National Education Policy (NEP)-2020 Compliant Curriculum

JSPM's

JAYAWANTRAO SAWANT COLLEGE OF ENGINEERING

Hadapsar, Pune- 411 028

(Approved by AICTE & Affiliated to Savitribai Phule Pune University,
Accredited with A+ Grade by NAAC & NBA Accredited)

An Autonomous Institute

Department of Engineering Science



F.Y. B.Tech

CURRICULUM

With effect from A.Y.-2026-27

2026 PATTERN

Engineering Fundamentals | Applied Sciences | Knowledge & Learning | Design & Innovation | Analytics & Problem Solving | Future Ready

Website
www.jspmjscoe.edu.in

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Maharashtra, India

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NOMENCLATURE

AEC	Ability Enhancement Courses
BSC	Basic Science Course
AICTE	All India Council for Technical Education
ELC	Experiential Learning Courses
CO	Course Outcome
CEP	Community Engagement Project
CCC	Co-Curricular Courses
CCE	Comprehensive Continuous Evaluation
HSSM	Humanities, Social Science, and Management
ESC	Engineering Science Course
IKS	Indian Knowledge System
PR	Practical
NPTEL	National Programme on Technology Enhanced Learning
NEP	National Education Policy
PO	Program Outcomes
PEO	Program Educational Objectives
PSO	Program Specific Objectives
SWAYAM	Study Webs of Active-learning for Young Aspiring Minds
UGC	University Grants Commission
FP	Field Project
VSE	Vocational and Skill Enhancement Course
WK	Knowledge and Attitude Profile

PREFACE BY BOARD OF STUDIES

Dear Students and Teachers,

The **First-Year B. Tech curriculum** serves as the foundation for developing technically competent, creative, responsible, and socially conscious engineering professionals. The curriculum has been thoughtfully designed to provide students with a strong foundation in engineering sciences, mathematics, basic engineering concepts, professional skills, and emerging technologies, while creating meaningful opportunities for learning beyond the traditional classroom.

The syllabus places significant emphasis on **experiential learning, hands-on activities, field-based learning, problem-solving, and real-world applications**. Students are encouraged to learn by doing, observing, exploring, experimenting, analysing, and reflecting on their experiences. Field visits, laboratory activities, mini-projects, technical activities, case studies, group work, community-oriented activities, and interdisciplinary assignments are incorporated to connect theoretical concepts with practical situations.

In accordance with the vision of **NEP 2020**, the curriculum promotes learner-centric, multidisciplinary, skill-oriented, and application-based education. It provides opportunities for students to develop critical thinking, creativity, communication, collaboration, innovation, leadership, digital competency, and problem-solving abilities. The curriculum also encourages students to understand the relationship between engineering, society, environment, culture, ethics, and sustainable development.

Special emphasis is given to **Indian Knowledge Systems (IKS)** and experiential activities that enable students to appreciate India's rich scientific, technological, cultural, and intellectual heritage. Through field activities, heritage visits, local studies, environmental activities, and contextual learning, students are encouraged to connect knowledge with their surroundings and understand the relevance of traditional knowledge in contemporary engineering and sustainable development.

The curriculum follows the philosophy of **Outcome-Based Education (OBE),** wherein learning outcomes are clearly defined and learning experiences are planned to help students achieve them. Assessment is therefore not restricted to conventional examinations but also includes practical work, projects, presentations, field activities, reflective exercises, teamwork, and other authentic assessment methods.

The First-Year B. Tech programme is thus envisioned as a transformative learning journey, where students move from being passive recipients of information to active participants in the learning process. The curriculum aims to nurture curiosity, confidence, innovation, ethical values, and a lifelong learning attitude among students.

It is hoped that this curriculum will provide students with a strong academic foundation as well as the practical exposure, professional skills, social awareness, and holistic perspective required to become competent engineers, innovative problem-solvers, responsible citizens, and lifelong learners.



Dr. C. A Manjare Chairman
BoS- Chairman

INSTITUTE VISION:

To be a leading Institution that fosters holistic education through innovative, interdisciplinary, skill-based, and industry aligned learning, for future ready professionals who contribute to global progress.

INSTITUTE MISSION:

1. To design and deliver interdisciplinary, industry-aligned curricula that integrate real world experiences, entrepreneurship, and emerging technologies.
2. To foster an innovative learning environment through cutting-edge pedagogical approaches, skill-based training, and startup incubation support.
3. To develop globally competent professionals by emphasizing holistic education, ethical values, and lifelong learning.

PROGRAM EDUCATIONAL OBJECTIVES

Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that the program is preparing a graduate to achieve.

PEO1 : The graduate will have a successful career in mechanical engineering with strong technical, research & professional skills.

PEO2 : The graduate will possess an ability to work in diversified fields along with team work and leadership qualities.

PEO3 : The graduate will continue to learn and to adapt in a society of constantly evolving technological environment

PROGRAM OUTCOMES

Program Outcomes (POs) are statements that articulate what students are expected to know, understand, and be able to do by the time they graduate from the program. These outcomes are aligned with the overall educational objectives of the program and reflect the skills, knowledge, attitudes, and behaviors acquired by students throughout their academic journey. On successful completion of B.E. in Mechanical Engineering, graduating students/graduates will be able to:

PO No.	Title	Program Outcome Description
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)

WK No.	Focus Area	Description
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.

Reference: Self-Assessment Report (SAR) Format Undergraduate Engineering Programs Graduate Attributes and Professional Competencies Version 4.0 (GAPC V4.0) - (August 2024) Page 55-56

GUIDELINES FOR EXAMINATION SCHEME

Term	Definition
Course Outcomes (COs)	Course Outcomes are narrower statements that describe what students are expected to know and be able to do at the end of each course. These relate to the skills, knowledge, and behavior that students acquire throughout the course.
Assessment	Assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of **Program Educational Objectives (PEOs)** and **Program Outcomes (POs)**.
Evaluation	Evaluation is one or more processes, performed by the **Evaluation Team**, to interpret the data and evidence gathered through assessment practices. It determines how well PEOs or POs are being achieved, and informs decisions for improvement.

ASSESSMENT AND EVALUATION:

Assessment and Evaluation shall be conducted in two parts:
1. Comprehensive Continuous Evaluation (CCE)
2. End-Semester Examination (ESE)

Component	Description	Marks
Comprehensive Continuous Evaluation (CCE)	Conducted at institute level, covering all Units of the syllabus. The design and mark allocation follow the Continuous Assessment Sheet structure.	**50**
End-Semester Examination (ESE)	Conducted at university level, typically covering the entire syllabus through summative examination.	**50**
	Total Marks per Subject	**100**

COMPREHENSIVE CONTINUOUS EVALUATION (CCE):

CCE contains

1. Field Activity - **30 marks**
2. Pedagogy Quiz - **10 marks**
3. Notebook Evaluation - **10 marks**

Term work: Term work evaluation for 50 marks includes Continuous Assessment Evaluation considering student's Attendance, Observations, Participation and Journal submission.

Practical Examination: 50 marks Practical Examination marks are distributed in two parts.

1. CAS - 25 marks
2. Practical implementation - 25 marks

End Semester Examination: End-Semester Examination (ESE) of 50 marks written theory examination based on all the unit of course syllabus will be scheduled at the end of semester. Questions will be based on Bloom's level from BL-2 to BL-4.

Every question paper contains 10 questions with option to Q.1a, b OR Q.2a, b, Q.3a, b OR Q.4a, b, Q.5a, b OR Q.6a, b, Q.7a, b OR Q.8a, b, and Q.9a, b OR Q.10a, b.

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(An Autonomous Institute)

Board of Studies - Engineering Science & Technology

Undergraduate Program – First Year B. Tech (2026 pattern)

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks					Credit			
				TH	PR	EL	CCE	ESE	TW	PR	TOTAL	TH	PR	EL	TOTAL
Semester-I															
1	BSC101ES	Basic Science Course	Engineering Mathematics-I	3		3	50	50			100	3		1	4
2	BSC102ES / BSC103ES	Basic Science Course	Engineering Physics/ Engineering Chemistry	2		3	50	50			100	2		1	3
3	ESC111ES / ESC112ES	Engineering Science Course	Engineering Graphics/ Engineering Mechanics	2		3	50	50			100	2		1	3
4	ESC113ES	Engineering Science Course	Basic Electrical and Electronics Engineering-I	2				50			50	2			2
5	ESC114ES	Engineering Science Course	Fundamentals of C Programming	2	2			50		50	100	2	1		3
6	VSEC131ES/ VSEC132ES	Vocational & Skill Enhancement Course	Fundamentals of Manufacturing & Product Prototyping (FMPP)/ Design Thinking & Idea Lab (DTI)		2				50		50	0	1		1
7	AEC141ES	Ability Enhancement Course	Professional Communication Skill			3	50				50	0		1	1
8	VSEC133ES	Vocational & Skill Enhancement Course	Electrical and Electronics Exploration Lab-I			3	50				50	0		1	1
9	CC142ES	Co-Curricular Courses	Health and Wellness, Yoga Education Sports and Fitness, Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/Performing Arts			3	50				50	0		1	1
Total Hours / Week				**11**	**4**	**18**	**300**	**250**	**50**	**50**	**650**	**11**	**2**	**6**	**19**
Learning hours in the semester-I				**165**	**60**	**270**						**165**	**60**	**270**	**495**

Dr. C. A Manjare
BoS- Chairman

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Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks					Credit			
				TH	PR	EL	CCE	ESE	TW	PR	TOTAL	TH	PR	EL	TOTAL
	Semester-II														
1	BSC151ES	Basic Science Course	Engineering Mathematics-II	3		3	50	50			100	3		1	4
2	BSC102ES/ BSC103ES	Basic Science Course	Engineering Physics/ Engineering Chemistry	2		3	50	50			100	2		1	3
3	ESC111ES/ ESC112ES	Engineering Science Course	Engineering Graphics/ Engineering Mechanics	2		3	50	50			100	2		1	3
4	ESC161ES	Engineering Science Course	Basic Electrical and Electronics Engineering-II	2				50			50	2			2
5	ESC162ES	Engineering Science Course	Programming in C++	2	2			50		50	100	2	1		3
6	VSEC131ES / VSEC132ES	Vocational & Skill Enhancement Course	Fundamentals of Manufacturing & Product Prototyping (FMPP)/ Design Thinking & Idea Lab (DTI)		2				50		50	0	1		1
7	AEC191ES	Indian Knowledge System	Indian Knowledge System			3	50				50	0		1	1
8	VSEC181ES	Vocational & Skill Enhancement Course	Electrical and Electronics Exploration Lab-II			3	50				50	0		1	1
9	CC192ES	Co-Curricular Courses	Health and Wellness, Yoga Education Sports, and Fitness, Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/Performing Arts			3	50				50	0		1	1
Total Hours / Week				**11**	**4**	**18**	**300**	**250**	**50**	**50**	**650**	**11**	**2**	**6**	**19**
Learning hours in the semester-I				**165**	**60**	**270**						**165**	**60**	**270**	**495**

TH – Theory **PR** – Practical **EL** – Experiencial Learning **CCE** – Comprehensive Continuous Evaluation
ESE – End Semester Examination **TW** – Term Work **PR** – Practical

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BoS- Chairman

JSPM's Jayawantrao Sawant College of Engineering, Hadapsar,

Pune, Maharashtra, India.

F.Y. B. Tech Curriculum (2026 Pattern)

SEMESTER- I

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JAYAWANTRAO SAWANT COLLEGE OF ENGINEERING, HADAPSAR, PUNE.

[An Autonomous Institute]

First Year B. Tech (2026 Pattern)

BSC101ES: ENGINEERING MATHEMATICS – I

Teaching Scheme	Credit	Examination Scheme
Theory: 3 Hours/Week EL: 3 Hours/Week	TH: 3 EL: 1 Total: 4	ESE: 50 Marks CCE: 50 Marks Total: 100 Marks

Prerequisite Courses, if any: Differentiation, Limit, Continuity, Homogeneous Equation, Variable Separable Form

Course Objectives: The objectives of the course are to

1. Understand differential calculus techniques to solve engineering problems.
2. Apply mathematical modeling techniques using differential equations for analyzing real world engineering problems.
3. Implement ordinary differential equation to real world problems.
4. Analyze matrices and system of linear equations in multidisciplinary engineering problems.
5. Analyze engineering problems using eigenvalues and eigenvectors.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Apply differential calculus to determine Physical quantities such as Velocity, Acceleration etc to solve engineering problems

CO2: Formulate mathematical model to solve Engineering Problems using ordinary differential equations

CO3: Apply appropriate techniques of ODE to solve real life problems.

CO4: Analyze Engineering Problems based on Temperature Distribution, Cryptography using matrices and systems of linear equations.

CO5: Examine the role of Eigen value and Eigen vectors in computation problems.

Course Contents

Unit I	Function of Single Variable	(09 Hours)

Mean Value Theorem, Taylor's and Maclaurin's series, Successive Differentiation and Leibnitz Theorem.

Real World Assignment

Modeling of Mathematical equation:

1. **Analyze speed of moving body.** (A ball is thrown upward with a speed of 16 feet per second from the top of a cliff that is 96 feet high. The ball will go up and then come down. How many seconds it takes until the ball reaches the ground.)
2. **Motion Analysis of Projectile.** (A plane initiates its departure at 2pm. The distance it will travel is 2500 feet. The plane arrives at its destiny at 7:30pm. Prove that, at least two times during the trip,
the speed of the plane is exactly 400 feet/h.

Exemplar

1 Freely falling body near the Earth's surface.
2 Speedometer.

Unit II	Ordinary Differential Equation	(09 Hours)

Exact differential equations, Equations reducible to exact form, Linear differential equations, Equations reducible to linear form and Bernoulli's equation.

Real World Assignment

Modeling of L-R-C circuit using mathematical equation:

1. **Analyze** (Analyzing a thermal gradient involves looking at how temperature changes across the thickness of a material.)
2. **Design (**Designing a fast-charging circuit (modeling a charging rate using RC circuit) for a new smartphone.

Exemplar

1 Radioactive decay.
2 Mixing Tank.

Unit III	Applications of Ordinary Differential Equation	(08 Hours)

Applications of Differential equations to Orthogonal Trajectories, Newton's Law of Cooling, Kirchhoff's Law of Electrical Circuits, One-dimensional Conduction of Heat.

Real World Assignment

1. **Analyze** (Newton's law of cooling involving thermal system).
2. **Identify the application** (Orthogonal Trajectories to relate physical and mathematical behavior of curves).

Exemplar

1 Rectilinear Motion,
2 One-dimensional heat equation.

Unit IV	Matrices and system of Linear Equation	(09 Hours)

Rank of a Matrix, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations.

Real World Assignment

1. **Find new direction of basis vectors after rotation** (A robotic arm operates in 3D space. At time t, the end effector is oriented along the standard axes. At time t, it rotates 900 about Z-axis(counterclockwise).We need to determine the new orientation of the arm (Use Rotational Matrix about z axis.)
2. **In defining target position in 3D space** (Imagine a robotic arm in a factory or hospital. It has joints (like elbows and wrists), and you want the tip of the arm to reach a certain spot — maybe to pick something up or perform surgery.)

Exemplar

1 Traffic Flow Problems.
2 Image processing using matrices.

Unit V	Linear Algebra - Eigen Values, Eigen Vectors and Diagonalization	(10 Hours)

Eigen Values and Eigen Vectors, Cayley Hamilton theorem, Diagonalization of a matrix, Reduction of Quadratic forms to Canonical form by Linear and Orthogonal transformations.

Real World Assignment

Coding and Decoding Message

1.Matrices are used in coding and decoding messages. Change the message into numbers, put those numbers into a matrix form, and multiply it with another special matrix (called the key or coding matrix) to create a secret message. To get the original message back, you do the opposite operation using the inverse matrix (decoding matrix) of that key matrix.
2.Eigenvalues and eigenvectors play a key role in Google's PageRank algorithm, which determines the importance of web pages based on link structures. How can we mathematically determine the
3.importance or ranking of webpages on the internet, based on how they are connected via hyperlinks?

Exemplar

1 Shapes of vibrating systems like bridges, buildings, and Mechanical components.
2 Control systems, such as in robotics and automated manufacturing.

Learning Resources

Text Books:

1 Reena Garg, "Mathematics – 1 Calculus and Linear Algebra", Khanna Book Publishing,1st Edition
2 B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Education,1st Edition.
3 B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers,45th Edition.

