conforming drawing is returned for correction. The mini project of Experiment 12 is done in groups of two or three and is defended individually in a viva voce.

Course Outcomes (COs)

CO	Course Outcome Statement	KL
CO1	Apply engineering drawing standards and conventions (BIS/ISO) while setting up and dimensioning a drawing.	3
CO2	Construct orthographic and sectional views of points, lines, planes and solids using a CAD package.	3
CO3	Develop surfaces and isometric views of solids, read given views to visualise the object, and apply this to draw detail and assembly drawings of machine components with sectioning, tolerancing and surface-texture indications..	3
CO4	Create three-dimensional models in CAD, derive two-dimensional views from them, and exchange drawing data in standard formats.	3
CO5	Compose, plot and defend a complete stream specific drawing set through a mini project, using contemporary CAD practice and emerging parametric/AI assisted tools.	6

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2				1	1		1		
CO2	3	3	2	2	2				1	1		1		
CO3	2	2	3	2	2		1		2	1	1	2		
CO4	2	1	3	2	3				1	1		2		
CO5	2	2	3	2	3	1	1	1	3	3	2	3		

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1	Internal Assessment (PS): continuous evaluation of experiment performance, the drawing portfolio/lab record, mini project and viva voce, and attendance	50 %
2	End Semester Practical Examination (PE): CAD exercise assigned on the spot (one common and one stream specific component), drawing record and viva voce	50 %

Suggested Reference (Latest Edition)	
1.	N. D. Bhatt and V. M. Panchal, Engineering Drawing, Charotar Publishing House, Anand (latest edition).
2.	M. G. Shah, C. M. Kale and S. Y. Patki, Building Drawing with an Integrated Approach to Built Environment, McGraw Hill Education (latest edition).
3.	R. S. Malik and G. S. Meo, Civil Engineering Drawing, Computech Publications (latest edition).
4.	Sham Tickoo, AutoCAD: A Problem-Solving Approach, CADCIM Technologies / Dreamtech Press (current release).
5.	C. Eastman, P. Teicholz, R. Sacks and K. Liston, BIM Handbook: A Guide to Building Information Modeling, John Wiley & Sons (latest edition).
6.	SP 46 : 2003, Engineering Drawing Practice for Schools and Colleges, Bureau of Indian Standards, New Delhi.
7.	IS 962 : 1989, Code of Practice for Architectural and Building Drawings, Bureau of Indian Standards.
8.	SP 34 (S&T) : 1987, Handbook on Concrete Reinforcement and Detailing, and IS 456 : 2000, Plain and Reinforced Concrete — Code of Practice, Bureau of Indian Standards.
9.	Pandey, S. K. (2001). *Learn AutoCAD: In a Easy Way*. S.K. Kataria & Sons. ISBN: 978-81-85749-78-5.
Online / e Resources	
1.	NPTEL/SWAYAM: Engineering Drawing and Computer Graphics, Prof. Rajaram Lakkaraju, IIT Kharagpur
2.	NPTEL/SWAYAM: Engineering Graphics and Design, Prof. Naresh V. Datla and Prof. S. R. Kale, IIT Delhi

3.	BIS Standards portal, https://www.services.bis.gov.in for the currently valid versions of SP 46, IS 962, IS 456.
4.	Autodesk Revit / FreeCAD BIM workbench official tutorials and documentation.

Course Context: This is a Project-Based Learning (PBL) course aligned with the AICTE model curriculum on Design Thinking & Innovation. Students work in teams through the complete Design Thinking cycle — Empathize, Define, Ideate, Prototype, Test — to solve a real-world problem. The emphasis is on doing, not lecturing: every session is a workshop or studio activity. The course builds creativity, teamwork, problem-solving, and an entrepreneurial mindset in first-year students of all branches.

