AC Item No.- 5.1
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VIDYAVARDHINI'S COLLEGE OF ENGINEERING AND TECHNOLOGY, VASAI-401202

(Autonomous Institute Affiliated to University of Mumbai)

(NAAC & NBA Accredited)

F.Y. B. Tech Curriculum Structure and Syllabus

(NEP 2020 Compliant)

Prepared by: Board of Studies (Department of Mechanical Engineering)

Approved by: Academic Council of VCET, Vasai (W)

(Effective from Academic year 2026-27)

Signed by

Dean Academics **Chairman: Academic**

Council

Contents

Nomenclature

ME: Mechanical Engineering Program

CO: Course Outcome

LO: Lab Outcome

PO: Program Outcome

PSO: Program Specific Outcome

PEO: Program Educational Objectives

BSC: Basic Science Course

BSL: Basic Science Lab

ESC: Engineering Science Course

ESL: Engineering Science Lab

AEC: Ability Enhancement Course

VSEC: Vocational and Skill Enhancement Course

VEC: Value Education Course

LLC: Liberal Learning Course

CC: Co-curricular

PCC: Program Core Course

IAT: Internal Assessment Test

CIAT: Continuous Internal Assessment Theory

CIAL: Continuous Internal Assessment Lab

ESE: End Semester Evaluation

L: Lecture

OR: Oral

PR: Practical

T: Tutorial

IKS: Indian Knowledge System

UHV: Universal Human Values

LM: Learning Methods

Preamble

Vidyavardhini's College of Engineering and Technology (VCET), Vasai, with autonomous status effective from Academic Year 2026–27, offers a forward-looking First Year B.Tech curriculum designed to meet industry standards and national priorities. The autonomy enables the institute to develop a flexible, industry-relevant, and continuously evolving academic framework.

The programme provides a strong foundation in engineering education through core subjects such as Applied Mathematics, Engineering Physics, Engineering Chemistry, Engineering Sciences, and Communication Skills. It aims to develop analytical thinking, problem-solving ability, creativity, and technical competence among learners.

The curriculum is aligned with Outcome-Based Education (OBE), Choice Based Credit System (CBCS), and the National Education Policy (NEP) 2020. It emphasizes multidisciplinary learning, continuous assessment, and learner-centric pedagogy.

To promote holistic development, the curriculum integrates Indian Knowledge Systems (IKS), Liberal Learning, and experiential components. Foundational insights to Programme Core Courses (PCC) and Skill-Based Courses are included to enhance practical understanding and industry readiness from the first year.

The academic structure ensures a balanced credit framework with opportunities for self-learning with co-curricular and extra-curricular engagement. The programme prepares students for higher studies, research, entrepreneurship, and professional careers in a dynamic technological environment.

In accordance with the guidelines for autonomous institutions issued by the All India Council for Technical Education (AICTE) and the University of Mumbai, the curricula for Second, Third, and Final Year B.Tech programmes shall be developed, approved, and implemented in a phased manner in subsequent academic years. These curricula will ensure academic continuity, vertical and horizontal integration, inclusion of emerging technologies, industry relevance, and adherence to Outcome-Based Education principles, subject to approval by the respective Boards of Studies and Academic Council of the Institute.

VCET is committed to nurturing competent, ethical, and socially responsible engineers contributing to national and global development.

F.Y. Syllabus Coordinator

Chairman
Board of Studies, Department of Mechanical Engg.

Vision of The Institute

To be a premier institution of professional education, fostering academic excellence, innovation, and skill enhancement to serve industry and society.

Mission of The Institute

1. To impart quality professional education through effective teaching-learning practices and industry-relevant curricula.
2. To foster research, innovation, and lifelong learning through interdisciplinary learning and modern infrastructure.
3. To strengthen industry collaboration for enhancing employability, entrepreneurship, and experiential learning.
4. To nurture ethical values, professionalism, leadership, and social responsibility for serving industry and society.

Vision of The Department

To be a pre-eminent department for transformation of students in mechanical engineering technically and ethically sound professionals.

Mission of The Department

1. To impart quality education through practical oriented initiatives.
2. To prepare industry ready professionals with ethical and moral values.
3. To promote entrepreneurship by creating various opportunities.

Program Outcomes (PO)

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 analyse 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 the public health and safety, whole -life cost, net zero carbon, culture, society, and environment as required. (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: Analyse 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 Teamwork: 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 and 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)

Program Specific Outcomes (PSO)

The graduates will be able to

1. Graduates will exhibit the ability to analyze and solve problems in Design, Thermal, Manufacturing and Renewable energy domains.
2. Graduates will incorporate technical and professional skills in their career.

Program Educational Objectives (PEO)

1. To facilitate students with modern tools and techniques and make them compatible to solve real Life problems.
2. To impart students with good scientific and technical knowledge to enable them to analyse, design, and create peculiar products to fulfill societal needs.
3. To infuse ethical and moral values, effective leadership skills, and entrepreneurship skills to make students professionally competent.
4. To encourage the students to interact with industry, professional bodies by participating in co-curricular activities.

Knowledge and Attitude Profiles (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: 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: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: 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: 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: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: 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: 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, 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 understanding and respect, and of inclusive attitudes

Sustainable Development Goals (SDG)

First Year B. Tech. Course wise Distribution

COURSE CATEGORY	COURSE TYPE	COURSE NAME	CREDITS
BSC:6(14) Theory	Basic Science Course (BSC)	Linear Algebra & Multivariable Calculus	3
		Engineering Physics	2
		Engineering Chemistry	2
		Applied Mathematics -II	3
		Elective Physics	2
		Elective Chemistry	2
BSL:4(2) Lab	Basic Science Lab (BSL)	Engineering Physics Lab	0.5
		Engineering Chemistry Lab	0.5
		Elective Physics Lab	0.5
		Elective Chemistry Lab	0.5
ESC:2(06)	Engineering Science Course (ESC)	Basic Electrical & Electronics for Computing Systems	3
		Engineering Mechanics	3
ESL:3(03)	Engineering Science Lab (ESL)	Engineering Graphics & Visualization Lab	2
		Basic Electrical & Electronics for Computing Systems Lab	1
		Engineering Mechanics Lab	1
VSEC:4(6)	Vocational and Skill Enhancement Course (VSEC)	Programming in C	2
		Basic Engineering skills & Practices -I	1
		Elective Skill Enhancement	2
		Basic Engineering skills & Practices -II	1
AEC:1(2)	Ability Enhancement Course (AEC)	Professional Communication Skills	2
IKS:1(2)	Indian Knowledge System (IKS)	Indian Knowledge System	2
VEC:1(2)	Value Education Course (VEC)	Universal Values for Personal & Professional Excellence	2
AEL:1(2)	Ability Enhancement Lab (AEL)	Professional Communication Skills Lab	1
PCC:1(3)	Program Core Course (PCC)	Elements of Mechanical Engineering	3
PCL:1(1)	Program Core Lab (PCL)	Elements of Mechanical Engineering Lab	1
LLC: 2(4)	Liberal Learning Course	LLC-I	2
		LLC-II	2
		TOTAL CREDITS	**47**

