AISSMS
COLLEGE OF ENGINEERING

ज्ञानम् सकलजनहिताय

An Autonomous Institute Affiliated to Savitribai Phule Pune University
Approved by AICTE, New Delhi and Recognised by Govt. of Maharashtra
Accredited by NAAC with "A+" Grade | NBA - 7 UG Programmes

Savitribai Phule Pune University

All India Shri Shivaji Memorial Society's

COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

Faculty of Science and Technology

National Education Policy (NEP) Compliant Curriculum

First Year B. Tech. (2025 Pattern)

[Common to All UG Programs]

(With effect from Academic Year 2025-26)

www.aissmscoe.com

Contents

Nomenclature

BSC	Basic Science Course
ESC	Engineering Science Course
PCC	Program Core Course
VSEC	Vocational and Skill Enhancement Course
IKS	Indian Knowledge System
AEC	Ability Enhancement Course
CCC	Co-Curricular Courses
NEP	National Education Policy
CO	Course Outcome
PO	Program Outcomes
MSE	Mid Semester Exam
ESE	End Semester Exam
TW	Term Work
CCA	Continuous Comprehensive Assessment
WK	Knowledge and Attitude Profile
L	Lecture
P	Practical
T	Tutorial

Course Code Nomenclature: Example		
Course Code BSC-101		
BSC: Basic Science Course	1: F. Y. B. Tech.	01 to 99 : Course Number

Preface

This document serves as a comprehensive curriculum for our autonomous engineering institute, which is set to align its educational framework with the National Education Policy (NEP) 2020. The NEP emphasizes a holistic and multidisciplinary approach to education, aiming to foster critical thinking, creativity, and innovation among students. Our goal is to provide an enriching academic environment that not only adheres to the highest standards of technical education but also prepares our students to meet the evolving demands of the industry and society for sustainable development.

The curriculum outlined in this document reflects a strong commitment to integrating theoretical knowledge with practical application, ensuring that graduates are well-prepared to address real-world challenges. It has been designed with flexibility and adaptability in mind, enabling students to explore diverse fields within engineering and technology while promoting interdisciplinary learning. Through the incorporation of modern teaching methodologies and cutting-edge resources, the program fosters a culture of excellence and continuous improvement.

This document provides detailed descriptions of the courses offered, the expected course outcomes, and the assessment methods employed. It is intended to serve as a valuable resource for students, faculty, and stakeholders, supporting the development of a dynamic academic environment committed to innovation and excellence in engineering education.

Dr. B. D. Bachchhav
Chairman, BOS
Engineering Sciences and Humanities

Program Outcomes (POs)

PO1	**Engineering knowledge**	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.
PO2	**Problem analysis**	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	**Design / Development of Solutions**	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for public health and safety, whole-life cost, net zero carbon, culture, society and environment. (WK5)
PO4	**Conduct Investigations of Complex Problems**	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis &interpretation of data to provide valid conclusions. (WK8)
PO5	**Engineering Tool Usage**	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling, recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	**The Engineer and The World**	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7)
PO7	**Ethics**	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9
PO8	**Individual and Collaborative Team Work**	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	**Communication**	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
PO10	**Project Management and Finance**	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects in multidisciplinary environments.
PO11	**Life-Long Learning**	Recognize the need for, and have the preparation and ability for: (i) independent and life-long learning, (ii) adaptability to new and emerging technologies, and (iii) critical thinking in the broadest context of technological change. (WK8)

Knowledge and Attitude Profile (WK)

WK1	**Natural Sciences and Social Sciences**	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	**Mathematics and Data Analysis**	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	**Engineering Fundamentals**	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	**Engineering Specialist Knowledge**	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	**Engineering Design and Environmental Considerations**	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	**Engineering Practice (Technology)**	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	**Role of Engineering in Society**	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	**Research and Critical Thinking**	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	**Ethics and Inclusive Behavior**	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability, etc., with mutual respect.

General Guidelines

I. General Guidelines for Examination:

The examination shall be conducted in **THREE** parts viz. Continues Comprehensive Assessment (CCA), Mid Semester Examination (MSE) and End Semester Examination (ESE).

a) Continuous Comprehensive Assessment (CCA):

- CCA focuses on continuously assessing a student's performance throughout the semester. Apart from classroom and laboratory learning, CCA activities can be undertaken to accelerate the attainment of the various outcomes in the course: The significance of CCA lies in its ability to provide a more accurate and all-round understanding of a student's abilities, skills, and knowledge. CCA promotes experiential learning, participatory learning, collaborative learning, active learning, self-learning, peer to peer learning, etc.
- CCA covers **20 marks** for Basic Science Courses, Engineering Science Courses and Program core courses.
- As part of the CCA framework, students are required to undertake **ANY TWO ACTIVITIES** from the prescribed set CCA1, CCA2, and CCA3 for evaluation.
- Each Activity will be performed in a **group of 5-6 students**.
- **CCA 1 (10 Marks):** Consist of **Course Activity** which could be industry application-based, internet-based, workshop-based, and laboratory-based or field based.
- **CCA 2 (10 Marks):** Consist of **Case Study /Survey** based on applications or content beyond Course Contents of the respective course.
- **CCA 3 (10 Marks)**: Consist of **Group Discussion/Seminar/Blog writing.**
- Course Teacher will guide the students to select the activities to be performed in CCA.
- Assessment of CCA will be done by Course Teacher of an individual student on regular basis.
- Students shall submit reports for any two selected activities (Out of CCA 1, CCA 2, and CCA 3) according to the schedule provided by the course teacher.
- CCA Activities will be reviewed periodically every four weeks during the laboratory hours.

Note: CCA (Continuous Comprehensive Assessment) activities are designed to go beyond the prescribed Course Contents, incorporating recent developments and practical applications related to the course.

b) Mid Semester Examination (MSE)

Mid Semester Theory Examination of **30 marks** will be based on Unit-1 and Unit-2 of Course Contents

- **Structure of Question paper**

Course Contents	Questions	Marks	Total Marks	Duration
Unit 1	Q 1 or Q 2	15	30	1 hour
Unit 2	Q 3 or Q 4	15		

c) End Semester Examination (ESE)

End Semester Theory Examination of **50 marks** will be based on unit number Unit3, Unit-4 and Unit-5 of Course Contents

- **Structure of Question paper**

Course Contents	Questions	Marks	Total Marks	Duration
Unit 3	Q 1 or Q 2	16	50	2 hours
Unit 4	Q 3 or Q 4	17		
Unit 5	Q 5 or Q 6	17		

The question paper for MSE and ESE should be framed in alignment with the course outcomes and in accordance with the Revised Bloom's Taxonomy, to assess various cognitive levels of the students. This should be effectively reflected in the dissemination through the question papers.

The Examination Department will schedule and conduct the MSE and ESE by prior display of examination Time-Table.

Assessment will be done Centralized under surveillance.

II. Guidelines for Term work and Tutorial:

i) Practical (PR)/Tutorial (TU) must be conducted in three batches per division.

ii) Minimum number of required Experiments/Assignments in PR/ Tutorial shall be carried out as mentioned in the syllabi of respective courses.

iii) Every Student should appear for Engineering Physics, Engineering Chemistry, Engineering Mechanics, Engineering Graphics, Basic Electrical Engineering, Basic Electronics Engineering, Programming and Problem Solving, Vocational Skill Enhancement course, Ability Enhancement Course, Indian Knowledge System and Co-Curricular Courses during the year.

iv) Institute is allowed to distribute Teaching workload of courses Engineering Physics, Engineering Chemistry, Engineering Mechanics, Engineering Graphics, Basic Electrical Engineering, Basic Electronics Engineering, Programming and Problem Solving, Vocational Skill Enhancement course, Ability Enhancement Course, Indian Knowledge System and Co-Curricular Courses in Semester I and II dividing number of First Year divisions into two appropriate groups.

v) Assessment of tutorial work has to be carried out as term- work examination. Term work Examination and Practical Examination at first year of engineering course shall be internal continuous assessment.

vi) Credit of tutorial and practical shall be awarded on internal continuous assessment.

vii) Credit for the course of workshop practical is to be awarded on the basis of continuous assessment/ submission of job work.

III. Guidelines for the Student Induction Program (SIP):

First Year B. Tech. students enter the institution with diverse backgrounds and varying levels of academic preparation. To support their transition, the Induction Program has been designed to facilitate adjustment to the academic and social environment, introduce the ethos and culture of the institution, and promote self-exploration and a sense of purpose. The induction program also aims to foster strong connections among students and between students and faculty, while encouraging learning beyond the classroom setting. The Induction Program spans two weeks one week at the beginning of the first semester and one week at the beginning of the second semester. While no formal examination is conducted, however student feedback is to be collected, and each class is required to prepare a report.

Objectives:

Objectives of Student Induction Program are to:

- Help students adjust to the new environment.
- Inculcate the culture and values of the institution.
- Foster bonding between students and faculty.
- Develop a sense of social responsibility.
- Promote holistic development: physical, emotional, intellectual, and ethical.

Expected Outcomes:

At the end of student Induction Program, students shall:

- Feel integrated into the college community
- Be aware of their roles as an engineering students and future professionals
- Have a basic understanding of ethics, values, and personal development
- Improve in communication, teamwork, and time management
- Show a positive attitude toward learning and social responsibility

Core Components:

In order to implement Student Induction Program following activities to be conducted by the institute.

A. Universal Human Values (UHV)
B. Proficiency Modules Activities
C. Expert Lectures / Invited Talks from Industry
D. Orientation Sessions by Deans
E. Department Orientation activities
F. Visits to Institute

Curriculum for First Year UG Course in B. Tech.

(Academic year: 2025-2026 onwards)

Semester- I

Course Category	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks				Credits			
			L	P	T	CCA	MSE	ESE	TW	L	P	T	Total
Basic Science Course	BSC101	**Engineering Mathematics- I**	3		1	20	30	50	25	3	-	1	04
	BSC102/ BSC103	**Engineering Physics/ Engineering Chemistry**	3	2	-	20	30	50	25	3	1	-	04
Engineering Science Course	ESC101/ ESC102	**Basic Electronics Engineering / Basic Electrical Engineering**	2	2	-	20	30	50	25	2	1	-	03
	ESC103/ ESC104	**Engineering Graphics / Engineering Mechanics**	2	2	-	20	30	50	25	2	1	-	03
	ESC105	**Fundamentals of Computer Science and Engineering**	2	2	-	20	30	50	25	2	1	-	03
Vocational and Skill Enhancement Course (VSEC)	VSEC101/ VSEC102	**Engineering Workshop/Design Thinking and Idea Lab**	-	2	-	-	-	-	25	-	1	-	01
Ability Enhancement Course	AEC101	**Professional Communication Skills**	-	-	2	-	-	-	25	-	-	2	02
Co-curricular Courses (CCC)	CCC101	**Co-Curricular Course I**	-	4	-	-	-	-	25	-	2	-	02
	Total		**12**	**14**	**03**	**100**	**150**	**250**	**200**	**12**	**07**	**03**	**22**

Curriculum for First Year UG Course in B. Tech.
(Academic year: 2025-2026 onwards)

Semester- II

Course Category	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks				Credits			
			L	P	T	CCA	MSE	ESE	TW	L	P	T	Total
Basic Science Course	BSC104	**Engineering Mathematics- II**	3	-	1	20	30	50	25	3	-	1	04
	BSC103/ BSC102	**Engineering Chemistry/ Engineering Physics**	3	2	-	20	30	50	25	3	1	-	04
Engineering Science Course	ESC102/ ESC101	**Basic Electrical Engineering /Basic Electronics Engineering**	2	2	-	20	30	50	25	2	1	-	03
	ESC104/ ESC103	**Engineering Mechanics / Engineering Graphics**	2	2	-	20	30	50	25	2	1	-	03
Program Core Courses	PCC101	**Programming and Problem Solving**	2	2	-	20	30	50	25	2	1	-	03
Vocational and Skill Enhancement Course(VSEC)	VSEC102/ VSEC101	**Design Thinking and Idea Lab/Engineering Workshop**	-	2	-	-	-	-	25	-	1	-	01
Indian Knowledge System	IKS101	**Indian Knowledge System**	-	-	2	-	-	-	25	-	-	2	02
Co-curricular Courses (CCC)	CCC102	**Co-Curricular Course II**	-	4	-	-	-	-	25	-	2	-	02
	Total		**12**	**14**	**03**	**100**	**150**	**250**	**200**	**12**	**07**	**03**	**22**

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SEMESTER – I

First Year B. Tech. (2025 Pattern)

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Course: Engineering Mathematics-I			Code:BSC101	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			MSE	30
Tutorial	1	1	ESE	50
			TW	25

- **Prerequisites:**

Understanding of basic concepts of algebra, linear algebra, trigonometry, geometry and calculus.

- **Course Objectives:**

To introduce the students to the concepts and methods in linear algebra, calculus, and Fourier series. The goal is to give students the tools to understand advanced mathematics and its applications, which will improve their ability to think analytically and be helpful in their fields.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Use the matrix algebra techniques comprehensively to analyze systems of linear equations.
CO2: Interpret and apply the concepts of Eigen values and Eigen vectors in solving engineering problems.
CO3: **Apply** the concept of Taylor-Maclaurin series, indeterminate forms, and Fourier series to solve complex engineering problems.
CO4: **Demonstrate** proficiency in calculating partial derivatives of functions of several variables and recognize its significance across various engineering disciplines.
CO5: **Apply** the concept of Jacobian to compute partial derivatives of implicit functions, to establish functional dependence, to estimate errors, approximations and to determine extreme values of functions.

- **Course Contents:**

Unit I	Linear Algebra-I- Matrices and System of linear Equations	8 Hours

Rank of a Matrix, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations, Applications to Engineering Problems.

Unit II	Linear Algebra-II- Eigen values and Eigenvectors, Diagonalization	8 Hours

Eigen values and Eigenvectors, Cayley-Hamilton Theorem, Diagonalization of a matrix, Reduction of quadratic form to Canonical form by Linear and Orthogonal transformations, Applications to Engineering Problems.

Unit III	Differential Calculus and Fourier Series	8 Hours

Taylor's Series and Maclaurin's Series, Expansion of Functions using Standard Expansions, Indeterminate forms, L'Hospital's Rule, Evaluation of Limits. Definition of Fourier Series, Dirichlet's Conditions, Full Range Fourier Series, Half Range Fourier Series, Harmonic Analysis.

Unit IV	Partial Differentiation	8 Hours

Introduction to functions of several variables, Partial Derivatives, Euler's Theorem on Homogeneous Functions, Partial Derivative of Composite Functions, Total Derivatives, Change of Independent Variables, Applications to Engineering Problems.

Unit V	Applications of Partial Differentiation	8 Hours

Jacobian and its applications, Error and Approximations, Maxima and Minima of Functions of two variables, Lagrange's method of undetermined multipliers, Applications to Engineering Problems.

- **Tutorials: (Any Eight)**

1. **Rank of Matrix & System of Linear Equations.**
   - Find rank using echelon and normal forms.
   - Solve consistent/inconsistent systems using Gauss elimination.
   - Applications in electrical circuits or structural analysis.

2. **Linear Dependence and Transformations**
   - Test for linear dependence of vectors.
   - Apply linear and orthogonal transformations.
   - Use transformation matrices in geometry or robotics problems.

3. **Eigenvalues, Eigenvectors, and Diagonalization.**
   - Find eigenvalues and eigenvectors of given matrices.
   - Diagonalize matrices.
   - Application to systems of differential equations and dynamic systems.

4. **Cayley-Hamilton Theorem & Quadratic Forms.**
   - Verify Cayley-Hamilton theorem for 3×3 matrices.
   - Reduce quadratic forms to canonical form using orthogonal transformation.
   - Interpret physical meaning in engineering mechanics.

5. **Taylor's and Maclaurin's Series.**
   - Expand functions like sin(x), ln(1+x), e^x using series.
   - Approximate functions to desired accuracy.
   - Engineering use: sensor calibration and signal estimation.

6. **Indeterminate Forms and L'Hospital's Rule.**
   - Solve limits involving 0/0, ∞/∞ forms using L'Hospital's Rule.
   - Compare standard limit forms.
   - Application in fluid dynamics and control systems.

7. **Fourier Series – Full and Half Range.**
   - Derive full-range Fourier series for periodic functions.
   - Compute half-range sine and cosine series.
   - Apply to waveform analysis in electrical engineering.

