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

LUCKNOW, UTTAR PRADESH

EVALUATION SCHEME & SYLLABUS

of

B. TECH.

First Year

ECE STREAM

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

AS PER AICTE MODEL CURRICULUM & NEP2020

(Effective from the Academic Session: 2026-27)

ECE Stream

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

Bachelor of Technology (ECE 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	AAS101C/ AAS102C	Quantum Physics and Electronic Sensors / Applied Chemistry for Emerging Electronics and Futuristic Devices	AS&H	3	0	0	45	30	70	100	03
2	BSC	AAS103C	Differential Calculus and Linear Algebra	AS&H	3	1	0	60	30	70	100	04
3	ESC	AEE101A/ AEC101A	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/ AME101A	Introduction to AI & Prompt Engineering/ Fundamentals of Mechanical Engineering	Respective Deptt./ ME	2	0	0	30	30	70	100	02
7	BSC	AAS151/ AAS152C	Applied Physics Lab/ Applied Chemistry for Emerging Electronics and	AS&H	0	0	2	30	50	50	100	01

			Futuristic Devices Lab									
8	ESC	AEE151A/ AEC151A	Electrical Engineering Lab / Electronics Engineering Lab	EE /ECE	0	0	2	30	50	50	100	01
9	ESC/ SDC	ACE151C/ 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*

ECE Stream

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

ECE Stream

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

Bachelor of Technology (ECE 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	AAS201C/ AAS202C	Quantum Physics and Electronic Sensors / Applied Chemistry for Emerging Electronics and Futuristic Devices	AS&H	3	0	0	45	30	70	100	03
2	BSC	AAS203C	Calculus, Laplace Transform and Numerical Techniques	AS&H	3	1	0	60	30	70	100	04
3	ESC	AEE201A/ AEC201A	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/ AME201A	Introduction to AI & Prompt Engineering/ Fundamentals of Mechanical Engineering	AS&H/ Respective Engg. Deptt.	2	0	0	30	30	70	100	02
7	BSC	AAS251/ AAS252C	Applied Physics Lab/ Applied Chemistry for Emerging Electronics and	AS&H	0	0	2	30	50	50	100	01

ECE Stream

			Futuristic Devices Lab									
8	ESC	AEE251A/ AEC251A	Electrical Engineering Lab /Electronics Engineering Lab	EE Deptt. / ECE Deptt.	0	0	2	30	50	50	100	01
9	ESC/ SDC	ACE251C/ 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

ECE Stream

Course Code	**AAS101C/AAS201C**
Title of the Course	Quantum Physics and Electronic Sensors
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 quantum mechanical principles governing the electronic properties of solids.
3. To develop a comprehensive understanding of the fundamental laws governing electric and magnetic fields and their roles in electronic equipment.
4. To understand the dielectric and magnetic materials and their roles in various technological devices and systems.
5. To comprehend the principles and applications of photonics.

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.	**Quantum Theory of Solids** Free electron theory, Fermi-Dirac distribution, energy bands in solids, band gap, conductors, semiconductors and insulators, effective mass, density of states, intrinsic and extrinsic semiconductors, conductivity of semiconductors, Fermi level.	20%

3.	**Electromagnetic Field Theory** Basic laws of electricity and magnetism, continuity equation for current density, displacement current, Maxwell equations in integral and differential form, Maxwell equations in vacuum and in conducting medium, Poynting vector and Poynting theorem, plane electromagnetic waves in vacuum and in conducting medium, skin depth.	20%
4.	**Dielectric and Magnetic Materials** **Dielectric materials:** Dielectrics, dielectric constant, electric displacement and polarization vectors, electric susceptibility, polarization mechanism, application of dielectric materials. **Magnetic Materials**: Magnetic susceptibility, dia-, para-, ferro-, materials, hysteresis loss, coercivity, remanence, importance of hysteresis curve, applications of magnetic materials.	20%
5.	**Photonics** **Fiber optic**s: Fundamental idea about optical fiber, acceptance angle, acceptance cone, numerical aperture, principle of light propagation in optical fiber, attenuation and attenuation coefficient in fiber. **Laser:** Interaction of radiation with matter (absorption, spontaneous and stimulated emission), principle of laser operation, Einstein's coefficient, Ruby laser, He-Ne laser, laser applications.	20%

Teaching-Learning Methodology

Topics are taught through interactive lectures using blackboard and ICT tools. Demonstrations, case studies and interactive sessions are used.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Understand the foundational concepts and principles of quantum mechanics.	K2
CO2	Understand the quantum mechanical principles governing the electronic properties of solids.	K2
CO3	Understand the fundamental laws governing electric and magnetic fields and their roles in electronic equipment.	K2
CO4	Understand the dielectric and magnetic materials and their roles in various technological devices and systems.	K2
CO5	Apply the principles and applications of photonics.	K3

ECE Stream

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	0	0	0	0	1	0	2
CO2	3	2	2	2	2	0	0	0	0	1	0	2
CO3	3	3	2	2	2	1	1	0	0	1	0	2
CO4	3	3	2	2	2	1	2	0	0	1	0	2
CO5	3	3	3	3	3	1	2	0	0	1	0	3

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. Electrical Engineering Materials – R.K. Rajput (S. Chand)
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 Semiconductor Devices
2. IEEE Power & Energy Society online learning resources
3. MIT Open Course Ware – Electromagnetic Energy

ECE Stream

Course Code	AAS102C /AAS202C
Title of the Course	Applied Chemistry for Emerging Electronics and Futuristic Devices
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 chemical basis of electronic materials including conductors, semiconductors, and insulators
2. To apply electrochemical principles to analyze battery, supercapacitor, and fuel cell systems for electronics
3. To study the chemistry of dielectric, magnetic, and optical materials used in electronic devices
4. To analyze the chemistry of nanomaterials and thin films for emerging electronic and photonic applications
5. To introduce the chemistry of organic electronics, flexible devices, and futuristic electronic systems