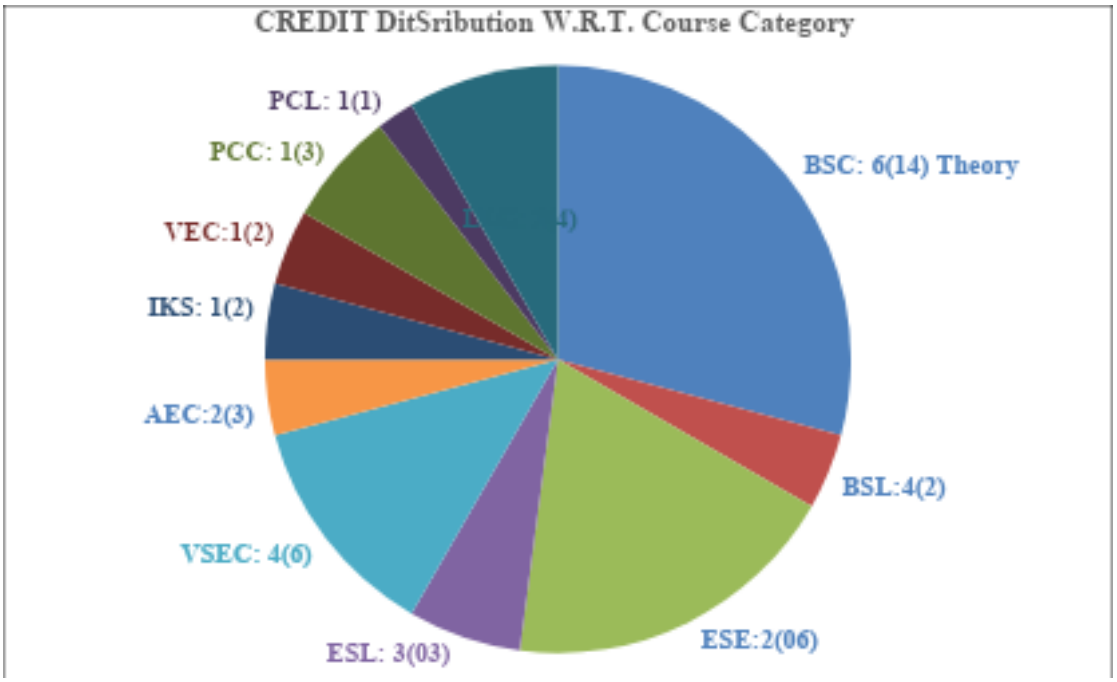

Figure 1: Pie-chart of vertical-wise allocation of credits

The F.Y. B. Tech. Curriculum Structure and Syllabus presented herein has been meticulously developed by the Board of Studies, Department of Mechanical Engineering, Vidyavardhini's College of Engineering and Technology, Vasai, in alignment with the National Education Policy (NEP) 2020. Integrating Outcome-Based Education (OBE) with the Choice Based Credit System, this curriculum is designed to equip first-year engineering students with a strong foundation in technical knowledge, practical skills, and professional values — encompassing Basic Sciences, Engineering Sciences, Indian Knowledge Systems, Value Education, and Liberal Learning, in the true spirit of holistic engineering education. The Board of Studies acknowledges the collective efforts of all faculty members, academic administrators, and stakeholders who contributed to the design and review of this curriculum, and commits to its periodic revision to incorporate emerging trends and advancements in Mechanical Engineering. Effective from the Academic Year 2026–27 and duly approved by the Academic Council of VCET, Vasai (W), this curriculum stands as a testament to the institution's unwavering commitment to nurturing technically proficient, ethically grounded, and socially responsible engineers who will contribute meaningfully to national development and the global engineering community.

Curriculum Structure
First Year B. Tech. (Semester-I)

Course Category	Course Code	Course Title	Teaching Scheme				Credits	Theory Examination Scheme (Marks)			Dur	Laboratory Examination Scheme (Marks)		Total
			Lecture	Tutorial	Practical	Self-Learning		IAT	CIAT	ESE	Hours	CIAL	PR/OR	
BSC	MEBSC101	Linear Algebra & Multivariable Calculus	3	-	-	2	3	20	20	60	2	-	-	100
BSC	MEBSC102	Applied Physics	2	-	-	2	2	10	10	30	1	-	-	50
BSC	MEBSC103	Engineering Chemistry	2	-	-	2	2	10	10	30	1	-	-	50
ESC	MEESC104	Basic Electrical & Electronics Engineering	3	-	-	3	3	20	20	60	2	-	-	100
AEC	MEAEC105	Professional Communication Skills	2	-	-	2	2	20	20	60	2	-	-	100
BSL	MEBSL101	Applied Physics Lab	-	-	1	-	0.5	-	-	-	-	25	-	25
BSL	MEBSL102	Engineering Chemistry Lab	-	-	1	-	0.5	-	-	-	-	25	-	25
ESL	MEESL103	Basic Electrical & Electronics Engineering Lab	-	-	2	-	1	-	-	-	-	25	25	50
AEL	MEAEL104	Professional Communication Skills LAB	-	-	2	-	1	-	-	-	-	25	-	25
ESL	MEESL105	Engineering Graphics & Visualizations Lab	-	-	4	-	2	-	-	-	-	50	50	100
VSEC	MEVSEC106	Programming in C	-	-	2*+2	-	2	-	-	-	-	25	25	50
VSEC	MEVSEC107	Basic Engineering skills & Practices -I	-	-	2	-	1	-	-	-	-	25	-	25
VEC	MEVEC108	Universal Values for Personal & Professional Excellence	2#	-	-	-	2	-	-	-	-	25	-	25
LLC	MELLC109	LLC-I	2#	-	-	-	2	-	-	-	-	25	-	25
		TOTAL	**16**	**-**	**16**	**11**	**24**	**80**	**80**	**240**	**08**	**250**	**100**	**750**

IAT: Internal Assessment Test	ESE: End Semester Evaluation
CIAT: Continuous Internal Assessment Theory	OR: Oral
CIAL: Continuous Internal Assessment Lab	PR: Practical

*Two hours of practical class to be conducted for full class as demo/discussion.
#Course evaluation is activity-based which may be an individual or group of four students

Curriculum Structure
First Year B. Tech. (Semester-II)

Course Category	Course Code	Course Title	Teaching Scheme				Credits	Theory Examination Scheme (Marks)			Dur	Laboratory Examination Scheme (Marks)		Total
			Lecture	Tutorial	Practical	Self-Learning		IAT	CIAT	ESE	Hours	CIAL	PR/OR	
BSC	MEBSC201	Differential Equations & Numerical Analysis	3	-	-	2	3	20	20	60	2	-	-	100
BSC	MEBSC202	Elective Physics	2	-	-	2	2	10	10	30	1	-	-	50
BSC	MEBSC203	Elective Chemistry	2	-	-	2	2	10	10	30	1	-	-	50
ESC	MEESC204	Engineering Mechanics	3	-	-	3	3	20	20	60	2	-	-	100
PCC	MEPCC205	Elements of Mechanical Engineering	3	--	-	3	3	20	20	60	2	-	-	100
BSL	MEBSL201	Elective Physics Lab	-	-	1	-	0.5	-	-	-	-	25		25
BSL	MEBSL202	Elective Chemistry Lab	-	-	1	-	0.5	-	-	-	-	25		25
ESL	MEESL203	Engineering Mechanics Lab	-	-	2	-	1	-	-	-	-	25	25	50
PCL	MEPCL204	Elements of Mechanical Engineering Lab	-	-	2	-	1	-	-	-	-	25	-	25
VSEC	MEVSEC205	Elective Skill Enhancement	-	-	2*+2	-	2	-	-	-	-	25	25	50
VSEC	MEVSEC206	Basic Engineering skills & Practices -II	-	-	2	-	1	-	-	-	-	25		25
IKS	MEIKS207	Indian knowledge system	2#	-	-	-	2	-	-	-	-	25		25
LLC	MELLC208	LLC-II	2	-	-	-	2	-	-	-	-	25		25
			17	**-**	**12**	**12**	**23**	**80**	**80**	**240**	**08**	**200**	**50**	**650**