8. **Partial Derivatives and Total Derivatives.**
   - Compute first and second order partial derivatives.
   - Total derivative and chain rule applications.
   - Real-life application: thermodynamics and material behavior.

9. **Jacobians and Applications.**
   - Evaluate Jacobians of transformation functions.
   - Use Jacobians for coordinate change (Cartesian to polar, etc.).
   - Application in continuum mechanics and robotics.

10. **Maxima, Minima & Lagrange's Method.**
    - Find critical points and classify them.
    - Use Lagrange multipliers for constrained optimization.
    - Applications in engineering design, cost minimization, stress optimization

● Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	**List of Course Activity**	**10 Marks**

1. **Use of Matrices in Electrical Circuits:**
   Learn how matrices are used to solve simple electrical circuit problems.
2. **Eigen values and Vibrations:**
   Explore how Eigen values help in understanding vibrations in mechanical systems.
3. **Fourier Series in Sound Waves:**
   Analyze sound waves using Fourier series and study how music and noise differ.
4. **Optimization of Resources in Engineering Projects:**
   Apply basic optimization techniques (like Lagrange multipliers) to distribute resources efficiently.
5. **Series Expansion in Engineering Approximations:**
   Use Taylor series to approximate complex functions and understand its engineering applications.

CCA 2	**Case Study/Survey**	**10 Marks**

List of Case Study:

1. **Use of Matrices in Structural Analysis:**
   Study how matrices help in analyzing forces and stresses in structures like bridges.
2. **Applications of Partial Derivatives in Heat Transfer:**
   Understand how partial derivatives are used to analyze heat distribution in objects.
3. **Solving Linear Equations in Traffic Flow Problems:**
   Examine how systems of linear equations help in analyzing and improving traffic flow.
4. **Use of Fourier Series in Analyzing AC Circuits:**
   Investigate the role of Fourier series in analyzing alternating current circuits.
5. **Use of Eigenvectors in Engineering Simulations:**
   Study how eigenvectors are used in simulations of physical systems like cars or airplanes.

List of Surveys:

1. **Use of Matrices in Computer Graphics:**
   Survey the role of matrices in animations, 3D rendering, and video games.
2. **Fourier Analysis in Everyday Life:**
   Survey on common uses of Fourier series, like sound and image compression in smart phones.
3. **Importance of Eigen values in Engineering Design:**
   Use of Eigen values in designing stable engineering systems like bridges and skyscrapers.
4. **Role of Partial Derivatives in Engineering Calculations:**
   Survey how engineers use partial derivatives in fields like thermodynamics and fluid.

CCA 3	**Seminar/ Blog writing**	**10 Marks**

List of Seminar Topics:

1. **How matrices help to solve Engineering problems:**
   Present a simple seminar on how matrices are used in different engineering fields.
2. **The role of Fourier Series in Signal Processing:**
   Explain how Fourier series help engineers work with sound and signal processing.
3. **Optimization Techniques in Engineering:**
   Basic optimization methods like Lagrange multipliers and their applications to engineering problems.
4. **Partial Derivatives in Fluid Mechanics:**
   Present the role of partial derivatives in studying fluid flow and pressures in engineering systems.
5. **Taylor Series in Engineering Approximations:**
   Explain how engineers use Taylor series to approximate complex functions and solve problems.

List of Topics for Blog:

1. **How Engineers Use Matrices in Design:**
   Write a simple blog explaining how matrices help engineers to design and solve problems.
2. **Fourier Series and its Applications in Engineering:**
   Create an easy-to-understand blog on how Fourier series is used in sound and signal analysis.
3. **Importance of Eigen values in Engineering Stability:**
   Write about how Eigen values help engineers to make sure structures like stability of bridges.
4. **Using Partial Derivatives in Thermodynamics:**
   Explain in a blog how engineers use partial derivatives to understand heat and energy flow.
5. **Taylor Series: The Simple Approach to Complex Engineering Problems:**
   Write a blog about how engineers use Taylor series to simplify and solve complex equations.

- **Text Books:**
  1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
  2. Higher engineering Mathematics by B. S. Grewal (Khanna publishers)

- **Reference Books:**
  1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
  2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
  3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)
  4. Applied Mathematics (Vol. I & Vol. II) by P. N. Wartikar and J. N. Wartikar (Pune Vidyarthi Griha Pra.)

- **e-Books**
  1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
  2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication)
  3. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)

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Course: Engineering Physics				Code:BSC102
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			MSE	30
Practical	2	1	ESE	50
			TW	25

- **Prerequisites:**

Foundation in mathematics (calculus, algebra), physics (mechanics, electromagnetism)

- **Course Objectives:**

Aim of this course is to equip students with strong foundation in Physics Principles and their applications for solving engineering problems. Also to enhance their knowledge of modern engineering materials& applications. The course also aims to relate students' theoretical knowledge with laboratory experiments.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Understand theory of semiconductors & their applications in some semiconductor devices.
CO2: Demonstrate knowledge of interference & polarization along with their Engineering applications.
CO3: **Explain** basics of Lasers & optical fibers & their use in some industrial applications
CO4: **Understand** concepts & principles in quantum mechanics. Relate them to some applications of physics.
CO5: **Identify** some modern engineering materials –magnetic, superconductors, Nano-materials and their properties and applications.

- **Course Contents:**

Unit I	Semiconductor Physics	8 Hours

Band theory of solids, conductivity in metals & semiconductors, Fermi Dirac statistical analysis, Fermi Dirac distribution function for metals & semiconductors, Position of Fermi level in intrinsic and extrinsic semiconductors, working of PN junction diode on energy level diagram, Photovoltaic devices, Solar cell – working, advantage, disadvantage, Fill factor, efficiency of solar cell, Hall Effect- Derivation for hall voltage, hall coefficient, applications of hall effect.

Unit II	Wave optics	8 Hours

Interference: Interference in thin uniform films with derivation, Non uniform film with fringe width derivation, Newton's rings & its applications, applications of interference-testing of optical flatness of surfaces & anti reflection coating. Polarization: Polarization of light, Brewster's law, Malus's law, Birefringent material, Double Refraction, Huygen's theory of double refraction. Applications of polarization (LCD, 3D movie).

Unit III	Photonics	8 Hours

Basics of lasers, Quantum Mechanical Process in Lasers, characteristics of laser, Types of lasers, Semiconductor Laser-Homo junction & Hetero junction laser, Nd:YAG Lasers. Engineering Applications of lasers, Holography. Principle of Fiber optic communication, Types of optical fibers, Numerical aperture, Acceptance angle, Attenuation, Advantages of Fiber optics, Application of optical Fiber.

Unit IV	Quantum Mechanics	8 Hours

Introduction to quantum theory, De Broglie's hypothesis, concept of phase velocity and group velocity, Heisenberg's uncertainty principle, Concept of wave function, Schrödinger's equations-time independent & time dependent, Applications of Schrödinger's Equation-Particle in infinite potential well (rigid box), particle in finite potential well (qualitative), Tunneling effect, Scanning Tunneling Microscope, Introduction to Quantum computing & its application.

Unit V	Modern Engineering materials	8 Hours

Magnetic Materials: Properties of magnetic materials, applications of magnetic materials- transformer cores, magneto optical recordings.
Superconductors: Introduction to superconductivity, Zero resistance, Meissner effect, Critical Magnetic Field, Type I & Type II superconductors, Josephson junction, Application of Superconductors- Maglev Train, SQUID.
Nanomaterials: Synthesis of nanomaterials (Physical Vapour Deposition), Properties –Electrical, Optical & Mechanical, applications –targeted drug delivery, electronic, space and defense, automobile.

- **List of Experiments (Any Eight)**

1. To Study Solar cell characteristics of solar cells and to determine the fill factor of given solar cell.
2. To determine Band gap in given Semiconductor.
3. To study hall effect in semiconducting samples and determine the Hall Coefficient
4. To determine radius of curvature of a Plano convex lens by formation of Newton's rings.
5. To verify Malus's law
6. To determine thickness of wire using Laser
7. Determine Numerical Aperture of an optical fiber
8. To determine velocity of ultrasonic waves and compressibility of liquid using ultrasonic interferometer
9. To calculate sound absorption coefficient for various materials.
10. To measure the wavelengths of spectral lines of polychromatic source using diffraction grating and spectrometer.
11. Thermal conductivity of bad conductor (Lee's method)
12. Experiment based on XRD.
13. Any one experiment using V lab.

- **Continuous Comprehensive Assessment (Any Two)** — **20 Marks**

CCA 1	List of Course Activity	10 Marks

1. Projects based on laser
2. Projects using magnets
3. Projects based on diodes, Solar cells
4. Projects based on Polarization, interference.

CCA 2	Case Study/Survey	10 Marks

List of Case Study:

1. Applications of Semiconductors
2. Applications of optics
3. Applications of Lasers

List of Surveys:

1. Applications of magnetic nano-materials
2. Applications of superconductors
3. Applications of Tunnel diode
4. Applications of quantum mechanics

CCA 3	Group Discussion/Seminar/ Blog writing	10 Marks

List of Course Group Discussion Topics:

1. Smart Sensors
2. Nano materials in solar cells
3. Use of Lasers in mechanical & civil Industries

List of Course Seminar Topics:

1. Fuel Cells in vehicles
2. Quantum Computers
3. Quantum Physics and AI

List of Topics for Blog:

1. Engineering Physics applications in Industries
2. Importance of physics in technologies
3. Quantum Mechanics in AI

- **Text Books:**
  1. Modern Engineering Physics: S L Gupta, Sanjeev Gupta, Dhanpatrai Publication.
  2. Text Book of Engineering physics: M.N.Avadhanulu , P.G.Kshirsagar, S.Chand Publication.
  3. Applied Physics –P.K.Palanisamy SCITECH Publications
- **Reference Books:**
  1. Fundamentals of Physics, Resnick and Halliday, John Wiley and sons
  2. Optics, Jenkins and White TATA Mcgraw hill
  3. Introduction to Solid State Physics, C Kittel, Wiley and Sons
  4. Lasers and Non-Linear optics, BB Laud, Oscar Publication
- **e-Books:**
  1. Introduction to quantum mechanics: AC Phillips
  2. Physics of quantum mechanics: University of Oxford
  3. Cutting edge nanotechnology

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Course: Engineering Chemistry			Code:BSC103	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			MSE	30
Practical	2	1	ESE	50
			TW	25

- **Prerequisites:**

A foundational understanding of basic chemistry, states of matter, periodic table, types of chemical bonds, molecular weight, equivalent weight, chemical reactions, concept of oxidation and reduction.

- **Course Objectives:**

Students will able to understand technology for improving the quality of water, UV-Visible, IR spectroscopic analysis techniques, properties and applications of specialty polymers and Nano-materials, to analyses conventional and alternative fuels, electro-analytical techniques of materials and preventive methods for corrosion control.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Understand the practical approaches and techniques required to effectively monitor water quality
CO2: Select appropriate electroanalytical techniques and methods of material analysis.
CO3: Demonstrate the structure, properties of advanced engineering materials for various technological applications.
CO4: Analyze different types of conventional and alternative fuels.
CO5: Explain causes of corrosion and methods for minimizing corrosion.

- **Course Contents:**

Unit I	Water Technology	8 Hours

Impurities in water, hardness of water: Types, Units and Numerical. Determination of hardness by EDTA method using molarity concept and alkalinity, numerical. Ill effects of hard water in boilers -, scale and sludge. Water treatment: i) Zeolite method and numerical ii) Demineralization method. Purification of water: Reverse osmosis and Electro dialysis. Modern technique for atmospheric water generation.
Green Chemistry: Definition, Goal of green chemistry, Need of green chemistry, Bhopal gas Tragedy (traditional and green synthesis of carbaryl).

Unit II	Instrumental methods for Analysis	8 Hours

Concept of Electrochemistry: Introduction, types of electrochemical cell, Electrode potential, types of reference electrode- calomel, glass & ion-selective electrode
[A] Conductometry: Introduction, conductivity cell, conductometric titrations of acid versus base with titration curve. (Strong acid- Strong base). Applications of conductometry.
[B] UV-Visible Spectroscopy: Introduction, statement of Beer's law and Lambert's law, Electronic transitions in organic molecule, terms involved in UV-visible Spectroscopy. Instrumentation (double beam) and its applications.
[C] IR spectroscopy: Introduction, Principle of IR Spectroscopy, types of vibrations: Stretching (symmetric and asymmetric) and bending (scissoring, rocking, wagging and twisting), application of IR spectroscopy.

Unit III	Engineering Material and its Application	8 Hours

[A] Polymers: Introduction, Definition Polymer, Monomer, Functionality of monomers, Classification of polymer (Thermal Behavior-Thermoplastics and Thermosetting). Specialty polymers: Introduction, preparation, properties and applications of the following polymers: 1. Engineering Thermoplastic: Polycarbonate 2. Bio-degradable polymers: Poly (hydroxy butyratehydroxyvalerate) 3. Polymer Composites.
[B] Nanomaterials: Introduction, classification of nanomaterials based on dimensions (zero dimensional, one-dimensional, two-dimensional and three-dimensional), structure, properties and applications of graphene and carbon nanotubes.

Unit IV	Energy Resources	8 Hours

Introduction (definition, classification of fuel based on chemical reactions and characteristics of an ideal fuel), Calorific value, Higher calorific value and Lower calorific value, Determination of calorific value: Principle, construction and working of Bomb calorimeter and Boy's gas calorimeter and numerical, Solid fuel: Coal: Analysis of Coal-Proximate and Ultimate analysis, numerical, Alternative fuels: Power alcohol and biodiesel. Hydrogen gas as a future fuel. Lithium Ion Battery, construction, working, advantages, applications.

Unit V	Corrosion & Its Prevention	8 Hours

Introduction, Types of corrosion – Dry and Wet corrosion, mechanism of dry corrosion, nature of oxide films and Pilling-Bedworth's rule, wet corrosion – mechanism: hydrogen evolution and oxygen absorption, Factors influencing rate of corrosion. Methods of corrosion control and prevention: Cathodic Protection (Sacrificial Anode and Impressed Current), metallic coatings and its types, surface preparation, methods to apply metallic coatings-hot dipping, electroplating. Corrosion Resistant / Anti corrosive paints.

- **List of Experiments (Any Eight)**

1. To determine Hardness of the given water sample by EDTA method.
2. To determine alkalinity of water by acid base titration method.
3. To determine strength of strong acid using pH meter.
4. To determine maximum wavelength of absorption of $CuSO_4$/$FeSO_4$/ $KMnO_4$, verify Beer's law and find unknown concentration of given sample.
5. Titration of a mixture of weak acid and strong base using conductometer.
6. Proximate analysis of coal-determination of moisture and ash content in coal sample.
7. To determine molecular weight/radius of macromolecule polystyrene/polyvinyl alcohol by viscosity measurement.
8. Study of corrosion of metals in medium of different atmospheric condition.
9. To coat copper and zinc on an iron plate using electroplating.
10. Preparation of biodiesel from oil.
11. Colloidal synthesis of 2-6 or 3-5 semiconductor quantum dots nanoparticles.

• Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	**List of Course Activity**	**10 Marks**

1. Model making of device to collect water from atmospheric humidity
2. Application of Lamberts Beers law in various field (medical equipments/devices, dye industry)
3. To construct sensor for detecting LPG gas leakage
4. Waste to best –eg. plastic bottle garden, Plastic bottle craft art, waste plastic to bricks
5. Project- Model making of various engines (petrol/diesel/CNG/combination)
6. Project- Electroplating of Iron articles with various metals like Cu, Au, Ag, Pt etc
7. EV-Lithium ion battery model making

CCA 2	Case Study/Survey	10 Marks

List of Case Study:

1. Recycling of waste water in your Society
2. To study construction working mechanism of water purifier units (Kent, Aqua guard etc.) for domestic purpose
3. Determination of hardness/ impurities/heavy metals in water of Mula-Mutha River.
4. Determination of Chloride/Sulphur/BOD/COD of Industrial waste / river water.
5. Recycling of waste polymer material –visit/survey in recycling plants.
6. Use of Au/Ag nanoparticles in drug industry.
7. CO_2 capturing /sensing from atmospheric gases.
8. Comparison of IC engine of diesel/petrol/CNG/EV.