Course Code	**AID151/AID251**
Title of the Course	Innovation & Design Thinking Lab (Project-Based Learning)
Course Category	Skill Development Course (SDC)
Total Credits	02
NCrF Hours	45
Mode	Studio / Workshop — Team-based Project Learning

Main Focus of the Course Outcomes

Employability	**Skill Development**	**Entrepreneurship**
✓	✓	✓

Course Objectives:

1. To introduce students to the Design Thinking process as a human-centred approach to problem solving
2. To develop empathy and the ability to identify real user needs and define meaningful problems
3. To build creative ideation, brainstorming, and lateral-thinking skills
4. To enable students to build low-cost prototypes and test them with users
5. To foster teamwork, communication, and an innovation and entrepreneurial mindset through a hands-on team project

Course Content — Design Thinking Modules (AICTE Aligned)

Module	**Description**	**Hours**

1.	**Module 1 – Introduction to Design Thinking & Innovation:** What is Design Thinking; difference between design thinking and conventional problem solving; the five stages (Empathize, Define, Ideate, Prototype, Test); innovation vs invention; examples of design thinking success stories (Apple, Airbnb, IDEO, Indian startups); creativity and the innovation mindset; introduction to the team project.	6 hrs
2.	**Module 2 – Empathize: Understanding the User:** Human-centred design; observation and user research techniques; conducting interviews and surveys; empathy mapping; identifying user needs, pain points, and latent needs; stakeholder analysis; developing personas. Studio Activity: field observation and user interviews for the chosen problem.	8 hrs
3.	**Module 3 – Define & Ideate:** Synthesising research; framing the problem statement (Point of View); 'How Might We' questions; brainstorming rules and techniques; SCAMPER, mind mapping, lateral thinking; idea selection and prioritisation (impact-effort matrix, dot voting); concept development. Studio Activity: define problem statement and generate/short-list solution ideas.	10 hrs
4.	**Module 4 – Prototype:** Purpose of prototyping; types of prototypes (paper, low-fidelity, working model, digital mock-up); rapid prototyping with low-cost materials; storyboarding; introduction to prototyping tools (cardboard, clay, 3D printing basics, Tinkercad, Figma/Canva for digital prototypes). Studio Activity: build a low-cost prototype of the team's solution.	12 hrs
5.	**Module 5 – Test, Iterate & Pitch:** User testing and feedback collection; iteration and refinement based on feedback; failure as learning; introduction to business model canvas (basic);	9 hrs

	value proposition; storytelling and pitching; preparing and delivering the final project pitch. Studio Activity: test prototype with users, iterate, and present the final pitch.	

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Explain the design thinking process and apply the innovation mindset to real problems	K2
CO2	Apply empathy tools (interviews, observation, empathy maps) to identify genuine user needs	K3
CO3	Define a clear problem statement and generate creative solutions through structured ideation	K3
CO4	Build a low-cost prototype of a proposed solution using appropriate tools	K3
CO5	Test and iterate the prototype based on user feedback and pitch the solution effectively as a team	K4

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	–	1	1	–	1	1	1	–	3
CO2	1	3	2	2	2	2	–	2	2	2	–	2
CO3	2	3	3	2	2	2	1	2	2	2	1	2
CO4	2	2	3	3	3	1	1	1	2	1	2	2
CO5	2	3	3	3	2	2	1	2	3	3	2	3

Evaluation Pattern

Sr.	Component	Marks	Weightage
1.	Internal Assessment (IA) — Stage-wise deliverables (Empathy report, Problem statement, Ideation, Prototype), Team-work, Design journal / portfolio	50	50%
2.	External Assessment (EA) — Final prototype demonstration + Project pitch + Viva Voce (by external examiner)	50	50%

Internal Assessment — Detailed Rubric (50 Marks)

Component	Deliverable	Marks
Empathize Stage	User research + empathy map + personas	10
Define Stage	Problem statement (POV) + How-Might-We	8
Ideate Stage	Brainstorm record + short-listed concept	8
Prototype Stage	Low-cost working prototype / model	12
Design Journal	Team logbook / portfolio of the whole process	7
Team Participation	Individual contribution + collaboration	5

Suggested Project Themes (Teams may choose or propose their own)

1. Campus & Community — waste management, water conservation, accessibility for the differently-abled, canteen queue management
2. Agriculture & Rural — low-cost farming tools, water-saving irrigation, crop storage, farmer information access
3. Health & Wellbeing — elderly care aids, hygiene solutions, mental wellness, first-aid tools
4. Sustainability & Environment — plastic reduction, energy saving, green mobility, air-quality awareness
5. Education & Skilling — learning aids, tools for rural schools, assistive learning for disabilities
6. Smart Living — affordable home automation, safety devices, smart utilities