IAT: Internal Assessment Test
CIAT: Continuous Internal Assessment Theory
CIAL: Continuous Internal Assessment Lab
ESE: End Semester Evaluation
OR: Oral
PR: Practical

*Two hours of practical class to be conducted for full class as demo/discussion.
#Course evaluation is activity-based which may be an individual or group of four students

Elective Physics

MEBSC202X	Elective Physics Theory
MEBSC2021	Physics for Intelligent Systems
MEBSC2022	Physics of Semi-conductors
MEBSC2023	Physics of Measurements and Sensors

MEBSL201X	Elective Physics Lab
MEBSL2011	Physics for Intelligent Systems
MEBSL2012	Physics of Semi-conductors
MEBSL2013	Physics of Measurements and Sensors

Elective Chemistry

MEBSC203X	Elective Chemistry Theory
MEBSC2031	Materials Chemistry
MEBSC2032	Chemistry for Environment and Sustainable Energy

MEBSL202X	Elective Chemistry Lab
MEBSL2021	Materials Chemistry Lab
MEBSL2022	Chemistry for Environment and Sustainable Energy Lab

Elective Skill Enhancement

MEVSEC205X	Elective Skill Enhancement
MEVSEC2051	Python Programming
MEVSEC2052	Object-Oriented Programming with Java
MEVSEC2053	Object-Oriented Programming with C++

Program	F. Y. B. Tech Mechanical Engineering								
Course	Linear Algebra & Multivariable Calculus						Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
MEBSC101	3	L	T	P	CIA (40)		ESE	CIAL	PR/OR
					IAT	CIAT			
		3	--	--	20	20	60	--	--

Course Prerequisites:

Basics Concepts of Matrices and Basics of Differentiation.

Course Objectives:

1. To develop strong foundational mathematical concepts in matrices, partial derivatives and multiple integration that are essential for solving engineering problems.
2. The aim is to equip them with techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power useful in their disciplines.

Course Outcomes:

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

CO1: Compute the rank of Matrix using Echelon form and PAQ form.
CO2: Apply the concept of rank of a matrix to solve system of linear equations arising in Mechanical and Civil Engineering.
CO3: Apply the concepts of Eigen Values and Eigen vectors to diagonalize the given matrix.
CO4: Determine the partial derivative of functions of Two & Three variables.
CO5: Determine extreme values of the function of two variables using Partial Differentiation.
CO6: Apply double and triple integration techniques to evaluate integrals over plane regions and surfaces.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Matrices** Types of Matrices (Hermitian, Skew Hermitian, Unitary, properties of Matrices (proofs not expected). The rank of a Matrix using Echelon form, Reduction to normal form, PAQ form. **Self-Learning:** Linear Dependence and Independence of vectors.	6	1
2	**Solutions of System of Linear Equations** System of homogeneous and non-homogeneous equations, their consistency, and solutions **Self-Learning:** Applications of System of Equations to Mechanical/Civil Engineering	6	2
3	**Eigen Values and Eigen Vectors** Characteristic equation, Eigen values and Eigen vectors, Example based on properties of Eigen values and Eigen vectors. (proofs not expected). Cayley-Hamilton theorem (without proof): Application to find the inverse of the given square matrix and to determine the given higher degree polynomial matrix.Similarity of matrices, Diagonalization of matrices. **Self-Learning:** Derogatory and Non-derogatory matrices, Function of Square matrix	7	3

4	**Partial Differentiation** Partial Differentiation: Function of two and three variables, Partial derivatives of first and higher order. Partial Differentiation of composite function. Euler's Theorem for Homogeneous functions with 2 independent variables. **Self-Learning:** Euler's Theorem for Homogeneous functions with 3 independent variables.	6	4
5	**Applications of Partial Differentiation** Applications of Partial Differentiation to find maxima and minima of a function of two independent variables, Lagrange's method of undetermined multiplier. **Self-Learning:** Optimisation in Mechanical engineering using partial differentiation.	6	5
6	**Double and Triple Integration** Introduction to basic curves (Straight lines, parabola, circle, cardioide). Double integration-definition, Evaluation of Double Integrals. Change the order of integration. (No Evaluation) , Evaluation of double integrals by changing to polar coordinates, Triple integration definition and evaluation in Cartesian coordinates, Triple integration evaluation in cylindrical and spherical polar coordinates. **Self-Learning:** Application of double integration to find Area, Mass of a Lamina and Application of Triple integration to find the Volume.	8	6

Learning Resources

Textbooks:

1. H.K Dass, "Advanced Engineering Mathematics, India, S. Chand Publications, 2025
2. B.S. Grewal, " Higher Engineering Mathematics", Khanna Publication, 2024

Reference Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, Inc, 2025
2. B.V Ramana, Higher Engineering Mathematics, India, Tata McGraw Hill, 2010
3. R.K.Jain and S.R.K.lyengar "Advanced Engineering Mathematics", Alpha science International Ltd., 2014

Online Resources

1. Engineering Mathematics-I, Prof. Jitendra Kumar, IIT Kharagpur, NPTEL IIT Karagpur https://onlinecourses.nptel.ac.in/noc25_ma79/preview

List of Assignments: Serial No.1 and 2 are compulsory. Any 6 Assignments from serial No.3 to 12.

Sr. No.	Name of the Assignment	Hours	CO Mapping
1	Activity-I ("Revision of Prerequisites for the course".)	1	
2	Activity-II ("Explore the math toolbox: Desmos, Geogebra")	1	
3	Types of Matrices and Rank of a Matrix	1	1
4	System of Homogeneous and non-homogeneous Linear Equation	1	2
5	Eigen Values and Eigen Vectors and Daigonalization	1	3
6	Application of Matrices	1	1,2,3
7	Partial Derivative and Composite Functions	1	4
8	Applications to find Maxima and Minima	1	5

9	Basic curves (Straight lines, parabola, circle, cardioide).	1	6
10	Evaluation of Double Integration, Change of Order and Change to Polar Co-ordinates	1	6
11	Triple Integration in Cartesian, Cylindrical and Spherical Co-ordinates	1	6
12	Applications of Double and Triple Integration	1	6

Sr No	List of Scilab Practical	Hrs
01	Rank of matrix	**04**
02	Eigen Values and Eigen Vectors	
03	Maxima and Minima	
04	Tracing of Curves	

Assessment:

Internal Assessment Test (IAT) for 20 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. Average of both the tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 20 Marks:

- A total of three CIA components (such as assignments, quizzes, presentations, case studies, etc.) shall be conducted.
- Each component will carry 5 marks, totaling 15 marks.
- Attendance will carry 5 marks.