Course Content

Unit	Description	Weightage
1.	**Chemistry of Electronic Materials:** Electronic structure and bonding in conductors, semiconductors, and insulators, silicon and germanium chemistry, doping chemistry (n-type and p-type), compound semiconductors (GaAs, GaN, InP), wide-bandgap semiconductors, chemical vapor deposition (CVD) and molecular beam epitaxy (MBE) principles	20%
2.	**Electrochemical Energy Devices:** Electrochemical cells, electrode kinetics, Nernst equation, Li-ion battery chemistry (cathode, anode, electrolyte materials), solid-state batteries, sodium-ion batteries, supercapacitor	20%

ECE Stream

	chemistry (EDLC and pseudocapacitors), fuel cells (PEM, alkaline), self-discharge and cycle life chemistry	
3.	**Dielectric, Magnetic and Optical Materials:** Dielectric materials and polarization, dielectric properties and applications in capacitors and insulation. Ferroelectric and piezoelectric materials ($BaTiO_3$, PZT) and their Applications. Liquid crystals and their applications in LCD displays. Electroluminescent materials, LEDs and phosphors for display and lighting systems. Magnetic materials including ferrites and rare-earth magnets, and their applications. Introduction to optical materials, optical fibers and magneto-optical applications in communication.	20%
4.	**Nanomaterials and Thin Films for Electronics:** Synthesis of nanoparticles (chemical reduction, sol-gel, hydrothermal), quantum dots (CdSe, InP, carbon dots), carbon nanotubes (CNT) and graphene synthesis, thin film deposition techniques (PVD, CVD, ALD, spin coating), self-assembled monolayers (SAM), 2D materials (MoS2, h-BN), nanoelectronics applications	20%
5.	**Unit V – Organic Electronics and Futuristic Devices:** Conducting polymers (polyaniline, polythiophene, PEDOT:PSS), organic semiconductors, organic light-emitting diodes (OLED) chemistry, organic photovoltaics (OPV), flexible and stretchable electronics, perovskite solar cells, memristors, molecular electronics, biodegradable electronics, neuromorphic device chemistry	20%

Teaching-Learning Methodology

Topics are taught through interactive lectures using blackboard and ICT tools. Laboratory demonstrations on electrochemical characterization, thin film deposition, and material synthesis are integrated. Case studies on failure of electronic materials and emerging device applications supplement classroom teaching.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Understand the chemistry of electronic materials and semiconductor fabrication processes	K2

ECE Stream

CO2	Apply electrochemical principles to analyze battery, supercapacitor, and fuel cell systems	K3
CO3	Analyze the chemistry of dielectric, magnetic, and optical materials for electronic devices	K4
CO4	Understand nanomaterial synthesis and thin film chemistry for emerging electronics	K2
CO5	Apply organic electronics chemistry to design futuristic and flexible electronic systems	K3

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	0	1	0	0	1	0	2
CO2	3	3	2	3	2	1	3	0	0	1	0	2
CO3	3	3	2	3	2	1	2	0	0	1	0	2
CO4	3	2	2	3	3	1	2	0	0	1	0	3
CO5	3	3	3	3	3	2	3	0	1	1	0	3

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. Electronic Properties of Materials – Rolf E. Hummel
3. Chemistry of Advanced Materials – C.N.R. Rao and J. Gopalakrishnan
4. Organic Electronics – Klauk (Ed.)
5. Nanomaterials: An Introduction to Synthesis, Properties and Applications – Vollath

Online Resources

1. NPTEL courses on Engineering Chemistry and Electronic Materials
2. IEEE Xplore resources on emerging electronic materials
3. MIT OpenCourseWare – Chemistry of Materials

ECE Stream

Additional References

Relevant review articles, research papers, and handouts on latest developments in:

1. Perovskite Solar Cells: Chemistry and Device Physics
2. 2D Materials for Next-Generation Electronics
3. Neuromorphic Computing: Materials and Devices

ECE Stream

Course Code	**AAS103C**
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 differential calculus to analyze and optimize electronics and electrical engineering systems.
2. Use multiple integrals to solve problems in electromagnetics and wireless communication.
3. Apply matrix algebra to analyze electrical networks and communication systems.
4. Solve differential equations for electrical circuits, signals, and control systems.
5. Apply vector calculus to analyze electromagnetic fields and antenna systems.

Course Content

Unit	**Description**	**Weightage**
1.	**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 function of two variables, Jacobians, properties of Jacobian (without proof), Maxima & Minima for a function of up to two variables. **Applications:** Signal strength analysis, Communication system optimization, Frequency response analysis, Amplifier gain optimization, Antenna parameter optimization.	20%
2.	**Multiple Integrals**: Evaluation of double and triple integrals, change of order of integration, Change of variable (double -integral), Beta and Gamma	20%

ECE Stream

	functions, Properties of Beta and Gamma function. Dirichlet's Integral. Application of double integrals and Triple Integral to find area and volume. **Applications :** Electromagnetism, Wireless Communication, Antenna Theory.	
3.	**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 :** Error detection and correction codes, Loop Current Analysis.	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 :** Digital signal processing (DSP), wireless communication, antenna array processing, image.	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:** Electromagnetism, Wireless Communication, Antenna Theory.	20%

Course Outcomes

CO	Course Outcome Statement	KL
CO1	Apply differential calculus to solve and optimize engineering problems.	K3
CO2	Use multiple integrals to analyze engineering systems and field applications.	K3
CO3	Apply matrix algebra to solve linear systems and circuit problems.	K3
CO4	Solve differential equations for modeling electrical and electronic systems.	K4

ECE Stream

CO5	Apply vector calculus to analyze electromagnetic fields and communication systems.	K4

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.

ECE Stream

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.