Suggested Learning Resources

1. AICTE Model Curriculum – Design Thinking (aicte-india.org)
2. The Design of Everyday Things – Don Norman
3. Change by Design – Tim Brown (IDEO)
4. Design Thinking Bootleg – Stanford d.school (dschool.stanford.edu, free)
5. IBM Enterprise Design Thinking – ibm.com/design/thinking (free)
6. NPTEL – Design Thinking: A Primer (IIT Madras)

Course Code	**AAS153 / AAS253**
Title of the Course	Language Lab
Course Category	Applied Science & Humanities (AS&H)
Total Credits	Non-Credit
NCrF Hours	30

Main Focus of the Course Outcomes

Employability	Skill Development	Entrepreneurship
✓	✓	

Course Objectives

1. Develop proficiency in Listening, Speaking, Reading and Writing (LSRW) skills for academic, professional and workplace communication.
2. Build confidence in spoken English through interactive, collaborative and technology-enabled learning.
3. Strengthen pronunciation, fluency, vocabulary, grammar and presentation skills using digital language learning tools.
4. Develop professional communication skills required for interviews, group discussions, presentations, meetings and workplace interactions.
5. Enhance employability, critical thinking, leadership, teamwork and ethical communication through experiential learning and AI-assisted language practice

Unit	Description
1	**Part I: Interactive Communication Skills Lab** The laboratory shall provide experiential learning through role plays, simulations, presentations, discussions and workplace communication activities. **List of Practical Activities** 1. Self-Introduction, Video Introduction, and SWOT Analysis 2. Professional Networking and Digital Professional Branding (LinkedIn, X, or Professional Blogs) 3. Business Communication: Email, Notice, Agenda, Minutes of Meeting, and Technical Report Writing 4. Group Discussion (Case-based, Panel Discussion, and Turn-taking Techniques) 5. Role Play on Workplace Communication, Professional Etiquette, Negotiation, and Conflict Resolution

	6. Mock Interview (HR, Technical, Behavioral, and Situational Interviews) 7. Extempore Speech, Just A Minute (JAM), and Elevator Pitch 8. Technical and AI-assisted Presentation with Ethical Use of AI 9. Non-verbal Communication: Body Language (Kinesics), Eye Contact, Gestures, Proxemics, Facial Expressions, and Voice Modulation 10. Listening and Phonetics: IPA Basics, Pronunciation, Stress, Intonation, Accent Neutralization, and Audio-Video Comprehension using language learning software 11. Critical Thinking through Case Studies, Debate, Storytelling, and Collaborative Problem-solving 12. Professional Digital Portfolio: Résumé, Cover Letter, Video Portfolio and Career Portfolio
2	**Part II: Computer-Assisted Language Learning** Students shall complete self-paced software-based language* learning modules aligned with **CEFR (Target Level: B2)** to enhance employability and workplace communication. **Suggested Modules** • Grammar and Vocabulary • Listening and Reading Comprehension • Pronunciation, Phonetics, Stress, and Intonation • Spoken English and Fluency • Business Communication and Email Writing • Interview Preparation and Presentation Skills **Suggested Tools** • Praat : https://www.fon.hum.uva.nl/praat/ • BBC Learning English : https://www.bbc.co.uk/learningenglish • Sounds of Speech : http://soundsofspeech.uiowa.edu/ • British Council Learn English : https://learnenglish.britishcouncil.org/ • Forvo : https://forvo.com/ • Mozilla Common Voice : https://commonvoice.mozilla.org/en • British council: English score app (Google play store) ***Note**: The institute may use any software that meets the suggested modules criteria, depending on its availability.

Course Outcomes

COs	Course Outcome Statement	KL
CO1	Demonstrate effective Listening, Speaking, Reading and Writing (LSRW) skills for academic, professional and workplace communication.	K3

CO2	Apply appropriate verbal and non-verbal communication skills in presentations, group discussions, interviews and workplace interactions.	K3
CO3	Use correct pronunciation, grammar, vocabulary and digital language learning tools to improve fluency and communication effectiveness.	K3
CO4	Analyse professional communication situations and prepare effective reports, presentations and formal workplace documents using appropriate communication strategies.	K4
CO5	Demonstrate employability skills, teamwork, leadership, ethical communication and AI-assisted communication practices in professional environments.	K3