End Semester Theory Examination (ESE) 60 marks:

Question paper format

Time duration for 60 marks paper is 2 hours

a. The question paper shall consist of six questions, carrying 10 marks each.
   i. Question No. 1 shall be set from CO1.
   ii. Question No. 2 shall be set from CO2.
   iii. Question No. 3 shall be set from CO3.
   iv. Question No. 4 shall be set from CO4.
   v. Question No. 5 shall be set from CO5.
   vi. Question No. 6 shall be set from CO6.

b. Each question shall have two options – Option A and Option B, and both options must be set from the same module.

c. The options should be of comparable difficulty level and should test similar learning outcomes.

d. Internal choice may be provided within each question, ensuring both options cover the same module.

e. Students will attempt all questions.

CO-PO-PSO Mapping (Linear Algebra & Multivariable Calculus)

Course Outcomes (CO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	2	-	2	-	2	2	-
CO2	3	2	-	-	2	-	2	-	2	-	2	2	-
CO3	3	3	-	-	-	-	2	-	2	-	2	-	-
CO4	2	2	-	-	-	-	-	-	2	-	-	2	-
CO5	2	2	-	-	-	-	-	-	2	-	-	-	-
CO6	3	2	-	-	2	-	-	-	2	-	-	-	-

Program	F. Y. B. Tech Mechanical Engineering							
Course	Applied Physics						Semester	I
Code	Credits	Teaching Scheme (Hrs./Week)			Theory Examination Scheme		Laboratory Examination Scheme	
MEBSC102	2	L	T	P	CIA (20)	ESE	CIAL	PR/OR
					IAT / CIAT			
		2	--	--	10 / 10	30	--	--

Course Prerequisites:
Basic knowledge of optics and atomic structure, Refractive index of a material, Snell's law, Dual nature of radiation, Photoelectric effect, Matter waves, Davisson-Germer experiment, Gauss's law, Faraday's law, Basics of vector algebra, partial differentiation concepts.

Course Objectives:
1. To provide a basic understanding of laser operation, fiber optics, and their applications.
2. To build the foundation of quantum physics in computing contexts.
3. To describe the significance of Maxwell's equations in wireless communication systems.

Course Outcomes:
After successful completion of the course, the learner will be able to:
CO1: **Illustrate** the working of laser action in a He-Ne laser and the principles of fiber optics.
CO2: **Compare** classical and quantum computing with reference to qubits, superposition, and entanglement.
CO3: **Apply** Maxwell's equations and electromagnetic wave principles in wireless communication.

Syllabus

Unit No.	Description	Hr.	CO Mapping
1	**Optical Communication:** **Laser:** Introduction to Laser, Characteristics of Laser, Spontaneous Emission and Stimulated Emission, Metastable State, Population Inversion, Resonant Cavity, Coherence Length and Coherence Time, Types of Pumping, Helium-Neon Laser. **Fiber Optics:** Total internal reflection and propagation of light, Critical angle, acceptance angle, acceptance cone, numerical aperture, Types of optical fibers: Single mode & multimode, step index & graded index, V-number and number of modes, Attenuation, attenuation coefficient. **Self-Learning:** Applications of Lasers Fiber optics communication system.	8	1
2	**Quantum Physics:** De Broglie hypothesis of matter waves, de Broglie wavelength for electron, Properties of matter waves, Wave function and probability density, mathematical conditions for wave function, problems on de Broglie wavelength, Schrödinger's time-dependent and time-independent equations (qualitative), Quantum tunneling, Fundamentals of quantum computing: concept of Qubit, Quantum Superposition theorem, Quantum Entanglement theorem. **Self-Learning:** Difference between classical computing and quantum computing	8	2

3	**Electromagnetic field & Wireless Communication:** **Electromagnetic field** Scalar and Vector fields, Physical significance of Gradient, curl and divergence, Divergence theorem, Stokes theorem. Maxwell's equations in point form, Integral form, and their Significance (Cartesian coordinates only). **Wireless communication**: Frequency ranges in the electromagnetic spectrum: classification, basics of antenna and wireless communication **Self-Learning:** Role of the electromagnetic spectrum in wireless communication.	8	3

Learning Resources

Textbooks:

1. M. N. Avadhanulu, P. G. Kshirsagar & Arun Murthy, A Textbook of Engineering Physics, S. Chand Publication.
2. D. K. Bhattacharya & Poonam Tandon, Engineering Physics.
3. R. K. Gaur and S. L. Gupta, Engineering Physics, Dhanpat Rai Publications.

Reference Books:

1. Ghatak and Thyagarajan, Lasers: Fundamentals and Applications, Springer.
2. A. K. Ghatak, S. Lokanathan, Quantum Mechanics, Laxmi Publications.
3. D. J. Griffiths, Introduction to Electrodynamics, Pearson Publication.

Online Resources:

1. Quantum Mechanics Lecture Series by Prof. H. C. Verma: https://www.youtube.com/playlist?list=PLWweJWdB_GuISnGkAafMpzzDBvTHg02At

Assessment:

Internal Assessment Test (IAT) for 10 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. The average of both the tests will be considered.

Continuous Internal Assessment-Theory (CIAT) for 10 Marks:

1. A total of minimum 2 CIA components (such as assignments, quizzes, presentations, etc.) shall be conducted.
2. Each component will carry 5 marks.

End Semester Theory Examination (ESE) 30 marks:

Question paper format

Time duration for 30 marks paper is 1hour

- Question paper will consist of three compulsory questions, given as below:
  - i. Question No. 1 shall be set from CO1
  - ii. Question No. 2 shall be set from CO2
  - iii. Question No. 3 shall be set from CO3
- Each question shall carry approximately 10 marks.

- Each question may have sub-questions, ensuring coverage of the respective module/COs.
- The questions should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within sub-questions, ensuring both options are from the same module.
- Students will attempt all questions

CO-PO-PSO Mapping (Applied Physics)													
Course Outcomes (CO)	Program Outcomes (PO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PS O2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	-	-	-	-	2	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	2	2	-	2	2	-

Program	F. Y. B. Tech Mechanical Engineering							
Course	Applied Physics Lab						Semester	I
Code	Credits	Teaching Scheme (Hrs./Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
MEBSL101	0.5	--	-	1	--	--	--	25	--

Lab Objectives:

- To study the application of lasers and calculate optical properties like numerical aperture.
- To study the behavior of a particle due to the tunnelling effect.
- To learn and use virtual labs and simulation tools for experiments.

Lab Outcomes:

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

LO1: Determine the wavelength of a He-Ne Laser source.
LO2: **Demonstrate** the beam divergence of the laser beam.
LO3: Determine acceptance angle by measuring numerical aperture of an optical fiber**.**
LO4: Determine the attenuation coefficient of an optical fiber.
LO5: **Determine** Planck's constant 'h' using different LEDs.
LO6: **Demonstrate** a magnetic field with distance along the axis of a current-carrying circular coil.

Lab Prerequisite:

- Fundamentals of optics, including reflection, refraction, interference, and diffraction.
- Basic principles of laser and fiber optics, quantum physics.
- Knowledge of graph plotting, data evaluation, and result interpretation.
- Basic computer operation skills.