Reference Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Pvt. Ltd., 11th Edition.
2. M. D. Greenberg, "Advanced Engineering Mathematics", Pearson Education, 2nd Edition.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Learning, 8th Edition.
4. George B. Thomas, Thomas' "Calculus", Pearson Education (Addison-Wesley), 15th Edition.
5. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics" Vol. I & Vol. II, Vidyarthi Griha Prakashan, Pune,9th Edition.
6. Ron Larson and David C. Falvo, "Elementary Linear Algebra", Houghton Mifflin Harcourt Publishing Company,9th Edition.

MOOC / NPTEL/ YouTube Links: -

https://youtube.com/playlist?list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&si=3xAONJdT2ph_jcvG

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First Year B. Tech (2026 Pattern)

BSC102ES: ENGINEERING PHYSICS

Teaching scheme	Credit	Examination Scheme
Theory: 2Hrs/Week EL: 3Hrs/Week	TH: 2 EL:1 Total: 3	ESE: 50Marks CCE: 50Marks Total: 100 Marks

Prerequisites: Atomic structure and wave-particle duality, Interference, diffraction & polarization of light, Intrinsic and extrinsic semiconductors. , Fundamentals of magnetism.

Course Objectives:

The objectives are

1. Implement the principles of photonics for optical systems in engineering applications.
2. Solve engineering problems by applying the principles of quantum mechanics to modern technologies
3. Apply the principles of wave optics to develop innovative engineering applications.
4. Apply the principles of semiconductor physics for renewable energy applications and NDT method using ultrasonic for engineering applications.
5. Illustrate the applications of nanotechnology and superconductivity in modern engineering systems.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Develop applications of lasers, optical fibers and holography in photonics using its principles.

CO2: Apply Schrödinger's wave equation to solve problems in quantum systems.

CO3: Interpret the principles of interference, polarization and double refraction in optical engineering applications.

CO4: Build the applications of semiconductor physics.

CO5: Apply the concepts of nanotechnology and superconductivity in engineering technologies.

Course Contents

Unit I	Fundamentals of Photonics	(07 Hours)

Laser: Spontaneous and stimulated emission, population inversion, pumping, active medium & active center, resonant cavity, Characteristics of lasers, CO_2 laser: construction and working, Holography (recording & reconstruction), Engineering applications of laser in material processing (cutting, drilling, welding).

Optical fibers: Critical angle, acceptance angle, acceptance cone, numerical aperture, total internal reflection and propagation of laser, Classification of optical fibers: Single mode & multi-mode, step index & graded index, Attenuation: attenuation coefficient, causes of attenuation, Advantages of optical fiber communication, numerical on parameters of optical fiber.

Real World Assignment

1. Develop lissagious figure model by using multiple mirror arrangement and DC Motors to visualize different patterns
2. Build laser security system using arduino and LDR for installation in banks or jewellery shops etc.

Exemplar

Laser pointers, Barcode scanners, Security holograms on credit cards, 3D data storage.

Unit II	Quantum Physics	(06 Hours)

de Broglie hypothesis of matter waves, de Broglie wavelength for a particle accelerated by KE "E" and a charged particle accelerated by Potential Difference "V", properties of matter waves , problems on de Broglie wavelength, Wave function and probability density, Schrödinger's time independent wave equation, Energy of a particle enclosed in a rigid box and related numerical problems, quantum tunneling, STM, Principles of quantum computing: concept of qbit, superposition and entanglement, comparison of classical & quantum computing, Applications of quantum computing.

Real World Assignments

1. Make a survey on scanning tunneling microscopy for understanding its working in atomic scale surface imaging.
2. Make a survey on application of quantum computing in fraud detection systems to identify suspicious activities in banks and payment companies.

Exemplar

Scanning Tunneling Microscope (STM), Nuclear fusion in stars

Unit III	Wave optics	(06 Hours)

Interference: Interference in thin film of uniform thickness, conditions of maxima and minima for reflected system, engineering applications – Antireflection Coating (ARC), determination of optical flatness, Numerical problems on thin film, Types of polarization: Un polarized, Polarized, PPL, Malu's law and related numerical problems, Double refraction: geometry of calcite crystal, Huygens' theory of double refraction, Engineering applications of polarization: LCD, communication & radar, 3D movies (recording, projection).

Real World Assignment

1. Develop ultrasonic RADAR system to detect obstacles in the path of moving object using ultrasonic sensing Technology.
2. Develop missile launcher using ultrasonic sensor and Servo Motors to demonstrate projection of missile for accurate target hitting as the defense application.

Exemplar

Anti-Reflection Coatings (ARC) on lenses, glasses, cameras, and solar panels, LCD Displays 3D Movies, Communication & Radar.

Unit IV	Semiconductor Physics	(06 Hours)

Semiconductor Physics: Valence band, conduction band, band gap energy, classification of solids on the basis of band theory, Fermi level and Fermi energy for metal, Fermi Dirac distribution function and its temperature dependence, position of Fermi level in intrinsic semiconductors (derivation), Fermi level for extrinsic semiconductors, working of PN junction diode on the basis of Fermi energy, Solar cell: principle, working, IV-characteristics, efficiency and fill factor, measures to improve efficiency of solar cell, advantages and applications in environmental sustainability, Hall effect: derivation for Hall voltage and Hall coefficient and related numerical problems .

Real World Assignment

1. Design Solar Tracker system using LDR and Servo Motors to increase the efficiency of a solar panel for domestic applications.
2. Design RPM detection system using hall sensor to measure rotational speed of motor as an optimizing parameter in industries.

Exemplar

Solar power in homes, industries, remote areas, Solar power bank

Unit V	Physics of Nanoparticles and Superconductivity	(05 Hours)

Nanoparticles: Quantum confinement and surface to volume ratio and its effect on properties of nanoparticles (optical, electrical, mechanical), methods of synthesis of nanoparticles – Physical Vapor Deposition, Applications of nanotechnology in automobiles, space & defence, medical field (targeted drug delivery).

Superconductivity: Temperature dependence of resistivity, critical magnetic field, critical current, Meissner effect and perfect diamagnetism, Type I and Type II Superconductors, Numerical problems on critical magnetic field, Josephson effect, SQUID: working principle and its applications.

Real World Assignment

1. Make a survey on synthesis method for nanoparticles which is known as physical vapour deposition and make report on it to understand working process.
2. Make a survey on types of superconductors to classify the materials for different applications in industries and write report on it.

Exemplar: MRI Machine**,** Maglev Trains

Learning Resources

Text Books:

1. M. N. Avadhanulu, P. G. Kshirsagar, and T. V. S. Arun Murthy, "*A Textbook of Engineering Physics*", **11th edition**, New Delhi: S. Chand Publishing, 2024.
2. R. K. Gaur and S. L. Gupta, "*Engineering Physics*", New Delhi: Dhanpat Rai Publications, **2021 Edition**.

Reference Books:

1. A. Ghatak, "*Optics*", **7th edition**, McGraw Hill Education, 2023.
2. C. Kittel, "Introduction to Solid State Physics", **9th edition**, John Wiley & Sons, 2018.
3. A. K. Ghatak and S. Lokanathan, "Quantum Mechanics", **6th edition**, Laxmi Publications, 2021.
4. S. K. Kulkarni, "Nanotechnology: Principles and Practices", **4th edition**, Capital Publishing Company, 2015.
5. R. A. Serway and J. W. Jewett, "Physics for Scientists and Engineers with Modern Physics", **10th edition**, Cengage Learning, 2019.

MOOC / NPTEL/ YouTube Links: -

1. Lectures by Walter Lewin: https://www.youtube.com/channel/UCiEHVhv0SBMpP75JbzJShqw
2. Quantum Mechanics Lecture Series by Prof. H. C. Verma: https://www.youtube.com/playlist?list=PLWweJWdB_GuISnGkAafMpzzDBvTHg02At

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First Year B. Tech (2026 Pattern)

BSC103ES: ENGINEERING CHEMISTRY

Teaching Scheme	Total Credit	Examination Scheme
Theory: 2 Hours/Week EL: 3 Hours/Week	TH: 2 EL: 1 Total: 3	ESE: 50 Marks CCE: 50 Marks Total: 100 Marks

Prerequisites:

1. Volumetric Analysis: Types of titrations.
2. Primary Reference Electrode-Standard Hydrogen Electrode, Electromagnetic radiation.
3. Properties of polymers.
4. Types & examples of Fuel.
5. Electrochemical series.

Course Objectives: The objectives of this course are to:

1. Acquire knowledge of water quality analysis technology and electro-analytical techniques for chemical analysis.
2. Understand the basic principles of electroanalytical techniques and spectroscopic methods used in chemical analysis.
3. Understand specialty polymers and nanomaterials.
4. Study conventional and alternative fuels based on their properties and applications.
5. Learn different causes of metal corrosion and preventive methods.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Analyze the practical approaches and techniques used for water purification, including ion exchange, zeolite treatment, electrodialysis, and reverse osmosis, for various types of water samples.

CO2: Explore the physicochemical properties (pH, electrical conductivity, acidity, and basicity) and molecular characteristics of soil and liquid samples using appropriate analytical techniques.

CO3: Demonstrate the structure and properties of advanced engineering materials for various Industrial applications.

CO4: Examine the different types of conventional and alternative fuels in automobiles.

CO5: Investigate causes of corrosion and methods for minimizing corrosion.

Course Contents

Unit I	Water Technology	(06Hours)

Introduction: 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 - priming and foaming, scale and sludge. **Water treatment**: i) Zeolite method and numerical ii) Demineralization method. Purification of water: Reverse osmosis and Electrodialysis.

Real World Assignment

1. Develop an Active Model of water purification system (Zeolite process) for water analysis.
2. Analysis of Activated Carbon Adsorption method in water purification.
3. Assessment of Hardness and Alkalinity Levels in different water samples.

Exemplar:

1. Water filter.
2. Waste water treatment center.
3. Municipal water treatment plant/center.

Unit II	Analytical Measurement Techniques	(06Hours)

Introduction: Types of reference electrode (calomel electrode), indicator electrode (glass electrode), Ion selective electrode -solid State electrode.

[A] Conductometry: Introduction, conductivity cell, conductometric titrations of strong acid versus strong base with titration curve. Applications of conductometry**.**

[B] pHmetry: Introduction, standardization of pH meter, pH metric titration of strong acid versus strong base with titration curve and its applications.

C] UV-Visible Spectroscopy: Introduction, statement of Beer's law and Lambert's law, Electronic transitions in organic molecules, terms involved in UV-visible Spectroscopy. Instrumentation (double beam) and its applications.

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Real World Assignments

1. Analysis of Total Dissolved Solids in a water by using TDS Meter for water quality monitoring.
2. Investigate soil fertility by measuring soil pH using a pH meter or pH paper**.**
3. Evaluate the quality of beverages through conductometric analysis.

Exemplar :

1. Food Industry-Pickles, fruit juices (orange, apple, grape, lemon), soft drinks and carbonated beverage etc.
2. Dyeing Industry- Bleaching solutions, Indigo dye, Textile finishing solutions.

Unit III	Advanced Engineering Materials	(06 Hours)

Introduction: Definition Polymer, Monomer, Functionality of monomers, Classification of polymer - Thermal Behavior-Thermoplastics and Thermosetting.

[A] Specialty polymers: Introduction, preparation, properties and applications of the following polymers: 1.EngineeringThermoplastic: Polycarbonate, 2. Bio-degradable polymers: Poly (hydroxybutyrate-hydroxyvalerate), 3. Conducting Polymer: Polyacetylene 4. Polymer composite-Fiber Reinforced Plastic (FRP).

[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, quantum dots (semiconductor nanoparticles).

Real World Assignment

1. Synthesis of Polymers**:** Urea–Formaldehyde, Phenol–Formaldehyde and Polyvinyl Alcohol Gel (Slime) on a Laboratory Scale.
2. Prepare polymer-based foam insulation materials using Polyvinyl Alcohol (PVA) and Urea–Formaldehyde polymers.
3. Prepare of Zinc Oxide (ZnO), Copper Oxide (CuO) & Iron oxide nanoparticles in laboratory.

Exemplar:

1. Helmets, laminates, solar panels and plywood.
2. LED, rechargeable batteries, power banks.

Unit IV	Alternative Fuels	(06 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 numericals.

Solid fuel-Coal: Analysis of Coal-Proximate and Ultimate analysis, numericals.

Alternative fuels: Power alcohol and biodiesel. **Liquid Fuel-Crude oil**: Refining of petroleum.
Lithium Ion Battery: construction, working, advantages, and applications.

Real World Assignment

1. Prepare biodiesel from vegetable oil using the transesterification process under laboratory conditions.
2. Analyze and compare different coal samples including peat, lignite, bituminous, and anthracite For their moisture content (%) and ash content (%) by using Proximate Analysis method.
3. Develop Solar Street Light Model.

Exemplar:

1. Thermal power plants
2. Steel industries.
3. Computer & mobile batteries.
4. Electric vehicle battery.

Unit V	Corrosion and its Prevention	(06 Hours)

Introduction: Types of corrosion – Dry and Wet corrosion, mechanism of dry corrosion, nature of oxide films and Pilling-Bosworth'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, Cementation, Metal Cladding.

Real World Assignment

1. Investigate the corrosion of a metal in acidic and basic conditions and analyze the effect of different pH environments on the rate of corrosion.
2. Develop a working model of Electroplating Process.
3. Survey of different corroded metallic installations and analyze the causes and extent of corrosion.

Exemplar:

1. Casting of metal.
2. Corroded metal objects present in surroundings.
3. Metal Alloys in metal articles.
4. Anti corrosive paints.

Learning Resources

Text Books:

1. Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd. "Textbook of Engineering Chemistry", 12th edition.
2. O. G. Palanna, Tata Magraw Hill Education Pvt. Ltd. "Engineering Chemistry". 2nd edition.
3. Dr. Sunita Rattan, S. K. Kataria & Sons Publisher "Textbook of Engineering Chemistry". 8th edition

Reference Books:

1. S. M. Khopkar, "Basic Concept of Analytical Chemistry", New Age-International Publisher, 2nd edition.
2. G. R. Chatwal& S. K. Anand, "Instrumental Methods of Chemical Analysis", Himalaya Publishing House.
3. P. S. Kalsi, "Spectroscopy of organic compounds", New Age-International Ltd., Publisher, 2nd edition.
4. V. R. Gowarikar, N. V. Viswanathan, Jayadev Sreedhar, "Polymer Science" Wiley Eastern Limited, 5th edition.
5. Shriver and Atkins, "Inorganic Chemistry", Oxford University Press, 5th edition.
6. G. L. Hornyak, J. J. Moone, H. F. Tihhale, J. Dutta, "Fundamentals of Nanotechnology", CRC press 1st

edition.
MOOC / NPTEL/ YouTube Links: - **https://nptel.ac.in/courses/113104082**

JSPM's
JAYAWANTRAO SAWANT COLLEGE OF ENGINEERING, HADAPSAR, PUNE.
[An Autonomous Institute]
First Year B. Tech (2026 Pattern)

ESC111ES: ENGINEERING GRAPHICS

Teaching Scheme	Credit	Examination Scheme
Theory: 2 Hours/Week **EL: 3 Hours/Week**	**TH: 2** **EL: 1** **Total: 3**	**CCE: 50 Marks** **ESE: 50 Marks** **Total: 100 Marks**

Essential Knowledge:

- Basic Geometric Knowledge.
- Basic geometrical measurements and Construction.
- Deviation of line, circle and polygon, Co-ordinate geometry.
- Computer literacy.

Course Objectives:

The objectives of course are to;

1. Acquire basic knowledge about engineering drawing, line types, dimension methods, and simple geometrical construction, projection of points and lines.
2. Project the regular planes with different resting and orientation conditions.
3. Acquire basic knowledge about physical realization of engineering objects and draw its different views.
4. Visualize three-dimensional objects to draw their isometric views.
5. Plot lateral development of solid objects.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Construct basic engineering geometries with theory of Projection of Points and Lines. **CO2: Analyze** the resting and orientation conditions of different Planes using projection methods. **CO3: Visualize** an object to draw 2D views by orthographic projection.
CO4: Create 3D objects from given orthographic views by isometric projection.
CO5: Develop the lateral surfaces of geometrical solids for real-world applications.

Course Contents

Unit I	Fundamentals of Engineering Drawing, Projection of Points and Lines	(06 Hours)

Fundamentals of Engineering Drawing: Need of Engineering Drawing, Drawing instruments, Drawing sheets sizes and their layouts, Types of Lines, Dimensioning Techniques, Coordinate system and reference planes.