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	–	–	2	–	–	–	2	3	–	1
CO2	1	2	1	–	2	1	–	2	3	3	1	1
CO3	1	2	–	–	3	–	–	1	2	3	–	2
CO4	1	3	2	1	2	1	–	2	2	3	1	2
CO5	1	2	2	–	3	2	1	3	3	3	2	3

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage**
1	Internal Assessment (PS): continuous evaluation of experiment performance, the portfolio/lab record, mini project and viva voce, and attendance	50 %
2	End Semester Practical Examination (PE)	50 %

Course Code	**AAC101 / AAC201**
Title of the Course	Environment & Sustainability
Course Category	Mandatory Non-Credit / Audit Course (AU)
Teaching Load (L-T-P)	2 – 0 – 0
Credits	00 (Non-Credit)

Course Objectives:

1. To create awareness about the environment, natural resources, and ecological balance
2. To understand the causes, effects, and control of environmental pollution
3. To understand the concept of sustainable development and the UN Sustainable Development Goals (SDGs)
4. To understand climate change, renewable energy, and the engineer's role in sustainability
5. To encourage students to adopt simple sustainable practices and environmental responsibility

Course Content

Unit	Description	Hours
1.	**Environment and Ecosystems:** Environment — definition, components (atmosphere, hydrosphere, lithosphere, biosphere); ecosystem — structure and function; food chain, food web, energy flow (basic concept); biodiversity — meaning, importance, and threats; need for conservation. Awareness focus: local ecosystems and why they matter.	6 hrs
2.	**Natural Resources and their Conservation:** Renewable and non-renewable resources; water resources — scarcity and conservation; forest and land resources; energy resources (brief); over-exploitation of resources; the concept of the 3 R's — Reduce, Reuse, Recycle; rainwater harvesting (concept). Awareness focus: simple resource-saving practices in daily life.	6 hrs
3.	**Environmental Pollution:** Air pollution — causes, effects, control (basic); water pollution — sources, effects, prevention; soil pollution; noise pollution; solid waste management — segregation, composting, recycling; e-waste and plastic waste (awareness). Awareness focus:	6 hrs

	pollution in the student's own city/campus and how to reduce it.	
4.	**Climate Change and Sustainable Development:** Global warming and greenhouse effect (simple explanation); climate change — causes and impacts; carbon footprint (concept + how to reduce); sustainable development — definition and need; UN Sustainable Development Goals (SDGs) — overview of the 17 goals; renewable energy — solar, wind, biomass (awareness level). Awareness focus: calculating and reducing one's own carbon footprint.	6 hrs
5.	**Environmental Protection, Law and the Role of Engineers:** Environmental protection measures; brief overview of environmental laws in India (Environment Protection Act, Water Act, Air Act — awareness only, no legal detail); role of individuals, society, and technology in environmental protection; green campus and green buildings (concept); role of engineers in sustainable design and clean technology; environmental ethics. Awareness focus: how each engineering branch can contribute to sustainability.	6 hrs

Suggested Field / Awareness Activities (any one to be completed)

1. Visit a nearby lake, river, park, or forest and prepare a short observation report
2. Conduct a waste segregation / plastic-free drive on campus and document it
3. Prepare a poster or short video on an environmental issue (water, air, plastic, climate)
4. Calculate your household or personal carbon footprint and suggest ways to reduce it
5. Plant and maintain a sapling; document its growth over the semester (Green initiative)
6. Survey energy or water use in a hostel/department and suggest saving measures

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Explain the components of environment and ecosystems and the importance of biodiversity	K2
CO2	Describe natural resources and identify practical measures for their conservation	K2

CO3	Explain the causes and control of environmental pollution and waste	K2
CO4	Explain climate change, carbon footprint, and the UN Sustainable Development Goals	K2
CO5	Identify the role of engineers and individuals in environmental protection and sustainability	K2

Co-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	–	–	1	1	3	1	–	–	–	1
CO2	2	2	1	–	1	2	3	1	–	–	–	1
CO3	2	2	1	1	1	2	3	2	–	–	–	1
CO4	2	2	1	1	1	2	3	2	–	–	–	2
CO5	2	2	2	–	1	3	3	3	1	1	–	2