List of laboratory experiments: (*Any six experiments)*

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Determination of wavelength using a Laser source.	1	1
2	Study of divergence of Laser beam.	1	2
3	Determination of numerical aperture of an optical fiber.	1	3
4	Measuring optical power attenuation in optical fiber.	1	4
5	Determination of 'h' using different LEDs.	1	5
6	Study quantum tunnelling through a potential barrier (simulation)	1	-
7	To study the variation of the magnetic field with distance along the axis of a circular coil carrying current (simulation).	1	6
8	Study of behaviour of particle trapped in a potential well.	1	-

Mini Project:

Project work will be extended to semester II as well. In semester I, a group of 5-6 students will be formed; a domain may be provided by faculty, and the group will frame a problem statement in consultation with faculty. A PPT presentation with problem statement, preliminary literature survey, execution plan and a probable outcome is to be considered for awarding marks.

Assessment:

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 5 to 6 practical based on the above list.
CIAL Marks: 25 Marks (Total marks) = 10 Marks (Average marks of Experiments) +10 Marks (Mini project work) + 5 Marks (Attendance)

LO-PO-PSO Mapping (Applied Physics Lab)													
Lab Outcomes (LO)	Program Outcomes (PO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
LO1	3	-	-	-	-	-	-	2	2	-	-	2	-
LO2	3	-	-	-	-	-	-	2	2	-	-	2	-
LO3	3	-	-	-	-	-	-	2	2	-	-	2	-
LO4	3	-	-	-	-	-	-	2	2	-	-	2	-
LO5	3	-	-	-	-	-	-	2	2	-	-	2	-
LO6	2	-	-	-	-	-	-	2	2	-	-	2	-

Program	F. Y. B. Tech Mechanical Engineering							
Course	Engineering Chemistry						Semester	I
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme
MEBSC103	2	L	T	P	CIA (20)		ESE	CIAL	PR/OR
					IAT	CIAT			
		2	--	--	10	10	30	--	--

Course Prerequisites:

Basic understanding of General Chemistry, including chemical bonding, reactions, and properties of matter, Fundamental knowledge of polymers and materials (basic idea of plastics, rubber, and metals) , Familiarity with corrosion concepts and simple electrochemical processes, knowledge of fuels and energy concepts (types of fuels, heat, and combustion basics)

Course Objectives:

1. To understand the characteristics of good fuel and performance of liquid fuels (petrol) including knocking, octane and cetane numbers, and emission control techniques.
2. To introduce important properties of polymers and to understand the occurrence and impact of corrosion in electronic devices and its practical implications.
3. To study the importance of Green Chemistry by comparative study of conventional and green routes of syntheses, solvents and fuels.

Course Outcomes:

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

CO1: Calculate the quantity of oxygen and air required for combustion of fuel based on its composition

CO2: Apply suitable polymeric materials for specific engineering applications based on their properties and corrosion behavior.

CO3: Apply the principles of green chemistry to study environmental impact for sustainable development.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Fuel and Combustion** Fuel: classification and characteristics of good fuel Calorific Value: Definition, types, determination, Dulong's formula with numerical Solid Fuels (Coal) : Proximate analysis, ultimate analysis with numerical Liquid Fuels (Petrol): Knocking; Octane number; Cetane number; Antiknocking agents; Unleaded petrol; Oxygenates (MTBE); Catalytic converter. Combustion**:** Calculations for the requirement of oxygen and air (by weight and by volume only) for given solid and gaseous fuels. Hydrogen fuel cell **Self-Learning :** Mining and refining of petroleum	8	1
2	**Polymer Science and Corrosion Control** **Polymer Science** Introduction: Properties of polymers; Molecular weight (Number average & Weight average) with numerical Glass transition temperature; Viscoelasticity &Conducting polymers Biodegradable(bio-polymers) – PLA, PGA, PCL, Applications and environmental impact **Corrosion Control**	8	2

	Introduction: Definition, Types and factors affecting rate of corrosion Methods to control corrosion: i) Selection & Proper designing ii) Cathodic protection iii) Metallic coating Corrosion in electronic devices – Causes, Effects and Prevention (Printed Circuit Boards (PCBs), Solder joints. **Self-Learning :** Classification of Polymers and galvanic cell.		
3	**Green Chemistry for Sustainable Development** Introduction: Definition; Atom economy with numerical Comparative study of synthesis (conventional and green route) of: (i) Indigo dye (ii) Adipic acid (iii) Carbaryl Green solvents: Characteristics and applications of supercritical solvents and ionic liquids Green fuels: Synthesis and advantages of: (i) Biodiesel (ii) Ethanol **Self-Learning:** Principles of Green Chemistry	8	3

Learning Resources

Text Books:

- A Textbook of Engineering Chemistry - Jain & Jain, Dhanpat Rai, 17th Edition 2021-22.
- A Textbook of Engineering Chemistry – Dara & Dara, S Chand, 1st Edition, reprint 2016.
- A Text Book of Engineering Chemistry – Shashi Chawla, Dhanpat Rai, 4th Edition, 2016-17.

Reference Books:

1. Wiley Engineering Chemistry, Wiley India, Wiley India Pvt. Ltd. New Delhi, 2nd Edition 2013.
2. Polymer Science by V. R. Gowariker, N.V. Viswanatha & J. Sreedhar, Wiley-Eastern Ltd, 4th Edition 2021.
3. Green Chemistry: V. K. Ahluwalia, Narosa publishing house

Online Resources

- Introduction to Polymer Science, IIT Kharagpur : https://nptel.ac.in/courses/104105124
- Corrosion - Part I By Prof. Kallol Mondal|IIT Kanpur : https://onlinecourses.nptel.ac.in/noc22_mm17/preview
- Fundamentals of Combustion By Prof. V. Raghavan | IIT Madras : https://onlinecourses.nptel.ac.in/noc21_me47/preview

Assessment:

Internal Assessment Test (IAT) for 10 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. Average of both the tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 10 Marks:

- A total of minimum 2 CIA components (such as assignments, quizzes, presentations etc.) shall be conducted.
- Each component carries 5 marks,

End Semester Theory Examination (ESE) 30 marks:

Question paper format

- Time duration for 30 marks paper is 1hours
- Question paper will consist of three compulsory questions, given as below:
  i. Question No. 1 shall be set from CO1
  ii. Question No. 2 shall be set from CO2
  iii. Question No. 3 shall be set from CO3
- Each question shall carry approximately 10 marks.
- Each question may have sub-topics, ensuring coverage of the respective module/COs.
- The questions should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within sub-topics, ensuring both options are from the same module.
- Students will attempt all questions

CO-PO-PSO Mapping (Engineering Chemistry)

Course Outcomes (CO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	2	-	2	-	-	2	2	-
CO2	3	2	-	-	-		-	-	2	-	-	-	-
CO3	2	-	-	-	-	2	-	-	-	-	-	-	-

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Engineering Chemistry Lab					Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme		Laboratory Examination Scheme	
		L	T	P	CIA (IAT / CIAT)	ESE	CIAL	OR
MEBSL102	0.5	--	--	1	-- / --	--	25	--

Lab Objectives:

1. To understand and perform quantitative chemical analysis using methods such as Kjeldahl Method, titration, and colorimetry
2. To understand the working principles of laboratory instruments and their calibration
3. To gain hands-on experience with analytical instruments like Flame Photometry

Lab Outcomes:

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

LO1: Apply quantitative analytical techniques to determine moisture, ash, Nitrogen & flash point of fuel.
LO2: Interpret effect of corrosion of metals in acidic medium.
LO3: Demonstrate Synthesis of bioplastic at laboratory level using corn starch (banana and potato).
LO4: Demonstrate volumetric techniques to determine % of Zn and Fe from alloy.
LO5: Apply quantitative analytical techniques to determine Na/K & concentration of $KMnO_4$ in given solution.