ECE Stream

Course Code	**AAS203C**
Title of the Course	Calculus, Laplace Transform and Numerical Techniques
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 differential equations using series methods and special functions applicable to engineering problems.
2. Introduce Laplace and Fourier transform techniques for analyzing differential equations and signal-processing applications.
3. Build a strong foundation in complex variable theory and its applications in engineering and applied sciences.
4. Understand the concepts of sequences and series, convergence tests, and their role in mathematical modeling.
5. Enable students to apply advanced mathematical techniques to solve real-world problems in computer science, electronics, communication, and engineering.

Course Content

Unit	Description	Weightage
1.	**Series Solution & Special Functions:** Ordinary and singular point, Series solution about an ordinary point, Solution of equation by Frobenius method to solve second order linear differential equations, formation of Indicial equation, Determination of indicial roots, cases of indicial roots: Distinct roots, equal roots, roots differ by an integer and not differ by an integer. **Applications:** Fluid mechanics, quantum mechanical wave equation, Heat transfer, Solving electromagnetic field equation.	20%

ECE Stream

2.	**Laplace Transform:** Definition of Laplace Transform, Existence Conditions, Linearity Property, Laplace Transform of some standard functions, I and II Shifting theorems (without proof), 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 :** Transfer Function Determination, Circuit Equations, Step Response.	20%
3.	**Fourier Series& Fourier Transform:** Periodic function, even and odd function, Dirichlet's Condition for the Existence of a Fourier Series, Fourier series expansion of a function in the interval *c* to *c+2l*, Change of Interval, Half Range Series: Half range sine and cosine series in the interval *-l* to *l*, Parseval's Identity, Fourier Integral theorem, Fourier transform, Inverse Fourier Transform, Finite Fourier Sine and Cosine transform. **Applications :** Computer Graphics, Cyber Security, Digital Image Processing, Machine Learning Feature Extraction, Image compression.	20%
4.	**Complex Analysis:** Functions of Complex Variables, Limit Continuity and Differentiability, Analytic Function, Cauchy-Riemann Equations (Cartesian and Polar Form), Harmonic Function, Milne-Thomson Method, 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, Evaluating the Real definite integrals. **Applications :** Network Theory, Electromagnetic Waves, Transmission line.	20%
5.	**Unit V -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:** Discrete Time Signal Representation.	20%

ECE Stream

Course Outcomes

CO	Course Outcome Statement	KL
CO1	Apply series solution and Frobenius methods to solve second-order linear differential equations arising in engineering applications.	K3
CO2	Use Laplace transform techniques to solve ordinary differential equations and analyze engineering systems such as electrical circuits and control systems.	K3
CO3	Apply Fourier series and Fourier transform methods to analyze periodic functions and solve problems in signal processing, image processing, and machine learning.	K3
CO4	Solve complex-valued functions using complex analysis techniques and evaluate complex integrals and residues for engineering applications.	K3
CO5	Solve the convergence of sequences and infinite series using appropriate convergence tests and apply these concepts to mathematical modeling and discrete-time systems.	K3

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	0	0	0	0	1	0	2
CO2	3	3	2	3	2	0	0	0	0	1	0	2
CO3	3	3	2	3	3	0	0	0	0	1	0	2
CO4	3	3	2	3	2	0	0	0	0	1	0	2
CO5	3	3	2	2	2	0	0	0	0	1	0	3

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

ECE Stream

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.

ECE Stream

Course Code	AEE101A/ AEE201A
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 — voltage, current, resistance, power, and energy — and apply Ohm's law
2. Apply Kirchhoff's laws and simple network theorems to analyse DC circuits
3. Understand AC circuits and the concept of power factor in electrical systems
4. Learn how transformers work and how they are used in everyday power supplies and energy distribution
5. Understand electrical machines (DC and AC motors) and relate them to emerging applications, solar PV system and safety aspects

Course Content

Unit	Description	Weightage
1.	**Unit I – Basic Electrical Quantities and DC Circuits:** Electric charge, current, voltage, EMF, resistance; Ohm's law; resistors in series and parallel; voltage divider and current divider; power and energy in a DC circuit; Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL); simple mesh and nodal analysis; Thevenin's theorem (concept and simple problem	20%
2.	**AC Circuits:** Generation of AC voltage; sinusoidal waveform — peak, RMS, and average values; form factor; phasor representation (simple); AC through pure R, pure L, pure C; series RL and RC circuits; impedance; active power (P), reactive power (Q), apparent power (S); power factor (PF); power factor improvement using capacitors; measurement of power in single-phase AC circuit using wattmeter.	20%

ECE Stream

3.	**Three-Phase Systems:** Advantages of three-phase supply over single-phase; generation of balanced three-phase voltage; star (Y) and delta (Δ) connections; phase and line voltages and currents; power in balanced three-phase circuits; two-wattmeter method for power measurement; concept of neutral wire	20%
4.	**Magnetic Circuits, Transformers:** Magnetic flux, flux density, MMF, reluctance; simple series magnetic circuit; Faraday's law of electromagnetic induction; self-inductance and mutual inductance; principle of operation of single-phase transformer; EMF equation; ideal transformer — voltage ratio, current ratio, turns ratio; basic equivalent circuit of single phase transformer, losses (core and copper), efficiency	20%
5.	**Electrical Machines and Emerging Electrical Systems:** DC motor — principle, back EMF, torque, speed control concept; Types of DC motors and their application; BLDC motor — basic concept and applications , three-phase induction motor — rotating magnetic field, slip, torque; Application of three phase induction motors, introduction to solar photovoltaic (PV) system- Single diode model, current-voltage characteristics, PV characteristics, electrical safety in laboratory	20%

Teaching-Learning Methodology

Topics are taught using interactive lectures, short video clips, and simple numerical with real-life examples. Students are encouraged to relate each concept to devices they use daily — phone chargers, laptops, fans, UPS, and EVs. Tutorial sessions focus on problem-solving. No electronics device theory is included here.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Apply Ohm's law and Kirchhoff's laws to analyse basic DC circuits	K3
CO2	Analyse single-phase AC circuits and explain power factor and its correction	K3
CO3	Analyse balanced three-phase circuits and measure three-phase power	K3