Evaluation Pattern

Sr.	Component	Weightage
1.	Assignment / Quiz / Class Test (awareness-based), Attendance and class participation	30%
2.	End Semester Examination (ESE)	70%

Suggested Learning Resources

1. Textbook of Environmental Studies for Undergraduate Courses – Erach Bharucha (UGC recommended)
2. Environmental Studies – Anindita Basak (Pearson)
3. Environmental Science – Y.K. Singh
4. UN Sustainable Development Goals – sdgs.un.org (free, official)
5. NPTEL – Environmental Studies / Sustainability courses (free video lectures)
6. Ministry of Environment, Forest & Climate Change (MoEFCC), Govt. of India – moef.gov.in

STANDARD OPERATING PROCEDURE (SoP)

Innovation & Design Thinking Lab (AID151/AID251) — Conduct Guidelines

Purpose: This SoP provides a standard, uniform procedure for conducting the Innovation & Design Thinking Lab across all departments, ensuring consistent delivery, fair assessment, and achievement of course outcomes in line with the AICTE Design Thinking framework.

1. Team Formation

1. Students are organised into teams of 4–5 members at the start of the semester.
2. Teams should be interdisciplinary/mixed wherever possible to encourage diverse thinking.
3. Each team elects a Team Lead (role rotates across project stages so every member leads once).
4. Each team maintains a shared Design Journal (physical logbook or digital document) from Day 1.

2. Weekly Session Structure (1 hr Tutorial + 2 hrs Studio)

1. Tutorial hour: instructor introduces the design-thinking concept/tool for the week with examples.
2. Studio hours (2 hrs): teams apply the tool to their own project under faculty facilitation.
3. The faculty acts as a facilitator/mentor, NOT a lecturer — guiding, questioning, and unblocking teams.
4. Every session ends with a 5-minute stand-up where each team states progress and next steps.
5. All work (notes, sketches, photos) is recorded in the team Design Journal the same day.

3. Stage-Gate Milestones (Aligned to 5 Design Thinking Stages)

Week	Design Thinking Stage	Deliverable / Gate
1–2	**Introduction + Team formation**	Team formed, problem area chosen, project charter
3–5	**Empathize**	User research, interviews, empathy map, personas

6–7	**Define**	Refined problem statement (POV) + How-Might-We questions
8–9	**Ideate**	Brainstorm record, shortlisted concept, concept sketch
10–12	**Prototype**	Low-cost working prototype / model built
13–14	**Test & Iterate**	User testing feedback + at least one iteration
15	**Pitch**	Final pitch, prototype demo, design journal submission

4. Role of Faculty Facilitator

1. Facilitate, do not dictate — let teams discover solutions themselves.
2. Ensure every team member participates; prevent free-riding through individual check-ins.
3. Provide timely feedback at each stage-gate before allowing progress to the next stage.
4. Arrange access to basic prototyping materials and tools (see Section 6).
5. Maintain a facilitation log recording each team's progress and individual contributions.
6. Invite an industry expert / entrepreneur / senior alumnus for the final pitch wherever possible.

5. Assessment Procedure

1. Internal Assessment (50 marks) is continuous and stage-wise, per the IA rubric in the syllabus.
2. Each stage-gate deliverable is assessed and recorded before the team proceeds.
3. Individual marks may vary within a team based on documented individual contribution.
4. External Assessment (50 marks) is conducted at semester end: final prototype demo + pitch + viva by an external examiner.
5. A team that has not cleared at least the Prototype stage-gate is not eligible for the final external assessment.
6. Design Journal is mandatory for both IA and EA — teams without a journal cannot be assessed.

6. Required Infrastructure & Materials

1. Design studio / open classroom with movable furniture for team work.
2. Whiteboards / chart paper, sticky notes (Post-its), markers, sketch pens.

3. Basic prototyping materials: cardboard, chart paper, glue, scissors, clay, thermocol, tape, craft materials.
4. Access to a computer lab with free tools — Tinkercad, Canva, Figma, Google Workspace.
5. Access (shared) to a 3D printer / maker-space / tinkering lab where available (ATL/IIC).
6. Projector / smart board for pitches and concept sharing.