List of Surveys:

1. Survey- Survey on "What Happen further with waste polymer used for domestic/medical purpose (flex, water bottles, carry bag etc)"
2. To study application/mechanism of electrodes in various sensors (air pollutants sensor, water level sensor in dams, TDS meter, enzyme/protein sensor in pregnancy kit, glucose sensor in glucometer)
3. Survey- Engines used in for CNG-Petrol-Diesel- EV and combination (Nexan, Honda, Maruti)

4. Survey- Methods used to prevent corrosion in Dams, Sea link
5. How spectroscopy techniques useful in X rays, PET Scan, Sonography etc.
6. Survey - Rainwater Harvesting
7. Survey - Trainings in National Water Academy, CWC, Khadakwasla Pune

CCA 3	Group Discussion/Seminar/ Blog writing	10 Marks

List of Course Group Discussion Topics:

1. Modern Techniques, units for atmospheric water generation
2. GD- why create best out of waste
3. Way to adopt Plastic free environment
4. Nanomaterial applications in day to day life
5. Polymers: Boon or Bane
6. GD-Application of acid base titration of pH and conductometry.

List of Course Seminar Topics:

1. Role of National association of corrosion engineers to give solutions for corrosion.
2. Indian River interlinking project/Ganga rejuvenation –Namami Gange project.
3. Sustainable development & renewable energy resources.
4. UV visible spectroscopy applications in biomedical equipments.
5. Methods used in Industries to control corrosion.

List of Topics for Blog:

1. Blog- Ukrane war for Lithium source
2. Carbon footprint
3. Green growth/biofuels/ green chemistry
4. Importance of recycling: water & polymer
5. Importance of Use of social transport/bike and car sharing (dunzo/uber/ola/lablab app)
6. Review research note on quantum dot applications (light emitting devices, drug,agriculture, medical)
7. Wheels on Hydrogen Gas Fuel cell

- **Text Books:**
  1. Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Pvt. Ltd.
  2. Textbook of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria & Sons Publisher.
- **Reference Books:**
  1. Engineering Chemistry, Jain and Jain 15th edition Dhanpat Rai Publishing Company Tata Mcgraw-Hill Education Publishing company Limited (Unit I, IV & V)
  2. Instrumental Methods of Chemical Analysis, G. R. Chatwal & S. K. Anand, Himalaya Publishing House (Unit II)
  3. Polymer Science, V. R. Gowarikar, N. V. Viswanathan, Jayadev Sreedhar, Wiley Eastern Limited (Unit III)
  4. Fundamentals of Nanotechnology, G. L. Hornyak, J. J. Moone, H. F. Tihhale, J. Dutta, CRC press (Unit III)
- **e-Books:**
  1. https://chem.nju.edu.cn/_upload/article/files/b5/6f/01f0f2434d708df797208aea2613/83f2b441-65ee-44a6-ac47-ed21db462c5d.pdf
  2. https://edisciplinas.usp.br/pluginfile.php/5955761/mod_resource/content/1/CORROSION_AND_CORROSION_CONTROL_An_Intro%20%20Revie%20and%20Uhlig.pdf

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Course: Basic Electronics Engineering			Code: ESC101	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			MSE	30
Practical	2	1	ESE	50
			TW	25

- **Prerequisites:**

Basic knowledge of physics, semiconductor materials and devices.

- **Course Objectives:**

The objective is to gain a comprehensive understanding of the working principles of PN junction diodes and special purpose diodes, Bipolar Junction Transistor (BJT) and MOSFET. Additionally, the aim is to understand the fundamental concepts and applications of operational amplifiers (Op-amps) and various electronic instruments. The learning extends to the concepts of different logic gates, digital circuits, microprocessors, and microcontrollers. Furthermore, it includes understanding the basic working principles of various sensors and communication systems.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Explain the working of P-N junction diodes and its applications.
CO2: Identify types of transistor and its applications.
CO3: **Understand** working of OP-AMP with its applications and use of electronic Instruments.
CO4: **Construct** and **test** digital circuits using universal/basic gates and understand the concept of VLSI.
CO5: **Identify** different electronics sensors and understand basic communication systems.

- **Course Contents:**

Unit I	Introduction to Electronics	6 Hours

Impact of Electronics in society, P-type Semiconductor, N-type Semiconductor, Introduction to active and passive components, P-N Junction diode construction, working and V-I characteristics of P-N Junction Diode, Types of Rectifiers. **Special purpose diodes:** Light Emitting Diode (LED), photo diode and its applications.

Unit II	Transistors (BJT & MOSFET)	6 Hours

Construction of BJT, types, Operation (CE Configuration), Transistor configurations (CE, CB, CC only circuit diagram). Input and output Characteristics of BJT in CE Configuration, BJT as a switch and amplifier. Enhancement Metal Oxide Semiconductor Field Effect Transistors (EMOSFET): Construction, Types, Operation, V-I characteristics, Regions of operation.

Unit III	OPAMP and Electronic Instruments	6 Hours

Operational amplifier: Introduction to OP-Amp, Pin configuration of IC 741. Functional block diagram of operational amplifier, Op-Amp parameters, Op- amp as Inverting and Non inverting amplifier (Derivation of voltage gain Av).
Electronic Instruments: Principles and block diagram of digital multimeter, Function Generator, Digital Storage Oscilloscope (DSO). DC power Supply.

Unit IV	Digital Systems	6 Hours

Number System: Binary, Decimal, Octal, Hexadecimal, their conversions, Binary addition. Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR. Demorgan's Theorem, Half adder, Full adder.
Introduction to Microprocessor and Microcontroller (Only block diagram and explanation). Introduction to VLSI Technology.

Unit V	Sensors and Communication System	6 Hours

Sensors: Classification of sensors, Temperature Sensor-Thermocouple, Optical Sensors, Motion Sensors – LVDT, Mechanical Sensors -Load Cell.
Basic Communication System: Block Diagram, Modes of Transmission, Communication Media: Wired and Wireless, Allotment of frequency band for different applications. Modulation, Need of Modulation. Introduction to AM & FM

- **List of Experiment: (Any Eight)**

1. Study of Active and Passive components
2. Measurements using various measuring instruments
3. V-I characteristics of P-N Junction Diode (Study the datasheet of typical PN junction diode)
4. Rectifier circuits: Study of Full Wave bridge rectifier using diodes
5. Frequency response of BJT: To plot frequency response of BJT amplifier (Simulation only)
6. Applications of Op-amp: Study of inverting and non-inverting amplifiers
7. Test and verify the truth tables of Basic Gates
8. Study of different types of transducers
9. Any two experiments using V Lab

• Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	**List of Course Activity**	**10 Marks**

1. Mini project on DC Regulated Power Supply
2. Mini project on Single stage common emitter BJT amplifier
3. Mini project on Application of Op-Amp
4. Mini project on LED Display/ Counter
5. Mini project on Application of any one Sensor

CCA 2	**Case Study/Survey**	**10 Marks**

List of Case Study:

1. Advanced Electronic Equipments and their Specification
2. Advanced Microcontrollers with Architecture

List of Surveys:

1. Advanced Semiconductor Materials
2. Advanced Electronic Sensors
3. Advanced Mobile Communication Technology

CCA 3	**Group Discussion/Seminar/ Blog writing**	**10 Marks**

List of Course Seminar Topics:

1. Application of Electronic Components
2. Architecture of Microprocessor
3. VLSI Technology
4. IC Fabrication Process
5. 5-G Technology

- **Text Books:**

1. Electronics Devices Thomas. L. Floyd, 9th Edition, Pearson (Unit I, II, III)
2. Modern Digital Electronics R.P. Jain, 4th Edition, Tata McGraw Hill (Unit IV)
3. Electronic Instrumentation H.S. Kalsi, 3rd Edition, Tata McGraw Hill (Unit IV)
4. Communication Electronics: "Principles and Applications" Frenzel, Tata McGraw Hill (Unit V)

- **Reference Books:**

1. Electronics Devices Thomas. L. Floyd, 11th Edition, Pearson.
2. Mobile Communication J. Schiller, 2nd Edition, Pearson.

- **e-Books:**

1. https://www.ee.iitb.ac.in/course/~dghosh/basicElectronics.pdf
2. https://www.freebookcentre.net/electronics-ebooks-download/BasicElectronics-Notes.html

Course: Basic Electrical Engineering			Code:ESC102	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			MSE	30
Practical	2	1	ESE	50
			TW	25

- **Prerequisites:**

A foundational understanding of intermediate physics is necessary & proficiency in intermediate mathematics is required.

- **Course Objectives:**

This course aims to impart fundamental knowledge of electrical quantities and basic laws of magnetism, along with their applications. It develops skills for analyzing DC and AC electric circuits and determining transformer performance. Additionally, it familiarizes students with different wiring schemes and teaches electricity bill calculations. Overall, the course provides a comprehensive understanding of electrical systems and their practical applications.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Analyze DC circuits using Kirchhoff's Laws, The Superposition Theorem and various network simplification techniques.
CO2: Examine magnetic circuits by evaluating parameters such as self-inductance, mutual inductance, and electromotive forces (EMFs).
CO3: Determine AC electrical quantities through the use of mathematical expressions, waveform analysis, and phasor diagrams.
CO4: Analyze and compute voltage, current, and power in both single-phase and three-phase AC electrical systems.
CO5: Explain the operating principles and real-world applications of Single-phase transformers, DC motors, and Induction motors.

- **Course Contents:**

Unit I	DC Circuits	6 Hours

Introduction: Overview of Power System showing stages such as Generation, Transmission and Distribution of electrical energy.
DC Circuits: Classification of electrical networks, simplifications of networks using series parallel combinations and star delta transformation technique, Kirchhoff's Laws and their applications for network solutions using loop analysis, Superposition theorem.

Unit II	Electromagnetism	6 Hours

Electromagnetism: Terminologies and fundamentals of Electromagnetism, series magnetic circuits, Force on a current carrying Conductor placed in magnetic field, Electromagnetic induction and faraday's laws, Types of EMF Induced, Coefficient of Coupling, Energy stored in magnetic circuit.

Unit III	AC Fundamentals	6 Hours

Generation of single-phase sinusoidal voltages and currents, their mathematical and graphical representation, Concept of cycle, period, frequency, instantaneous, peak, average and RMS. values, peak factor and form factor. Phase, Phase difference, lagging, leading in phase quantities and their phasor representation. Rectangular and polar representation of phasor. Study of AC circuits consisting of pure resistance, pure inductance, pure capacitance.

Unit IV	AC Circuit	6 Hours

Single Phase AC Circuits: Series R-L, R-C and R-L-C circuits, concept of impedance, power factor, phasor diagrams, Voltage, current and power waveforms. Concept of active, reactive, apparent and complex power. Resonance in RLC series circuits.
Polyphase A.C. Circuits: Concept of three-phase AC symmetrical system, phase sequence, balanced and unbalanced load. Voltage, current and power relations in three phase balanced star and delta connected loads along with phasor diagrams.

Unit V	Introduction to Electric Machine	6 Hours

Single Phase Transformer: Construction, working principle, EMF equation, transformation ratio, rating, types, losses, regulation and efficiency at different loading conditions.

Electrical Motors:

a) D.C. Motors: Construction, working principle, types, characteristics and EMF equation (no derivation).

b) Three Phase Induction Motor: Working principle using rotating magnetic field theory, types and applications.

- **List of Experiment (Any Eight)**

1. To study safety precautions while working on electrical systems, handling of various equipment's such as rheostat, multi-meter, ammeters, voltmeters, wattmeter's etc
2. Study of wiring materials, switch board and different wiring schemes. (Simple wiring & staircase wiring)
3. To verify Kirchhoff's laws
4. To verify Superposition theorem
5. To measure steady state response of series RL circuit
6. To measure steady state response of series RC circuit
7. To study RLC series resonance
8. To verify the relation between phase and line quantities in three phase balanced star delta connections of load
9. To determine efficiency and regulation of transformer by using direct loading test
10. To Study cut section view of three phase Induction motor
11. To measure insulation resistance of Transformer, Induction Motor and Cables by using Megger
12. To study Single-Phase LT electricity bill

• Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	**List of Course Activity**	**10 Marks**

1. Magnetic circuits: Students will collect B-H curves and hysteresis loops for various types of magnetic and non-magnetic materials from the internet. Based on the permeability and shapes of the curves, each student will decide the suitability of each material for different applications.
2. Magnetic circuits: Students Group will prepare a coil without the core. Students will note the deflection of the galvanometer connected across the coil for: movement of the North Pole of the permanent magnet towards and away from the coil (slow and fast movement), movement of the South Pole of the permanent magnet towards and away from the coil (slow and fast movement). Students will demonstrate and prepare a report based on their observations.

CCA 2	Case Study/Survey	10 Marks

List of Case Study:

1. Case Study on LT Electricity Bill.
2. Transformer: Students will visit a nearby pole-mounted sub-station and prepare a report based on the following points: i. Rating: kVA rating, primary and secondary voltage, connections ii. Different parts and their functions iii. Earthing arrangement iv. Protective devices.
3. Student will visit the Institute workshop and prepare a report which includes the following points: i. Different types of prime movers used, their specifications and manufacturers ii. Method of starting and speed control iii. Different protective and safety devices used.

List of Surveys:

1. Undertake a Market survey regarding commonly used electrical equipment which is not covered in the curriculum and prepare a one-page report.
2. Undertake a market survey of different domestic electrical appliances based on the following points: i. Manufacturers ii. Specifications/ratings iii. Salient features iv. Applications. and prepare a report.
3. Undertake a market survey of safety electrical Equipment and prepare a one-page report.

CCA 3	Group Discussion/Seminar/ Blog writing	10 Marks

List of Course Group Discussion Topics:

1. Electrical Safety and Standards.
2. Renewable Energy Sources in Electrical Engineering.

List of Course Seminar Topics:

1. Prepare a PowerPoint presentation or animation for showing the working of DC or AC motors
2. Prepare a PowerPoint presentation or animation for showing the working of three phase Induction motor.
3. Prepare a PowerPoint presentation or animation for showing the working of Single Phase Transformer.

List of Topics for Blog:

1. Emerging technologies in electrical engineering.
2. Future trends in renewable energy sources.

- **Text Books:**

1. B.L. Theraja, "A textbook on Electrical Technology, Vol-I", S Chand Publications.
2. K. Mehta, Rohit Mehta, "Basic Electrical Engineering", S Chand Publications.
3. J. B. Gupta, "A textbook of Electrical Engineering", S. K. Kataria & Sons.
4. S. K. Bhattacharya, "Electrical Machines", McGraw Hill Education.

- **Reference Books:**

1. L. Wadhwa, "Basic Electrical Engineering", New Age International (P) Limited.
2. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill Education.
3. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford University Press.

- **e-Books:**

1. A text book of basic electrical engineering Full Book (PDF).
2. NPTEL Notes Basic Electrical Technology.
3. Text book of electrical Engineering And Technology –all about circuits.

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Course: Engineering Graphics			Code:ESC103	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			MSE	30
Practical	2	1	ESE	50
			TW	25

- **Prerequisites:**

Basic understanding of geometric shapes such as points, lines, planes, curves, along with their properties, including perimeter, area. They should also be familiar with basic geometric tools (e.g., ruler, compass, protractor) and fundamental methods of geometric construction.

- **Course Objectives:**

To develop students' ability to visualize and represent objects in 2D and 3D using standard drawing practices. The course aims to enhance skills in technical drawing, geometric construction, and interpretation of engineering blueprints using manual or CAD tools.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: **Understand** the fundamentals of Engineering Graphics and **apply** the knowledge of projection methods to prepare the drawings for points and lines.
CO2: **Construct** accurate projections of planes inclined to one or both reference planes using standard drawing methods.
CO3: **Construct** various Engineering curves and develop the lateral surface of solids.
CO4: **Apply** the concept of orthographic projection to **draw** orthographic views for visualizing the physical object.
CO5: **Envisage** and **sketch** three-dimensional objects from given orthographic views.

- **Course Contents:**

Unit I	Fundamentals of Engineering Drawing and Projection of Point and Line	6 Hours

Fundamentals of Engineering Drawing: Introduction to drawing instruments and their uses, drawing sheets sizes and their layouts, Type of Lines, dimensioning methods, general rules of dimensioning and reading of part print.
Projection of Point and Line: Theory of projection, projection of point, projection of line when parallel to both the reference planes, projections of lines when it is perpendicular to one of the reference planes, when line is inclined to one and parallel to other reference plane, line inclined to both reference planes (Problems on first angle projection only).