ECE Stream

CO4	Explain transformer working and calculate turns ratio, efficiency, and equivalent circuit	K2
CO5	Explain operating principles of DC and AC motors, solar PV systems	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)

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. Electric Vehicles: Motor Types, Battery Packs, and Charging Systems
2. Smart Grid and AI-Based Demand Management
3. Solar PV Systems: From Panel to Grid

ECE Stream

Course Code	AEC101A / AEC201A
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 p-n junction diode behaviour and apply it in rectifier and voltage regulator circuits
2. Understand BJT and MOSFET as switches and amplifiers in digital and analog circuits
3. Understand operational amplifier characteristics and use it in basic signal conditioning circuits
4. Understand digital logic gates, Boolean algebra, and basic combinational circuits
5. Relate electronics fundamentals to real products — microcontrollers, IoT devices, smartphones, and embedded systems

Course Content

Unit	Description	Weightage
1.	**Diodes and Power Supply Circuits:** p-n junction — concept of depletion layer, forward and reverse bias; ideal diode vs real diode; V-I characteristics; diode as a switch; half-wave and full-wave bridge rectifier; filter capacitor; Zener diode — Zener breakdown, voltage regulator circuit; LED — working and current-limiting resistor; applications: USB charger rectifier, 5V/3.3V regulated supply for Arduino/Raspberry Pi, LED indicators in electronics products	20%
2.	**Transistors as Switches and Amplifiers:** Bipolar Junction Transistor (BJT) — Construction & VI characteristics of BJT, NPN and PNP, three regions of operation (cut-off, active, saturation); BJT as a switch (digital control of relay, buzzer, motor); BJT as a common-emitter amplifier (concept and gain);	20%

ECE Stream

	Introduction to FETs, MOSFET — N-channel MOSFET, gate-source voltage, MOSFET as a switch; why MOSFET is preferred in digital ICs and power electronics; applications: transistor switch for driving a relay in home automation, MOSFET in motor speed control (PWM concept), transistor in class-A amplifier for audio	
3.	**Operational Amplifier (Op-Amp):** Ideal op-amp characteristics — infinite gain, infinite input impedance, zero output impedance; practical characteristics of 741 IC, inverting amplifier — voltage gain formula; non-inverting amplifier — gain formula; voltage follower (buffer); summing amplifier; comparator — op-amp as comparator, threshold detection; applications: sensor signal amplification (temperature, light, pressure), audio amplifier, automatic night lamp comparator circuit, differential amplifier for ECG/EEG front-end (concept)	20%
4.	**Digital Electronics Basics:** Number systems — binary, decimal, hexadecimal (conversion only); logic levels (HIGH/LOW, 0/1); basic logic gates — AND, OR, NOT, NAND, NOR, XOR with truth tables; Boolean algebra — basic laws and De Morgan's theorems; k-map (upto 4 variables), half adder and full adder (truth table and logic diagram); multiplexer concept; flip-flop — SR and D flip-flop (concept only); applications: binary addition in CPU ALU, MUX in data routing, digital signals in microcontroller I/O, basics of PLA / PLD devices.	20%
5.	**Electronic Systems and Emerging Applications:** Microcontroller overview — what is a microcontroller, GPIO pins, ADC- ADC types – digital ramp type & flash type ADC, PWM (concept only, not programming); communication interfaces — UART, SPI, I2C (what they do, not detailed protocol); sensors and signal chain — sensor → conditioning (op-amp) → ADC → microcontroller; wireless communication basics — Bluetooth, Wi-Fi, Zigbee (concept); power management in electronics — LDO regulator, DC-DC converter (concept); applications: IoT weather station, smart home sensor node,	20%

ECE Stream

	wearable health device, EV battery management system (BMS) electronics overview	

Teaching-Learning Methodology

Topics are taught using interactive lectures, circuit simulations (Falstad / Tinkercad), and short video demonstrations. Every concept is anchored to a real product — phone charger, Arduino board, amplifier, logic gate in CPU. Tutorial sessions focus on simple circuit calculations. No deep derivations — understanding and application are the goal.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Analyse diode circuits and design a simple rectifier and Zener voltage regulator	K3
CO2	Explain BJT and MOSFET operation and apply them as switches in digital control circuits	K3
CO3	Design basic op-amp circuits for signal amplification and threshold comparison	K3
CO4	Apply Boolean algebra and design simple combinational logic circuits	K3
CO5	Relate electronics fundamentals to microcontrollers, IoT nodes, and EV electronics systems	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%

ECE Stream

Suggested Textbooks / Reference Books

1. Electronic Devices and Circuit Theory – Boylestad and Nashelsky (Pearson)
2. Electronics: Fundamentals and Applications – D. Chattopadhyay and P.C. Rakshit
3. Digital Design – M. Morris Mano (Pearson)
4. Op-Amps and Linear Integrated Circuits by Ramakant A. Gayakwad, Pearson Education / Prentice Hall

Online Resources

1. NPTEL – Basic Electronics, IIT Kharagpur / IIT Bombay
2. Falstad Circuit Simulator – falstad.com/circuit (free, browser-based)
3. Tinkercad Circuits – tinkercad.com (free, simulate Arduino + electronics)

Additional References

Relevant articles, datasheets, and resources on:

1. IoT Hardware: Microcontrollers, Sensors, and Wireless Modules
2. EV Battery Management System (BMS): Electronics Overview
3. Introduction to FPGA and Programmable Logic

ECE Stream

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%

ECE Stream

		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%

ECE Stream

		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.