7. Safety, Ethics & Academic Integrity

1. Students must handle tools (cutters, glue guns, 3D printers) safely and under supervision.
2. User research must be respectful; informed consent must be taken for interviews and photographs.
3. Projects must be original team work; plagiarism of existing products without acknowledgement is not permitted.
4. Teams are encouraged to consider social impact, inclusivity, and sustainability in their solutions.
5. Any promising innovation may be forwarded to the Institution's Innovation Council (IIC) / incubation cell for further support.

8. Documentation & Records to be Maintained

1. Team-wise Design Journal / Portfolio (empathy maps, sketches, photos, test notes).
2. Faculty facilitation log (per team, per session).
3. Stage-gate assessment sheets with marks.
4. Final project report (short) + pitch deck + prototype photographs.
5. Course file: syllabus, SOP, CO-PO mapping, sample deliverables, and result analysis.

Note: *This SOP is aligned with the AICTE model curriculum on Design Thinking & Innovation and the objectives of the Institution's Innovation Council (IIC) under the Ministry of Education's Innovation Cell. Departments may adapt studio scheduling to local timetable while retaining the five-stage design-thinking flow and stage-gate assessment.*

STANDARD OPERATING PROCEDURE (SoP) for General Proficiency

1. Title

Standard Operating Procedure (SoP) for implementation of **General Proficiency**

2. Objective

1. To promote **holistic development** of students beyond academic learning
2. To inculcate **discipline, ethical values, and social responsibility**
3. To enhance **communication, leadership, and teamwork skills**
4. To align student development with the vision of **NEP 2020**
5. To prepare students for **professional and societal challenges**

3. Scope

This SoP shall be applicable to:

- All **undergraduate (B.Tech) students**
- All **affiliated and constituent institutions** of the University
- All semesters (or as notified by the University)

4. Course Structure

Parameter	Details
Course Name	General Proficiency
Marks	50
Credits	Non-Credit
Nature	Mandatory
Type	Internal Assessment (Non-Theory)

5. Components of Assessment

Category	Marks	Key Evaluation Parameters
Discipline & Ethics	10	Attendance, punctuality, adherence to rules, respect for faculty and peers, ethical behavior
Communication & Leadership Skills	10	Language proficiency, confidence, presentation skills, leadership, problem-solving
Co-curricular Activities	10	Participation in debates, seminars, sports, cultural events, social service

Teamwork & Collaboration	10	Group participation, coordination, cooperation, helping attitude
Professional & Technical Skills	10	Practical knowledge, digital literacy, innovation, creativity

6. Evaluation Process

- Evaluation shall be conducted **semester-wise**
- Assessment shall be based on:
    - ✓ Continuous observation by faculty
    - ✓ Participation in activities
    - ✓ Performance in institutional and external events
- Students may be given opportunity for:
    - ✓ **Self-assessment**
    - ✓ **Faculty assessment**

7. Implementation Mechanism

- Each department shall nominate a **Faculty Coordinator**
- A **Proficiency Assessment Committee** may be constituted at institute level
- Records shall be maintained in:
    - ✓ Digital format
    - ✓ Activity log / portfolio of students

8. Documentation & Record Keeping

- Students shall maintain:
    - ✓ Participation certificates
    - ✓ Activity reports
    - ✓ Portfolio of achievements
- Institutes shall maintain:
    - ✓ Attendance and evaluation records
    - ✓ Consolidated marks sheet

9. Grading & Reporting

- Marks shall be awarded out of **50**

- The score shall be:
  - ✓ Reflected in **Grade Card**
  - ✓ Considered for **overall student evaluation (non-SGPA component, if applicable)**

10. Alignment with NEP 2020

The course aligns with:

- **Holistic Development (Para 4.4)**
- **Co-curricular Integration (Para 4.8)**
- **Ethics & Value-based Education (Para 4.27)**
- **Life Skills & Multidisciplinary Learning (Para 11.5)**
- **Student Well-being (Para 4.42)**

11. Expected Outcomes

Students will be able to:

- Demonstrate **discipline and ethical behavior**
- Exhibit **effective communication and leadership skills**
- Participate actively in **co-curricular and social activities**
- Work effectively in **teams**
- Apply **technical and professional skills in real-life situations**

12. Review and Monitoring

- Periodic review shall be conducted by:
  - ✓ **Departmental Committee**
  - ✓ **Academic Council (if required)**
- Feedback from students and faculty shall be considered for improvement