Unit II	Projection of Plane	6 Hours

Introduction, Projection of plane when plane is: i) Parallel to one plane and perpendicular to other, ii) Inclined to one plane and perpendicular to other, iii) Inclined to both reference planes. (Resting on HP only and limited to six sides).

Unit III	Engineering Curves and Development of Lateral Surfaces	6 Hours

Engineering Curves: Conic Sections- Ellipse, Parabola, Hyperbola by directrix-focus method and Ellipse, Parabola by rectangle method, Helix on Cylinder (one convolution), Cycloid, Involute of a circle, Archimedean spiral (one convolution).
Development of Lateral Surfaces: Introduction, Method of development, development of lateral surfaces of prism and pyramid (Limited to six surfaces), cylinder, cone.

Unit IV	Orthographic Projection	6 Hours

Introduction, Principle of projection, plane of projection, orthographic projection including sectional view, difference between first and third angle method of projection, hidden features, curved features, circular features. (Problems by first angle projection method only)

Unit V	Isometric View	6 Hours

Introduction of isometric projection and isometric view, isometric lines, planes, non-isometric lines and planes, isometric scale, Construction of isometric view from given orthographic views.

• List of Experiment

Minimum Two problems on Each topic

1 Sheet No.1: Projection of Line
2 Sheet No.2: Projection of Plane
3 Sheet No.3: Engineering Curves and Development of Lateral Surfaces
4 Sheet No.4: Orthographic Projection
5 Sheet No.5: Isometric Projection

Guidelines for Submission:

1 Each sheet should be drawn on A2 size (594 X 420 mm) Half imperial drawing sheet.
2 All drawings must be neat and clean, properly dimensioned.
3 Each assignment will be evaluated based on accuracy, clarity and adherence to drawing standards.

• Continuous Comprehensive Assessment (Any Two) — 20 Marks

CCA 1	List of Course Activity	10 Marks

1. 3D model of solid object using an orthographic and/or isometric drawings by using card board or any other suitable material.
2. Model making for Development of Surfaces by using card board or any other suitable material.
3. 3D Model by Using CAD Software.
4. 3D Model object using different engineering curves.
5. Draw orthographic projections of a mechanical component, including all views and hidden features of a real object.
6. Model making on Projection of Line.
7. Model making on Projection of Plane.

CCA 2	Assignments/Case Study/Survey	10 Marks

B-1: List of Case Study:

1. Study real-world examples where drawing inaccuracies led to significant issues in manufacturing or construction/failure of component.
2. Compare engineering drawing standards (ISO) used in automotive or aerospace industries.
3. Reading and interpretation of industrial part drawing.
4. Conventional representation of mechanical elements.
5. Industrial visit to create awareness of ISO drawing Standard.

B-2 List of Surveys:

1. Representation of various types of bearing symbols.
2. Analyze how dimensioning practices vary between small-scale and large-scale engineering projects.
3. Create a survey to find out which drawing instruments are most commonly used and preferred by students and professionals.
4. Applications and significance of different engineering curves in engineering sectors.
5. Survey of industrial component along with part drawing & its analysis.

CCA 3	Group Discussion/Seminar/ Blog writing	10 Marks

List of Course Group Discussion Topics:

1. The Importance of Standardization in Engineering Drawings.
2. Manual Drawing vs. CAD: Pros and Cons.
3. Global Collaboration and Communication Through Engineering Drawings.
4. Educational Approaches to Teaching Engineering Drawing.
5. Use of Virtual Reality (VR)/Animation in revolutionizing the field of engineering drawing.

List of Course Seminar Topics:

1. Research the evolution of engineering drawing techniques and standards.
2. The Impact of Engineering Drawings on Quality Control.
3. The Role of Engineering Drawings in Product Development.
4. Role of Engineering Graphics in Electrical/Electronics/Computer/Civil Engineering.
5. Study and reading of industrial drawings to understand standard industrial practice viz. dimensioning, GD &T, surface finish, welding symbols etc for machine drawing/production drawing/part drawing/assembly drawing.

List of Topics for Blog:

1. Write a blog post explaining the practical applications of various engineering curves in real-world scenarios.
2. Write a blog post highlighting best practices for creating accurate and clear engineering drawings.
3. Recent developments in CAD software's and features.
4. Role of Artificial Intelligence in Engineering Drawing and design.

- **Text Books:**

1. Bhatt, N. D. and Panchal, V. M., (2016), "Engineering Drawing", Charotar Publication, Anand, India.
2. K. Venugopal, K, (2015), "Engineering and Graphics", New Age International, New Delhi.

- **Reference Books:**

1. Bhatt, N. D., (2018), "Machine Drawing", Charotor Publishing House, Anand, India
2. Dhawan, R. K., (2000), "A Textbook of Engineering Drawing", S. Chand, New Delhi
3. Jensen, C., Helsel, J. D., Short, D. R., (2008), "Engineering Drawing and Design", McGraw-Hill International, Singapore.

- **e-Books:**

1. "Basic Engineering Drawing" by R. S. Rhodes, Publisher: Internet Archive, Publication Year: 1975, https://archive.org/details/basicengineering0000rhod
2. "Engineering Drawing by N. D. Bhatt", Publisher: Internet Archive, Publication Year: Not specified, https://archive.org/details/engineering-drawing-by-n.-d-bhatt
3. "Engineering Drawing & Design" by David A. Madsen, Publisher: Delmar Thomson Learning, Publication Year: 2007, https://archive.org/details/engineeringdrawi0000mads_z5o6
4. Mechanical Drawing Self-Taught" by Joshua Rose, Publisher: Project Gutenberg, Publication Year: 2007 (re-released), https://www.gutenberg.org/ebooks/23319
5. "Technical Drawing" by David L. Goetsch, Publisher: Delmar, Publication Year: 2000, https://archive.org/details/technicaldrawing0004goet

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Course: Engineering Mechanics			Code:ESC104	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			MSE	30
Practical	2	1	ESE	50
			TW	25

- **Prerequisites:**

Basic knowledge and clear concept of Engineering Mathematics and Physics.

- **Course Objectives:**

To enlighten students with the core concepts of Engineering Mechanics to tackle real-life situations of static and dynamic systems thereby enhancing their problem-solving, analytical and design skills.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Understand basic concepts of forces, moments and couples in a two-dimensional force system.
CO2: Apply the concept of free body diagram for static equilibrium in a two-dimensional force system.
CO3: Analyze the practical example involving friction and application of two force members.
CO4: Analyze rectilinear and curvilinear motion of particles.
CO5: Apply Newton's second law, work energy and impulse momentum principles for particles.

- **Course Contents:**

Unit I	Force systems and its resultants	6 Hours

Force System: Introduction, type of motion, fundamental concepts and principle, force system, resolution and composition of forces, resultant of concurrent force system, moment of a force, Varignon's theorem, resultant of parallel force system, couple and resultant of general force system.
Centroid: Introduction, centroid of basic figures, centroid of composite figure, moment of inertia of simple geometrical figure, parallel axis theorem, perpendicular axis theorem, moment of inertia of composite figure.

Unit II	Equilibrium	6 Hours

Introduction, free body diagram, equilibrium of coplanar forces, equilibrium of two forces, three force principle, equilibrium of concurrent, parallel and general force system, types of load, types of support, types of beam and support reaction.

Unit III	Friction and Trusses	6 Hours

Friction: Introduction, sliding and rolling friction, laws of coulomb friction, coefficient of friction, angle of repose, angle of friction, cone of friction, friction on inclined plane, ladder friction and belt friction.
Trusses: Two force and multi force member, assumption of analysis, analysis of truss, identification of zero force members, method of joint and method of section.

Unit IV	Kinematics of particle	6 Hours

Introduction, basic concept, rectilinear motion: motion with uniform acceleration, gravitational acceleration and variable acceleration, curvilinear motion: rectangular components, motion of projectile, normal and tangential components.

Unit V	Kinetics of particle	6 Hours

Introduction, Newton's second law of motion, equation of motion, Newton's law of gravitation, application of Newton's second laws to rectilinear and curvilinear motion, conservative and non-conservative forces, work energy principle, conservation of energy, impulse momentum principle and impact.

• List of Experiment

Journal consists of the following

A. Compulsory experiments.

1. Verification of the Polygon law of forces.
2. To find support reaction of beam.
3. To determine coefficient of friction.
4. Determination of coefficient of restitution.

B. Graphical Solution of the followings (Any two)

1. Equilibrium of concurrent force system.
2. Equilibrium of parallel force system.
3. Forces in the member of pin jointed truss.

C. Assignment on each unit: Minimum four complex numerical on each unit.

• Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	**List of Course Activity**	**10 Marks**

1. Analysis of Simple Beam Deflection.
2. Dynamic Analysis of a Pendulum System.
3. Impact Testing of Materials.
4. Frictional Analysis of Different Surfaces.
5. Comparison of Beam Materials.
6. Study and application of different types of Trusses.
7. Effect of Truss Geometry on Structural Stability.

CCA 2	**Case Study/Survey**	**10 Marks**

List of Case Study:

1. Forces in Structural Components of Skyscrapers.
2. Wind Forces on Tall Buildings.
3. Dry Friction in Mechanical Systems.
4. Motion Analysis of Robotic Arms.
5. Cantilever Beam Failure.
6. Friction in Earthquake Faults.
7. Study of Structure of Sydney Harbour Bridge.

List of Surveys:

1. Survey on Kinetic Energy Harvesting
2. Survey on Advanced Materials for Beam Structures
3. Survey on Failure Mechanisms in Truss Bridges
4. Survey on Lightweight Truss Design
5. Survey on Optimization Techniques for Truss Structures
6. Survey on Force Analysis in Structural Health Monitoring.
7. Survey on Force Measurement Techniques.

CCA 3	**Group Discussion/Seminar/ Blog writing**	**10 Marks**

List of Topics:

1. Major failures in Civil Engineering and root cause analysis.
2. Machine Learning and Artificial Intelligence in Engineering Mechanics.
3. Applications of Computational Fluid Dynamics (CFD) in Engineering Mechanics.
4. Applications of Newton's laws of motion in real life.
5. Python application in Engineering Mechanics.
5. Resolution and Composition of Force.
6. Kinematics and Kinetics of particle.
7. Kinematics and kinetics of rigid body.
8. Analysis of cables at same and different support level

NOTE: Students can select any other activity based on Course Contents consultation with Course Teacher

- **Text Books:**
  1. Engineering Mechanics, Ferdinand Singer, 3rd edition, Harper and Row
  2. Engineering Mechanics (Statics and Dynamics) by Hibbeler R. C., Pearson Education
- **Reference Books:**
  1. Engineering Mechanics, S Timoshanko and Young, Tata McGraw Hill Education Pvt. Ltd. New Delhi.
  2. Vector Mechanics for Engineers – Statics, Beer and Johnston, Tata McGraw Hill
  3. Vector Mechanics for Engineers – Dynamics, Beer and Johnston, Tata McGraw Hill.
  4. Engineering Mechanics - Statics and Dynamics, Meriam J. L. and Kraige L.G., John Wiley and Sons
- **e-Books:**
  1. Engineering Mechanics: Statics and Dynamics by J.L. Meriam& L.G. Kraige
  2. Vector Mechanics for Engineers: Statics and Dynamics by Ferdinand Beer & E. Russell Johnston Jr.
  3. Engineering Mechanics: Dynamics by R.C. Hibbeler
  4. Engineering Mechanics: Statics by R.C. Hibbeler

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Course: Fundamentals of Computer Science and Engineering			Code: ESC105	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			MSE	30
Practical	2	1	ESE	50
			TW	25

- **Prerequisites:**

Foundational understanding of mathematics, logic, and basic probability concepts.

- **Course Objectives:**

The objectives of this course are to understand the basic computer system, fundamental concepts of C programming, use operators and expressions effectively, and apply control flow structures for problem solving. It enables students to design solutions using arrays, strings, and user-defined functions, while also justifying the use of structures in problem solving, thereby equipping them with essential skills to design and implement programs in C.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: **Understand** basic of computing system and **Design** algorithms for simple computational problems.
CO2: **Use** mathematical, Logical Operators and Expressions.
CO3: **Apply** Control Flow structures for decision making.
CO4: **Design** a solution using Arrays and Strings.
CO5: **Design** and **Apply** User Defined functions and Structures in Problem solving using C programming language.

- **Course Contents:**

Unit I	Introduction to Computing & Program Design Tools	6 Hours

Introduction to Computing: Basics of Computer system: Hardware, Software, I/O Devices, Memory, Types of Software: System and Application Software, Types of Programming Languages: Machine, Assembly and High-level Languages, Applications of Computer in various domains**.**
Program Design Tools: Art of Programming through Algorithms, Flowcharts.

Unit II	Introduction to C Programming & Operators and Expressions	6 Hours

Introduction to C Programming:
Introduction, Procedural programming, Structure of C, Keywords and Identifiers, Constants, Character Set, C Tokens, Variables, Data types.
Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Ternary operators.

Unit III	Decision Making and Branching & Loop Control Structures	6 Hours

Decision Making and Branching: Control structures in C, Simple If Statement, If-Else, Nested If-Else, Cascaded If -Else, Switch-Case Statement.
Loop Control Structures: For Statement, while Statement, do-while, break & continue Statement, Go-to Statement.

Unit IV	Array & String in C	6 Hours

Array & String in C:
Array-Declaration, Initialization of One-Dimensional arrays, Two-Dimensional Arrays, Multi-Dimensional Array Character Arrays and Strings: Declaration and Initialization String Variables, Reading Strings from Terminal, Writing Strings to Screen, Putting Strings Together, Comparison of Two Strings, Introduction to String Handling Functions.

Unit V	Functions in C	6 Hours

Functions in C: Built in Functions, User-defined Functions, A Multi-Function Program, Elements of User defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but No Return Values, Arguments with Return values, No Arguments but Returns a Value, Functions that Return Multiple Values, Nesting of Functions, Recursion.

Structures: What is a Structure? Structure Type Declarations, Structure Declarations, Referencing Structure Members, Referencing Whole Structures, Initialization of Structures.

- **List of Experiment (Any Eight)**

1. To accept the number and Compute a) square root of number, b) Square of number, c) Cube of number d) Area of circle/rectangle e) Temperature conversion
2. Write a C program to
    a) Check if the given number is even or odd.
    b) Check if the given number is prime or not.
3. Write a C program that uses relational operators to compare the temperatures of two cities to determine which one is hotter, colder, or if they have the same temperature.
4. To accept the no. of terms from the user and generate & print the Fibonacci series.
5. To accept an object mass in kilograms and Calculate its Energy. Energy is calculated as e=mc2 where m is the mass of the object and c is speed of light.
6. In array do the following:
    a) Find given element in array.
    b) Find Max element.
    c) Find Min element.
    d) Find frequency of given element in array.
    e) Find Average of elements in Array.
7. Write a C program for employee salary calculation given, Basic, H.R.A. 20 % of Basic, and D.A. 150 % of Basic.
8. To accept a student's marks for five subjects, compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course. If student scores aggregate greater than 75%, then the grade is distinguished. If aggregate is 60>= and <75 then the
   Grade of first division. If aggregate is 50>= and <60, then the grade is second division. If aggregate is 40>= and <50, then the grade is third division.
9. To accept two numbers from user and compute smallest divisor and Greatest Common
   Divisor of these two numbers. Implement using user defined function.
10. Write a C program that accepts a string from the user and performs the following string operations- i. Calculate length of string ii. String reversal iii. Equality check of two
    Strings iv. Check palindrome v. Check substring.
11. Create Structure EMPLOYEE for storing details (Name, Designation, gender, Date of Joining and Salary), and store the data and update the data in structure.
12. Write a C program that uses a structure to model a real-life example of a book record system. Define a structure to represent a book with attributes like title, author, and year of publication. Perform operations like adding a new book, displaying book details, and searching for a book by title.
13. Write a program to demonstrate calculator operations using user defined functions.

● Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	**List of Course Activity**	**10 Marks**

1. Design a Calculator with basic functions. Add more functionality such as graphic user interface and Complex calculations like power and factorial
2. Design rolling dice game. When the program runs, it will randomly choose a number between 1 and 6 (Or other integer you prefer). Print that number. Request user to roll again. Set the min and max number that dice can show. For the average die, that means a minimum of 1 and a maximum of 6.
3. Guess Number Game: Randomly generate a number unknown to the user. The user needs to guess what that number is. If the user's guess is wrong, the program should return some sort of indication as to how wrong (e.g. the number is too high or too low). If the user guesses correctly, a positive indication should appear. Write functions to check if the user input is an actual number, to see the difference between the inputted number and the randomly generated numbers, and to then compare the numbers.

CCA 2	**Case Study/Survey**	**10 Marks**

List of Case Study:

1. Study of "C" Program compilation Process, testing and debugging.
2. Study of Infix, Prefix and Postfix expressions.
3. Study of Tower of Hanoi.
4. Generation of Monthly Balance sheet.
5. Study and Generation of Calendar.

List of Surveys:

1. How 'main' method works in C Programming.
2. Paradigms of programming.
3. Current Market Scenario for Project/ Application Development in C Language.

CCA 3	**Group Discussion/Seminar/ Blog writing**	**10 Marks**

List of Course Group Discussion Topics:

1. C Preprocessor Directives.
2. Memory allocation in C Programming.
3. Type casting and Type conversion in C Programming.
4. Is it time to retire C?

List of Course Seminar Topics:

1. Memory management in C.
2. Application of Structure and Union in C.
3. File handling in C.

List of Topics for Blog:

1. Future of C Programming.
2. Is C Programming relevant in current scenario?
3. C: The programming language that always in demand

NOTE: Students can select any other activity based on Course Contents in consultation with Course Teacher.

● **Text Books:**

1. Programming in ANSIC, 8e –E. Balagurusamy.
2. Let Us C -Yashavant Kanetkar, BPB Publication.

● **Reference Books:**

1. Maureen Spankle ―Problem solving & programming concept Pearson,2011.
2. B. W. Kernighan and D. M. Ritchie, ―The C Programming Language, Second Edition, PHI..
3. Herbert Schildt, ―C: The Complete Reference, Fourth Edition, McGraw Hill.
4. B. S. Gottfried, Programming with C (Schaum's Outline Series), 2nd ed. McGraw-Hill, 1996.
5. ISRD Group, ―Programming and Problem-Solving Using C, Tata McGraw Hill, 2008.

● **e-Books:**

1. **https://studylib.net/doc/25796931/programming-in-ansic--8e---balagurusamy**

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Course: Engineering Workshop			Code: VSEC101	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	--	--	CCA	--
			MSE	--
Practical	2	1	ESE	--
			TW	25

- **Prerequisites:** Basic Sciences, Engineering Drawing.

- **Course Objectives:**

The objective is to understand workshop layout and safety norms, acquire basic knowledge of machine tools, learn the fundamentals of manufacturing processes, and develop practical skills through hands-on experience with hand tools, power tools, and machine tools in manufacturing and welding shops.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Understand workshop safety rules and industry safety norms.
CO2: Draw a workshop layout and illustrate various sections of a typical workshop.
CO3: Understand the construction, working and functions of various machine tools and their parts.
CO4: Demonstrate proficiency in handling of cutting tools and machine tools to manufacture a job.
CO5: Describe the applications, advantages and operation of advanced machine tools in modern manufacturing.

- **List of Experiments**

Note: Any eight experiments/demonstrations must be completed, out of which two Job Performance tasks are compulsory.

I	**Safety Norms**
Safety: Identify and explain the following safety related considerations for any specific industry. Potential hazards present in industry 2) General safety rules 3) List various safety Devices used. **Industry visit:** Metal working / Chemical / Cement / Defense / Aerospace / Marine / Construction / Railway / Electronics / Technical Exhibitions etc. Note: Students have to prepare an industry visit report.	
II	**Layout**
Draw a typical layout of workshop with arrangement of equipment's considering a specific industry or workshop. (Block diagram)	
III	**Demonstration of Lathe and its operations**
Demonstration on various functions of lathe parts, Step turning and facing, drilling operation on a Mild Steel cylindrical job on centre lathe. Understanding the concept of speed, feed and depth of cut.	
IV	**Demonstration of Drilling machine and its operations**
Demonstration on construction of drilling machine, Tool holding devices, Concept of speed, feed and depth of cut.	
V	**Demonstration on Milling machine and its operations**
Demonstration on construction, table movements, indexing methods and tooling of milling machine.	
VI	**Demonstration on Foundry practices**
Overview of casting processes and techniques, equipment, materials, mould making.	
VII	**Fitting Job**
Introduction to different fitting tools. Use and setting of fitting tools for marking, center punching, chipping, cutting, filing, drilling, their use, different measuring tools, Files – Material and classification.	
VIII	**Carpentry Job**
Introduction to wood working, kinds of woods, hand tools & machines, and single piece pattern making.	

IX	Welding Job
Introduction to joining process, types of welding processes, electrodes used and types of joints. One Permanent joint either using resistance welding/Arc welding.	
X	**Advanced Machine Tools**
Demonstration (construction and operation) of any one advance machine tool such as CNC turn /CNC mill/VMC/HMC/3D Printer/Non-traditional machines such as EDM, ECM, AJM, WJM, LBM, EBM etc.	

- **Guidelines:**
  1. Student has to maintain a workshop diary/write-up consisting of drawing / sketches of the jobs and list of tools, equipment, and procedure used for performing the job and time schedule.
  2. Term work assessment shall be based on the timely completion of jobs, quality of job, and skill acquired.
  3. The demonstration of machine tool to be conducted by teaching faculty.

- **Text Books:**
  1. H.S.Bawa, "Workshop Practice", Tata McGraw Hill Education (Publisher).
  2. S. K. Hajra Choudhary, Nirjhar Roy, "Element of Workshop Technology: Vol.1 and 2", Media Promoters and Publishers Pvt. Ltd., 15th Edition, 2012.

- **Reference Books:**
  1. John, K. C., (2010), Mechanical Workshop Practice, Prentice Hall Publication, New Delhi

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Course: Design Thinking and Idea Lab			Code: VSEC102	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	--	--	CCA	--
			MSE	--
Practical	2	1	ESE	--
			TW	25

- **Prerequisites**

Basic understanding of problem-solving and communication skills. Students should be open to creative thinking, teamwork, and learning user-centered approaches.

- **Course Objectives:**

To help learners understand the design thinking process and use it to solve problems by practicing research, idea generation, prototyping, and teamwork to create practical and user-friendly solutions.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Explain the stages of design thinking and their role in creative problem solving.
CO2: Apply user research methods to empathize and define real-world problems.
CO3: Use ideation techniques to generate and select innovative solutions.
CO4: Build and evaluate prototypes based on user feedback.
CO5: Develop and present practical solutions through collaborative project work.

- **Course Contents:**

Week	Topics	Practical Activity
1	**Design Thinking** Definition and Importance of Design Thinking,5-Phase Process: Empathies, Define, Ideate, Prototype, Test, Design Thinking vs. Traditional Problem-Solving.	Orientation & Group Formation Ice breaking Activity (eg.30 Circles)
2	**Problem Identification** Definition of a Problem , 17 Sustainable Goals, (Eg. DTIL in Industry- Business Model Canvas)	Problem Identification (Individual Brainstorming followed by Dot Voting, sticky notes, checklist, diagraph)
3	**Problem Statement** Definition of a problem, Importance, Characteristics of a good problem statement:	Refine Problem Scope (using 5 Whys Statement, Root Cause analysis, Finalize Challenge)
4	**Empathies** understanding the user's needs, pain points, behaviors, while defining a meaningful problem statement.	Understanding users through observations / surveys/interviews/Questionnaire (AEIOU Framework, Empathy Map, Persona Creation)
5	**Define** Create a Problem Statement: Focus on a user-centered, actionable challenge. (Set clear goals, constraints, and target users.)	Formulate Objectives: Revisit Problem statement using fault tree analysis, potential failure mode and effect analysis, Point of View(POV)
6	**Ideate** Brainstorm diverse solutions, encourage creative thinking, prioritize feasible ideas.	Ideation Session (Mind mapping, SCAMPER, sketching, and brainstorming)
7	**Prototype** What is Prototype, Types of prototype, Build Low-Fidelity Prototypes: Create simple, inexpensive models of your ideas.	Low Fidelity Prototyping (Low-Fi) Paper Prototypes, Sketching.

Week	Topics	Practical Activity
8	**Test** Validate ideas with real users, iterate based on feedback.	User Testing (Usability Testing, Feedback Capture Grid)
9	**Iteration/Refinement** Refine and improve prototype.	Feedback Integration, Prototype Update (I Like, I Wish, I Wonder)
10	**Retest**	Take End User Feedback
11	**Pitch Preparation**	Presentation Preparation (Pitch Structure, Storytelling, Visual Aids)
12	**Final Showcase**	Presentation and Evaluation (Final Pitch, Roadmap, Reflection, Lessons Learned)

- **e-Books:**
  1. Design Kit: The Human-Centered Design Toolkit, IDEO.org, (2015) https://www.designkit.org/resources/1
  2. Design Thinking for Innovation, NPTEL IIT Bombay https://onlinecourses.swayam2.ac.in/aic23_ge17/preview
  3. Brown, T., (2010), Design Thinking (Harvard Business Review article) https://hbr.org/2009/06/design-thinking

- **Text Books:**
  1. Norman, D. (2013). The Design of Everyday Things. Basic Books, NY.
  2. Norman, D. (2004). Emotional Design. Basic Books, NY.
  3. Brown, T. (2019). Change by Design. HarperCollins Publishers, NY.

- **Reference Books:**
  1. E. F. Crawley, "Creating the CDIO Syllabus, a universal template for engineering education," 32nd Annual Frontiers in Education, Boston, MA, USA, 2002, pp. F3F-F3F, doi:10.1109/FIE.2002.1158202.
  2. Dym, C. L., Agogino, A. M., Eris, O., Frey, D. D., & Leifer, L. J. (2005). Engineering design thinking, teaching, and learning. Journal of Engineering Education, 94(1), 103-120.
  3. Panke, S. (2019). Design thinking in education: Perspectives, opportunities and challenges. Open Education Studies, 1(1), 281-306.

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Course: Professional Communication Skills			Code:AEC101	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	-	-	CCA	---
			MSE	---
Tutorial	2	2	ESE	---
			TW	25

- **Prerequisites:**

Foundational literacy and language skills are crucial for effective communication and learning. They provide the necessary tools to understand, interpret, and express ideas clearly. Equally important is a willing attitude and an open mind set for engaging with new concepts, participating actively and maximizing the learning experience.

- **Course Objectives:**

This course focuses on foundational communication, active listening, and digital communication. You will also learn to craft effective business writing, understand non-verbal cues, and deliver engaging presentations. Finally, you will develop strong interpersonal skills and learn to build rapport through teamwork and collaboration.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Apply fundamental communication principles to enhance interpersonal & professional interactions.
CO2: Analyze professional texts and compose effective written communications.
CO3: Utilize techniques and visual aids to deliver engaging and professional oral presentations.
CO4: Demonstrate effective interpersonal skills in team discussions and collaborative tasks.
CO5: Demonstrate professional leadership, ethical awareness and effective interpersonal skills in workplace interactions.

- **Course Contents:**

Unit I	Introduction and Ice Breakers & Active Listening Skills

Introduction and Ice Breakers:

Introduction, Core Elements of the Communication Process, understanding Communication Styles, Significance of Context.

Active Listening Skills:

Mindful Presence, Barriers to Effective Listening, Interpreting and Decoding Verbal & Non-Verbal Cues, Practice Empathy & Non-Judgment, Art and Science of Providing Feedback.

Unit II	Reading and Writing Skills

Effective Reading: Process, types and reading rate adjustment, tips for improving reading skills, reading between the lines, reading comprehension.

Mastering Professional Email Communication, Key Principles of Professional Digital Etiquette, Writing Effective Business Letters and Memos.

Unit III	Effective Speaking

Basics of verbal and non-verbal communication, Pronunciation Guide, Vocal Delivery and Body Language, Language Functions, Introducing yourself.

Importance of Public Speaking, Content Organization and Audience Engagement, Developing Presentations Skills, Group Discussion: Principles and Practice.

Unit IV	Workplace Communication

Key elements for a strong Professional Presence, Power of Emotional Quotient (EQ), Developing Interpersonal Skills and Building Rapport, Respecting Professional Decorum, Professional Networking and Making Connections, Job Search Communication: Resumes, Cover Letters, and Interviews Skills, Professional Follow Ups.

Unit V	Effective Leadership

Understanding different leadership styles and their impact, Self-Awareness and Influential communication, Team Building & Motivation, Decision-Making & Problem-Solving, Change Management.

List of Activity/Assignment:

Term-work shall consist of minimum 10 activities/ assignments to be performed on the entire Course Contents (any two from each topic).

1. **Active Listening Skills:**
   - The Communication Breakdown Challenge
   - Style Swap
   - Barrier Identification
   - Feedback Fiesta
   - Listen and Respond Thoughtfully
2. **Reading and Writing Skills:**
   - Email Doctor
   - Digital Dilemmas
   - Tone Translator
   - Letter Perfect
   - Memo Makeover
   - Purposeful Persuasion
3. **Effective Speaking:**
   - Body Language Bingo or “Mirror, Mirror”
   - Professional Persona
   - Verbal-Nonverbal Alignment Check
   - "Tell Me About Yourself" Challenge
   - Presentation Skills
   - Group Problem-Solving Challenge
4. **Workplace Communication:**
   - Blindfolded Build
   - Empathy Exchange
   - Conflict Resolution Role-Play
   - Decision-Making Challenges
   - LinkedIn Profile Power-Up (Critique and Improve)
   - Resume and Cover Letter Clinic (Peer Review)
   - Mock Interview Marathon
5. **Effective Leadership**
   - Shadowing Leaders
   - Survival Scenarios
   - Ethical Dilemma Discussions
   - Difficult Conversations Role-Play

NOTE: Students can select any other activity based on course content in consultation with Course Teacher.

Text Books:

1. Communication Skills for Engineers by S. Mishra & C. Muralikrishna (Pearson)
2. Communication Skills for Technical Students by T.M. Farhatullah (Orient Longman)
3. Written Communication in English by Saran Freeman (Orient Longman)
4. Essential English Grammar (Elementary & Intermediate) Raymond Murphy (CUP)
5. Communication for Business: A Practical Approach by Shirley Tailor (Longman)

Reference Books:

1. Developing Communication Skills by Krishna Mohan & Meera Banerji (Macmillan)
2. Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill)
3. Sasikumar et al. A Course in Listening and Speaking. New Delhi: Foundation Books, 2005.
4. Tony Lynch, Study Listening. Cambridge: Cambridge UP, 2004.

Course: Co-Curricular Course-I			Code: CCC101	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	----	----	CCA	--
			MSE	--
Practical	4	2	ESE	--
			TW	25

- **Co-Curricular Module**

1. Physical Fitness
2. Yoga and Mediation
3. Sports
4. Self-defense for Women
5. Personality Development
6. Innovation and Creativity
7. Performing Arts – Drama and Dance
8. Applied Arts and Fine Arts
9. NCC
10. Digital Media Creator
11. Basic Fire Safety
12. Education in Traditional Instruments

- **Course Objectives:**

This course aims to produce well-rounded engineers who are not only technically proficient but also socially responsible and culturally aware. It encourages overall personality development by enhancing leadership, teamwork, communication, and time management skills. The course also focuses on building essential soft skills such as public speaking, interpersonal communication, and emotional intelligence for professional success. Additionally, it cultivates creativity, critical thinking, and problem-solving abilities through active participation in technical clubs, competitions, and innovation challenges.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: **Demonstrate** enhanced physical fitness and mental well-being through consistent participation in physical training, sports, yoga, and meditation.
CO2: **Exhibit** improved interpersonal skills, self-confidence, self-discipline, time management, stress management and leadership qualities through involvement in personality development and self-defense activities.
CO3: **Demonstrate** creative thinking and innovation skills by engaging in performing arts, fine arts, and design thinking sessions.
CO4: **Exhibition** awareness of civic responsibilities, national pride, and teamwork through participation in NCC and community-based programs.
CO5: **Apply** digital/media tools responsibly for effective communication and collaboration**,** while understanding safety protocols and basic life-saving techniques.

- **Note:**

1. Student shall select any one module out of followings under this course.
2. Student participated under one of the following categories course and won regional, university, state, national, international prizes/certificate of merit shall be awarded requisite number of credits.
3. Term work is based on continuous evaluation process.