ECE Stream

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

ECE Stream

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)

ECE Stream

Course Code	**ACS201**
Title of the Course	Essentials of Data Structures
Teaching Dept.	Computer Science Engineering (CSE)
Pre-requisite	ACS101 – Programming Language (C/C++ + Python)
Course Category	Engineering Science Course (ESC)
L – T – P	2 – 0 – 0
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**

ECE Stream

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()	20%

ECE Stream

		Real connect: Binary search in database index. Python sort() uses Timsort. E-commerce ranking, leaderboard, ML data preprocessing = sorting.	
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 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.*	20%

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) —	1. Stack using array — push and pop 5 elements 2. Queue using array — enqueue and dequeue 3. Balanced parentheses checker

ECE Stream

	what is front? 3. Check '({[]})' balanced — show stack trace	
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. BFS from A on: A-B, A-C, B-D, C-E	1. BST insert and inorder in python 2. Graph as adjacency list in Python dict 3. BFS using queue in Python (10–15 lines)

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

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	0	0	0	0	1	0	2
CO2	3	3	2	2	2	0	0	0	1	1	0	2
CO3	3	3	2	2	3	0	0	0	1	1	0	2
CO4	3	3	2	2	3	0	0	0	1	1	0	2

ECE Stream

CO5	3	3	2	3	2	0	0	0	1	1	0	3

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)

ECE Stream

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

ECE Stream

	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

CE Stream

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

ECE Stream

	• 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

ECE Stream

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

ECE Stream

	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 %

ECE Stream

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/

ECE Stream

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%

ECE Stream

	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%

ECE Stream

	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%

ECE Stream

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%

ECE Stream

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.

ECE Stream

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%

ECEstream

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

ECE Stream

Course Code	**AME101A / AME201A**
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 introduce the fundamentals of engineering mechanics, strength of materials, and engineering materials for mechanical system applications.
2. To develop an understanding of thermodynamics and heat transfer principles in computing, data centre, and electric vehicle systems.
3. To familiarize students with machine elements and power transmission mechanisms used in modern mechanical and robotic systems.
4. To provide foundational knowledge of conventional and advanced manufacturing processes, including additive and CNC manufacturing.
5. To introduce mechatronics, actuators, robotics, drones, and Industry 4.0 concepts for emerging engineering applications.

Course Content

Unit	**Description**	**Weightage**
1.	**Engineering Mechanics and Strength of Materials (Basics):** Types of forces and their effects; concept of stress and strain; beams — types of loads (point load, UDL), engineering materials — metals, polymers, ceramics, composites (properties and uses). Applications: frame of a laptop/server rack, load on a tower antenna, material selection for a robot arm, chassis of an electric vehicle.	20%
2.	**Thermodynamics and Heat Transfer Basics:** System and surroundings; laws of thermodynamics; heat transfer — conduction, convection, radiation. Applications: cooling fan and heat sink in a computer processor, AC in a server room/data centre, EV battery thermal management.	20%

ECE Stream

3.	**Machine Elements and Power Transmission:** Fasteners — bolts, screws, keys (types and use); shafts and couplings — rigid and flexible; bearings — ball bearing and roller bearing; belts and chains. Applications: gear train in a robotic joint, belt drive in a 3D printer, ball bearings in drone motor.	20%
4.	**Manufacturing Processes:** Casting, forming, machining (drilling, milling, grinding), joining — soldering, brazing; additive manufacturing — 3D printing, CNC machining concept. Applications: 3D-printed drone frame, cast aluminium heat sink, welded server rack.	20%
5.	**Mechatronics, Robotics, and Emerging Mechanical Systems:** Introduction to mechatronics; actuators — DC motor, stepper motor, servo motor, hydraulic and pneumatic actuators, introduction to robotics (Cartesian, SCARA, articulated), drones — airframe, propulsion, flight controller concept and Industry 4.0.	20%

Teaching-Learning Methodology

Topics are taught using interactive lectures, short videos, and product demonstrations. Every concept is connected to a real product familiar to CSE/ECE/EE students — laptops, smartphones, drones, robots, 3D printers, and EVs. No heavy numerical problems — conceptual clarity and application awareness are the goals. Tutorial sessions use case studies and product teardown discussions.

Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Understand the concept of basic mechanics, stress–strain, and material properties to engineering systems.	K2
CO2	Understand thermodynamic principles and heat transfer modes in thermal management systems.	K2
CO3	Explain the principles of machine elements and power transmission in mechanical and robotic systems.	K2
CO4	Explain conventional and advanced manufacturing processes for engineering components.	K2
CO5	Illustrate the concept of actuators, robotics, drones, and Industry 4.0 concepts in emerging mechanical systems.	K2

ECE Stream

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 – Hibbeler (Pearson Education Publication).
2. A Textbook of Mechanical Engineering – R.K. Rajput (Lakshmi Publication).
3. Manufacturing Technology (Vol. I & II) – P.N. Rao (McGraw Hill Publication).
4. Materials Science and Engineering: An Introduction – William D. Callister Jr. & David G. Rethwisch (Wiley Publication).
5. Fundamentals of Modern Manufacturing – Mikell P. Groover.

Online Resources

6. NPTEL – Introduction to Mechanical Engineering, IIT Bombay
7. MIT Open Course Ware – Introduction to Design and Manufacturing

Additional References

Relevant articles, videos, and resources on:

8. Robotics and Automation: Mechanical Foundations
9. Electric Vehicles: Drivetrain, Braking, and Thermal Management
10. Additive Manufacturing and 3D Printing in Electronics Product Design

ECE Stream

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.

ECE Stream

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.