Projection of Point and Line. Theory of projection - Projection of points, 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 planes, Line inclined to both reference planes by first angle projection method.

Real World Assignment: Draw problems on Projection of points and lines.

1. Draw the projection of a honey bee (flying insect), which is assumed to be in a class room at a height of 2 m from the floor and 3.5 m from the board by considering it as a point.
2. Draw the projections of a ladder resting against a wall at a specified inclination and determine the true length of it.
3. Draw the projection from top view and front view of a tool gate bar of length 6 meter opened to allow the vehicles to move. The angle of the bar is 70^0 with ground.
4. Draw the projection of a pole, which is fixed in the ground with dimension of 120 centimeters height above the ground, with a circumference of 30 centimeters.
5. Draw the projection of the given tube light as a line from top view and front view with length of 1 meter fixed on a wall at a height of 2.5 meter.

Exemplar / Practical Applications:

1. Drill center positioning.
2. Drawings of Mechanical/Machine components.
3. Line diagrams of construction plans.
4. Electrical Panel layouts and wiring diagrams.

Unit II	Projection of planes	(06 Hours)

Introduction, Projection of planes (Triangular, Square,Rectangular, Pentagonal, Hexagonal and Circular) when, Plane is parallel to one reference plane and perpendicular to other, Projection of plane when plane is inclined to one reference plane and perpendicular to other, Projections of planes when it is inclined to both HP and VP.

Real World Assignments: Draw problems on Projection of planes.

1. Draw the front and top view of a rectangular classroom board of size 3feet x 4 feet placed on a wall.
2. Draw the projections of a rectangular solar panel (120×100 mm) inclined at 30^0 to the ground.
3. Draw the projection of a kite (Rhombus 100×70 mm) flying in the air making 30^0 to the ground as HP and 45^0 to the sky acting as a VP.
4. Determine inclination of the rectangular sheet metal plate 50 mm x 70 mm with HP when, stands on one of its shorter edges in H.P and is raised about this edge so that the top view becomes a square of 50 mm.

Exemplar / Practical Applications:

1. Drawings of roofs, solar panel frame design, ramps.
2. Drawings of airplane wings, body panels, and aerodynamic surfaces.
3. Drawing of road slopes, canals, and inclined structures.
4. Drawing of machine parts like plates, brackets, and inclined surfaces.

Unit III	Orthographic Projections	(06 Hours)

Introduction, Principle of projection, Methods of Projection,(First and Third angle projection). Orthographic Projection of solids and machine elements/automobile components, including hidden features,curved features, circular features and Full Sectional orthographic projection by first angle projection method.

Real World Assignment: Draw problems on Orthographic projections.

1. Draw orthographic projection of Machine components. (V-Block, Hexagonal Nut and Bolt, connecting rod, Machine vice piston, or connecting rod from a given pictorial view).
2. Draw FV, TV and SV of given objects (A cylindrical water bottle, A Cube dice).
3. Draw orthographic projection of Workshop Job prepared during the workshop practice or any product developed (Step Turning, CNC Product,3D Printing product).
4. Draw orthographic views of a study table or chair with suitable dimensions.
5. Design a mobile phone stand and prepare its orthographic views.

Exemplar / Practical Applications:

1. Assembly drawings of machine components.
2. Construction Drawings (Detailed layout and Construction/Architectural details).
3. Design Diagrams (Proto type and production diagram).
4. Draw orthographic projections for 3D manufactured parts.
5. Draw orthographic projections for project components used in projects of various subjects in FY B.Tech.

Unit IV	Isometric Projections and Views	(06 Hours)

Introduction, Isometric lines and planes, Non-isometric lines and planes, Isometric scale, Isometric projection and view. Creating isometric views from orthographic views of machine elements/automobile components.

Real World Assignment: Draw problems on Isometric projections.

1. Draw 3D models of Machine components. (V-Block, Hexagonal Nut and Bolt, Connecting rod, Machine vice).
2. Draw 3D objects from a given FV, TV and SV (A cylindrical water bottle, A Cube dice).
3. Draw isometric views of Workshop Job prepared during the workshop practice or any product developed (Step Turning, CNC Product,3D Printing product).

Exemplar / Practical Applications:

1. Architectural drawings (Illustrating building and floor planes).
2. Manufacturing drawings and assembly instructions (Depicting machine parts and sequence of assembly).
3. Construction drawings (Construction Frame work for better visualization).
4. Draw isometric projections for 3D manufactured parts.
5. Draw isometric projections for project components used in projects of various subjects in FY B.Tech.

Unit V	Development of Lateral Surfaces and Introduction to Computer Graphics	(06 Hours)

Development of Lateral Surfaces: Introduction to development of lateral surfaces and its industrial applications., Method of development, development of lateral surfaces for regular solids, cube, prisms, pyramids, cylinders, and cones.

Introduction to computer Graphics: Introduction to CAD software, Evolution of CAD, Importance of CAD, Basic Commands - Edit, View, Insert, Modify, Dimensioning Commands, setting and tools etc. and its applications to construct the 2D drawings and 3D models using softwares.

Real World Assignment: Draw problems on Development of lateral surfaces.

1. Develop Full/lateral surface of regular right solids (Cylinder, Cone, Prisms and Pyramids) and using a drawing sheet.
2. Develop Frustum of cones and pyramids using a drawing sheet.
3. Demonstration of Full/lateral surface development using a drawing sheet of any 3D objects like Step turning, Tapper turning jobs performed in workshop practice.

Exemplar / Practical Applications:

1. Sheet metal industry jobs viz. storage tanks and containers.
2. Automobile body and Aerospace Industry components (Body panels).
3. Roofing sheets and domes in construction Engineering.
4. Machine and engine assemblies.

Learning Resources
Text Books: 1. Bhatt, N.D., **"Engineering Drawing: Plane and Solid Geometry",** Charotar Publishing House Pvt. Limited, 53rd Edition, 2023. 2. Jolhe, D. A.,**"Engineering Drawing with introduction to AutoCAD",** Tata McGraw Hill, New Delhi.
Reference Books: 1. K. R. Gopalakrishna, & Sudhir Gopalakrishna: **"A Textbook of Computer Aided Engineering Drawing",** 39th Edition, Subash Stores, Bangalore, 2017. 2. K. Venugopal, K, (2015), **"Engineering and Graphics"**, New Age International, New Delhi. 3. Madsen, D. P. and Madsen, D. A., (2016), **"Engineering Drawing and design"**, Delmar Publishers Inc., USA. 4. Dhawan, R. K., (2000), **"A Textbook of Engineering Drawing"**, S. Chand, New Delhi. 5. Frederick E. Giesecke, et al.,**"Technical Drawing with Engineering Graphics"** Prentice Hall, 2016. 6. Luzadder Warren J., Duff John M.,**"Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production"**- Prentice-Hall of India Pvt. Ltd., New Delhi.Eastern Economy Edition, 2005.
MOOC / NPTEL/ YouTube Links: - 1. NPTEL Course: **Engineering Graphics and Design.** https://onlinecourses.nptel.ac.in/noc21_me128/preview 2. NPTEL Course: **Introduction and Geometric Construction.** https://archive.nptel.ac.in/content/storage2/courses/112103019/module1/lec3/1.html 3. NPTEL Course: **Computer Aided Design and Manufacturing.** https://archive.nptel.ac.in/courses/112/102/112102101/

JSPM's

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[An Autonomous Institute]

First Year B. Tech (2026 Pattern)

ESC112ES: ENGINEERING MECHANICS

Teaching Scheme	Credit	Examination Scheme
Theory:2 Hours/Week **EL: 3 Hours/Week**	**TH: 2** **EL: 1** **Total: 3**	**CCE: 50 Marks** **ESE:50 Marks** **Total: 100 Marks**

Prerequisite Courses:

- Elementary Mathematics (Algebra, Trigonometry, and Geometry)
- Basic Physics concepts related to force, motion, and gravity
- Graphical interpretation of simple engineering problems.

Course Objectives:

1. To develop students' ability to **analyze the problems involving forces**, moments with their applications
2. To draw accurate **free body diagrams representing forces** and to analyze the equilibrium of system of forces.
3. To teach the basic principles of centroid, center of gravity, and moment of inertia and determine them for different simple and composite bodies.
4. **To analyze kinematics** of rectilinear, curvilinear, and projectile motion.
5. To **apply the principles of kinetics**, Newton's laws, work-energy, and impulse-momentum to analyze engineering motion.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: DESCRIBE basic concept of forces, moments and couples in two-dimension force system.
CO2: APPLY free body diagrams to analyze static equilibrium in two-dimensional force systems, including friction and beams.
CO3: Locate the centroid and **COMPUTE** the moment of inertia of sections**.**
CO4: ANALYZE the principles of kinematics, rectilinear motion, curvilinear motion, and projectile motion to determine the motion of engineering systems.
CO5: APPLY Newton's second law, work energy and impulse momentum principles for particle

Course Contents

PART-A: STATICS

Unit I	Fundamentals of Statics and Force Systems	(6 Hours)

Introduction of Mechanics: Principle of Statics, concept of rigid body, Force system, Types of force system, concurrent and nonconcurrent force system, resultant of parallel force system and resultant of general force system, Moment of force & Couple, Law of transmissibility of force, Varignon's theorem of moments, Law of parallelogram of forces.

Real World Assignment

1. To verify the Law of parallelogram of forces using an apparatus and determine the resultant of two concurrent forces acting at a point through graphical and experimental methods.
2. To find the equilibrium of several parallel forces acting on a member using the graphical method.
3. Identify and analyze forces acting on a roadside hoarding, traffic signal pole, or mobile tower.

Draw free body diagrams and determine the resultant force system.

4. Investigation of moments in mechanical devices of a door, spanner, wheel nut wrench, or seesaw and explain the role of moment and couple in its functioning with calculations.

Exemplar / Practical Applications

- Steering wheel operation in automobiles.
- Load distribution on bridge girders and floor beams.
- Opening and closing of doors using handles.
- Pulling a cart using a rope at different positions

Unit II	Equilibrium of Rigid body and Beams	(06 Hours)

- **Equilibrium of forces:** Concept of free body diagram, Types of supports, Lami's Theorem, equilibrium of coplanar (Concurrent, Parallel and General force system) forces.
- **Friction:** Introduction, laws of Coulomb friction, equilibrium of blocks on horizontal & Inclined planes, ladder friction & Belt friction.
- **Beams:** Introduction to beams, Types of beams & Types of loads. (Point load, UDL & UVL)

Real World Assignment

1. Verification of **Lami's theorem** for three coplanar forces acting at a point in equilibrium.
2. To **determine** support reactions for simply supported beams
3. **Design and Analyze a Portable Ladder Safety Model**
4. **Development of a Belt Friction Model** to determine tension variation and power transmission.

- **Ceiling fans** are suspended using support systems that must withstand their weight and dynamic effects safely.

Exemplar / Practical Applications

- Equilibrium of a lamp suspended by two cables.
- Power transmission in automobiles, conveyor belts, and textile machines.
- Analysis of forces acting on a hanging traffic signal or streetlight pole.
- Supports used in bridges, roof trusses, gantry cranes, and machine frames.

Unit III	Centroid & Moment of Inertia of Plane areas	(07 Hours)

- **Centroid of Plane areas:** Introduction, Locating the centroid of rectangle, triangle, circle, semicircle & quadrant, centroid of composite areas & wire bends.
- **Centre of Gravity (CG):** Introduction, Locating the CG of simple bodies (Rectangular plate, circular disc, Cylinder & Sphere).
- **Moment of inertia of plane areas:** Introduction of Moment of inertia, moment of inertia of simple geometrical figure, parallel axis theorem, perpendicular axis theorem, moment of inertia of composite figure.

Real World Assignment

- Measure dimensions of a composite object (e.g., machine bracket, table top, sign board) and determine its centroid analytically and using CAD software.
- Design a decorative signboard/ Notice board plates consisting of rectangular, triangular, and circular sections. Determine the location of its centroid to identify the proper point of support for stable installation.
- To determine the Centre of Gravity (C.G.) of commonly used everyday objects by balancing them on a finger or knife edge and to understand how the distribution of mass affects the location of the Centre of Gravity.

Exemplar / Practical Applications

- **Civil Engineering:** Design of beams, columns, bridges, and roof trusses.
- **Mechanical Engineering:** Bicycle frames, machine bases, flywheels, and shafts.
- **Aerospace Engineering:** Aircraft wing sections and lightweight structural components.
- **Manufacturing Industry:** Crane hooks, machine supports, and fabricated structures.
- **Automobile Engineering:** Chassis members and suspension components

PART-B: DYNAMICS		
Unit IV	**Kinematics of particle**	**(06 Hours)**

- **Kinematics:** Introduction to Kinematics and basic concept, Equation of motion,
- **Rectilinear motion:** Motion with uniform acceleration, Motion Under Gravity and variable acceleration.
- **Curvilinear motion:** rectangular components, Normal and Tangential components.
- **Projectile motion:** Introduction to Projectile Motion, Components of Projectile Motion

Real World Assignment

- Drop a small ball from a known height and observe its motion under gravity to find the gravity of ball.
- Investigate the trajectory of a water jet at different projection angles and compare the experimental horizontal range with theoretical projectile motion calculations.
- To conduct an activity to measure the motion of a trolley or toy car on an inclined track with uniform acceleration. Determine displacement, velocity, and acceleration, and compare the experimental results with kinematic equations.

Exemplar / Practical Applications

- Acceleration and braking of cars, starting and stopping of elevators, train motion between stations.
- Vehicles negotiating curved roads, Ferris wheels, satellite motion around the Earth, rotating machinery
- Vehicle movement in city traffic, roller coaster rides, electric vehicle acceleration control systems.
- Cricket ball throw, football kick, basketball shooting, javelin throw, water fountains and irrigation sprinklers.

Unit V	**Kinetics of particle**	**(05 Hours)**

Kinetics: Introduction to kinetics, Newton's second law of motion, equation of motion, application of Newton's second laws to rectilinear and curvilinear motion, conservative and nonconservative forces, work energy principle, conservation of energy, impulse momentum principle and impact.

Real World Assignment

- Design a protective structure to prevent an egg from breaking when dropped from a height.
- Investigate the coefficient of restitution of various sports balls by conducting bounce tests and analyze how the rebound characteristics influence their practical applications.
- Determine the coefficient of restitution for a given pair of materials by conducting an impact experiment and analyze its significance in real-world engineering applications.
- To investigate the principle of conservation of momentum by studying the collision between two toy cars and comparing the total momentum before and after impact under different collision conditions.
- To analyze momentum conservation during collisions.

Exemplar / Practical Applications

- Automobile Crash Safety Systems, Airbags and Seat Belts, Protective Helmets
- Playground and Sports Surface Design,
- Robotics and Automation
- Industrial Impact Hammers and Forging Operations

Learning Resources

Text Books:

Engineering Mechanics

1. Hibbeler R. C., **"Engineering Mechanics - Statics",** Prentice Hall ,14th Edition
2. Hibbeler R. C., **"Engineering Mechanics - Dynamics",** Prentice Hall ,14th Edition
3. Beer F. P., Johnston E. R. et al., **"Vector Mechanics for Engineers: Statics Dynamics",** McGraw-Hill Publication, 12th Edition.

Reference Books:

1. F.P. Beerand E.R. Johnston **"Vector Mechanics for Engineers"** Vol. I and II'',10th edition, Tata McGraw-Hill Education, 2012, ISBN:978-0077402327.

2. Engineering Mechanics: S Timoshanko, Dtp Young and J.V. Rao, Tata McGraw Hill Education Pvt. Ltd. New Delhi

3. A. Nelson **"Engineering Mechanics: Statics and Dynamics"**, 1st edition Tata McGraw-Hill Education, 2009, ISBN: 978-0-07-014614-3.