Lab Prerequisite:

1. Knowledge of basic safety practices in the Chemistry Laboratory.
2. Knowledge of volumetric analysis

List of laboratory experiments: (*Any Ten Experiments)*

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Determination of Flash point of oil using Pensky-Martens apparatus	1	1
2	Determination of nitrogen by Kjeldahl's method	1	1
3	Determination of moisture content of coal	1	1
4	Determination of ash content of coal	1	1
5	To study rate of corrosion of metals in acidic medium	1	2
6	Synthesis of Bioplastics from corn starch (banana and potato).	1	3
7	Estimation of Zinc in Brass alloy	1	4
8	Estimation of Fe in Steel	1	4
9	To determine the concentration of given sample of $KMnO_4$ by colorimetric method	1	5
10	Determination of Na/K by Flame photometry	1	5

Sr No	List of Assignments	Hrs
01	Numerical based on calorific value determination and proximate analysis of coal	**01**
02	Numerical based on ultimate analysis of coal	**01**
03	Electrochemical corrosion in different medium.	**01**
04	Numerical based on average molecular weight of polymers	**01**

Assessment:

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 5 to 6 practicals based on the above list. Also, CIAL Journal must include at least 2 assignments.

CIAL Marks: 25 Marks (Total marks) = 15 Marks (Average marks of Experiments) +5 Marks (At least 2 LMs of 5 marks each) + 5 Marks Attendance

LO-PO-PSO Mapping (Engineering Chemistry Lab)

Lab Outcomes (LO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
LO1	3	-	-	-	-	3	-	2	2	-	2	2	-
LO2	3	-	-	-	-	-	-	2	3	-	3	-	-
LO3	2	-	-	-	-	3	-	2	2	-	2	-	-
LO4	3	-	-	-	-	-	-	3	2	-	2	-	-
LO5	3	-	-	-	-	-	-	2	2	-	2	-	-

Program	F. Y. B. Tech . Mechanical Engineering								
Course	Basic Electrical & Electronics for Engineering						Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
MEESC104	3	L	T	P	CIA (40)		ESE	CIAL	PR/OR
					IAT	CIAT			
		3	--	--	20	20	60	--	--

Resistance, inductance, capacitance, series and parallel connections of resistance, concepts of voltage, current, power, and energy, and their units.

1. To provide knowledge on the fundamentals of DC circuits
2. To provide knowledge of single-phase and three-phase AC circuits.
3. To inculcate fundamental knowledge of the 1-Φ transformer.
4. To provide basic knowledge on the fundamentals of machines.
5. To provide knowledge of semiconductor diodes & Transistors.
6. To provide knowledge of Battery Energy Storage Systems.

Course Outcomes:

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

CO1: Apply various network theorems to determine the circuit response/behavior
CO2: Illustrate the working principle of 1-Φ and 3-Φ AC circuits.
CO3: Illustrate the construction, operation, and applications of 1-Φ transformers.
CO4: Explain the working principle of Motors.
CO5: Describe the construction, operation, and applications of semiconductor diodes & Transistors
CO6: Explain the concepts of battery energy storage systems and their applications.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**DC Circuits** (Only independent sources) Kirchhoff's Laws, Ideal and Practical Voltage and Current Sources, Source Transformation, Mesh and Nodal Analysis, Star-Delta / Delta-Star Transformations, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, and Maximum Power Transfer Theorem **Self-Learning**:Millman's Theorem to solve DC circuits.	7	CO1
2	**AC Circuits** Generation of alternating voltage, average and RMS values, phase angle and phase difference, Single-phase ac series circuits, consisting of R, L, C, RL, RC, RLC combinations, definitions - real, reactive, and apparent power, admittance (Y), Series resonance. **Generation of Three-Phase** Voltage & current relationships in Star and Delta Connections, Phasor Diagram & Power Measurement. **Self-Learning**:Parallel AC circuits.Parallel resonance	7	CO2
3	**Magnetic Circuits** Flux Density, Flux Linkage, Magnetic circuit & airgap, Self & Mutual Inductance, Transformer: Working principle of single-phase transformer, types of single-phase transformer, transformation ratio, ideal and practical transformer, Transformer losses, efficiency. **Self-Learning**:Types and applications of transformers used in power distribution.	6	CO3

4	**Motors** Construction, working, characteristics, and application of DC machines, Single-phase Induction Motor, Brushless DC motor, Stepper motor. Factors in the selection of the motor and its rating. **Self-Learning**: Hub motor: construction, working principle, and applications	**6**	**CO4**
5	**Semiconductor diode** Basics of PN Diode,Characteristics and operation of Zener Diode and application as a voltage regulator. Construction of an LED. LED applications in indicative and lighting displays. **Transistors:** Introduction to Transistors: structure and operation of BJT. BJT configurations (only common emitter). Application of BJT in amplification and switching. **Self-Learning**: Application of BJT in oscillators	**07**	**CO5**
6	**Introduction to Battery Energy Storage Systems and Application in EV** Types of storage battery (Lead Acid, Lithium Battery, etc.), Charging & Discharging of a cell, SoC (State of Charge), Capacity of the Cell, Depth of Discharge (DOD), Efficiency. Rechargeable batteries, Applications of batteries. Introduction to UPS and SMPS. **Self-Learning**: Introduction to EV (Electric vehicle) and its types, EV components	**06**	**CO6**

Learning Resources

Text Books:

1. V. N. Mittal and Arvind Mittal, “Basic Electrical Engineering,” Tata McGraw-Hill, (Revised Edition)
2. D P Kothari and I J Nagrath “Theory and Problems of Basic Electrical Engineering”, PHI, 13th edition 2011.
3. B.R Patil, “Basic Electrical Engineering,” Oxford Higher Education,
4. Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky
5. C. L. Wadhwa, “Electric Power Systems,” New Age International Publishers,
6. C.C. Chan and K.T. Chau, “Modern Electric Vehicle Technology,” Oxford University Press.

Reference Books:

1. B.L. Theraja “Electrical Engineering “Vol. I and II
2. S.N. Singh, “Basic Electrical Engineering” PHI, 2011Book
3. V. K. Mehta, “Basic Electrical Engineering”, S. Chand and Company Ltd., New Delhi.
4. Edward Hughes, “Hughes Electrical and Electronic Technology”, Pearson Education (Tenth edition)
5. Iqbal Husain, “Electric and Hybrid Vehicles: Design Fundamentals,” CRC Press, Second Edition

Online Resources

Fundamentals of Electrical Engineering, Prof. Debpriya Das, IIT Kharagpur, NPTEL IIT Kharagpur, https://nptel.ac.in/courses/108105112

Assessment:

Internal Assessment Test (IAT) for 20 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I, and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. The average of both tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 20 Marks:

- A total of three CIA components (such as assignments, quizzes, presentations, case studies, etc.) shall be conducted.
- Each component will carry 5 marks, adding up to 15 marks.

- Attendance will carry 5 marks.

End Semester Theory Examination (ESE) 60 marks:

Question paper format
Time duration for 60 marks paper is 2 hours
a. The question paper shall consist of six questions, carrying 10 marks each.
i. Question No. 1 shall be set from CO1.
ii. Question No. 2 shall be set from CO2.
iii. Question No. 3 shall be set from CO3.
iv. Question No. 4 shall be set from CO4.
v. Question No. 5 shall be set from CO5.
vi. Question No. 6 shall be set from CO6.
b. Each question shall have two options – Option A and Option B, and both options must be set from the same module.
c. The options should be of comparable difficulty level and should test similar learning outcomes.
d. Internal choice may be provided within each question, ensuring both options cover the same module.
e. Students will attempt all questions.