ECE Stream

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.	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%

ECE Stream

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)

ECE Stream

Course Code	**AAS152C/ AAS252C**
Title of the Course	Applied Chemistry for Emerging Electronics and Futuristic Devices 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 study the electrical properties of conducting, semiconducting, and insulating materials
2. To characterise electrochemical energy storage devices used in electronics
3. To study properties of dielectric and magnetic materials relevant to electronic devices
4. To synthesise and characterise nanomaterials and thin films for electronic applications
5. To explore properties of organic and polymer-based electronic materials

List of Experiments (Any 10 Experiments)

Exp.	**Theory Unit**	**Title**	**Description / Objective**
1	Unit I	Electrical Conductivity of Electrolyte Solutions	Measure electrical conductivity of electrolyte solutions (NaCl, KCl, H2SO4) at varying concentrations using conductivity meter; determine limiting molar conductivity; relate to ionic conduction in electrolytes
2	Unit I	Band Gap of Semiconductor by Conductivity Method	Measure electrical resistance of a semiconductor sample (Ge) at different temperatures; plot ln(R) vs 1/T; determine band gap energy; relate to semiconductor device material selection

ECE Stream

3	Unit II	EMF of Electrochemical Cell and Nernst Equation	Measure EMF of Daniell cell at varying ion concentrations; verify Nernst equation; relate to battery cell voltage and electrochemical energy device design
4	Unit II	Charge-Discharge Characteristics of Supercapacitor	Study charge and discharge curves of a supercapacitor; measure capacitance, energy density, and power density; compare with Li-ion battery; relate to energy storage in electronic devices
5	Unit II	Electrodeposition of Thin Metal Film	Electrodeposit a thin copper or nickel film on a substrate; measure film thickness using gravimetric method; calculate current efficiency; relate to thin film technology in electronic device fabrication
6	Unit III	Dielectric Constant of Insulating Material	Measure dielectric constant (permittivity) of a polymer film or ceramic material using LCR meter at varying frequencies; study frequency dependence; relate to capacitor dielectric selection
7	Unit III	Magnetic Properties – B-H Curve (Demonstration)	Observe B-H hysteresis loop for soft and hard magnetic materials; determine retentivity, coercivity, and saturation magnetisation; relate to ferrite core materials in inductors and transformers
8	Unit IV	Synthesis of Silver Nanoparticles by Chemical Reduction	Synthesise silver nanoparticles by reduction of AgNO3 with sodium borohydride; confirm formation by UV-Vis spectroscopy (plasmon peak ~420 nm); study size-dependent colour change
9	Unit IV	Thin Film Deposition by Spin Coating	Prepare a thin polymer or sol-gel film on a glass substrate by spin coating; measure film thickness by Newton's rings method; relate to spin-coated films in OLEDs and photovoltaic devices
10	Unit V	Electrical Conductivity of Conducting	Synthesise polyaniline by chemical oxidative polymerisation; measure its electrical conductivity using four-probe

ECE Stream

		Polymer (Polyaniline)	method at different doping levels; relate to organic electronics applications
11	Unit V	Solar Cell – I-V and P-V Characteristics	Plot I-V and P-V curves of a solar cell; measure Voc, Isc, fill factor, and efficiency under different illumination levels; relate to photovoltaic chemistry and organic solar cells
12	Unit IV	UV-Vis Spectroscopy of Quantum Dots / Dye Solution	Record UV-Vis absorption spectrum of a quantum dot solution or dye (methylene blue); study Beer-Lambert law; relate to optical properties of quantum dots in display and imaging applications

Equipment / Chemicals Required

1. Conductivity meter and conductivity cell
2. Temperature-controlled resistance measurement setup for semiconductor
3. Electrochemical cell setup with voltmeter and salt bridge
4. Supercapacitor charge-discharge test setup
5. Electrodeposition setup (DC power supply, electrodes)
6. LCR meter or impedance analyser
7. B-H curve demonstrator / CRO
8. UV-Vis spectrophotometer
9. Spin coater and Newton's rings setup
10. Four-probe conductivity meter
11. Solar cell module with light source, rheostat, multimeters

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	Measure electrical conductivity of solutions and determine semiconductor band gap	K3

ECE Stream

CO2	Characterise electrochemical cells, supercapacitors, and electrodeposited thin films	K3
CO3	Measure dielectric constant and observe magnetic hysteresis of electronic materials	K3
CO4	Synthesise silver nanoparticles and characterise thin films by UV-Vis and optical methods	K3
CO5	Measure conductivity of conducting polymers 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	3	1	3	3	0	1	0	1	1	0	2
CO2	3	3	2	3	3	1	2	0	1	1	0	2
CO3	3	3	2	3	3	1	2	0	1	1	0	2
CO4	3	3	2	3	3	1	2	0	1	1	0	2
CO5	3	3	2	3	3	2	3	0	1	1	0	3

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. Electronic Properties of Materials – Rolf E. Hummel
3. Nanomaterials: An Introduction to Synthesis, Properties and Applications – Vollath

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

ECE Stream

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

ECE Stream

Course Code	AEE151A / AEE251A
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 hands-on DC circuit experiments
2. Measure AC voltage, current, power, and power factor in single-phase circuits
3. Set up three-phase circuits and measure three-phase power
4. Determine transformer turns ratio and efficiency through a simple load test
5. Study DC and AC motor characteristics and demonstrate solar PV operation as an emerging electrical application

List of Experiments (Any 10 Experiments)

Exp.	Theory Unit	Title	Objective / Description
1	Unit V	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	Unit I	Verification of Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL)	Verify Kirchhoff's Voltage Law in a series circuit and Kirchhoff's Current Law in a parallel circuit.

ECE Stream

3	Unit I	Thevenin's Theorem Verification	Find the open-circuit voltage (Vth) and equivalent resistance (Rth) of a DC network; connect different loads and verify that measured terminal voltages match Thevenin's prediction.
4	Unit II	AC Measurements – Voltage, Current, and Frequency	Use a voltmeter and ammeter to measure single-phase AC supply voltage and load current; verify using voltmeter, ammeter and wattmeter; observe waveform and measure frequency using a basic CRO.
5	Unit II	Determination of the parameters of ac single phase series RLC circuit.	Measure the source voltage (V), circuit current (I), active power (P), and voltages across each component. Use these values to calculate impedance, individual reactances, and phase angles
6	Unit II	Resonance in an RLC series circuit	Study the phenomenon of resonance in an RLC series circuit and obtain the resonant frequency.
7	Unit II	Power and Power Factor Measurement and Power Factor Improvement Using Capacitor	Connect a single-phase inductive load (choke coil); measure voltage, current, and active power using a wattmeter; compute power factor. Add capacitors in parallel steps across the inductive load; measure and record power factor at each step; observe reduction in line current.
8	Unit III	Three-Phase Star Connection – Voltage and Current Verification	Set up a balanced three-phase star-connected resistive load; measure phase and line voltages and currents; verify that $VL = \sqrt{3} \times Vph$ and $IL = Iph$.
9	Unit III	Three-Phase Power Measurement – Two-Wattmeter Method	Measure total active power and power factor of a three-phase balanced load using two single-phase wattmeters.