4. Ferdinand Singer**,"Engineering Mechanics Statics and Dynamics"**, Harper and Row, ISBN:0063506610

5. Engineering Mechanics by Basudeb Bhattacharyya- Oxford University Press

6. Principle of Dynamics, Donald T. Greenwood, Pearson; ISBN-13: 978-0137099818

7. Engineering Mechanics: Statics & Dynamics (vol 1), J. L. Meriam, L.G. Kraige; Wiley; ISBN-13: 978-8126543960.

MOOC / NPTEL/ YouTube Links: -

1. http://nitttrc.edu.in/nptel/courses/video/112106286 /L01.html Introduction to engineering mechanics
2. https://www.youtube.com/watch?v=6u_rjLjv-MY&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=3 Introduction of force system with examples
3. https://www.youtube.com/watch?v=tM5hsUiNpGA Calculation of beam reactions for various types of beams
4. https://www.youtube.com/watch?v=RGT1g_lu440 Calculation of coefficient of friction for horizontal and inclined plane
5. https://www.youtube.com/watch?v=wfjLNSfPXAI Centroid of plane/composite figures, C.G. of plane/composite solids

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[An Autonomous Institute]

First Year B. Tech (2026 Pattern)

ESC113ES: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING-I

Teaching Scheme	Credit	Examination Scheme
Theory: 2 Hours/Week	Theory: 2	ESE: 50 Marks

Prerequisite Courses, if any: Evolution of Electronics, Basic semiconductor theory, Positive & Negative charges, Modern Electron Theory

Course Objectives: The Objectives of the Course are to:

1. Determine the voltage and current using Kirchhof's law and Superposition Theorem.
2. Demonstrate Resistive, Inductive and capacitive circuit using single phase supply.
3. Identify Electronic components and Sensors for Project Development.
4. Understand the working Principles of PN Junction diodes, Bipolar Junction Transistors & MOSFET.
5. Interpret the concepts of Op-Amp and IC 555 with its applications.

Course Outcomes: After successful completion of the course, students will be able to:

CO1: Solve the electrical network by using various laws for the measurement of current and voltage.

CO2: Verify the properties of Resistance, Inductance and Capacitance by using Single-Phase Supply .

CO3: Distinguish various Electronic Components and Sensors for the Implementation of real-world applications.

CO4: Illustrate the use of Diodes and Transistors for small scale Electronic Projects.

CO5**:** Perform the Domestic Applications using Op-Amp IC 741 and Timer IC 555.

Course Contents

Unit I	AC Fundamentals and DC Circuit	(6 Hours)

Elementary Concepts: Concept of Resistance, EMF, Current, Potential Difference, Ohm's Law, Conductance, Resistivity, Conductivity, Resistance Laws, Concept of Insulation Resistance.

AC Fundamentals: Basic definition Waveform, Cycle, Period, Frequency, Instantaneous, Peak, Average and RMS Value, Peak factor and Form factor, mathematical representation of Sinusoidal voltage and current.

DC Circuit: Comparison between AC & DC Supply, Network Terminologies, Classification of Network, Analysis of Series-Parallel Resistances, Kirchhoff's Laws using Loop analysis, Superposition Theorem.

Real World Assignments

1. Electrical wiring system at home using series and Parallel wiring.
2. Develop Series and Parallel Electrical circuit board by using bulbs and switches

Exemplar/ Practical Applications: Electric Heater, Series Decoration Lighting, Parallel home wiring.

Unit II	Single Phase AC Circuit	(6 Hours)

Concept of Phase Difference, Concept of lagging, leading and in phase quantities their Phasor and graphical representation, Mathematical representation using Polar and Rectangular form of phasor

Study of AC circuits consisting of Pure Resistance, Pure Inductance, Pure Capacitance, Series R-L and R-C circuit across single phase AC supply, concept of impedance, power factor, phasor diagrams, Voltage, current and power waveforms, Concept of active, reactive and apparent power. Concept of Resonance in a series RLC circuit.

Real World Assignments.

1. Observe the voltage and current waveform for R-L, R-C and RLC series circuit using an Oscilloscope

2. Measurement of Resonant frequency of a series RLC circuit

Exemplar/ Practical Application: Electrical Irons and Kettle, Fan, Motor and Inductive loads

Unit III	Emerging Trends in Electronics and Sensor Technologies	(6 Hours)

Current trends in Electronics: AI-ML, IoT, Telecommunication, wearable technology, robotics, Signals: Analog & digital, Introduction to active and passive components, **Sensors:** classification of Sensors, Selection Criteria of sensors, construction, working principle & Applications of sensors-a) **Temperature Sensors:** Thermocouple, RTD, b)**Distance Sensors:** Ultrasonic sensor, IR sensor, proximity sensor, and c) **Other sensors:** LDR, Moisture sensor & Gas sensor.

Real World Assignments:

1. Emerging trends in the field of IOT- Develop a system for Smart Agriculture -Soil Health Monitoring with IOT (Node MCU) using Moisture and pH Sensors.
2. Develop a system for smart Home with IOT (Node MCU) using Smart Switches to control household appliances (lights and Fans of 5Amp).
3. Implement a Project for Automatic Street light control using LDR Sensors.

Exemplar/ Practical Applications: Smart Agriculture Systems, 5G , Wearable health Monitoring devices, Distance (Liquid Level) Measurement Ultrasonic Sensor or IR Sensor.

Unit IV	Diodes, Transistors and Their Applications	(7 Hours)

P-N Junction Diode: V-I characteristics of P-N junction Diode, Diode as a Switch, Half wave rectifier, Full wave rectifier, Bridge rectifier .

Special Purpose Diodes: Zener Diode, Light Emitting Diode (LED) and photodiode**:** Construction, working principle, V- I characteristics and applications.

Bipolar Junction Transistor: Construction, Types, Regions of Operation, Input-Output Characteristics in Common Emitter mode, BJT as Switch & Amplifier.

Enhancement Metal Oxide Semiconductor Field Effect Transistors (EMOSFET): Construction Types, Operation, V-I characteristics, MOSFET as Switch & Amplifier.

Real World Assignments:

1. Develop a portable charging circuit for regulated power delivery to a standard Li-ion battery.
2. Construct an Autonomous Solar diya circuit that automatically charges during daylight and illuminates at night.

Exemplar/ Practical Applications: DC Power Supply, Amplifiers, Integrated Circuits (IC), LED ON-OFF indicator, Remote Control, MOSFET as a switch to control DC motor.

Unit V	Operational Amplifier and IC 555 Timer Applications	(5 Hours)

Operational Amplifier: Pinout of 741 IC, Ideal & Practical values of performance parameters, Op-amp applications: Inverting, Non-inverting amplifier.

IC 555 Timer: Pinout & Internal Block Diagram of IC 555. Applications of IC-555: Astable & Monostable Multivibrator, PWM signal Generation, Schmitt Trigger.

Real World Assignments:

1. Assemble IC 555 circuit to vary duty cycle of PWM signal for Speed Control of DC Motor.
2. Implement an Automated Mechatronic System for Printed Circuit Board (PCB) Etching.

Exemplar/ Practical Applications: PA Systems, Function Generator, Timer Delay Circuits in Traffic light, Motion Detection Systems

Learning Resources

Text Books:

1. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill Education, 2nd edition 2019.
2. B.L. Theraja, A K Theraja "ABC of Electrical Engineering", S Chand Publications.
3. "Electronics Devices" Thomas`, L. Floyd, 9th Edition, Pearson
4. "Sensors and Transducers" by D. Patrnabis, 2nd Edition, PHI

Reference Books:

1. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford University Press, 2nd edition

2018.
2. C. L. Wadhwa, "Basic Electrical Engineering", New Age International (P) Limited 5th edition 2024
3. S K Bhattacharya, "Electrical Machines", McGraw Hill Education, 2nd edition, 2008
4. "Sensors Handbook", by S. Soloman, 2nd Edition.

MOOC/NPTEL/ Youtube Links:

https://nptel.ac.in/courses/108105112 (Fundamentals of Electrical Engineering, IIT Kharagpur) Electronic Systems Design: Hands-on Circuits and PCB Design with CAD software

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[An Autonomous Institute]
First Year B. Tech (2026 Pattern)

ESC114ES: FUNDAMENTALS OF C PROGRAMMING

Teaching Scheme	Credit	Examination Scheme
Theory: 2 Hours/Week **Practical:**2 Hours/Week	**TH: 2** **PR: 1** **Total: 3**	ESE: 50 Marks PR: 50 Marks Total: 100 Marks

Prerequisite:

Students should have

1. Basic knowledge of computers and computer operations.
2. Logical and analytical reasoning skills
3. Knowledge of simple mathematical operations

Course Objectives:

The objectives are

1. To develop basic programming skills using problem-solving techniques and C language fundamentals.
2. To implement C programs using operators, expression evaluation, and standard mathematical library functions for engineering applications.
3. To design program logic using decision-making statements and loops for designing program logic.
4. To manipulate data in C programs using one-dimensional arrays, two-dimensional arrays, and string functions.
5. To apply user-defined functions and structures for developing modular and efficient C programs.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Construct algorithms, flowcharts, and basic C programs using programming fundamentals.

CO2: Examine the role of C operators and expression evaluation in computational problem-solving.

CO3: Select appropriate decision-making statements for developing C programs.

CO4: Apply suitable array and string operations for developing ERP modules.

CO5: Design modular C solutions using functions and structures for ERP applications.

Course Contents

Unit I	Introduction to Programming and Problem Solving	5 Hrs

Introduction to programming: Introduction to programming, role of programming language in engineering and industry, Basic problem-solving concepts (steps in problem solving).
Algorithm and flowchart: Definition of Algorithm, characteristics of Algorithm, steps for developing algorithms. Definition of flowchart, characteristics of flowchart, symbols used in flowchart
Basics of C: History of C language, features and applications of C language, Structure of a C program, basic input and output functions printf() & scanf(), comments in C language, compilation and execution process.
Basic data types: int, float, char, double, constants and literals. Variable declaration and initialization, storage size of data types**,** format specifiers, type modifiers & qualifiers**,** variable scope and lifetime.

Exemplar: Student Information System, EMI Calculator

Real World Assignment

Develop following applications using basic input output statements and fundamental of C-

1. **Loan EMI Estimator**: Design a program using algorithms and flowcharts to accept the Loan Amount and Repayment Period (in months) as input, calculate the Monthly EMI (Loan Amount ÷ Repayment Period), and display the Monthly EMI
2. **GST Calculator** – Design a program using algorithms and flowcharts for a retail store to calculate the GST amount and the final payable bill for customer purchases.
3. **Age Calculator**: Design a program using algorithms and flowcharts to accept the Applicant Name and Year of Birth as input, calculate the Age (assuming the current year is 2026), and display the Applicant Name and Age.
4. **Currency Converter**: Design a program using algorithms and flowcharts to accept the Amount in Indian Rupees (INR) and the Exchange Rate as input, convert the amount into US Dollars (USD), and display the converted amount in USD.
5. **Temperature Converter**: Design a program using algorithms and flowcharts to accept the Temperature in Celsius as input, convert it into Fahrenheit using the appropriate formula, and display the temperature in Fahrenheit.

Unit II	Operators and Expression Evaluation in C	5 Hrs

Operators in C: Arithmetic operators, Relational operators, Logical operators, Bit-wise operators, Assignment operators, Increment and Decrement operators, Conditional operator and sizeof() operator. Implicit and explicit type conversion (type casting).
Expression Evaluation (Infix, Prefix and Postfix) and Mathematical Functions: Operator precedence and associativity, importance of precedence rules, evaluation of expressions, simple expression solving, Conversion techniques, standard library mathematical functions (use of <math.h> header file).

Exemplar: Online Shopping Billing System, Parking Management System

Real World Assignment:

Develop following applications using basic input output statements and operators-

1. **Salary Calculator:** Design a program using algorithms, flowcharts, and C programming to accept the Basic Salary, HRA, and DA as input, calculate the Gross Salary using arithmetic operators, and display the Gross Salary
2. **Scientific Calculators** – Develop a C program that accepts user input and performs operations such as addition, subtraction, multiplication, division, modulus, power, square root, logarithm, and trigonometric functions using the <math.h> library.
3. **Permission Management System**- To develop a C program that demonstrates permission management using bitwise operators and binary representation Using Bitwise Operators.
4. **Parking Slot Counter**- To develop a C program that updates occupied and available parking slots using increment and decrement operators**.**
5. **Income Tax Calculator-** To develop a C program that calculates Income Tax using slab-wise taxation and the conditional (ternary) operator without using if-else statements.

Unit III	Decision Making Statements and Looping in C	7 Hrs

Decision-Making Statements: Simple if statement, if-else statement, nested if-else statement, if-else ladder, switch statement, Use of goto, break and continue keywords in decision making statements.
Iterative Control Structures: while loop, do-while loop, for loop, nested loops, Use of goto, break and continue keywords in loops, difference between entry-controlled and exit-controlled loops.

Exemplar: Password Validation System, Cinema Seat Layout Generator

Real World Assignment:

Develop following applications using decision making statements and looping in C-

1. **Login Authentication System** – Execute a program using if statement to verify username and password.
2. **Number Pattern Printing** – Design a program using nested loops to print star and number patterns.
3. **Bus Ticket Booking Menu** – Develop a program using switch statement and loops for menu-driven ticket operations.

4. **Quiz Application –** Design a program using loops and decision-making statements for question handling and score calculation.
5. **Game Development Logic** – Develop a program using decision-making, loops, and recursion for game controls, scoring, and level management.

Unit IV	Arrays, Strings and Pointers	7 Hrs

One-Dimensional (1D) Arrays: Introduction to 1D array, declaration and initialization, accessing elements, memory representation, and basic array operations.
Two-Dimensional (2D) Arrays: Introduction to 2D arrays, declaration and initialization, accessing matrix elements, row-wise and column-wise representation, and basic matrix operations.
String: Introduction to strings, standard library functions, string manipulation function: strlen(), strcpy(), strncpy(), strcat(), strncat(), strcmp(), strncmp(), strchr(), strrchr(), strstr(), strtok(), strrev(), strupr(), strlwr().
Introduction to Pointers: Definition and need of pointers, Pointer variables and memory addresses, Declaration and initialization of pointers, Address (&) and indirection (*) operators.

Exemplar: Cricket Score Tracker, Rainfall Data Analysis

Real World Assignment:
Develop following applications using arrays and string functions in C-

1. **Text Editors and Search Engines** – Develop a C program using character arrays and string handling functions to search, replace, and manipulate text data.
2. **Student Result Management Systems** – Develop a C program using one-dimensional and two-dimensional arrays to store student marks, calculate total and percentage, and display the result.
3. **Banking and ATM System:** Develop a C program using arrays to implement basic banking and ATM operations such as deposit, withdrawal, balance enquiry, and transaction processing.
4. **Classroom Seating Arrangement:** Develop a C program using a two-dimensional array to implement classroom seating arrangement and search for a student's roll number and position.
5. **Monthly Sales Analysis:** Develop a C program using a two-dimensional array to analyse monthly sales and display branch-wise and product-wise sales totals.

Unit V	Functions and Structures	6 Hrs

User Defined Functions: Function definition, function declaration, function calls, return values. Advantages of functions.
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, passing arguments to functions. Nesting of Functions, recursive function, static variable, difference between library functions and user-defined functions.
Structures: Introduction to structures, structure definition, declaration and initialization, accessing structure members.

Exemplar: Railway Ticket Reservation System, Hospital Record Management System

Real World Assignment
Develop following applications using user defined functions and structure in C-

1. **Employee Payroll System** – Develop a C program using structures and user-defined functions to calculate and display employee payroll details, including salary, bonus, tax, and final salary.
2. **Online Shopping Bill System** – Develop a C program using structures, user-defined functions, and recursion to generate an online shopping bill with discounts, GST, and final bill amount.
3. **Courier Charge Calculator** - Develop a C program using user-defined functions with default parameters to calculate and display courier charges based on parcel weight and delivery distance.
4. **Parking Fee Calculator**: Develop a C program using user-defined functions with default parameters to calculate and display parking charges based on vehicle type and parking duration.
5. **Bank Interest Calculator**: Develop a C program using user-defined functions with default parameters to calculate and display simple interest and total amount based on account details.

Learning Resources

Text Books:

1. **Brian W. Kernighan and Dennis M. Ritchie**, "*The C Programming Language"*, Pearson Education.
   About the book: A classic and highly influential book on C programming. It explains the language fundamentals, operators, control structures, functions, arrays, pointers, structures, and file handling through concise explanations and practical examples. Pearson identifies Kernighan as the co-author of the book, while Bell Labs records Ritchie's historical contact address.
2. **Ram Kumar and Rakesh Agrawal**, "*Programming in ANSI C"*, Tata McGraw-Hill Education.
   About the book : A foundational C programming text designed for beginners. It introduces ANSI C concepts systematically and provides programming examples and exercises to develop problem-solving and programming skills. Library records confirm the authorship of Ram Kumar and Rakesh Agrawal.
3. **E. Balagurusamy**, "*Programming in ANSI C"*, McGraw Hill Education.
   About the book: A popular introductory C programming textbook that explains concepts from elementary to advanced levels. It covers arrays, strings, functions, pointers, structures, dynamic memory allocation, files, and programming exercises. The latest McGraw Hill edition also includes case studies, debugging exercises, interview questions, and projects.
4. **Yashavant Kanetkar**, "*Exploring C"*, BPB Publications.
   About the book: A practical C programming book that emphasizes understanding C concepts through examples and programming exercises. It is useful for developing programming fundamentals and strengthening problem-solving skills.