- **Course Contents:**

Module 1	Physical Fitness

1.Foundation of Physical Fitness:

- Introduction to Physical Fitness
- Importance of physical fitness in student life
- Components of physical fitness (strength, endurance, flexibility, coordination, balance)
- Basic fitness assessment and goal setting

2.Warm-up and Stretching Techniques Dynamic and static stretches:

- Joint mobility and injury prevention
- Breathing techniques during physical activity

3. Cardiovascular Endurance Activities:

- Jogging, running, brisk walking
- Circuit training basics
- Monitoring heart rate during cardio

4. Strength and Resistance Training:

- Bodyweight exercises: push-ups, squats, lunges, planks
- Core strengthening techniques
- Introduction to resistance bands or light weights (optional)

5: Fitness Games and Group Activities:

- Team-building sports (e.g., football, volleyball, dodgeball)
- Recreational games to enhance agility and teamwork

Module 2	Yoga and Meditation

1: Introduction to Yoga:

- History and philosophy of yoga (Patanjali's Yoga Sutras – basic understanding)
- Importance of yoga in student life
- Overview of types of yoga (Hatha, Raja, Bhakti, etc.)

2: Basic Yoga Asanas (Postures):

- Standing postures: Tadasana, Vrikshasana
- Sitting postures: Sukhasana, Vajrasana
- Supine postures: Bhujangasana, Setu Bandhasana
- Prone postures: Dhanurasana, Makarasana
- Benefits, precautions, and alignment for each posture

3: Breathing Techniques (Pranayama):

- Introduction to breath awareness
- Nadi Shodhana (alternate nostril breathing)
- Bhramari (bee breathing)
- Sheetali and Sheetkari for cooling and calming

4: Introduction to Meditation:

- What is meditation and why it matters
- Guided meditation (body scan, breath focus)
- Introduction to mindfulness practice

5: Relaxation Techniques:

- Shavasana (corpse pose)
- Yoga Nidra (yogic sleep) – beginner practice
- Music-assisted relaxation

6: Yogic Lifestyle and Daily Routine:

- Concept of sattvic lifestyle
- Basic diet and sleep awareness
- Personal discipline and time management

Module 3	Sports

1: **Introduction to Sports and Fitness:**

- Benefits of regular sports participation
- Overview of individual and team sports
- Sportsmanship, ethics, and fair play

2: **Warm-Up, Cool-Down & Basic Conditioning:**

- General warm-up and stretching exercises
- Cool-down and recovery practices
- Injury prevention and first aid basics

3: Individual Sports – Basic Techniques:

Choose 1 or 2 sports from: Athletics (running, long jump, shot put)

- Badminton

- Table Tennis
- Chess or Carrom (optional indoor activities) Focus: Basic rules, techniques, scoring, and gameplay

4: Team Sports – Basic Rules and Skills:

Choose 1 or 2 sports from:

- Football
- Volleyball
- Basketball
- Cricket etc

Focus: Positions, basic skills, communication, and simple strategies

5: Fitness Drills and Agility Training:

- Endurance drills, speed training, and agility ladders
- Group relay challenges
- Fitness testing (baseline assessment)

6: Mini Competitions or Project and Evaluation:

- Intra-group matches and friendly competitions
- Observation of performance, participation, and team spirit
- Peer, mini Project and instructor feedback

Module 4	**Self-Defense for women**

1: Introduction to Self-Defense:

- Importance of mindset, awareness, and mental preparedness
- Understanding threats, fear control, and personal safety mindset
- Role of discipline and decision-making under pressure

2: Basic Techniques – Punches, Blocks, and Kicks:

- Punches: Jab, Cross, Hook, Uppercut
- Blocks: High Block, Low Block, Inside Block, Outside Block
- Kicks: Push Kicks, Knee Strikes
- Partner drills & reaction drills
- Execution and combination of strikes and blocks

3: Fitness & Strength Conditioning:

- Endurance, agility, and strength workouts
- Combat conditioning
- Reaction-time training and explosive movements
- Handling stress, fear, and improving pressure performance

4: Real-Life Situations and Scenario Training:

- Confined space defense (elevator, street, vehicle)
- Mock attacks and stress-testing
- Role play drills and real-life application of self-defense

5: Grappling, Escapes & Close-Combat:

- Ground defense: Escaping from mount & side control
- Clinch work and close-range fight management
- Live drill simulations for situational awareness.

6: Traditional Weapons Awareness & Lathi Session:

- Weapon awareness: Knife, stick, and gun threat overview
- Defense drills: Basic Nunchaku & Lathi-Kathi techniques
- Realistic attack-response scenarios
- Mock weapon defense sessions

Module 5	Personality Development

- Communication Skill and Mindfulness
- Confidence Building
- Presentation Skill
- Emotion Management
- Stress Management
- Relationship Management
- Adjustment Problem

Module 6	Innovation and Creativity

1. Introduction to Innovation and Creativity:

- Concept and importance of creativity and innovation in daily and professional life
- Divergent Vs convergent thinking Growth mindset and fixed mindset
- Famous innovators and break through ideas (Indian and global)
- Icebreaker activities: “Who I Am” Canvas, “What’s Missing in My Life?”, “Inverted Pyramid”

2. Creativity Techniques and Thinking Models:

- Brainstorming techniques and ground rules
- Mind Mapping – idea expansion and synthesis
- SCAMPER: Substitute, Combine, Adapt, Modify, put to other use, Eliminate, Rearrange
- Six Thinking Hats (Edward de Bono) Role play and gamification: “Yes, And…”, “Stuck Elevator”, “Random Word Trigger”

3. Problem Identification and Ideation:

- Observing day-to-day life and listing 10 problems
- Problem tree and cause-effect diagrams
- Framing "How Might We" questions
- Group ideation sessions using various techniques
- 30 Circles Activity / Draw Toast / Ideation Cards

4. Way to Design Thinking:

- Overview of 5 stages: Empathize, Define, Ideate, Prototype, Test
- Empathy mapping and stakeholder interviews (role-play)
- Defining problem using Point-of-View (POV) statements
- Case studies: design thinking in action

5. Prototype and Communication Basics:

- What is a prototype? Types: sketch, storyboard, model, digital mockup
- Tools and materials: paper, clay, cardboard, PPT, Canva
- Team presentations of ideas using poster templates
- Peer feedback using “I Like, I Wish, What If…” method
- Mini-pitch competition

Module 7	Performing Arts – Drama and Dance

Performing Arts – Drama, Dance, Singing and Music:

1. Introduction to performing Arts:

- Different forms of performing arts.
- Importance of performing arts
- Aims and objectives of performing arts
- Development of performing arts through various stages.

2. Roles and Responsibilities of performing Arts:

- Types of performing arts events
- Types of venue and performance space.
- Introduction to responsibilities during performance and rehearsals.

3. **Explore Skills and Techniques:**
   - Skills and techniques as appropriate to chosen roles.
   - Performance skills and techniques as appropriate to discipline.
   - Production Skills.
4. **Group Activity:**
   - Worming up
   - Preparation
   - Communicating with group members.
   - Safe working
   - Working as a team.
5. **Live performance:**
   - Theme
   - How rehearsals are structured
   - Sharing ideas and opinions
   - Preparation for live performance
6. **Final Presentation.**

Module 8	Applied Arts and Fine Arts

- Types of lines, Drill lessons and design principles.
- Colors wheel and basic colors scheme
- Composition of basic shape and forms 2D design, composition study and layout.
- Art and Craft (Design composition, different technique and style implementation, creative project/ task of applied and fine art)
- Logo design (basic layout, logo type internal manual/ digital)

Module 9	NCC

1. Introduction to Leadership & Team Spirit:
- Understanding the role of leadership in NCC.
- Learning teamwork through group activities, parades, and basic drill formations.
- Participating in exercises that foster cooperation, unity, and mutual respect.

2. Foundation of Discipline & Conduct:
- Importance of punctuality, clean turnout, and personal discipline.
- Learning proper behavior, respect for officers, seniors, and peers.
- Introduction to saluting procedures, fall-in/fall-out, and reporting formats.

3. Awareness of National Values:
- Familiarity with national symbols, flag, anthem, and NCC song.
- Promoting patriotism, unity in diversity, and respect for India's Constitution.
- Understanding of moral values and civic responsibility.

4. Basic Physical Conditioning:
- Regular participation in warm-up exercises, stretching, and light jogging.
- Emphasis on maintaining physical fitness, stamina, and daily routines.
- Introduction to basic physical efficiency tests and marching drills.

5. Communication & Confidence Building:
- Basic public speaking through group discussions, briefings, and storytelling.
- Participation in anchoring, introductions, and classroom interactions.
- Development of stage presence and verbal confidence.

6. Career Orientation & NCC Benefits:
- Introduction to the NCC organization, structure, and its role in nation building.
- Understanding the value of NCC certificates (A/B/C) and their career advantages, especially in defense forces, police, and civil services.

7. Service-Oriented Thinking:

- Participation in cleanliness drives, tree plantations, and blood donation awareness.
- Developing the mindset of a socially responsible citizen.
- Encouraging small acts of service and contribution to local communities.

8. Adventure Exposure:

- Initial exposure to mock trekking, map reading, and orientation activities.
- Promotion of self-reliance, willingness to try new experiences, and team-based challenges.

9. Environmental Sensitization:

- Introduction to environmental issues like pollution, waste management, and climate change.
- Participation in eco-club activities, plastic-free campaigns, and poster-making.

10. Orientation for Military & Civic Roles:

- Basic knowledge of military structure, ranks, and uniform etiquette.
- Introduction to drill commands like attention, stand at ease, and turns.
- Understanding the qualities of a good citizen, and the connection between discipline and national service.

Module 10	Digital Media Creator

1: Introduction to Media Landscape:

- History, evolution, and introduction to marketing principles
- Overview of media types: traditional vs. digital (TV, radio, print, digital, social)
- Key players: publishers, agencies, platforms
- Role of media in brand building and marketing
- Overview of media functions in modern communication

2: Social Media & Digital Marketing:

- Digital transformation in media
- Social media platforms and trends
- Social media in digital marketing strategies
- OTT platforms, streaming, and podcasting

3: Content Writing, Video making, Tools & Analytics:

- Writing for web, blogs, and social media
- Video making Technics
- Crafting copy for ads, captions
- Introduction to marketing tools (Canva, Meta Ads, Google Analytics, Mail chimp)
- Social media metrics: engagement, reach, CTR Basic reporting and performance tracking

Module 11	Basic Fire Safety

1. Introduction to Fire Safety:

- What is fire? Definition and the Fire Triangle
- Types of fire (Class A, B, C, D, K)
- Importance of fire safety in engineering environments
- Common causes of fire in labs, hostels, and classrooms

2. Fire Prevention Techniques:

- Safe storage and handling of flammable materials
- Electrical safety and avoiding short circuits
- Housekeeping best practices
- Significance of regular maintenance of equipment

3. Fire Detection and Alarm Systems:

- Types of fire detectors (smoke, heat, flame)
- Fire alarm systems – manual and automatic
- Emergency warning signs and symbols

Module 12	Education in Traditional Instruments

1 Introduction to Indian Traditional Instruments

- Classification: String (Tantuvadya), Percussion (Avanaddha), Wind (Sushir)
- Historical and cultural background
- Overview of North Indian (Hindustani) and South Indian (Carnatic) traditions

2 Basic Music Theory & Acoustics:

- Swaras and Talas
- Scales and rhythm cycles
- Basics of sound: frequency, resonance, harmonics

3 Instrument Study – Design and Engineering:

- Materials used in traditional instruments
- Acoustical properties
- Comparative study with modern instruments

4 Hands-on Learning – Choose One Instrument:

- Basic playing techniques
- Instrument care and maintenance
- Group practice sessions
- Guest sessions by instrument experts

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Savitribai Phule Pune University

All India Shri Shivaji Memorial Society's

COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

National Education Policy (NEP) Compliant Curriculum

Faculty of Science and Technology

SEMESTER – II

First Year B. Tech. (2025 Pattern)

www.aissmscoe.com

Course: Engineering Mathematics-II			Code:BSC104	
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			MSE	30
Tutorial	1	1	ESE	50
			TW	25

- **Prerequisites:**
  Understanding of basic concepts of algebra, linear algebra, trigonometry, geometry and calculus.

- **Course Objectives:**
  To introduce the students to advanced integration techniques, solid geometry, multiple integrals and their applications, curve tracing and mathematical modeling of physical systems through the use of differential equations. The goal is to give students the knowledge and resources they need to understand advanced mathematics and its applications, which will improve their ability to think critically.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Apply effective mathematical tools to solve the first-order differential equations.

CO2: Apply mathematical techniques to model physical processes, such as Newton's law of cooling, electrical circuits, rectilinear motion, mass-spring systems, and heat transfer.

CO3: **Comprehend** advanced integration techniques, including Reduction formulae, Beta functions, Gamma functions, Differentiation under integral sign, which are essential for evaluating multiple integrals and their practical applications.

CO4: **Trace** curves based on given equations and calculate arc length for various types of curves and **understand** the concepts of solid geometry by using equations for spheres, cones, and cylinders.

CO5: **Apply** their knowledge to evaluate multiple integrals and use them to find areas bounded by curves and volumes bounded by surfaces.

- **Course Contents:**

Unit I	First Order Ordinary Differential Equations	8 Hours
Definition, Order and Degree of DE, Formation of DE. Solutions of Variable Separable DE, Exact DE, Linear DE and reducible to these types.		
Unit II	**Application of Differential Equations**	**8 Hours**
Applications of DE to Orthogonal Trajectories, Newton's Law of Cooling, Electrical Circuits, Rectilinear Motion, Fourier Law of heat conduction.		
Unit III	**Integral Calculus**	**8 Hours**
Reduction formulae, Beta and Gamma functions, Differentiation Under the Integral Sign (DUIS), Error Function, Applications to Problems in Engineering.		
Unit IV	**Curve Tracing and Solid Geometry**	**8 Hours**
Curve Tracing: Tracing of Cartesian, Polar and Parametric curves, Rectification of Curves. **Solid Geometry:** Cartesian, Spherical Polar and Cylindrical Coordinate Systems, Sphere, Cone and Cylinder.		
Unit V	**Multiple Integral and their applications:**	**8 Hours**
Double and Triple integration, applications to area and volume.		

- **Tutorials: Any Eight**

1. **Basics of Differential Equations.**
   - Identify order and degree of differential equations.
   - Form differential equations from given functions.
   - Classify types of first-order differential equations.

2. **Solution of First-Order DEs – I.**
   - Solve variable separable type Des.
   - Solve exact differential equations.
   - Verification of exactness and integrating factor method.

3. **Solution of First-Order DEs – II.**
   - Solve linear differential equations.
   - DEs reducible to linear or separable form.
   - Application in mixing and population models.

4. **Applications of Differential Equations.**
   - Orthogonal trajectories in Cartesian and polar forms.
   - Newton's law of cooling – temperature decay problems.
   - Electrical circuit (RL/RC) models using Des.

5. **Real-life Engineering Applications of DE.**
   - Rectilinear motion under gravity or variable force.
   - Fourier's law of heat conduction.
   - Construction of simple mathematical models from physical systems.

6. **Integral Calculus – I.**
   - Use of reduction formulas in evaluation of integrals.
   - Evaluate integrals involving $\sin^n x$, $\cos^n x$, $x^n e^x$, etc.
   - Apply in physics and engineering contexts.

7. **Beta, Gamma, and Error Functions.**
   - Evaluation of Beta and Gamma functions.
   - Establish relationship between Beta and Gamma.
   - Solve problems involving Error function (erf).

8. **Differentiation Under Integral Sign (DUIS).**
   - Use Leibnitz's rule for DUIS.
   - Evaluate integrals with parameters using DUIS.
   - Engineering applications involving transient analysis.

9. **Curve Tracing and Solid Geometry.**
   - Trace Cartesian, parametric, and polar curves.
   - Rectification: finding arc length of curves.
   - Identify and analyze Sphere, Cone, Cylinder in 3D coordinate systems.

10. **Multiple Integrals and Applications.**
    - Evaluate double and triple integrals.
    - Use change of order and variable where applicable.
    - Applications to compute area, volume, and mass in engineering problems.