CO-PO-PSO Mapping (Basic Electrical & Electronics for Engineering)													
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	2	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-
CO6	2	-	-	-	-	2	-	-	-	-	2	2	-

Program	F. Y. B. Tech . Mechanical Engineering							
Course	Basic Electrical & Electronics for Engineering Lab					Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme		Laboratory Examination Scheme	
MEESL103	1	L	T	P	CIA	ESE	CIAL	OR
					IAT CIAT			
		--	--	2	-- --	--	25	25

Lab Objectives:

1. To impart the basic concept of network analysis and its application.
2. To provide the basic concept of AC circuit analysis and its application.
3. To provide an understanding of the operation of the transformer.
4. To study the operation of machines.
5. To explain the diode & Transistors
6. To study the battery energy storage system

Lab Outcomes:

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

LO1: Show the behavior of DC circuits using network theorems
LO2: Demonstrate experiments on single-phase and three-phase AC circuits
LO3: Illustrate the performance of a single-phase transformer
LO4: Demonstrate the performance of Motors
LO5: Implement an experiment on a VI characteristic of semiconductor diodes and Transistors
LO6: Demonstrate the performance of battery energy storage systems

Lab Prerequisite:

Students should have a basic understanding of electrical circuit fundamentals, including voltage, current, resistance, and simple circuit laws (Ohm's Law, KCL, KVL). Familiarity with basic electrical measuring instruments (multimeter, ammeter, voltmeter) and laboratory safety practices is essential.

List of laboratory experiments: (*Any Ten Experiments)*

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Basic safety precautions. Introduction to and use of measuring instruments: voltmeter, ammeter, multimeter, oscilloscope. Real- life resistors, capacitors, and inductors	02	LO1
2	To measure the output voltage across the load resistor/current through the load resistor, and verify the result using Mesh and Nodal analysis	02	LO1
3	Verification of the Superposition Theorem.	02	LO1
4	Verification of Thevenin's and Norton's theorems	02	LO1
5	Verification of the Maximum Power Transfer Theorem.	02	LO2
6	To find the resistance and inductance of a coil connected in series with a pure resistance using the voltmeter method	02	LO2
7	To measure the relationship between phase and line, currents and voltages in a three-phase system (star & delta)	02	LO3
8	To demonstrate cut-out sections of the single-phase transformer.	02	LO3
9	To demonstrate the working of the motor/Machines	02	LO4
10	Study of a single-phase induction motor	02	LO4
11	To plot Zener diode voltage regulation characteristics	02	LO4
12	To demonstrate the application of LED in an indicative and lighting display	02	LO5
13	To demonstrate the application of a BJT as a switch	02	LO5
14	Study of Different Types of Batteries	02	LO6
15	Measurement of Battery Voltage and Current under Different Load Conditions	02	LO6

Sr No	List of Assignments	Hrs	LO Mapping
01	Assignment on Basic Electrical Safety Practices	02	LO1
02	Numerical assignment on Mesh analysis and nodal analysis		LO2
03	Numerical assignment on Thevenin, Norton, and the maximum power transfer theorem		LO3
04	Numerical assignment on series and parallel circuits		LO4
05	Assignment on single-phase transformer		LO4
06	Assignment on motors/machines		LO5
07	Assignment on Diodes, BJT, and FET		LO5
08	Assignment on Battery Energy Storage System		LO6

Assessment :

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 8 practicals based on the above list. Also, the CIAL Journal must include at least 3 assignments.
CIAL Marks: 25 Marks (Total marks) = 15 Marks (Average marks of Experiments) +10 Marks (At least 2 LMs of 5 marks each)

LO-PO-PSO Mapping (Basic Electrical & Electronics Engineering Lab)													
Lab Outcomes (LO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
LO1	3	-	-	-	-	-	-	2	2	-	-	-	-
LO2	3	-	-	-	-	-	-	2	2	-	-	-	-
LO3	2	-	-	-	-	-	-	2	2	-	-	-	-
LO4	2	-	-	-	-	-	-	2	2	-	-	2	-
LO5	3	-	-	-	-	-	-	2	2	-	2	-	-
LO6	2	-	-	-	-	-	-	2	2	-	2	2	-

Program	F. Y. B. Tech Mechanical Engineering								
Course	Professional Communication Skills						Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
MEAEC105	2	L	T	P	CIA (40)		ESE	CIAL	PR/OR
					IAT	CIAT			
		2	-	--	20	20	60	--	--

Course Prerequisites:

Ability to comprehend and construct grammatically correct sentences, Familiarity with general and workplace-related vocabulary, Basic fluency and clarity in verbal expression.

Course Objectives:

1. To practice the fundamentals, processes, methods, and strategies for overcoming communication barriers in organizational contexts.
2. To enhance listening skills for comprehending, interpreting, and analyzing oral communication in diverse contexts.
3. To develop effective speaking and presentation skills using appropriate content organization, delivery techniques, and digital tools.
4. To strengthen reading skills by developing strategies for comprehending, summarizing, and evaluating technical and non-technical texts.
5. To develop students' ability to use principles of professional correspondence and appropriate language in drafting formal letters, emails, and technical documents.
6. To cultivate professional etiquette, ethical principles, and integrity for responsible conduct in academic and professional contexts.

Course Outcomes:

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

CO1: Apply the fundamentals, processes, methods, and strategies to overcome barriers of communication in organizational contexts.

CO2: Illustrate active listening skills by comprehending, analyzing and responding appropriately to oral communication in different communicative contexts.

CO3: Demonstrate structured speeches and presentations using effective content organization, speaking skills, and digital tools.

CO4: Apply effective reading strategies to comprehend, summarize and evaluate technical and non-technical texts.

CO5: Use the principles of professional correspondence and appropriate language while drafting formal letters, emails, and technical documents.

CO6: Apply professional etiquette, ethical principles and integrity in professional contexts.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Fundamentals of Communication** **Basic Concepts & Process of Communication:** Definition, Objectives, Postulates; Stimulus, Sender, Encoding, Message, Medium, Channel, Receiver, Decoding, Feedback **Methods of Communication:** Verbal (Written and Spoken). Non-verbal cues are perceived through the five senses (Visual, Auditory, Tactile, Olfactory, Gustatory), Non-verbal cues transmitted through the body, voice, space, time, silence. **Barriers to Communication:** Mechanical, Physical, Semantic and Linguistic, Psychological, Socio-cultural **Organization Communication:** Formal (Upward, Downward,	6	1