Reference Books:

1. **Brian W. Kernighan and Dennis M. Ritchie**, "*The C Programming Language"*, **2nd Edition**, Pearson Education.
   About the book: The second edition is a landmark reference for C programming and incorporates the ANSI C standard. It provides a clear treatment of C syntax, data types, operators, functions, pointers, structures, libraries, and programming techniques.
2. **Herbert Schildt**, *C: "The Complete Reference"*, **4th Edition**, McGraw Hill Education.
   About the book: A comprehensive reference covering C language fundamentals, advanced programming concepts, standard libraries, and practical programming techniques. Schildt is a prolific programming author who has written extensively on C and other programming languages.

MOOC/NPTEL/YouTube Links

NPTEL Courses

1. NPTEL – Problem Solving Through Programming in C Offered by IIT Kharagpur
2. NPTEL – Programming, Data Structures and Algorithms Using Python Helpful for comparative programming understanding
3. NPTEL – Data Structures and Algorithms IIT Madras level introductory DS concepts
4. NPTEL – Introduction to Operating Systems Supports system programming exposure
5. https://www.coursera.org/learn/c-for-everyone/?utm_source=chatgpt.com

MOOCs:

1. Coursera – C Programming Specialization
2. edX – Introduction to C Programming
3. Udemy – C Programming for Beginners

YouTube Channels / Playlists

1. **Gate Smashers – C Programming and System Programming**: https://www.youtube.com/@GateSmashers
2. **Jenny's Lectures CS/IT – C Programming Playlist**:

https://www.youtube.com/@JennyslecturesCSIT

3. **freeCodeCamp.org – Full C Programming Course**: https://www.youtube.com/watch?v=KJgsSFOSQv0
4. **CodeWithHarry – C Language Tutorials** https://www.youtube.com/watch?v=aZb0iu4uGwA

Software / Tools Recommend

1. GCC Compiler
2. Code::Blocks IDE
3. Visual Studio Code
4. GDB Debugger

List of Lab Programs

1. Write a C Program to accept member details (Name, ID, Course, and Mobile Number) and print a formatted membership card.
2. Write a C Program to calculate the Simple Interest by accepting the Principal Amount, Rate of Interest, and Time from the user.
3. Develop a C program to accept the marks obtained in five subjects. Calculate the total, percentage, and grade using arithmetic, relational, logical, assignment, and conditional operators. Display "Pass" only if the student scores at least 40 marks in each subject and an overall percentage of 50% or above.
4. Develop a C program to accept the principal amount, annual interest rate, loan tenure, and monthly income. Calculate the EMI and determine whether the EMI exceeds 40% of the monthly income using arithmetic, relational, logical, and conditional operators. Display the loan approval status.
5. Design and develop a menu-driven Scientific Calculator using switch-case statements in C to perform
   a) Arithmetic operations (addition, subtraction, multiplication, division, and modulus)
   b) Mathematical operations (square, cube, square root, power, logarithmic, and exponential)
   c) Trigonometric operations (sine, cosine, and tangent)

   The program should repeatedly display the menu, accept the user's choice, execute the selected Operation and exit only when the Exit option is selected.
6. Write C Programs to Implement Loop-Based Applications using Iterative and Nested Loop Statement to calculate:
   a) To check Prime number using loops.
   b) To calculate factorial of a number using loops.
   c) To check Armstrong number using loops.
   d) To print Fibonacci series.
   e) To generate multiplication tables using loops.
   f) Pattern printing using nested loops.
   g) To calculate LCM & GCD of two numbers using loops.
7. Design and develop a menu-driven to
   a) Write a C program to accept the full name of a student and display the initials using appropriate string functions. [input : Ravina Kedar Shinde, Output: R. K. Shinde]
   b) Write a C program to accept an email address and determine whether it contains a valid domain (e.g., @gmail.com) using strstr().
   c) Write a C program to determine whether a string is a palindrome.

d) Write a C program to count the number of vowels, consonants, digits, spaces, and special characters in a string.
e) Write a C program to remove all spaces from a string.

8. Write a C program to perform addition of two matrices using 1-D and 2-D arrays and nested loops.
9. Write a menu driven C program using function:
   a) To enter the number of hours worked and hourly wage and calculate total earnings.
   b) To enter the number of items manufactured and cost per item and calculate total production cost.
   c) To enter distance travelled and time taken and calculate speed.
   d) To enter selling price and cost price and calculate profit or loss.
10. Write a C program to create a structure for storing student details and display them.

JSPM's

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First Year B. Tech (2026 Pattern)

VSEC131ES: FUNDAMENTALS OF MANUFACTURING & PRODUCT PROTOTYPING

Teaching Scheme	Credit	Examination Scheme
PR: 2 Hours/Week	PR: 1	TW: 50 Marks

Prerequisite Courses, if any:

- Basic Science.
- Drawing

Course Objectives:

The objectives of course are to:

1. Acquire the basic knowledge of safety, measuring instruments & tools available in central workshop used in manufacturing.
2. Inculcate the knowledge of basic types of manufacturing processes performed on lathe machine.
3. Impart skillsets of practical aspects used to manufacture products from sheet metal & wood.
4. Develop the modern skills of manufacturing through hands-on practices using simulations, programming and modelling using modern softwares and machines.

Course Outcomes:

After successful completion of the course, students will be able to:

CO. 1 Design a shop floor layout for manufacturing industry by adapting necessary safety guidelines

CO. 2 Manufacture precision components on conventional lathe machines by developing process sheet.

CO. 3 Demonstrate proficiency in various cutting techniques & operations to manufacture a useful product from sheet metal.

CO. 4 Develop a useful wooden product using carpentry techniques and operations.

CO. 5 Print a 3D model using 3D Printing Technology showcasing skills for setup, operate, and to perform post-processing in 3D printing

List of Experiments/Assignments

Module I	Industrial Shop Floor & Safety	(04 Hours)

Real World Assignment

1. Visit any industry and prepare a report consisting
   a. Shop floor layout.
   b. Specifications & applications of machines used on shop floor.
   c. General rules and guidelines for safety

Exemplar –

Building drawing & Layout plan of any industry, Slip gauges, Voltage & Current Indicators, Pressure gauges, Helmets, goggles, aprons, PPE kits, Steel rule, Calipers, Vernier Caliper, Micrometer, Dial Gauge, Vernier height Gauge, marking gauge, anvil, 'V' block and surface plate

Module II	Manufacturing on Lathe Machine	(08 Hours)

Real World Assignment

1. Prepare detailed process sheet & manufacture any useful part or component on conventional lathe machine.

   (For a part or component selected any five machining operations must be performed from list below)

   a. Facing
   b. Turning
   c. Taper turning,
   d. Grooving
   e. Knurling
   f. Center Drilling
   g. Boring
   h. Chamfering
   i. Filleting
   j. External Threading
   k. Internal Threading

2. Demonstration (construction and operation) of any one advance machine such as CNC turn / mill, VMC, plasma arc machining, Laser cutting, CNC wood router etc.

Exemplar–Candle stand, Square & hexagonal Bolts, Square & Hexagonal nuts, Table lamp body, wall mount hanger, Piston, Cycle pedal, Shaft and key coupling, Sleeve coupling, Engine components, bush, collar, stud, stepped pulley, spindle, gear, knurled handle, Any other useful product.

Module III	Sheet Metal working & Welding	(06 Hours)

Real World Assignment

1. Prepare detailed process sheet & manufacture any useful Sheet Metal Product.
   (For a sheet metal product selected any five operations must be performed from list below)
   a. Cutting Operations
      Shearing, Blanking, Punching, Perforating, Notching
   b. Bending and Forming Operations
      Bending, Folding, Flanging, Hemming, Seaming, Curling, Beading
   c. Joining Operations
      Riveting, Spot Welding, Seam Welding
   d. Finishing Operations
      Deburring, Grinding, Painting/Coating

Exemplar –Rectangular tray, Square box, Dustpan, Funnel, Cylindrical container, Conical funnel, Tool tray, Scoop, Pipe elbow, Ventilation duct, Letter/document tray, Mug or cylindrical can, any other useful product.

Module IV	**Carpentry**	**(06 Hours)**

Real World Assignment

1. Prepare detailed process sheet & manufacture any useful Wooden Product.
   (For a wooden product selected any five operations must be performed from list below)
   a. Measuring
   b. Marking
   c. Sawing
   d. Planing
   e. Ripping
   f. Chiseling
   g. Grooving
   h. Rebating
   i. Notching
   j. Nailing/Screwing/Gluing
   k. Sanding

Exemplar – Wooden Mallet, Wooden Tray, Book Shelf, Wooden Tool Box, Small Wooden Stool, Wooden Bench, Wooden Coat Hanger, Picture Frame, Wooden Pen Stand, Mortise and Tenon Joint, Wooden Towel Rack, any other useful product.

Module V	**3D Printing**	**(06 Hours)**

Real World Assignment

1. Create simple 3D models using CAD software and print using 3D printing machine. (Component manufactured should be related to specific branch)

Exemplar – Pen Stand, hanger clamps, Pots, Festive & decorative items, Desk items, Idols of gods & Goddesses, statues, automobile components, models or prototypes of mechanical parts or components, body of semiconductors, electronic parts

Learning Resources

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 7.

Reference Books:

1. Mikell P. Groover, "Introduction to Manufacturing Processes", Wiley Publications

2. John, K.C., "Mechanical Workshop Practice", Prentice Hall Publication, New Delhi

3. Chua Chee Kai, Leong Kah Fai, "3D Printing and Additive Manufacturing: Principles & Applications", 4th Edition, World Scientific, 2015.

4. Automation, Production system & Computer Integrated manufacturing, M. P. Groover Person India, 2007 2nd edition.

5. CAD/CAM: Principles and Applications by P.N. Rao

MOOC / NPTEL/YouTube Links: -

NPTEL Course on Fundamentals of Additive Manufacturing Technologies by Prof. Sajan Kapil, IIT Guwahati, https://onlinecourses.nptel.ac.in/noc21_me115/preview

NPTEL Course on Fundamentals of Industrial safety by Prof. Thomas, IIT Madras https://www.youtube.com/watch?v=3VReVbsmjKI

AutoCAD Basic Tutorial for Beginners - Part 1 of 3: https://www.youtube.com/watch?v=cmR9cfWJRUU

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First Year B. Tech (2026 Pattern)

VSEC132ES: DESIGN THINKING AND IDEA LAB

Teaching Scheme	Credit	Examination Scheme
PR: 2 Hours/Week	PR: 01	Term work: 50 Marks

Course Objectives:

The objectives of course are to understand:

1. **Understand** the core principles of design thinking and its role in engineering.
2. **Understand** the role of empathy and user interaction in exploring and identifying real-world social problems.
3. **Understand** the role of innovative solutions in addressing complex challenges related to the SDGs.
4. **Understand** the process of developing prototypes to address identified problems.
5. **Present** solutions to identified problems using storyboards and various prototyping techniques, including paper, rapid, and digital prototyping.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Understand the key stages of Design Thinking and their relevance to engineering problem-solving.

CO2: Investigate user needs using social interaction, data collection, and empathy tools.

CO3: Apply ideation tools to generate innovative solutions for identified problems.

CO4: Prepare the prototypes for effective design solutions.

CO5: Reflect on the design process and communicate outcomes through presentations and report writing.

Course Guidelines:

1. Practical laboratory sessions provide hands-on experience to apply theoretical concepts, enhance critical thinking, creativity, teamwork, and problem-solving skills.
2. Each session includes 1 hour of concept explanation and 1 hour of activity/assignment/group discussion/brainstorming.
3. Laboratory and workshop facilities provide opportunities for students to develop, prototype, test, and refine design solutions using appropriate tools and resources, thereby connecting theory with real-world applications.

Course Contents

Unit I	Introduction to Design Thinking	(05 Hours)

- Introduction of design thinking process
- Design Thinking Models -Convergent and Divergent,
- Double Diamond Thinking approach
- Phases of Design Thinking-Empathize, Define, Ideate, Prototype, Test & Reflect

Unit II	Empathize & User Discovery	(04 Hours)

- Explore / Review Sustainable Development Goals, SIH problem statements
- Social-Interaction - Surveys and questionnaires
- Data Collection Methods/Tools used to Empathize End Users – AEIOU Framework/Empathy Map/Persona Creation, Brainstorming, Dot voting

Unit III	Problem Defining & Ideation	(06 Hours)

- Define: Articulate the Problem
- Synthesizing the information gathered during Empathize.
- Tools/Techniques- 5 Whys Technique, Point of View (POV) Statement, Problem Statement Template
- Ideate: Generate Creative Solutions
- Three lenses of Design Thinking: Desirability, Feasibility and Viability
- Six Thinking Hats Method

Unit IV	Prototyping and Testing	(07 Hours)

- Creation of Prototypes for Multiple Concepts
- Implementation plan – Instructional Design Rapid Prototypes: Paper Prototypes, Storyboarding, Digital Prototyping
- Identification of target audience
- Testing- Gathering feedback on prototypes from users.
- Evaluation of Potential Solutions,
- Iteration Plan- Refines the solution based on feedback & testing results.
- Selection of best design

Unit V	Reflect	(06 Hours)

- Presentation on prototype
- Synthesis and review - Reflection report - Share and Communicate.
- Experiential Learning Theory: Experience, reflection, conceptualization, and experimentation.
- Interpretation of results and Inference
- Share & Communicate learning through-Presentation, Report, Poster & Video etc.

Learning Resources

Text Books:

1. "Design Thinking for Strategic Innovation" by Idris Moote
2. "The Design of Everyday Things" by Don Norman
3. "Designing Your Life" by Bill Burnett and Dave Evans
4. "The Design Thinking Playbook" by Michael Lewrick

Reference Books:

1. "Design Thinking: Understanding How Designers Think and Work" by Nigel Cross
2. "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by Tim Brown
3. "Design Thinking for Visual Communication" by Ranjan Nayar and Jaidip Subedi
4. "The Design of Everyday Things" by Don Norman
5. "Design Thinking: Creativity and Innovation" by S. Balaram

MOOC / NPTEL/ YouTube Links: -

1.Introduction to Design Thinking (SWAYAM / NPTEL)

▸ YouTube lectures:

https://www.youtube.com/watch?v=Jf0yvWkQ15Q

https://www.youtube.com/watch?v=C4SA-EJm_VM

THEMES OF SMART INDIA HACKATHON

No.	Theme	Description
1	**Smart Automation**	Intelligent use of technology and Artificial Intelligence to transform processes, utilize resources efficiently, and generate valuable insights.
2	**Fitness & Sports**	Ideas and technologies that promote fitness, physical activity, sports performance, and healthy lifestyles.
3	**Heritage & Culture**	Innovative ideas that showcase, preserve, and promote India's rich cultural heritage, traditions, and history.
4	**MedTech / BioTech / HealthTech**	Innovative technologies addressing healthcare needs, medical challenges, biotechnology, and emerging health-related opportunities.
5	**Agriculture, FoodTech & Rural Development**	Solutions to improve agriculture, food processing, farm productivity, resource management, and rural development.
6	**Smart Vehicles**	Intelligent technologies and devices that improve transportation, mobility, safety, and commuting.
7	**Transportation & Logistics**	Solutions addressing challenges related to transportation networks, logistics infrastructure, traffic, and urban mobility.
8	**Robotics & Drones**	Robots and drones designed to address challenges such as medical emergencies, surveillance, search and rescue, and other critical operations.
9	**Clean & Green Technology**	Sustainable solutions for waste segregation, waste disposal, sanitation, pollution reduction, and environmental protection.
10	**Tourism**	Innovative solutions to improve tourism services, travel experiences, hospitality, hotels, and related industries.
11	**Renewable / Sustainable Energy**	Innovative methods for generating, managing, storing, and efficiently utilizing renewable and sustainable energy sources.
12	**Block chain & Cyber security**	Solutions using blockchain, decentralized technologies, and cybersecurity to protect digital information and improve trust and security.
13	**Smart Education**	Digital and technology-enabled learning solutions that make education more effective, flexible, accessible, and engaging.
14	**Disaster Management**	Solutions for disaster preparedness, risk mitigation, emergency response, recovery, and effective disaster management.
15	**Toys & Games**	Creative and innovative toys and games inspired by civilization, history, culture, education, and modern technology.
16	**Miscellaneous**	Technology-based ideas for sectors such as hospitality, financial services, entertainment, retail, and other emerging areas.
17	**Space Technology**	Applications of engineering and technology for the design, development, operation, and advancement of space exploration systems.