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10	Unit IV	Single-Phase Transformer – Turns Ratio and Load Test	Measure primary and secondary voltages to verify turns ratio; perform a load test at multiple loads; compute efficiency
11	Unit V	DC Motor – Speed Variation and Direction Reversal	Connect a DC shunt motor; observe speed change with armature voltage variation using a variable DC supply; reverse terminals to reverse direction.
12	Unit V	Three phase induction Motor –Direction Reversal	Connect a three phase induction motor; interchange supply terminals to reverse direction.
13	Unit V	Solar PV Module – Open Circuit Voltage, Short Circuit Current, and I-V Curve	Measure Voc and Isc of a solar PV module; connect a rheostat load and plot the I-V and P-V curves;

Equipment / Instruments Required

1. DC regulated variable power supply (0–30V) and digital multimeters
2. Resistor kit and rheostat
3. Single-phase variac, AC voltmeter, ammeter, and wattmeter
4. Choke coil (inductive load) and capacitor bank for PF correction
5. CRO / Digital oscilloscope (even a basic model is sufficient)
6. Three-phase supply panel with balanced star resistive load
7. Two single-phase wattmeters for three-phase power measurement
8. Single-phase step-down transformer (230V/12V or 230V/24V) with load panel
9. Small DC motor (permanent magnet or shunt type, 12–24V)
10. Solar PV module (5–20W), rheostat, multimeters

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.

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Course Outcomes (COs)

COs	Course Outcome Statement	KL
CO1	Verify Ohm's law, KVL, KCL, and Thevenin's theorem through DC circuit experiments	K3
CO2	Measure AC power and power factor and demonstrate capacitor-based PF improvement	K3
CO3	Set up three-phase circuits and measure power using the two-wattmeter method	K3
CO4	Determine transformer turns ratio and efficiency through a load test	K3
CO5	Demonstrate DC motor speed control and plot the I-V curve of a solar PV module	K3

CO-PO Articulation Matrix

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

ECE Stream

Course Code	AEC151A / AEC251A
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. Plot V-I characteristics of diode and Zener; set up rectifier and regulated power supply circuits
2. Study BJT and MOSFET as switches; drive a real load (LED, relay, motor)
3. Set up and measure inverting, non-inverting, and comparator op-amp circuits
4. Verify basic logic gate truth tables and implement a simple combinational circuit
5. Explore an emerging application — IoT sensor node or solar cell characteristics

List of Experiments (Any 10 Experiments)

Exp.	Theory Unit	Title	Objective / Description with Application
1	Unit I	Diode V-I Characteristics	Plot forward and reverse V-I characteristics of a silicon diode; identify knee voltage and reverse breakdown. Application: understanding the diode in a phone charger rectifier.
2	Unit I	Half-Wave and Full-Wave Bridge Rectifier	Set up half-wave and bridge rectifier circuits on breadboard; observe output waveforms on CRO without and with filter capacitor; measure DC output voltage. Application: DC power supply for a microcontroller development board.

3	Unit I	Zener Diode Voltage Regulator	Set up a Zener regulator circuit; vary input voltage and load; measure regulated output voltage; observe line and load regulation. Application: 5V/3.3V supply regulation for Arduino / Raspberry Pi.
4	Unit II	BJT as a Switch – LED and Relay Driver	Use an NPN BJT to switch an LED and a relay ON/OFF using a small base current from a signal source; observe saturation and cut-off. Application: microcontroller GPIO driving a relay to control a 230V lamp (home automation).
5	Unit II	MOSFET as a Switch – PWM Motor Speed Control	Use an N-channel MOSFET to control a small DC motor; apply a PWM signal (from signal generator or function generator) to gate; observe motor speed change. Application: motor speed control in drones, robots, and EV wheel drives.
6	Unit III	Op-Amp – Inverting and Non-Inverting Amplifier	Set up IC 741 in inverting (gain = –10) and non-inverting (gain = +11) configurations; apply a 100 mV sinusoidal input; measure output voltage and verify gain. Application: amplifying a small sensor signal (microphone, thermocouple).
7	Unit III	Op-Amp as Comparator – Automatic Night Lamp	Set up op-amp comparator with an LDR (light sensor) as one input and a reference voltage divider as the other; observe output switching HIGH/LOW with changing light levels; drive an LED via transistor. Application: automatic street light / night lamp controller.
8	Unit IV	Logic Gate Truth Table Verification	Verify truth tables of AND, OR, NOT, NAND, NOR, and XOR gates using a digital logic trainer (IC 7408, 7432, 7404, 7400, 7402, 7486); verify De Morgan's theorem using NAND and NOR gates. Application: basic

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			building blocks of any digital system — CPU, microcontroller, FPGA.
9	Unit IV	Half Adder and Full Adder Circuit	Implement half adder using XOR + AND gates; implement full adder using two half adders + OR gate; verify truth table. Application: binary addition in CPU ALU; understanding how a computer adds two numbers.
10	Unit V	Solar Cell – I-V Characteristics and Maximum Power Point	Measure Voc and Isc of a solar cell; vary load resistor and plot I-V and P-V curves; identify Maximum Power Point (MPP). Application: sizing solar panels for IoT gateway nodes and off-grid sensor stations.
11	Unit V	IoT Sensor Node – Temperature and Humidity Monitoring (Demo)	Set up an Arduino/NodeMCU with a DHT11/DHT22 temperature and humidity sensor; display readings on serial monitor; (if Wi-Fi available) send data to a free IoT dashboard. Application: smart home weather station, server room environment monitoring, campus IoT node.
12	Unit I–V	Mini Project / Simulation – Circuit Design on Falstad / Tinkercad	Students design and simulate a chosen circuit (rectifier + Zener supply, transistor relay driver, op-amp amplifier, or logic circuit) on Falstad or Tinkercad; present findings. Application: industry uses EDA tools for every circuit — this is the first step.