● Continuous Comprehensive Assessment: (Any Two)		20 Marks
CCA 1	**List of Course Activity**	**10 Marks**

List of Course Projects:

1. **Modeling and Simulation of Newton's Law of Cooling:**
   Build a project simulating temperature changes in objects using differential equations.
2. **Design and Analysis of an Electrical Circuit:**
   Implementing differential equations in analyzing RL or RC circuits in a simulation software.
3. **Orthogonal Trajectories in Engineering Applications:**
   A project to design and analyze orthogonal trajectories, for example in structural engineering.
4. **Curve Tracing Software:**
   Develop software for tracing Cartesian, Polar, and Parametric curves, helping students visualize complex curves.
5. **Heat Transfer Analysis Using Fourier Law:**
   Create a model to simulate heat conduction in different materials using the Fourier Law of heat conduction

CCA 2	**Case Study/Survey**	**10 Marks**

List of Case Studies:

1. **Application of Differential Equations in Rectilinear Motion:**
   Study a case where differential equations are used to describe motion in engineering applications such as robotics or vehicle dynamics.
2. **Case Study on the Cooling of Electronic Components:**
   Explore real-life examples of cooling systems in electronics, applying Newton's Law of Cooling.
3. **Electrical Circuit Analysis Using Linear Differential Equations:**
   Analyze a case study on using linear ODEs in electrical engineering, e.g., the behavior of RC or RL circuits.
4. **Heat Conduction in Industrial Materials:**
   Investigate how the Fourier Law of heat conduction is used to solve engineering problems in materials like metals or polymers.
5. **Mathematical Modeling of Climate Change Using Differential Equations:**
   Study the application of differential equations in modeling environmental changes, particularly temperature fluctuations over time.

List of Surveys:

1. **Understanding the Use of Differential Equations in Engineering:**
   Use of Ordinary Differential equations for design, analysis and optimization.
2. **Applications of Integral Calculus in Engineering:**
   Use of reduction formulae, Gamma and Beta functions.

CCA 3	**Seminar/ Blog writing**	**10 Marks**

List of Course Seminar Topics:

1. **An Overview of First-Order Differential Equations and Their Applications:** A seminar on the definition, methods, and real-life applications of first-order ODEs.
2. **Fourier Law of Heat Conduction in Industrial Applications:** A seminar focusing on how the Fourier Law of heat conduction is used in industry, such as in materials science and engineering.
3. **Application of Beta and Gamma Functions in Engineering:** A seminar explaining the role of these special functions in solving engineering problems related to integrals and distributions.
4. **Differentiation Under the Integral Sign: A Powerful Tool in Engineering:** A seminar discussing the importance of the DUIS technique in solving complex integrals in engineering.
5. **Application of Multiple Integrals in Structural and Fluid Mechanics:** A seminar on how double and triple integrals are used to find areas, volumes, and other quantities in engineering problems.

List of Topics for Blog:

1. **Introduction to Differential Equations in Engineering:** A blog post explaining the significance of differential equations in various engineering fields and how they are used to model real-world phenomena.
2. **The Importance of Curve Tracing for Engineers:** A blog that explores how curve tracing techniques are crucial in the design process, from CAD software to physical structures.
3. **How Beta and Gamma Functions Simplify Engineering Problems:** A blog that explains the application of Beta and Gamma functions in simplifying complex integrals and solving engineering problems.

4. **Exploring the Use of Multiple Integrals in Engineering:** A blog post that explains how double and triple integrals are used to calculate areas, volumes, and mass in different engineering fields.
5. **Practical Applications of Newton's Law of Cooling:** A blog that discusses how Newton's Law of Cooling is applied in everyday engineering applications like refrigeration, electronic cooling, and temperature regulation systems.

- **Text Books:**
  1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
  2. Higher engineering Mathematics by B. S. Grewal (Khanna publishers)

- **Reference Books:**
  1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
  2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
  3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)
  4. Applied Mathematics (Vol. I & Vol. II) by P. N. Wartikar and J. N. Wartikar (Pune Vidyarthi Griha Prakashan)

- **e-Books:**
  1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
  2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication)
  3. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)

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Course: Programming and Problem Solving			Code:PCC101	
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			MSE	30
Practical	2	1	ESE	50
			TW	25

- **Prerequisites:**

Foundational understanding of mathematics, logic, and basic probability concepts, logical reasoning to solve mathematical problems and interpret results.

- **Course Objectives:**

The objectives of this course are to develop an understanding of problem-solving concepts and introduce the fundamentals of Python programming; to learn various data types and decision control statements for logical implementation; to gain knowledge of functions and string handling for effective programming; to acquaint students with file handling techniques and their practical benefits; and to provide hands-on experience in data visualization using Python for meaningful interpretation and presentation of data.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1. **Apply** various skills in problem solving.
CO2. **Choose** appropriate programming constructs and features to solve the problems in diversified domains.
CO3. **Demonstrate** the ability to implement common string manipulations in Python.
CO4. **Exhibit** the programming skills for the problem solving using functions.
CO5. **Apply** Python Programming skills to perform file operations and visualize data using standard libraries for real world problem solving.

- **Course Contents:**

Unit I	Problem Solving Concepts and Basics of Python	6 Hours

Problem Solving using computer, Features of Python, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Advance data types- Tuples, Lists, Sets and Dictionary.

Unit II	Decision Control and Loop Statements	6 Hours

Decision control statements, Selection/conditional branching Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures, while loop, for loop, Nested loops, The break, continue, pass

Unit III	Strings	6 Hours

Concatenation, appending, multiplication and slicing. Strings are immutable, string formatting operators, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, Iterating strings

Unit IV	Function	6 Hours

Need for functions, Function definition, call, variable scope and lifetime, Types of arguments, return statement. Lambda Function, documentation string.

Unit V	File Handling and Data Visualization	6 Hours

Opening a file, Modes for opening a file, closing a file, Reading and writing from a file, File Methods Numpy and Matplotlib: Introduction to libraries and its applications, plotting using matplotlib, data manipulation using pandas.

List of Experiments

Group A (for AIML, Computer, E&TC, VLSI any 12 and for other branches Any 9)

1. Program to perform all operation (addition, multiplication, subtraction, division, modules) and expression.
2. Program to convert degree Fahrenheit into degree Celsius.
3. To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions
4. Program to determine whether a person is eligible to vote or not
5. Program to find whether the given number is even or odd
6. Program to determine whether the character entered is a vowel or not.
7. Program to calculate the sum and average of first 10 numbers
8. Program to find whether the given number is an Armstrong number or not.
9. Program to enter a number and then calculate the sum of its digits.
10. Program to print the multiplication table of n, where n value is entered by user
11. Program to demonstrate operation on lists
12. Program that counts the occurrences of a character in a string. Do not use built in function.
13. Write a python program that accepts a string from user and perform following string operations-
    i. Calculate length of string ii. String reversal iii. Equality check of two strings iii. Check palindrome
    ii. Check substring
14. Program to reverse of string by user defined function.
15. Program to design calculator using functions
16. The program should subtract the DOB from today's date to find out whether a person is eligible to vote or not.
17. Program to read contents of on one file and copy it into another file.
18. Program to display all the lines of a text file that starts with word "This"
19. Program to append a user provided string to the end of an existing text file.
20. Program to keep records of Student data, manipulate files to store, update and delete such information
21. Program to create two 3x3 matrices and perform following operations: add, subtract, multiply, display shape, dimensions, rank, dtype.
22. Program to plot line chart, bar chart, pie chart, scatter chart, histogram for two different arrays.

Programme specific experiments:

Group B (Any Three)

Electrical Engineering:

1. Write a program to solve electrical network (KVL/KCL) using python.
2. Write a program for star delta conversion using python.
3. Write a program to calculate the impedance of RLC circuit using python.
4. Write a program to calculate efficiency of single phase transformer using python.

Civil Engineering:

1. A concentrated load of 1000KN is applied at the ground surface. Write a program to compute the vertical pressure (i) at a depth of 4m below the load, (ii) at a distance of 3m at the same depth. Use Boussinesq's equation.
2. A Filtered water discharge of 1MLD has a chlorine demand of 4.8 mg/l. It is required to maintain a chlorine residual of 0.2 mg/l. Write a program to determine the quantity of bleaching powder necessary of 6 months (Chlorine Available-25%).
3. A simply supported beam AB having spam of 4 meters loaded with following cases: Case 1) 100 KN at centre. Case 2) 50 KN at 1 meter from A support. Write a program to determine support reactions at A and B.
4. Two forces P and Q acting on a body 180 KN and 240 KN respectively. The angle between the two forces is 60 degrees. Determine the resultant of force P and Q and its direction with respect to Q force using python.

Mechanical Engineering/ Mechanical Engineering (Sandwich)/ Robotics and Automation Engineering:

1. On a certain planet a correctly calibrated spring balance shows the weight of a body 12 N, the mass of which is 4.893 kg. Write a program to find the value of gravity on this planet.
2. Write a program to estimate the heat loss through a red brick wall of length 5m, height 4m and thickness 0.25m, if the temperatures of the wall surfaces are maintained at 110^{o} centigrade and 40^{o} centigrade respectively. K for red brick is 0.70 W/mk.
3. Assume five liters of Oil weigh 61.80 N. Write a program to calculate i) Specific Weight ii) Specific mass using python.
4. Calculate thermodynamic properties (e.g., enthalpy, entropy, internal energy) of ideal gases using python.

Chemical Engineering:

1. Calculate the molar mass of a compound from its chemical formula (e.g., H_2O, NaCl) using python.
2. Implement Ideal Gas Law Calculator using python.
3. Calculate the heat capacity of a substance based on temperature change and energy input using python.
4. Calculate pH of strong/weak acid and base solutions using python.

• Continuous Comprehensive Assessment:(Any Two)		20 Marks
CCA 1	**List of Course Activity**	**10 Marks**

1. Design a Calculator which performs basic arithmetic operations using functions.
2. Create a password strength checker where Input a password and check its strength. Use conditions to check for uppercase, lowercase, digits, and special characters
3. Design a student marks recorder and data visualizer application

CCA 2	**Case Study/Survey**	**10 Marks**

1. Smart Energy Consumption in Homes. Use Python to analyze household energy usage patterns [Data input/output, control structures]
2. Student Performance Dashboard using Matplotlib

List of Surveys:

1. Digital Problem-Solving Skills Among Students
2. Applications of Python in AI & Machine Learning
3. Popularity of Different Python Libraries Among Beginners

CCA 3	**Group Discussion/Seminar/ Blog writing**	**10 Marks**

List of Course Group Discussion Topics:

1. How are Python transforming industries like finance, healthcare, and e-commerce?
2. The Role of Python in Cybersecurity – How secure is it?
3. Logical Thinking vs. Creativity – Which is more important in programming?
4. Is Python the best language for Artificial Intelligence and Data Science?

List of Course Seminar Topics:

1. Loops in Python – When to Use ‘for’ vs. ‘while’
2. String Manipulation Techniques in Python
3. Python for Data Science – Introduction to Pandas & NumPy
4. Why Python is Popular in IoT Development?

List of Topics for Blog:

1. Top 10 Python Programming Mistakes Beginners Make
2. Why Python is the Best First Programming Language?
3. How Python is Changing the Future of AI and Machine Learning

NOTE: Students can select any other activity based on course content in consultation with Course Teacher

- **Text Books:**
  1. Reema Thareja, “Python Programming Using Problem Solving Approach”, Oxford University Press, ISBN 13: 978-0-19-948017-6
  2. R. NageswaraRao, “Core Python Programming”, Dreamtech Press; Second edition ISBN10:938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL
- **Reference Books:**
  1. R. G. Dromey, “How to Solve it by Computer”, Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, “Problem Solving and Programming Concepts”, Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 9780132492645
  2. Romano Fabrizio, “Learning Python”, Packt Publishing Limited, ISBN: 9781783551712, 1783551712
  3. Paul Barry, “Head First Python- A Brain Friendly Guide”, SPD O’Reilly, 2nd Edition, ISBN:978-93-5213-482-3
  4. Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, ISBN10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
  5. Jeeva Jose, P. Sojan Lal, “Introduction to Computing & Problem Solving with Python”, Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 9789382609810
- **e-Books:**
  1. "Think Python: How to Think Like a Computer Scientist" by Allen B. Downey
  2. "A Byte of Python" by C.H. Swaroop
  3. "Automate the Boring Stuff with Python" by Al Sweigart

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Course: Indian Knowledge System			Code:IKS101	
Teaching Scheme		**Credit**	**Evaluation Scheme**	
Lecture	--	--	CCA	---
			MSE	---
Tutorial	2	2	ESE	---
			TW	25

- **Prerequisites:**

Foundational knowledge of Indian history, culture, and the evolution of ancient texts and traditions.

- **Course Objectives:**

To explore and analyze the scientific, technological, and philosophical foundations of the Indian Knowledge System (IKS) across diverse fields such as agriculture, physics, chemistry, mathematics, metallurgy, architecture, Ayurveda, and yoga, with the aim of understanding their historical significance, practical applications, and relevance to contemporary science and sustainable living.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: **Understand** traditional Indian scientific knowledge and practices, including agriculture, water harvesting, medicine, and architecture, and evaluate their relevance and application in contemporary contexts.
CO2: **Know** scientific principles and technological advancements in ancient India in the fields of physics, chemistry, and textile technology, and appreciate their historical significance and practical applications
CO3: **Apply** knowledge of ancient Indian mathematical concepts and Vedic techniques to solve basic arithmetic and algebraic problems
CO4: **Understand** ancient Indian advancements in metallurgy and architectural styles, and evaluate their scientific, cultural, and historical contributions to material science and structural design.
CO5: **Understand** the principles of ancient Indian agricultural practices, Ayurveda, and yoga, and assess their holistic approaches to health, well-being, and sustainable living.

- **Course Contents:**

Unit I	Indian Traditional Knowledge; Science and Practices

Introduction to the Science and way of doing science and research in India, Ancient Science in Intra & Inter Culture Dialogue & coevolution. Traditional agricultural practices, Traditional water-harvesting practices, Traditional Livestock and veterinary Sciences Traditional Houses & villages, Traditional Forecasting, Traditional Ayurveda & plant based medicine, Traditional writing Technology.

Unit II	Physics & Chemistry in India

Physics in India: Vaisheshika darshan Atomic theory & law of motion, theory of panchmahabhoota, Brihath Shathaka (divisions of the time, unit of distance), bhaskarachaya (theory of gravity, surya siddhanta & sidhanta shriomani), Lilavati (gurutvakashan shakti).

Chemistry in India: Vatsyayana, Nagarjuna, Khanda, Al-Biruni, Vagbhata-building of the ras-shala (laboratory), working arrangements of ras-shala, material and equipment, Yaśodhara Bhatta-process of distillation, apparatus, saranasamskara, saranataila.

Unit III	Mathematics in India

Mathematics in India: Baudhayana's Sulbasutras, Aryabhaṭa, Bhaskaracharya-I, Severus Sebokht, Syria, Brahmagupta, Bhaskaracharya-II, Jyeşţhadeva.

Introduction to Vedic Mathematics, Basic Arithmetic techniques - multiplication, square & cube, divisibility test, Highest common factor (HCF) of polynomials, multiplication and division of polynomials.

Unit IV	Ancient Indian Science (Metallurgy and Architecture)

Metallurgy in India: Survarṇa (gold) and its different types, prosperities, Rajata (silver), Tamra (copper), Loha (iron), Vanga (tin), Naga/sisa (lead), Pittala (brass)

Architecture in India: Nagara (northern style), Vesara (mixed style), and Dravida (southern style), Indian vernacular architecture, Temple sytle, cave architecture, rock cut architecture, kalinga architecture, chandels architecture, rajput architecture, jain architecture, sikh architecture, Maratha architecture, Indo-Islamic architecture, Indo-Saracenic revival architecture, Greco Buddhist style.

Unit V	Ancient Indian Science (Agriculture)

Agriculture in India: krishisuktas, Krishiparashara, Brihatsamhita, Types of crops, Manures, Types of land devamatruka, nadimatruka, use of animals in warfare, animal husbandry, Animals for medicines. Ancient transport in India.

NOTE: Term work evaluation is based on assignments/activities/Presentations.