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First Year B. Tech (2026 Pattern)

AEC141ES: PROFESSIONAL COMMUNICATION SKILLS

Teaching Scheme	Credit	Examination Scheme
PR: 2 Hours/Week EL: 3 Hours/Week	PR: 01 EL:01	Term work: 50 Marks

Prerequisites:

12th English - Basic knowledge of Listening, Speaking, Reading, and Writing (LSRW) skills.

Course Objectives:

The objectives of course are to understand:

1. To develop professional communication competence among first-year engineering students through structured practice in listening, speaking, reading, writing, and workplace interaction.
2. To prepare learners for academic, professional, and industry communication situations through practical and activity-based learning.
3. To strengthen employability skills such as presentations, interviews, group discussions, email writing, and professional etiquette.

Course Outcomes:

After successful completion of the course, students will be able to:

1. **CO1:** Recognize and apply the fundamentals of professional and technical communication in academic and workplace contexts.
2. **CO2:** Demonstrate effective listening, speaking, reading, and writing skills with clarity, fluency, and confidence.
3. **CO3:** Draft professional documents such as emails, resumes, reports, notices, and short presentations.
4. **CO4:** Participate effectively in group discussions, interviews, meetings, and team-based communication tasks.
5. **CO5:** Adapt communication behavior to workplace expectations including etiquette, cross-cultural sensitivity, digital professionalism, and collaboration.

Course Contents

Unit I	Foundations of Professional Communication	(04 Hours)

• Communication in engineering and industry; communication cycle; barriers to communication; verbal, non-verbal, and visual communication; principles of effective communication; introduction to communication laboratory and language practice notebook.

Real World Assignments

1. Self-introduction and peer introduction.
2. Conversational role play in workplace situations.
3. Group discussion.

Unit II	Listening and Speaking Skills	(06Hours)

• Active listening; listening sub-skills such as predicting, clarifying, inferencing, evaluating, and note-taking; pronunciation, stress, and intonation; self-introduction; formal introductions; telephonic etiquette; JAM; short talks; conversational role plays; speaking using audio-visual prompts.

Real World Assignments

1. Listening comprehension and note-making exercise.
2. JAM (Just a Minute) / short talk.
3. Group discussion.
4. Speech / seminar presentation.
5. Observation of a recorded presentation and suggestions for improvement.

Unit III	Reading and Writing Skills	(06 Hours)

• Reading process; skimming, scanning, intensive and extensive reading; reading comprehension; professional sentence construction; paragraph development; email writing; memo, notice, and circular drafting; agenda and minutes; resume and cover letter writing; report writing including technical and internship reports; editing, proofreading, abstract and conclusion writing.

Real World Assignment

1. Email writing and professional correspondence.
2. Resume building and cover letter writing.
3. Technical / internship report writing and presentation.

Unit IV	Interpersonal and Workplace Communication	(04 Hours)

• Greeting and welcoming; giving instructions and directions; making inquiries; handling complaints; accepting appreciation and criticism; workplace politeness; persuasion; voice modulation; professional etiquette; teamwork; communication with peers, seniors, clients, and support staff; cross-cultural communication basics.

Real World Assignment

1. Interview simulation / mock HR interview.
2. Reading comprehension and summary writing.
3. Cross-cultural communication activity.

Unit V	Industry Readiness and Digital Professionalism	(04 Hours)

• Group discussion principles and practice; interview skills and mock interviews; presentation skills with micro presentations; meeting communication; professional ethics; communication in hybrid and online environments; LinkedIn profile basics; digital professionalism; workplace collaboration tools and netiquette.

Real World Assignment

1. Complaint handling / help-desk communication simulation.
2. LinkedIn summary or digital profile writing task.
3. Participation in institute / intercollegiate communication events.

Learning Resources
Text Books: 1. Communication Skills for Engineers by S. Mishra and C. Muralikrishna. 2. Communication Skills for Technical Students by T. M. Farhatullah. 3. Written Communication in English by Saran Freeman. 4. Essential English Grammar by Raymond Murphy. 5. Communication for Business: A Practical Approach by Shirley Taylor.
Reference Books: 1. Developing Communication Skills by Krishna Mohan and Meera Banerji. 2. Business Correspondence and Report Writing by R. C. Sharma and Krishna Mohan. 3. A Course in Listening and Speaking by Sasikumar et al. 4. Study Listening by Tony Lynch.
MOOC / NPTEL/ YouTube Links: - **https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr25_ed62**

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First Year B. Tech (2026 Pattern)

VSEC133ES: ELECTRICAL & ELECTRONICS EXPLORATION LAB-I

Teaching Scheme	Credit	Examination Scheme
EL: 3 Hours/Week	EL:1	CCE: 50 Marks

Prerequisite Courses, if any: Basic Electronics concepts, Positive & Negative charges, Resistance measurement using Colour Code, Connections of measuring devices.

Course Objectives: The objectives of the course are to:

1. Apply the knowledge of Electrical & Electronics for product Innovation.
2. Design and fabricate Digital and mechatronic systems
3. Develop Digital systems by interfacing sensors, microcontrollers, and cloud platforms.
4. Validate various Electrical, Electronic & Mechanical components in the product.
5. Demonstrate the prepared circuit and identify its potential as a market ready product

Course Outcomes: After successful completion of the course, students will be able to:

CO1: Identify real-world engineering problems and apply Electrical & Electronics principles to develop innovative solutions.
CO2: Simulate the Electronic Circuits.
CO3: Select appropriate Electrical & Electronic components for project Development
CO4: Substantiate the product with respect to Electrical, Electronic & Mechanical engineering aspects.
CO5: Present the Prototype in the context of Intellectual Property Rights(IPR).

Course Contents

Module I	Problem Statement Identification	(9 Hours)

Empathize & Define real-world user needs, Literature Survey,Multi- Problem Statement identification, synopsis writing, Finalization of the Problem Statement Learning how to identify real-world user needs, Problem Formulation of Circuit diagram, Study of Components in the circuit diagram using datasheets.

Exemplar/ Practical Applications:
smart traffic and parking management system, IoT based Smart Agriculture System

Module II	Project Simulation	(9 Hours)

Introduction to Project Simulation Software: TinkerCAD & Arduino IDE , Using Tinkercad/multisim/Proteus to simulate Electronic Circuits, TinkerCAD libraries: Sensors & Peripherals, Using Arduino IDE to write codes.

Exemplar/ Practical Application: Arduino LCD interfacing simulation , Arduino Automatic Plant Watering System simulation.

Module III	Selection of Embedded or IoT components	(9 Hours)

Finalization of components after successful simulation, System Components: breadboard/PCB, power supply- battery/adapter, Arduino Uno, Displays- 16x2 LCD/ 0.96-inch OLED, Active & Passive Components, Peripherals with their datasheets, Analog & Digital Inputs-Outputs, PWM, motor interfacing, Sensor Interfacing & Data Acquisition.

Exemplar/ Practical Applications: Arduino Uno, ESP8266 D1 Mini, Resistors, Potentiometers, Capacitors, Diodes, LED, Push Button, BJT, MOSFET, Relay, Buzzer

Module IV	Assembling and Product Testing	(9 Hours)
Assembling and testing the project as per Electrical and Electronic circuit Diagram, Final Assembly of all Electrical, Electronic and mechanical parts, Safety precaution while project assembly : Safe handling of soldering irons, charged capacitors, handling of high wattage components, Prototype Testing.		
Exemplar/ Practical Applications: Assembling of 555 PWM generator circuit for DC motor control, Assembling of 741 amplifier circuit		
Module V	**Project validation and showcase**	**(9 Hours)**
Project validation Checklist : overall working, safe Power level , Hardware integration, Enclosure compatibility Technical Report Writing, Technical Poster Design, Video Demonstration, Digital Repositories, Presentation Delivery, Technical Publication: IPR filing.		
Exemplar/ Practical Applications: Project posters, Project videos, student's presentations.		

Learning Resources

Text Books:

1. B.L. Theraja, A K Theraja "ABC of Electrical Engineering", S Chand Publications
2. Arduino-For-Beginners-REV2
3. Electronic Circuit Basics With Tinkercad: by Alex Reyes
4. Sensors and Transducers by D. Patrnabis, 2nd Edition, PHI
5. "Electronics Devices" Thomas.` L. Floyd, 9th Edition, Pearson

Reference Books:

1. Fundamentals of Electronic Systems Design by Jens Lienig and Hans Bruemmer (Springer)
2. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford University Press, 2nd edition 2018.
3. C. L. Wadhwa, "Basic Electrical Engineering", New Age International (P) Limited 5th edition 2024
4. "Sensors Handbook", by S. Soloman, 2nd Edition.

MOOC/NPTEL/ Youtube Links:

https://nptel.ac.in/courses/108105112 (Fundamentals of Electrical Engineering, IIT Kharagpur) Electronic Systems Design: Hands-on Circuits and PCB Design with CAD software

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First Year B. Tech (2026 Pattern)

CC142ES: CO-CURRICULAR COURSE-I

Teaching Scheme	Credit	Examination Scheme
EL: 3 Hours/Week	EL: 1	CCE: 50 Marks

Course Objectives: The Objective of the Course is to:

To promote the holistic development of students by enhancing their physical health, mental well-being, fitness, social responsibility, creativity, cultural awareness, and life skills through participation in co-curricular courses.

Course Outcomes: After completion of course, student will be able to:

Adopt healthy lifestyle for overall personality development through participation in co-curricular activities.

Basket of Co-curricular Courses:

1. Health and Wellness
2. Yoga Education
3. Sports and Fitness
4. Cultural Activities
5. NSS/NCC
6. Fine/ Applied/ Visual/Performing Arts
7. Digital Wellness

Here are some tips and ideas to help you choose the right courses

1. **Consider Your Interests and Hobbies**
   Think about what you enjoy doing in your free time or what activities you have always wanted to try. Co-curricular courses can be a great opportunity to pursue passions outside your major.
2. **Explore Different Fields**
   Choosing courses from different areas can provide a well-rounded experience. For instance, you might pick one course related to Health, Sports and Community services.
3. **Balance Your Schedule**
   Ensure that the co-curricular courses fit well with your academic schedule and personal commitments. Avoid overloading yourself, as these courses should enhance your experience, not add undue stress.
4. **Look at Course Benefits**
   Some co-curricular courses offer skills that can be beneficial in your future career or personal development. For example, leadership training, public speaking, or project management.
5. **Consult with Advisors or Seniors**
   Talking to academic advisors, professors, or senior students can give you insights into which courses are popular, have good instructors, or offer valuable experiences

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Pune, Maharashtra, India.

F.Y. B. Tech Curriculum (2026 Pattern)

SEMESTER- II

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First Year B. Tech (2026 Pattern)

BSC151ES: ENGINEERING MATHEMATICS - II

Teaching Scheme	Credit	Examination Scheme
Theory: 3 Hours/Week **EL: 3 Hours/Week**	**TH: 3** **EL: 1** **Total: 4**	**CCE: 50 Marks** **ESE: 50 Marks** **Total: 100 Marks**

Prerequisite Courses, if any:

- Integration, Differential Equation, Three-dimensional coordinate systems

Course Objectives: The objective of the course are to

1. Familiarize the students with advanced techniques of integration.
2. Apply Tracing of curve and their applications in different branches of engineering.
3. Implement Multiple integral to determine Area, Volume, Mass, Centroid, Moment of Inertia..
4. Develop the fundamental concept of several variable functions and partial differentiation.
5. Apply the different techniques of number theory in computation problems.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Design a Mathematical Model to solve Engineering Problems namely Work Done, Air Traffic Jam using Integral techniques.

CO2: Analyze graphical engineering problems using curve Tracing and arc length of various curves

CO3: Formulate multiple integrals to determine the area and volume enclosed by multi-dimensional surfaces.

CO4: Implement the Jacobian matrix for computational engineering.

CO5: Apply Number Theory in Database Engineering for Cryptography.

Course Contents

Unit I	Integral Calculus	(09 Hours)

Reduction Formulae, Beta and Gamma functions, Differentiation Under Integral Sign and Error functions

Real World Assignment

In telecommunications, data (like a YouTube video, a WhatsApp message, or a voice call) is broken down into millions of tiny pieces called data packets. These packets travel through the air or cables to get to your phone. How will we use Beta function.to minimize the frequency of air traffic jams.

Exemplar

1. Analyze safety and passenger comfort limits based on higher-order.
2. Analyze and minimize data traffic jam.

Unit II	Curve Tracing and Rectification of Curve	(09 Hours)

Tracing of Curves – Cartesian, Polar and Parametric curves, Rectification of curves.

Real World Assignment

Apply standard curve tracing rules (symmetry, intercepts, asymptotes, region of existence, and derivatives) to structural design a supporting cable. (In structural engineering, the deflection of a beam under load is modeled by the equation by $y = x^3 - 3x^2 + 2x$.Where y represents the deflection of the beam and x represents the distance from the fixed end. Using curve tracing, analyze the behavior of the deflection curve and determine the maximum deflection point, intervals of increase and decrease, and sketch the curve.)

Exemplar

Aircraft Wing Design,Rectification.

Unit III	Multiple Integral and Applications	(09 Hours)

Double and Triple integrations, change of order of integration, Applications to find Area,Volume, Mass, Centre of Gravity and Moment of Inertia.

Real World Assignment

A civil engineering team is surveying a natural valley basin to convert it into a water reservoir (purpose to store water to generate electricity) for a sustainable smart-city project. The irregular, curved floor of the valley is modeled by the function z = f(x, y) = 10 + $0.05x^2$+ $0.02y^2$ (representing depth/elevation relative to a reference plane). The top of the reservoir will be capped by a rectangular retaining wall spanning from x = -20to x = 20 and y = -30 to y = 30 Before building the dam structure, the team must determine the total volume of water the reservoir can hold when filled to capacity.

Exemplar

Multiple integral applied in civil engineering applications (calculating mass and moments of inertia)

Unit IV	Multivariable Calculus – Partial Differentiation	(09 Hours)

Euler's Theorem on Homogeneous functions, Partial derivative of Composite Function, Jacobian and its applications, Errors and Approximations, Maxima and Minima of functions of two variables.

Real World Assignment

Analyze of heat flow to model temperature distribution in object.

1. A tightly stretched flexible string has its ends fixed at x = 0 and x = l. At time t ~ 0, the string is given a shape defined by F(x) = (1- x), where p is constant, and then released. Find the displacement of any point x of the string at any time t > 0.
2. Suppose the stress (in MP a) on a rectangular metal plate is modeled by the function:$\sigma(x, y) = 40xy - x^2 - y^2$, where x and y are the coordinates (in cm) on the metal plate. Find the location (x, y) where the stress is maximum or minimum, and classify the critical point.
3. The Resistance of copper wire is given by $R(t, a) = \rho(1 + at) \times l/a$.Find how fast the electrical resistance R is increasing or decreasing over time. ($\frac{\partial R}{\partial t}$)

Maximize and Minimize problems.

A company manufactures two types of typewriters – electrical (E) and manual (M). The revenue function of the company, in thousands, is: R=8E+ 5M + 2EM – E^2 - $2M^2$+ 20, Determine the quantity of electrical and manual typewriters which lead to maximum revenue. Also calculate the maximum revenue.

Exemplar

1. HeatEquation, Wave Equation (Tea, Boiler).
2. Machine learning to minimize network error (reduce transmission error).
3. Heat Conduction Analysis, Linear Regression Model.
4. Solution of partial differential equation for Steady State Heat Conduction Analysis.
5. Finite element Methods.

Unit V	Number Theory	(09 Hours)

Division Algorithm,GCD and LCM (G.C.D. of two integers as a linear combination of the two integers), Euclidean Algorithm, Relatively prime integers, Euclid Lemma and its generalization, Congruence relations and its properties, Residue Classes:Definition,Examples,addition and multiplication modulo n,Euler's and Fermat's Theorems.