STANDARD OPERATING PROCEDURE (SoP) for Academic Activity Points (AICTE Activity Point Programme)

1. Title

Standard Operating Procedure (SoP) for implementation of **Academic Activity Points for Award of Degree**

2. Objective

- To promote **holistic development** of students beyond academics
- To encourage **community engagement, innovation, and social responsibility**
- To develop **leadership, teamwork, and entrepreneurial skills**
- To align with **AICTE guidelines and NEP 2020**

3. Scope

This SoP shall be applicable to:

- All **B.Tech students**
- All **affiliated and constituent colleges**
- Students admitted under **regular, lateral entry, and transfer categories**

4. Activity Points Requirement

Student Category	Minimum Activity Points
Regular Students (4-Year Programme)	100
Lateral Entry Students	75
Transferred Students	50

5. Nature of Activity Points

- **Mandatory for award of degree**
- **Non-credit** (not counted in SGPA/CGPA)
- Reflected in **final semester grade card**

6. Activity Categories and Approved Activities

Activity Summary Table

Sl. No.	Activity Head	Minimum Duration (Weeks)	Hours	Maximum Points	Evaluated By

				per Activity	
1	Helping local schools to improve results and enhance enrolment	2	80–90	20	Coordinator NSS / Youth Red Cross/ College Internal Compliant Committee / Mentor
2	Preparing business proposal for village income enhancement	2	80–90	20	Same
3	Sustainable water management system development	2	80–90	20	Same
4	Tourism promotion initiatives	2	80–90	20	Same
5	Promotion of appropriate technologies	2	80–90	20	Same
6	Energy conservation initiatives	2	80–90	20	Same
7	Skill development for rural population	2	80–90	20	Same
8	Digital financial inclusion initiatives	2	80–90	20	Same
9	Women empowerment awareness programmes	2	80–90	20	Same
10	Waste management system development	2	80–90	20	Same
11	Marketing support for rural produce	2	80–90	20	Same
12	Food preservation and packaging	2	80–90	20	Same
13	Automation of local activities	2	80–90	20	Same

14	Rural awareness programmes	2	80–90	20	Same
15	Participation in national initiatives (Swachh Bharat etc.)	2	80–90	20	Same
16	Rainwater harvesting awareness programmes	2	80–90	20	Same

7. Activity Duration and Completion

- Minimum duration per activity: **2 weeks**
- Minimum engagement: **80–90 hours**
- Activities can be completed during:
    - ✓ Weekends
    - ✓ Vacations
    - ✓ Semester breaks

8. Evaluation Mechanism

- Evaluation shall be carried out by:
    - ✓ Faculty Mentor
    - ✓ NSS / Activity Coordinator
    - ✓ Institutional Committee
- Assessment criteria:
    - ✓ Participation
    - ✓ Quality of work
    - ✓ Impact and outcomes

9. Implementation Framework

- Each institute shall appoint:
    - ✓ **Activity Point Coordinator**
    - ✓ **Monitoring Committee**
- Responsibilities:
    - ✓ Approve activities

- ✓ Monitor student progress
- ✓ Validate submitted documents

10. Documentation Requirements

Students must maintain:

- Activity reports
- Certificates
- Proof of participation (photos/videos)
- Mentor verification

Institutes must maintain:

- Student-wise records
- Consolidated activity reports

11. Submission and Reporting

- Institutes shall submit **consolidated reports to the University**
- Activity points shall be verified before **final semester completion**
- Points shall be reflected in the **Grade Card**

12. Compliance Requirement

- Earning required Activity Points is **mandatory for award of degree**
- In case of non-compliance:
    - ✓ **Degree shall not be awarded**
    - ✓ Final Grade Card may be withheld

13. Monitoring and Review

- Periodic review at:
    - ✓ Department level
    - ✓ Institute level
- University may conduct:
    - ✓ Audits
    - ✓ Compliance checks

14. Expected Outcomes

Students will:

- Develop **social responsibility and ethical values**
- Gain **practical exposure and real-world experience**
- Improve **leadership and teamwork skills**
- Enhance **employability and innovation capability**

15. Alignment with NEP 2020

- Holistic and multidisciplinary education
- Skill-based and experiential learning
- Community engagement
- Value-based education