- **List of Assignments/Activities/Presentations (Any Eight)**

1. Students should select one traditional Indian practice (e.g., agriculture, water harvesting, Ayurveda, etc.) and prepare a presentation explaining its scientific basis and cultural relevance. They should also discuss how it has evolved or been preserved in modern times.
2. Compare the atomic theory of Vaisheshika Darshan with Bhaskaracharya's idea of gravity. Explain how these ideas were used in ancient times, like echo sound technology in forts and palaces.
3. Study the work of Vagbhaṭa and Yaśodhara Bhatta in ancient Rasashala (laboratory) methods. Show how their ideas were also used in old Indian cloth dyeing and finishing techniques.
4. Assign a group of students to research one ancient Indian mathematician or text (such as Aryabhaṭa or the Sulbasutras) and present their key mathematical ideas.
5. Students to propose one Vedic Mathematics technique with a solved example.
6. Students to propose and discuss the properties and uses of metals like gold, copper, and iron in ancient Indian metallurgy. A group of students should present how these metallurgical practices contributed to advancements in tools, art, or technology.
7. Students to propose and discuss various ancient Indian architectural styles such as Nagara, Dravida, or Indo-Islamic. Assign a group of students to present how these styles reflect cultural diversity and influenced later architectural developments.
8. Study the ideas of ancient texts like Krishiparashara and Brihatsamhita about farming and animals. Explain how crops were grown, land was used, and animals helped in war, medicine, and farming.
9. Study how Ayurveda explains the human body, mind, and Panchamahabhuta (five elements). Explain the ideas of yoga, tridosha, triguna, and how they help in keeping a healthy life.
10. A site visit to an ancient Indian museum offers a remarkable glimpse into priceless artifacts, timeless cultural heritage, and the rich art, traditions, forts, rasashala and stories of ancient civilizations.

- **Text Books:**

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
3. PB Sharma, S. Narain, Doctors Scientists and Engineers of Ancient India, Kalpaz Publications 2017

- **Reference Books:**

1. SK Das, The education system of Ancient hindus, Gyan publication house, India
2. RP Kulkarni, Glimpese of Indian Engineering and Technology (Ancient & Medieval period, Munshiram Manoharlal Publishers Pvt. Ltd. 2018
3. AK Pathak, Science and Technology in India, Anshika prakashan pratapgarh, 2016
4. NVP, Unithiri, Indian Scientific Traditions (Professor K.N. Neelakantan Elayath Felicitation Volume), publication division unieristy of Calicut, 2006
5. Anonyms, History of Science in India- Volume-1 Part-1 (Physics, Mathematics and Statistics), the national academy of science, India & the ramkrishna mission institute of culture, 2014
6. R.N Basu. T K Bose, CS, Cakraborty History of Science in India Agricultural Science (Volume V), the national academy of science, India & the ramkrishna mission institute of culture 2014
7. A Gosh, History of Science in India (Volume-1 Part-II Astronomy), the national academy of science, India & the ramkrishna mission institute of culture, 2014
8. S Biswal, BL rav, vedic Science and technology. DK Print world, 2009

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Course: Co-Curricular Course-II				Code:CCC102
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	----	----	CCA	--
			MSE	--
Practical	4	2	ESE	--
			TW	25

- **Co-Curricular Module**

1. Physical Fitness
2. Yoga and Mediation
3. Sports
4. Self-defense for Women
5. Personality Development
6. Innovation and Creativity
7. Performing Arts – Drama and Dance
8. Applied Arts and Fine Arts
9. NCC
10. Digital Media Creator
11. Basic Fire Safety
12. Education in Traditional Instruments

- **Course Objectives:**

The course aims to produce well-rounded engineers who are not only technically proficient but also socially responsible and culturally aware. It focuses on holistic personality development by enhancing leadership, teamwork, communication, and time management skills. Students are equipped with essential soft skills like public speaking, interpersonal communication, and emotional intelligence for professional success. The course also fosters creativity, critical thinking, and problem-solving through technical and cultural activities, while promoting physical well-being and career readiness.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Demonstrate improved physical health, fitness, and mental well-being through regular participation in physical training, sports, yoga, and meditation activities.

CO2: Exhibit improved interpersonal skills, self-confidence, self-discipline, time management, stress management and leadership qualities through involvement in personality development and self-defense activities.

CO3: Demonstrate creative thinking and innovation abilities by participating in performing arts, fine arts and design thinking sessions.

CO4: Exhibition awareness of civic responsibilities, national pride and teamwork through engagement in NCC and community-oriented activities.

CO5: Use digital/media tools for communication and collaboration and recognize the importance of fire safety and emergency preparedness through practical training.

- **Note:**

1. Student shall select any one module out of followings under this course.
2. Student participated under one of the following categories course and won regional, university, state, national, international prizes/certificate of merit shall be awarded requisite number of credits.
3. Term work is based on continuous evaluation process.

- **Course Contents:**

Module 1	Physical Fitness

1. Fitness Progression and Lifestyle Integration

- Review and Advanced Fitness Assessment, Reassessment of fitness goals
- BMI, endurance, strength, and flexibility comparisons
- Introduction to fitness journals and tracking progress

2. Aerobic and Anaerobic Workouts

- HIIT (High Intensity Interval Training) introduction
- Dance fitness/Zumba sessions
- Sprint drills and shuttle runs

3. Mental Well-being and Stress Management

- Importance of physical activity in reducing stress

- Guided meditation and breathing exercises
- Coping strategies for academic and personal stress

4. Nutrition and Healthy Living

- Basics of diet and hydration for fitness
- Impact of junk food and sedentary lifestyle
- Personal wellness planning

5. Capstone Activity / Fitness Challenge

- Group fitness competitions or challenges
- Student-led activity sessions
- Reflection and feedback on fitness journey

Module 2	**Yoga and Meditation**

1: Intermediate Yoga Asanas

- More dynamic and balancing postures: Trikonasana, Garudasana, Ardha Matsyendrasana, Paschimottanasana.
- Focus on strength, flexibility, and balance
- Postural corrections and self-awareness

2: Advanced Pranayama Techniques

- Anulom-Vilom (advanced practice)
- Kapalabhati (cleansing technique)
- Ujjayi and Bhastrika (with supervision)

3: Meditation Techniques and Concentration

- Om chanting and mantra meditation
- Trataka (candle gazing for concentration)
- Self-inquiry and silent sitting

4: Emotional and Mental Health through Yoga

- Yoga for managing stress, anxiety, and anger
- Developing emotional resilience and awareness
- Building focus and mindfulness for study efficiency

5: Yoga for Common Student Ailments

- Eye strain relief exercises
- Yoga for back pain, posture correction, and fatigue
- Breathing techniques for energy and alertness

Module 3	**Sports**

1: **Intermediate Techniques and Drills**

- Continued development of skills in chosen individual/team sports
- Sport-specific drills for accuracy, control, and stamina
- Application of strategies and tactics

2: **Rules, Refereeing, and Scoring**

- In-depth understanding of rules and refereeing
- Practice of scoring methods
- Leadership roles (team captain, referee, scorer)

3: **Strength and Sport-Specific Conditioning**

- Resistance training (bodyweight) for sport performance
- Flexibility, mobility, and core strength training
- Sport-specific endurance drills

4: Advanced Game Play

- Small-sided games and tactical formations
- Real-match scenarios and strategies
- Improving communication and coordination under pressure

5: Organizing a Sports Event

- Planning, coordination, and execution of a mini sports tournament
- Roles: organizing committee, volunteers, officiating
- Basics of event management

6: Assessment and Recognition

- Skill demonstration and match performance
- Evaluation based on skill progression, teamwork, and participation
- Certificates or points awarded for active involvement

Module 4	Self-Defense for women

1: Advanced Practice – Punch, Kick & Block Combos

- Combo drills: Jab–Cross–Knee, Hook–Elbow–Push Kick
- Block and counter: Inside block to punch, low block to knee
- Reaction partner drills: One-step attacks with defense response
- Target pad workout: Repeated high-intensity strike rounds (3 sets x 1 min)

2: Strength, Speed & Stamina Training (Final Fitness Challenge)

- Full-body fitness: Squats, jump jacks, planks, mountain climbers
- Power sets: 1-minute punching bag drills + shuttle runs
- Combat endurance: Girls vs girls relay challenge with punching/kicking stations
- Final Test: 3-round fitness + striking circuit to test power, speed & control

3: Advanced Physical Fitness & Combat Endurance

- Full-body HIIT circuits: squats, pushups, jump lunges, mountain climbers
- Resistance training using bodyweight and partner drills
- Reaction & agility ladder drills for fast footwork
- Stretching, mobility & recovery techniques for injury prevention

4: Traditional Weapon Handling – Lathi Kathi Masterclass

- Advanced Lathi movements: spinning, blocking, striking combos
- Group coordination: Lathi kata routines for rhythm and control
- Partner drills for attack–defense sparring using sticks
- Cultural insight: Role of Indian martial traditions in women's defense.

5: Evaluation & Drills

- Combination drills: Punches, blocks, kicks (Speed + Power)
- Execution under evaluation (5 marks: Blocks + Punches)
- Reflex evaluation and partner responses
- Fitness + Confidence scoring through simulation

6: Final Combat & Confidence Test

- Realistic sparring (Mock Fight Drills)
- Pressure handling and strategy (Real Fight = 5 marks)
- Mental strength & Confidence Test

Module 5	Personality Development

- Importance of Health
- Motivation
- Goal Setting
- Time Management
- Positive Thinking
- How to be college Friendly
- Career Growth
- People Networking
- Use of social media

Module 6	Innovation and Creativity

1. Advanced Tools and Application Frameworks

- TRIZ (Theory of Inventive Problem Solving) – simplified overview
- Creative heuristics: Reverse thinking, Analogy, Provocation
- Innovation Canvas / Lean Canvas (lite version)
- Introduction to Value Proposition Canvas

2. Mini-Project: Innovation Challenge

- Choose a real-world problem (campus, community, environment)
- Define problem → Empathize → Ideate → Prototype
- Build working or visual model using low-cost materials
- Weekly mentoring and reflection sheets
- Progress check with feedback

3. Creativity in Indian Context

- Frugal Innovation / Jugaad examples: Mitticool, Jaipur Foot, Aravind Eye Care
- Innovations from rural India: Rice ATM, Terracotta Refrigerator
- Social entrepreneurship initiatives
- Group analysis and case storytelling

4. Presenting and Pitching Innovation

- Elements of a strong pitch: problem, solution, user impact, scalability
- Storytelling techniques and visual communication (posters, slides, demos)
- Elevator pitch activity (60-second idea pitch)
- Peer review and rubric-based evaluation
- Mock panel feedback (faculty or student jury)

5. Capstone Showcase and Celebration

- Organize an Innovation Mela or Creative Fest
- Exhibit team projects with posters and/or live demos
- Peer assessment and self-evaluation
- Jury feedback and idea recognition
- Submission

Module 7	Performing Arts – Drama and Dance

1. **Explore different types of staging and professional environment.**
   - Professional environments
   - Consideration of staging and professional environments
   - Importance of staging and professional environments.
2. **Analyse the present scenario of different performing arts**
   - Role of government of India to promote the artists and performing arts.
   - Guru Shishya parampara
   - Present scenario of Dance, Drama and Music
3. **Distinguish between live performance and recorded performance.**
   - What is live performance
   - Meaning of recorded performance
   - Key difference live and recorded performance
4. **Documenting experiences and evaluating personal contribution.**
   - Detailing experience personal contribution and development.
   - Making judgements and contributions
   - Methods of providing commentary
   - Storage and presentation methods.

5. Group activity for small scale production

- Identifying needs of different groups or team members
- Each team present their innovative ideas
- Rehearsals
- Final production.

Module 8	Applied Arts and Fine Arts

- Canvas painting (using design principles colours schemes and composition of basic elements)
- Poster Design (Digital) [Event Poster/ Informative poster design/ Educational poster design)
- Outdoor Visit (Art exhibition, Art workshop, Art seminar, outdoor sketching activity etc)
- Art and Design- creative technique workshop (one day)
- Design for social awareness (NSS poster design/ Any college activity poster/ College Social awareness activity poster and background poster etc)

Module 9	NCC

1. Applied Leadership & Command Responsibility

- Taking up leadership roles during parades and public events.
- Practicing command delivery in drill practices (e.g., giving and executing commands clearly).
- Leading small teams in organizing NCC events and activities.

2. Disciplined Lifestyle & Officer-Like Conduct

- Practicing self-discipline in time management, grooming, and punctuality.
- Understanding code of conduct for NCC cadets in public settings.
- Maintaining uniform standards, correct badging, and turn-out checks.

3. Constitutional Duties & Patriotism in Action

- Organizing flag hoisting, national festivals, and patriotic skits.
- Participating in sessions on duties of citizens and values of democracy.
- Conducting awareness campaigns on national integration and civic duties.

4. Fitness Regimen & Endurance Training

- Engaging in endurance-building exercises, obstacle practice, and group PT challenges.
- Conducting mini fitness assessments and leading warm-up sessions.
- Understanding the role of nutrition and rest in physical performance.

5. Strategic Communication & Leadership Presence

- Leading briefing sessions, news reading, and group discussions with confidence.
- Participating in extempore, debates, and official event anchoring.
- Developing clear communication under pressure (mock reporting, parade orders).

6. Career Planning & Defense Orientation

- Attending guest lectures from defense personnel and civil service officers.
- Preparing for entries like NDA, CDS, Agniveer, and understanding the selection process.
- Resume writing and group interviews (mock session for job/career readiness).

7. Community Leadership & Social Impact Projects

- Planning and executing a social outreach project (e.g., cleanliness, health check-up camp).
- Creating impact reports and presenting project results to instructors.
- Promoting social causes through awareness rallies and street plays.

8. Adventure & Survival Skills

- Engaging in actual mini treks, navigation using compass/maps, and tent setup.
- Learning first-aid basics, emergency response drills, and survival techniques.
- Participating in inter-group competitions in adventure-based activities.

9. Eco-Action Projects & Environmental Leadership

- Conducting plastic ban drives, tree plantation campaigns, or water-saving workshops.
- Preparing presentations on climate change, biodiversity, or waste management.
- Leading NCC green squads for maintaining campus cleanliness.

10. Military Drill & Civic Role Modelling

- Practicing complex parade formations, command execution, and timing.
- Taking charge during morning parade, flag ceremonies, or march-past leadership.
- Understanding the cadet's role as a model citizen, contributing to civil society and emergency response.

Module 10	Digital Media Creator

1: Public Relations & Communication

- Basics of PR and media relations
- Press releases and media kits
- Managing brand reputation (online and offline)
- Crisis communication
- Internal and external communication strategy

2: Strategic Media Planning & Buying

- Advertising planning and budgeting
- Creating a marketing plan
- Target audience and segmentation
- Case studies of successful campaigns
- Understanding media buying and ad placements
- Ad formats: display, video, native, influencer marketing

3: Media Law & Ethics

- Intellectual property and copyright
- Defamation and privacy laws
- Ethical dilemmas in journalism and content creation

Module 11	Basic Fire Safety

1: Firefighting Equipment

- Types of fire extinguishers (Water, Foam, CO_2, Dry Chemical, Wet Chemical)
- How to identify and use fire extinguishers (PASS technique)
- Fire blankets, sand buckets, hose reels

2: Emergency Procedures and Evacuation

- Evacuation plans and assembly points
- Roles and responsibilities during fire emergencies
- How to raise an alarm and communicate effectively?
- Safety drills – Do's and Don'ts

3: Hands-On Training / Fire Drill

- Live demonstration of fire extinguisher use
- Mock evacuation drill
- Role-play: emergency scenarios and response

Module 12	Education in Traditional Instruments

1: Introduction to Indian Traditional Instruments

- Overview of Indian classical music systems: Hindustani & Carnatic
- Classification: String (Tantuvadya), Wind (Sushirvadya), Percussion (Avanaddha)
- Cultural and historical significance

2: Fundamentals of Sound and Music

- Physics of sound: frequency, pitch, resonance, timbre
- Acoustics: vibration in strings, air columns, membranes
- Relation to instrument construction

3: Instrument Design & Engineering

- Materials used: wood, metal, skin, bamboo, etc.
- Instrument tuning and calibration
- Modern engineering parallels: sensors, resonance boxes, sound amplification

4: Instrument Handling & Practice

- Students select one instrument (e.g., Tabla, Flute, Veena, Mridangam, Dholak)
- Introduction to playing posture, hand techniques, and basic notes/rhythms
- Regular guided practice sessions

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Task Force for Curriculum Design and Development

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