Equipment / Instruments Required

1. DC regulated power supply and digital multimeters
2. CRO / Digital Storage Oscilloscope
3. Signal / Function generator
4. Breadboard and component kit (diodes, Zener, BJT NPN, N-MOSFET, IC 741, TTL ICs)
5. Digital logic trainer board (ICs 7408, 7432, 7404, 7400, 7402, 7486)
6. LDR, relay (5V), LED, small DC motor (hobby grade)
7. Solar cell module (small, 0.5–2W)
8. Arduino / NodeMCU board + DHT11/DHT22 sensor + USB cable

ECE Stream

9. Laptop with Falstad Circuit Simulator and Tinkercad access (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	Plot diode and Zener characteristics and set up a regulated DC power supply circuit	K3
CO2	Use BJT and MOSFET as switches to drive real loads including relay and motor	K3
CO3	Set up op-amp inverting, non-inverting, and comparator circuits and verify gain and switching	K3
CO4	Verify logic gate truth tables and implement half adder and full adder circuits	K3
CO5	Demonstrate solar cell characteristics and set up a basic IoT sensor monitoring node	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

ECE Stream

Course Code	**ACE151C / ACE251C**
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 Electronics Engineering Stream (ECE), rather than generic examples.
5. To introduce schematic capture and printed circuit board layout as the drawing language of electronics, and to relate the board to the mechanical enclosure that houses it.

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	3

	(line conventions); IS 11669 (preparation of general engineering drawings); ISO 128 series.). Familiarisation with the CAD interface: coordinate entry, units, limits, object snap, layers, linetypes 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: parabolic reflector profile of a dish antenna, and the exponential/tapered profiles used in horn antennas and waveguide transitions.	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 instrument enclosure, a shielding can and a rectangular to circular waveguide transition.	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	**Graphical symbols and circuit schematic drawing**	4

ECE Stream

	Standard graphical symbols for passive components, semiconductor devices, sources, connectors and instruments as per IEEE Std 315 / IEC 60617 / IS 2032. Preparation of a neat schematic of a small circuit (regulated d.c. power supply or an op amp signal conditioning stage) with reference designators, net labels and a component list; block diagram of the same system for comparison.	
9	**Printed circuit board layout from schematic** Footprint assignment, board outline, component placement, track width and clearance selection with reference to IPC 2221 and IPC 7351, ground pour, single - and double-sided routing, silkscreen and assembly drawing; generation of Gerber and drill files. Students see explicitly how the same circuit gives rise to two different documents the schematic and the layout.	4
10	**3D modelling of an electronic enclosure** Solid model of a box type enclosure or a heat sink using extrude/shell/pattern features; cut outs for connectors, display and mounting bosses checked against the board of Experiment 9; automatic generation of the fabrication drawing with dimensions and tolerances.	4
11	**Panel/rack layout, sheet composition and plotting** Front panel and 19-inch rack layout drawing with cut outs and legends; cable/harness and interconnection diagram; composition of a complete sheet with title block, plotting to scale, and export to PDF, DXF and Gerber for fabrication.	3
12	**Mini project with an introduction to AI assisted EDA** In groups of two or three, students produce the complete documentation set for a small electronic system (for example an IoT sensor node): block diagram, schematic, PCB layout, Gerber output, enclosure model and fabrication drawing. The session includes a demonstration of auto placement/auto routing, design rule checking, AI assisted schematic to layout tools and 3D board–enclosure co design. Evaluation by presentation and viva voce.	6
	Internal assessment, viva voce and end semester practical examination	**03**
	Total	**45**

ECE Stream

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 Electronics Engineering Stream (ECE) 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 (on successful completion of the course, the student will be able to:)	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 circuit schematics, PCB layouts and enclosure drawings using standard symbols.	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
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

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CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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.	R. S. Khandpur, Printed Circuit Boards: Design, Fabrication, Assembly and Testing, McGraw Hill Education (latest edition).
3.	K. Venugopal, Engineering Drawing and Graphics + AutoCAD, New Age International Publishers (latest edition).
4.	IEEE Std 315, Graphic Symbols for Electrical and Electronics Diagrams, IEEE.
5.	IEC 60617, Graphical Symbols for Diagrams, International Electrotechnical Commission.
6.	IPC 2221, Generic Standard on Printed Board Design, and IPC 7351, Land Pattern Standard, IPC.
7.	SP 46 : 2003, Engineering Drawing Practice for Schools and Colleges, Bureau of Indian Standards.
8.	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 (https://nptel.ac.in/courses/112105294).
2.	NPTEL/SWAYAM: Engineering Graphics and Design, Prof. Naresh V. Datla and Prof. S. R. Kale, IIT Delhi (https://archive.nptel.ac.in/content/syllabus_pdf/112102304.pdf).

ECE Stream

3.	KiCad official documentation and tutorials, https://docs.kicad.org.
4.	IPC and IEC standards portals for the currently valid editions of the design standards cited above.

ECE Stream

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,	6 hrs

ECE Stream

	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.	
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); value proposition; storytelling and pitching; preparing and delivering the final project pitch. Studio Activity: test prototype with users, iterate, and present the final pitch.	9 hrs

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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

ECE Stream

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)

ECE Stream

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.

ECE Stream

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

ECE Stream

	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

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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

ECE Stream

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.

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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.

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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.*

CE Stream

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

ECE Stream

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**

ECE Stream

- 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

ECE Stream

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

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				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

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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

ECE Stream

- ✓ 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

ECE Stream

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

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