Real World Assignment

Handling Large Data (You run a massive digital movie library (like Netflix). You have thousands of high-definition movies, but they are way too big to fit onto one single computer. Even if they did fit, that one computer would crash because thousands of people would be trying to watch movies from it at the same time..Given a set of N digital movies uniquely indexed by an integer ID x lie from 1 to N and a cluster of K decentralized storage nodes indexed from 0 to K-1, Can you use the remainder of a modulo operation to cleanly distribute a massive dataset so no single computer overflows?

Exemplar

Encryption Data, Sharing secret key.

Learning Resources

Text Books:

1 Ivan Niven , Herbert S. Zuckerman, Hugh L. Montgomery,"An Introduction to the Theory of Numbers",John Wiley & Sons,,5th Edition.

2 B. V. Ramana, "*Higher Engineering Mathematics"*, Tata McGraw Hill Education,1st Edition.

3 B. S. Grewal, "*Higher Engineering Mathematics"*, Khanna Publishers,45th Edition.

Reference Books:

1. Erwin Kreyszig, "*Advanced Engineering Mathematics"*, Wiley India Pvt. Ltd., 11th Edition.
2. M. D. Greenberg, "*Advanced Engineering Mathematics"*, Pearson Education, 2nd Edition.
3. Peter V. O'Neil, "*Advanced Engineering Mathematics"*, Thomson Learning, 8th Edition.
4. George B. Thomas, *Thomas' "Calculus"*, Pearson Education (Addison-Wesley), 15th Edition.
5. P. N. Wartikar and J. N. Wartikar, "*Applied Mathematics*" Vol. I & Vol. II, Vidyarthi Griha Prakashan, Pune, 9th Edition.
6. Ron Larson and David C. Falvo, "*Elementary Linear Algebra"*, Houghton Mifflin Harcourt Publishing Company,9th Edition.

MOOC / NPTEL/ YouTube Links: -

https://youtu.be/ZLbnIdA-h0s?si=IKhMGM_nhYs9UVMa

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JAYAWANTRAO SAWANT COLLEGE OF ENGINEERING, HADAPSAR, PUNE.

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First Year B. Tech (2026 Pattern)

ESC161ES: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING-II

Teaching Scheme	Credit	Examination Scheme
Theory: 2 Hours/Week	Theory: 2	ESE: 50 Marks

Prerequisite Courses, if any: Electrical Circuit and Elements-R, L and C, Boolean Algebra, Electromagnetic wave.

Course Objectives: The Objectives of the Course are to:

1. Demonstrate Three phase Supply using star and delta connected loads.
2. Implement concepts of magnet to induce EMF using electromagnetic Induction Principle.
3. Understand the operation of electrical machines such as Transformer, AC and DC Motors.
4. Design the schematic Digital Circuits by applying the knowledge of Digital Logic Design (DLD).
5. Explore the architectural elements, building blocks and various modulation techniques of the Telecommunication System

Course Outcomes: After successful completion of the course, students will be able to:

CO1: Interpret the three-phase system using inductive and capacitive load.

CO2: Apply the concepts of Magnet to induction of EMF using electromagnetic induction Principle.

CO3: Elaborate the operation of Electrical Machines as Transformer, AC and DC motors.

CO4 Realize the Digital combinational and sequential logic circuits by using DLD technology.

CO5: Examine the fundamental concepts of AM, FM, GSM by developing IOT based systems.

Course Contents

Unit I	Three Phase AC circuit	(5 Hours)

Three Phase AC Circuit: Concept of 3 phase AC Symmetrical system, Phase sequence, Balanced and unbalanced load, Concept of Line and Phase parameters, Relation between voltage, current and power for three phase star connected and delta connected balanced inductive load.

Real World Assignments

1. Demonstrate the rotation of Three Phase Motors by changing Phase Sequence
2. Observe the balanced and unbalanced load in three phase supply system

Exemplar/ Practical Applications: Three phase Induction Motor, three phase distribution panel.

Unit II	Electromagnetism & Electromagnetic Induction	(6 Hours)

Electromagnetism: Magnet and Magnetic properties. Law of Magnetism, Concept of Flux Density, Field Strength, Permeability, MMF, Reluctance, their units, and relationships. Force acting on conductor placed in magnetic field, Fleming's left-hand rule. Comparison of Electric and Magnetic circuits.
Electromagnetic Induction: Faraday's Laws of Electromagnetic Induction, Lenz's Law, Fleming's Right-hand rule, Types of Induced EMF.

Real World Assignments

1 Develop solenoid using Electromagnet and copper coil

2 Demonstration the various properties of Magnet using permanent magnet.

Exemplar/ Practical Applications: Magnetic Door Locks, Speakers, Magnetic Compass to identify geographical direction.

Unit III	Electrical Machines	(7 Hours)

Single phase Transformer: Construction, Working Principle, EMF equation of transformer, Losses in Transformer, Efficiency & Regulation, Applications of transformer

DC Motors: Construction, Working Principle, applications-DC Series and Shunt Motor

AC Motor- Construction, Rotating Magnetic Field, Working Principle, applications-Three Phase Induction Motor

Real World Assignments

1. Develop regulated power supply using single phase transformers.
2. Operation of toys using DC motors.

Exemplar/ Practical Applications: Pumps and compressor, Step down transformer in welding machine, Cranes and Conveyor belt using DC motors.

Unit IV	Logic Gates and Digital System	(7 Hours)

Number System: Introduction of Binary, Decimal, Octal, Hexadecimal number system, Conversion of Decimal to Binary, Octal, Hexadecimal and Binary, Octal & Hexadecimal to decimal,Binary Addition.

Logic Gates - AND, OR, NOT, XOR, XNOR. Universal Gates – NAND, NOR.

Logic circuits - Half & Full adders. SR, JK, T & D Flip-Flops and Multiplexer-Demultiplexer. (8:1, 1:8 respectively).

Introduction to ATMEGA328 Microcontroller (Only block diagram and explanation).

Real World Assignments

1. Construct a Table Top Real Time Clock using ATMEGA 328 Microcontroller and Digital display.
2. Build a IOT Based Residential Water Tank Level Controller using ESP8266 Microcontroller.
3. Develop a 4:1 Multiplexer using NOT, AND & OR gate for a single digital clock display for selection of any one parameter- Time, Date, Alarm, or Stopwatch.

Exemplar/ Practical Applications: Industrial safety door, Smart Watches, Automatic Token system, Timer and Counter Fuel/Water/Temperature Indicators.

Unit V	Communication Systems	(5 Hours)

Communication Systems: Block Diagram of Communication system, Media: Wired and Wireless, Need of Modulation, Types of modulation: **AM & FM, IEEE** Electromagnetic Spectrum, Block diagram of GSM system, Block diagram of IoT based communication System.

Real World Assignments

1. Develop an Arduino-Based Wireless LASER Data Communication System for Line-of-Sight Transmission.
2. Construct an IoT-Based Real-Time RFID Attendance Management System .

Exemplar/ Practical Applications: FM radio, Mobile phones, IEEE frequency spectrum, Telephone exchange center.

Learning Resources

Text Books:

1. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill Education, 2nd edition 2019.
2. B.L. Theraja,A K Theraja "ABC of Electrical Engineering", S Chand Publications,201
3. "Electronics Devices by Thomas."` L. Floyd, 9th Edition, Pearson
4. "Modern Digital Electronics" by R. P. Jain, 4th Edition, Tata McGraw Hill
5. Electronic Communication Systems by Kennedy & Davis, 4th Edition, Tata McGraw Hill

Reference Books:

1. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford University Press, 2nd edition
2. C. L. Wadhwa, "Basic Electrical Engineering", New Age International (P) Limited 5th edition 2024
3. S K Bhattacharya, "Electrical Machines", McGraw Hill Education, 2nd edition, 2008 "Sensors Handbook," by S. Soloman, 2nd Edition.

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First Year B. Tech (2026 Pattern)

ESC162ES: PROGRAMMING IN C++

Teaching Scheme	Credit	Examination Scheme
Theory: 2 Hours/Week **Practical: 2 Hours/Week**	**TH: 2** **PR: 1**	**ESE: 50 Marks** **Practical: 50 Marks** **Total: 100 Marks**

Prerequisite:

Students should have:

1. Basic knowledge of computer systems and operations.
2. Basic understanding of algorithms and flowcharts.
3. Fundamental knowledge of programming concepts, including variables, operators, control structures, and functions.

Course Objectives:

The course objectives are:

1. To develop classes and objects while applying appropriate access control mechanisms for secure and organized programming.
2. To implement advanced function concepts for enhancing object-oriented programming in C++.
3. To apply inheritance concepts for building modular, reusable, and efficient object-oriented applications.
4. To examine the role of abstract classes and runtime polymorphism for developing flexible object-oriented applications.
5. To develop file handling applications for secure data storage and retrieval.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Construct C++ classes and objects by incorporating appropriate access control mechanisms for developing secure and well-structured applications.
CO2: Utilize function concepts for developing efficient object-oriented programs.
CO3: Implement inheritance techniques for creating modular, reusable, and maintainable object-oriented applications.
CO4: Analyze the use of abstract classes and runtime polymorphism in creating extensible object-oriented applications.
CO5: Develop file handling solutions using text and binary files for ensuring reliable data storage and retrieval.

Course Contents		
Unit I	**Introduction to C++ and Fundamentals of OOP**	**6 hours**

Introduction to C++ and OOP :Overview of C++, Procedural-Oriented Programming (POP) vs Object-Oriented Programming (OOP), Features and Advantages of OOP, Concepts of OOP: Abstraction, Encapsulation, Inheritance, Polymorphism

Structure of a C++ Program: Header Files, Namespace Declaration, main() Function, Basic Structure of a C++ Program, Program Compilation Process, Program Execution Process

Classes and Objects and access control :Introduction to Classes, Defining a Class, Creating Objects, Accessing Class Members, Member Functions, Access Specifiers**:** Public, Private, Protected (optional but recommended), Scope Resolution Operator (::)

Constructors and Destructors: Introduction to Constructors, Syntax of Constructors, Characteristics of Constructors, Types of Constructors, Default Constructor, Parameterized Constructor, Copy Constructor, Object initialization Using Constructors, Introduction to Destructors, Syntax of Destructors, Characteristics of Destructors, Automatic Invocation of Destructors, Object Clean-up Process, Constructor vs Destructor.

Exemplar: Banking Transaction System, Library Management System

Real Life Applications:

Develop following applications using basics of Object-Oriented Programming

1. **Banking System** – Design a program for secure handling of customer accounts, transactions, and balance management using encapsulation and access control.

2. **Library Management System** – Develop a program for organizing book issue, return, and member details using object-oriented concepts.

3. **Railway Reservation System** – Design a program for ticket booking, passenger management, and seat allocation using classes and constructors.

4. **Smart Home Automation System** – Develop a program for controlling smart devices through abstraction and polymorphism concepts.

5. **Mobile Recharge System** – Design a program for recharge plan processing and billing using constructors and object-oriented design.

Unit II	**Advanced Functions and Polymorphism in C++**	**6 Hours**

Function Overloading: Definition of function overloading, compile-time polymorphism with different numbers and types of arguments, constructor overloading

Inline Functions: Concept of inline functions, syntax and usage, advantages of inline functions for small and frequently used functions.

Friend Functions: Definition and declaration of friend functions, accessing private data members using friend functions, and applications of friend functions.

Static Members: Static data members and static member functions, shared memory allocation, accessing static members using the class name.

Exemplar: Calculating areas of different geometric shapes, quick simple interest calculation

Real Life Applications:

Develop following applications using Advanced Functions and Polymorphism in C++

1. **Product Billing System** – Develop a program using constructor overloading and compile-time polymorphism for managing billing operations with different input parameters.

2. **Employee Attendance Counter** – Design a program using static data members and static member functions for tracking total employee attendance.

3. **Banking Interest Calculator** – Develop a program using inline functions for fast and efficient interest calculation in banking applications.

4. **Smart Calculator System** – Design a program using function overloading for performing multiple arithmetic operations with different argument types.

5. **Parcel Delivery Charge System** – Implement a program using compile-time polymorphism for calculating delivery charges using different parameter combinations.

Unit III	Object Reusability through Inheritance	6 Hours

Introduction to Inheritance: Concept and need for inheritance, base and derived classes, advantages of inheritance, and code reusability.

Types of Inheritance: Single, Multiple, Multilevel, Hierarchical, and Hybrid inheritance with suitable examples.

Constructors in Inheritance: Constructor execution order in inheritance, calling base class constructors from derived class constructors, and initialization of base and derived class objects.

Virtual Inheritance: Virtual base classes, diamond problem (ambiguity in multiple inheritance), and its resolution using virtual inheritance.

Exemplar: Employee Salary System, Student Result Management System

Real Life Applications:

Develop following applications using Object Reusability through Inheritance

1. **Movie Ticket Booking System** – Design a program using polymorphism and inheritance for seat category and ticket management.

2. **Fitness Center Management System** – Design a program using classes and inheritance for trainer and member record management.

3. **Car Rental System** – Design a program using multiple inheritance for customer, vehicle, and booking details.

4. **Pharmacy Management System** – Design a program using hierarchical inheritance for medicine and supplier management.

5. **Tourism Management System** – Design a program using inheritance for package booking and customer information handling.

Unit IV	Object Reusability through Abstract Classes	6 Hours

Abstract Classes: Introduction, need and characteristics of abstract classes, creating abstract classes, object creation restrictions, implementing derived classes, and advantages and limitations of abstract classes.

Pure Virtual Functions: Introduction, syntax, characteristics, rules, declaring pure virtual functions, creating abstract classes using pure virtual functions, and implementation in derived classes.

Runtime Polymorphism: Function overriding, dynamic binding, and implementation of runtime polymorphism using abstract classes and pure virtual functions.

Exemplar: Shape area calculator, Online Payment System

Real Life Applications:

Develop following applications using Object Reusability through Abstract Classes

1. **Employee Management System**: Design a system to manage different types of employees (Manager, Developer, Salesperson). Each employee has common details, but salary calculation differs for each type.
2. **Banking System**: Develop a banking application with different account types (Savings, Current, Loan). Each account calculates interest and withdrawal rules differently.
3. **Vehicle Management System**: Create a system to manage different vehicles (Car, Bike, Truck). Each vehicle has a unique method to start, stop, and calculate fuel efficiency.
4. **Shape Area Calculator**: Design a program to calculate the area of different shapes (Circle, Rectangle, Triangle). Each shape implements its own area calculation.
5. **Online Payment System**: Build a payment gateway that supports multiple payment methods (UPI, Credit Card, Debit Card, Net Banking). Each payment method processes transactions differently.

Unit V	Managing Records using File Handling Concepts	6 Hours

File Streams and Stream Classes: Introduction to file handling, stream classes (ifstream, ofstream, fstream), file opening and closing operations.

File Opening Modes: Read, write, append, binary, and other commonly used file modes.

Reading and Writing Files: File input and output operations using ifstream, ofstream, and fstream for data storage and retrieval.

Sequential and Random File Access: Sequential file processing, direct/random file access using file pointers, and seekg(), seekp(), tellg(), and tellp() functions.

Text and Binary File Operations: Reading and writing text and binary files, storing structured data, and applications and advantages of binary file handling.

Introduction to Templates: Meaning of Templates, Need for Templates, Types of Templates – Function Templates, Class Templates, Template Syntax

Exemplar: Product Search and Retrieval System, Library Book Record System

Real Life Applications:

Develop following applications using File Handling Concepts

1. **Courier Tracking System** – Develop a program that stores shipment details and delivery status using file operations.

2. **Insurance Claim Management System** – Develop a program that maintains policyholder and claim records securely.

3. **Digital Diary Application** – Develop a program that saves personal notes and reminders using text file handling.

4. **Event Registration System** – Develop a program that stores participant details and event schedules.

5. **Electricity Bill Management System** – Develop a program that generates and stores electricity billing records.

Learning Resources

Text Books:

1. E. Balagurusamy, "*Object-Oriented Programming with C++"*, 8th Edition, McGraw Hill Education.
   About the book: A comprehensive textbook covering the fundamentals of C++ and object-oriented programming. It explains classes and objects, constructors, inheritance, polymorphism, templates, exception handling, file handling, and other important C++ concepts with examples and exercises.
2. Yashavant Kanetkar, "*Let Us C++"*, 3rd Edition, BPB Publications.
   About the book: A practical and beginner-friendly book that introduces C++ programming through simple explanations, examples, and programming exercises. It develops fundamental programming skills and covers object-oriented concepts and important C++ features. The author's publicly listed contact is kanetkar@kicit.com

Reference Books:

1. Bjarne Stroustrup, "*Programming: Principles and Practice Using C++"*, 2nd Edition, Addison-Wesley.
   About the book: A comprehensive introduction to programming written by the designer and original implementer of C++. It focuses on programming principles, problem-solving, object-oriented programming, generic programming, data structures, and practical software development. The 2nd edition is based on C++11 with some C++14 features. The author's publicly listed contact is bs@research.att.com
2. Herbert Schildt, "*C++: The Complete Reference"*, 4th Edition, McGraw Hill Education.
   About the book: A detailed reference book covering C++ syntax, keywords, libraries, object-oriented programming, inheritance, polymorphism, templates, STL, namespaces, RTTI, and other advanced C++ features. It is particularly useful as a reference for both fundamental and advanced C++ concepts.

MOOC / NPTEL/ YouTube Links: -

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_cs78
2. https://nptel.ac.in/courses/106105151
3. https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs34
4. https://www.youtube.com/playlist?list=PLGdMwVKbjVQ_PrNxQB3EtZ35wLAkyW-CQ
5. https://www.youtube.com/watch?v=UdZNvPECQ5U
6. https://www.coursera.org/learn/c-plus-plus-programming-fundamentals?utm_source=chatgpt.com

List of Lab Programs	
Unit I:	**Basics of Object-Oriented Programming Using C++: Classes, constructors, and Destructors**
1. **Hospital Patient Management System:** Design a C++ program to manage patient records using classes, constructors, destructors, and access specifiers. The system should allow adding, displaying, and updating patient information. **2. Hotel Room Reservation System:** Develop a C++ application to manage hotel room bookings using classes, constructors, and encapsulation. The system should maintain guest details, room allocation, and booking status.	
Unit II:	**Advanced Functions and Polymorphism in C++**
Electricity Bill Calculator: Design a C++ program using function overloading, inline functions, and static members to calculate electricity bills for different consumer categories. **Student Grade Evaluation System:** Develop a C++ application using function overloading and friend functions to calculate grades and generate academic performance reports for students.	
Unit III:	**Object Reusability through Inheritance**
University Management System: **Design a C++ program using inheritance to manage information about students, faculty, and administrative staff while demonstrating different inheritance types.** 6. Hospital Staff Management System: **Develop a C++ application using inheritance to manage doctor, nurse, and technician records with common and specialized functionalities.**	
Unit IV	**Object Reusability through Abstract Classes**
Online Food Delivery System: **Design a C++ application using abstract classes and runtime polymorphism to manage different food delivery modes such as dine-in, takeaway, and home delivery.** 8. Smart Parking Management System: **Develop a C++ program using abstract classes and pure virtual functions to manage parking operations for different vehicle categories with customized parking charges.**	
Unit V:	**Managing Records using File Handling Concepts**
Student Attendance Record System: **Design a file handling application using text and binary files to store, search, update, and display student attendance records securely.** **10. Inventory Management System: Develop** a C++ application using file handling techniques to maintain product inventory records with facilities for adding, modifying, searching, and deleting product information.	

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JAYAWANTRAO SAWANT COLLEGE OF ENGINEERING, HADAPSAR, PUNE.

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First Year B. Tech (2026 Pattern)

AEC191ES: INDIAN KNOWLEDGE SYSTEM

Teaching Scheme	Credit	Examination Scheme
EL: 3 Hours/Week	EL: 1	CCE: 50 Marks

Prerequisite Courses, if any:

- Basic understanding of Indian history.
- Awareness of Indian culture and heritage.
- Interest in interdisciplinary learning.

Course Objectives:

1. Understand the evolution of engineering and technology in ancient India.
2. Explore traditional materials, manufacturing techniques, and sustainable construction practices.
3. Appreciate Indian innovations in water resource management, metallurgy, transportation, and urban planning.
4. Develop ethical engineering practices inspired by Indian philosophical principles.
5. Apply IKS concepts to modern engineering design, innovation, and entrepreneurship.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Interpret the contributions of the origin and evolution of the Indian Knowledge System.

CO2: Analyze the scientific principles and engineering relevance of ancient Indian mathematical and astronomical knowledge.

CO3: Identify the characteristics of major Indian architectural styles and the principles of Vedic astronomy.

CO4: Examine the role of Ayurvedic principles, ecological ethics, and sustainable lifestyle practices rooted in Indian traditions

CO5: Adopt the yogic practices in improving health, stress management, self-discipline, and overall quality of life.

Course Contents

Unit I	Introduction to Indian Knowledge System	(09 Hours)

Meaning and scope of IKS, Evolution of Indian knowledge traditions, Gurukul education system, Vedas, Upanishads, and ancient literature, Indian philosophy and scientific temperament, Importance of IKS in NEP 2020

Real World Assignment

1. Presentation on ancient Indian universities (Nalanda, Takshashila, Vikramshila)

Unit II	Indian Mathematics & Astronomy in IKS	(09 Hours)

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of $\pi\pi$, Trigonometry, Algebra, Chandah Sastra of Pingala,
Indian Astronomy, celestial coordinate system, Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System Astronomical Instruments (Yantras) Jantar Mantar or Raja Jai Singh Sawal.

Real World Assignments

1. Explain the concept of the Indian Calendar System including Meaning of Panchang, Solar calendar and Lunar calendar, Lunar months and Solar months, Tithi, Nakshatra, Yoga, and Karana
2. Describe the importance of astronomy in the Indian Calendar System with Role of Sun and Moon movements ,Seasonal calculations, Festival determination, Agricultural relevance
3. Write a detailed note on the observatories of India which includes 1. Jantar Mantar Jaipur 2. Jantar Mantar Delhi

Unit III	Ancient Indian Science (Architecture)	(09 Hours)

Architecture in India: Nagara (northern style), Vesara (mixed style), and Dravida (southern style), Indian vernacular architecture, Temple style, cave architecture, rock cut architecture, Kalinga architecture, Chandela architecture, Rajput architecture, Jain architecture, Sikh architecture, Maratha architecture Indo-Islamic architectural, Indo-Saracenic revival architecture, Greco Buddhist style.

Real World Assignment

1. Describe the features of Kalinga Architecture. 1. Konark Sun Temple 2.Lingaraja Temple
2. Explain Chandela architecture with suitable examples. 1. Khajuraho Group of Monuments
3. Explain the characteristics of Jain Architecture. 1. Dilwara Temples 2. Ranakpur Jain Temple
4. Write a note on Maratha Architecture. 1. Shaniwar Wada 2. Raigad Fort 3. Water management system
5. Prepare a Field Visit / Virtual Visit Report

Unit IV	Indian Knowledge for Health, Environment and Sustainability	(09 Hours)

Ayurveda and holistic health, Influence of Pancha Mahabhuta on Internal environment of Human being, Indian food systems and lifestyle

Environmental ethics in Indian traditions, Ecological Concepts in Indian Traditions (Sacred groves and biodiversity conservation, River worship traditions, Tree worship and conservation ethics, Animal protection and compassion)

Sustainable development practices in Indian culture, Sustainable Lifestyle Practices in Indian Culture (Minimalism and controlled consumption, Community-centered living, Ethical use of natural resources)

Real World Assignment

1. Prepare a case study on the role of Ayurveda in managing (1. Stress and anxiety 2. Digestive disorders 3. Immunity improvement 4. Lifestyle diseases)
2. Field visit to sacred groves, rivers, or heritage water structures
3. Field visit to heritage water structures or eco-villages

Unit V	Introduction to Yoga	(09 Hours)

Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age. Brief Introduction of Hatha yoga, Raja yoga, Karma yoga, Gyana Yoga, Bhakti yoga Understanding eight steps of Ashtanga yoga, Understanding Shatkriyas , the six cleansing procedures of Yoga

Real World Assignment

1. Discuss the role of Yoga in:

- Stress management
- Healthy lifestyle
- Work-life balance
- Prevention of diseases
- Mental health and meditation, Student life and professional life

Learning Resources

Text Books:

1. **B. Mahadevan**, *Introduction to Indian Knowledge System: Concepts and Applications*, PHI Learning Pvt. Ltd., New Delhi, 2022.
2. **AICTE – Indian Knowledge Systems Division**, *Introduction to Indian Knowledge System* (Course Material).
3. **Kapil Kapoor and Avadhesh Kumar Singh (Editors)**, *Indian Knowledge Systems*, D.K. Printworld, New Delhi.
4. **S. Balachandra Rao**, *Indian Mathematics and Astronomy: Some Landmarks*, Jnana Deep Publications.

Reference Books:

1. **B. Mahadevan, Vinayak Rajat Bhat and Nagendra Pavan R. N.**, *Indian Knowledge System*, PHI Learning Pvt. Ltd.
2. **Michel Danino**, *The Lost River: On the Trail of the Sarasvati*, Penguin India.
3. **A. L. Basham**, *The Wonder That Was India*, Picador India.
4. **Dharampal**, *Indian Science and Technology in the Eighteenth Century*, Other India Press.
5. **Swami Jitatmananda**, *Modern Physics and Vedanta*, Bharatiya Vidya Bhavan.
6. **R. Balasubramaniam**, *The Saga of Indian Science and Technology*, Infinity Foundation.
7. **S. R. Rao**, *Indian Heritage and Culture*, McGraw Hill Education.
8. **R. N. Iyengar**, *Engineering in Ancient India*, Centre for Ancient History and Culture.

MOOC / NPTEL/ YouTube Links: -

https://onlinecourses.swayam2.ac.in/e-learning/preview/imb23_mg53

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First Year B. Tech (2026 Pattern)

VSEC181ES: ELECTRICAL AND ELECTRONICS EXPLORATION LAB-II

Teaching Scheme	Credit	Examination Scheme
EL: 3 Hours/Week	EL:1	CCE: 50 Marks

Prerequisite Courses, if any:

Basic Electronics concepts, Positive & Negative charges, Resistance measurement using Colour Code, Connections of measuring devices.

Course Objectives: The objectives of the course are to:

1. Apply the knowledge of Electrical & Electronics for product Innovation.
2. Design and fabricate Digital and mechatronic systems
3. Develop Digital systems by interfacing sensors, microcontrollers, and cloud platforms.
4. Validate various Electrical, Electronic & Mechanical components in the product.
5. Demonstrate the prepared circuit and identify its potential as a market ready product

Course Outcomes: After successful completion of the course, students will be able to:

CO1: Identify real-world engineering problems and apply Electrical & Electronics principles to develop innovative solutions.

CO2: Simulate the Electronic Circuits.

CO3: Select appropriate Electrical & Electronic components for project Development

CO4: Substantiate the product with respect to Electrical, Electronic & Mechanical engineering aspects.

CO5: Present the Prototype in the context of Intellectual Property Rights(IPR).

Course Contents

Module I	Problem Statement Identification	(9 Hours)

Empathize & Define real-world user needs, Literature Survey,Multi- Problem Statement identification, synopsis writing, Finalization of the Problem Statement Learning how to identify real-world user needs, Problem Formulation of Circuit diagram, Study of Components in the circuit diagram using datasheets.

Exemplar/ Practical Applications: smart traffic and parking management system, IoT based Smart Agriculture System

Module II	Project Simulation	(9 Hours)

Introduction to Project Simulation Software: TinkerCAD & Arduino IDE , Using Tinkercad/multisim/Proteus to simulate Electronic Circuits, TinkerCAD libraries: Sensors & Peripherals, Using Arduino IDE to write codes.

Exemplar/ Practical Application: Arduino LCD interfacing simulation , Arduino Automatic Plant Watering System simulation.

Module III	Selection of Embedded Systems & IoT components	(9 Hours)

Finalization of components after successful simulation , System Components: breadboard/PCB, power supply- battery/adapter , Arduino Uno, Displays- 16x2 LCD/ 0.96 inch OLED, Active & Passive Components, Peripherals with their datasheets, Analog & Digital Inputs-Outputs, PWM, motor interfacing, Sensor Interfacing & Data Acquisition.

Exemplar/ Practical Applications: Arduino Uno ,ESP8266 D1 Mini , Resistors, Potentiometers,Capacitors, Diodes, LED, Push Button, BJT, MOSFET, Relay, Buzzer

Module IV	Assembling, Product Testing & Validation	(9 Hours)
Assembling and testing the project as per Electrical and Electronic circuit Diagram, Final Assembly of all Electrical, Electronic and mechanical parts, Safety precaution while project assembly : Safe handling of soldering irons, charged capacitors, handling of high wattage components, Prototype Testing.		
Exemplar/ Practical Applications: NE555 Pulse Generator Adjustable Frequency Module , Assembling of 741 amplifier circuit		
Module V	**Project validation and showcase**	**(9 Hours)**
Project validation Checklist : overall working, safe Power level , Hardware integration, Enclosure compatibility Technical Report Writing , Technical Poster Design , Video Demonstration , Digital Repositories , Presentation Delivery , Technical Publication: IPR filing.		
Exemplar/ Practical Applications: Project posters, Project videos, student's presentations		

Learning Resources

Text Books:

1. B.L. Theraja, A K Theraja "ABC of Electrical Engineering", S Chand Publications
2. Arduino-For-Beginners-REV2
3. Electronic Circuit Basics With Tinkercad: by Alex Reyes
4. Sensors and Transducers by D. Patrnabis, 2nd Edition, PHI
5. "Electronics Devices" Thomas.` L. Floyd, 9th Edition, Pearson

Reference Books:

1. Fundamentals of Electronic Systems Design by Jens Lienig and Hans Bruemmer (Springer)
2. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford University Press, 2nd edition 2018.
3. C. L. Wadhwa, "Basic Electrical Engineering", New Age International (P) Limited 5th edition 2024
4. "Sensors Handbook", by S. Soloman, 2nd Edition.

MOOC/NPTEL/ Youtube Links:

https://nptel.ac.in/courses/108105112 (Fundamentals of Electrical Engineering, IIT Kharagpur)
Electronic Systems Design: Hands-on Circuits and PCB Design with CAD software

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First Year B. Tech (2026 Pattern)

CC192ES: CO-CURRICULAR COURSE-II

Teaching Scheme	Credit	Examination Scheme
EL: 3 Hours/Week	**EL: 1**	**CCE: 50 Marks**

Course Objectives: The Objective of the Course is to:

To promote the holistic development of students by enhancing their physical health, mental well-being, fitness, social responsibility, creativity, cultural awareness, and life skills through participation in co-curricular courses.

Course Outcomes: After completion of course, student will be able to:

Adopt healthy lifestyle for overall personality development through participation in co-curricular activities.

Basket of Co-curricular Courses:

1. Health and Wellness
2. Yoga Education
3. Sports and Fitness
4. Cultural Activities
5. NSS/NCC
6. Fine/ Applied/ Visual/Performing Arts
7. Digital Wellness

Here are some tips and ideas to help you choose the right courses

1. **Consider Your Interests and Hobbies**

Think about what you enjoy doing in your free time or what activities you have always wanted to try. Co-curricular courses can be a great opportunity to pursue passions outside your major.

2. **Explore Different Fields**

Choosing courses from different areas can provide a well-rounded experience. For instance, you might pick one course related to Health, Sports and Community services.

3. **Balance Your Schedule**

Ensure that the co-curricular courses fit well with your academic schedule and personal commitments. Avoid overloading yourself, as these courses should enhance your experience, not add undue stress.

4. **Look at Course Benefits**

Some co-curricular courses offer skills that can be beneficial in your future career or personal development. For example, leadership training, public speaking, or project management.

5. **Consult with Advisors or Seniors**

Talking to academic advisors, professors, or senior students can give you insights into which courses are popular, have good instructors, or offer valuable experiences

Task Force for Curriculum Design and Development

Team Members for Course Design

Sr. No	Name of Faculty	Sr. No	Name of Faculty
1	Dr. Chandraprabha Manjare	2	Prof. Ravindra Yadav
3	Dr. Aishwarya Gawand	4	Prof. Rajkumar Panchal
5	Dr. Sumit Kumar	6	Dr. Dipali Kolhe
7	Prof. Rajiv Mhamane	8	Prof. Sagar Joshi
9	Prof. Bhagyalaxmi Abnave	10	Dr. Manish Gardi
11	Prof. Santosh Kumar Lawate	12	Prof. Saba Karbhari
13	Prof. Rakesh Wakchaure	14	Prof. Abhijeet Kamble

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