	Horizontal), Informal (Grapevine) **Self-Learning:** Channels of Organizational Communication		
2	**Developing Basic Listening & Speaking Skills** **Basic Listening Skills:** Importance & Types of Listening; Barriers to effective listening and strategies for improvement; Listening for Details, Gist and Inference; Listening to Diverse Spoken Texts; Note-taking, Interpretation, Summarization and Application **Basic Speaking Skills:** Fundamentals of Spoken Communication; Speaking Skills: Intonation, Pace, Energy level, etc.; Monologues: Self-introduction, Impromptu Speeches, etc.; Dialogues: Situational Interactions, Role Plays, etc.; Professional Presentation Techniques: Purpose, Audience, and Venue Analysis, Content Organization, Effective Delivery, Clear and Concise Language, and Appropriate Use of Digital Tools. **Self-Learning Topics:** Listening for Gist, Details & Inference	7	2, 3
3	**Developing Basic Reading & Writing Skills** **Basic Reading Skills:** Importance and Types of Reading (Intensive and Extensive Reading); Reading Techniques: Skimming, Scanning, and the SQ5R Method; Functional Grammar and Verbal Aptitude; Summarisation Skills: Converting Text to Graphic Organisers and Vice Versa, Summarising in Point Form, and Identifying the Central Idea in One Sentence. **Basic Writing Skills:** Paragraph Organization: Topic Sentence, Supporting Ideas, and Concluding Sentence; Coherence and Cohesion: Logical Organization, Referencing, Repetition, Substitution, Ellipsis, and Transition Signals; Seven Cs of Business Writing; Professional Writing: Complete Block Letter Format; Types of Formal Letters: Request, Permission, Claim, Adjustment, and Sales Letters; Email Writing; User Instructions and Special Notices. **Self-Learning:** Skimming and Scanning	7	4, 5
4	**Professional Skills** **Goal Setting:** SMART Goal Setting, Planning and Prioritization, and Digital Portfolio Development. **Professional Etiquette:** Professional Behaviour, Workplace Etiquette, Formal Dressing and Dining Etiquette, Cell Phone and Cubicle Etiquette; Empathy, Respect and Courtesy, Accountability, Acceptance of Constructive Criticism, Responsible Use of Social Media, Flexibility, Teamwork, and Cooperation. **Professional Ethics:** Core Ethical Values and Principles, Ethical Use of AI Tools, Plagiarism, Copyright and Academic Integrity, Ethical Dilemmas, and Case Studies. **Self-Learning Topics:** Responsible Use of AI & Academic Integrity	6	6
Learning Resources			

Textbooks:

1. Raman, M. & Sharma, S. (2017). *Communication Skills*. Oxford University Press.
2. Raman, M. & Sharma, S. (2022). *Technical Communication: Principles and Practice* (4th ed.). Oxford University Press.
3. Kumar, S. & Lata, P. (2024). *Communication Skills.* (3rd ed.). New Delhi: Oxford University Press.
4. Sharma, R. C., & Mohan, K. (2017). *Business Correspondence and Report Writing* (3rd ed.). McGraw Hill Education. .

Reference Books:

1. Rizvi, M. A. (2018). *Effective Technical Communication* (2nd ed.). McGraw Hill.
2. Alex, K. (2014). *Soft skills: Know Yourself & Know the World*. (3rd ed.). S. Chand Publishing.
3. Murphy, R. (1998). *Essential English Grammar* (2nd ed.). Cambridge University Press.
4. Verma, S. (2005). *Body Language: Your Success Mantra.* S. Chand Publishing.
5. Laws, A. (2000). *Presentations.* Summertown Publishing.
6. Wallace, H. R., & Masters, L. A. (2011). *Personal Development for Life and Work* (10th ed.). South-Western Cengage Learning.
7. Lewis, N. (2008). *Word Power Made Easy*. Goyal Publishers.

Online Resources

1. Business English Communication by Prof. Aysha Viswamohan, IIT Madras. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_hs184
2. Public Speaking by Prof. Binod Mishra. IIT Roorkee. https://nptel.ac.in/courses/109107195
3. Developing Soft Skills and Personality by Prof. T. Ravichandran. IIT Kanpur. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_hs249
4. Soft Skills by Prof. Binod Mishra. IIT Roorkee. https://nptel.ac.in/courses/109107121

Assessment:

Internal Assessment Test (IAT) for 20 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. IAT-I will be an oral test for 20 marks. IAT-II will be a written test for 20 marks covering all 4 modules. Average of both the tests will be considered.

Continuous Internal Assessment-Theory (CIAT) for 20 Marks:

- CIA components (such as case studies, quizzes, assignments, etc.) shall be conducted.
- Each component will carry 5 marks

End Semester Theory Examination (ESE) 60 marks:

Question paper format

Time duration is 2 hours

Question paper carrying 60 marks:

a. The question paper shall consist of six questions, carrying 10 marks each.
   i. Question No. 1 shall be set from CO1.
   ii. Question No. 2 shall be set from CO2.
   iii. Question No. 3 shall be set from CO3.
   iv. Question No. 4 shall be set from CO4.
   v. Question No. 5 shall be set from CO5.
   vi. Question No. 6 shall be set from CO6.

b. Each question shall have two options – Option A and Option B, and both options will be from the same module.

CO-PO-PSO Mapping (Professional Communication Skills)													
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	2	3	-	-	-	2
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	2	2
CO4	-	-	-	-	-	-	-	2	2	-	-	2	-
CO5	-	-	-	-	-	-	-	2	3	-	-	2	-
CO6	-	-	-	-	-	-	-	2	2	-	2	-	2

Program	F. Y. B. Tech Mechanical Engineering							
Course	Professional Communication Skills LAB						Semester	I
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
MEAEL104	1	--	--	2	--	--	--	25	--

Lab Objectives:

1. To understand listening skills by identifying details, gist, and inferences in diverse communication contexts.
2. To examine communication barriers, audience, and purpose for effective communication.
3. To analyse texts for relevant academic and professional tasks.
4. To demonstrate the ability to produce clear and purposeful professional writing.

Lab Outcomes:

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

LO1: : Demonstrate effective listening by analyzing and responding to oral communication in diverse contexts.

LO2: Apply proficient speaking skills by analyzing communication barriers, audience, purpose, and contexts

LO3: Analyze texts to comprehend, interpret, and summarize accurately.

LO4: Illustrate the ability to draft well-structured texts for professional purposes.

List of laboratory experiments:

Sr. No.	Name of the Experiment	Hrs	LO Mapping
1	Listening Activity-1: Listening Analysis Activity	2	1
2	Listening Activity-2: Performance-Based Listening Task	2	1
3	Oral Activity-1: Self-Introduction and Introducing Others in Formal and Informal Contexts	2	2
4	Oral Activity-2: Extempore, JAM (Just-A-Minute)	2	2
5	Oral Activity-3: Debate, Elevator Pitch	2	2
6	Reading Activity-1: Summarizing in bullet or point form	2	3
7	Reading Activity-2: Book Review	2	3
8	Reading Activity-3: Objective Test on Verbal Aptitude & Grammar	2	3
9	Writing Activity-1: Email Writing	2	4
10	Writing Activity-2: User Instructions	2	4

Assessment:

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 6 Experiments based on the above list.

CIAL Marks: 25 Marks (Total marks) = 10 Marks (Average marks of Experiments) +10 Marks (Presentation) + 5 Marks (Attendance)

LO-PO-PSO Mapping (Professional Communication Skills Lab)													
Lab Outcomes (LO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
LO1	-	-	-	-	-	-	-	2	2	-	-	-	-
LO2	-	-	-	-	-	-	-	3	3	-	2	-	2
LO3	-	-	-	-	-	2	2	2	2	-	-	-	-
LO4	-	-	-	-	-	-	-	2	3	-	-	-	2

Program	F. Y. B. Tech Mechanical Engineering							
Course	Engineering Graphics & Visualization Lab						Semester	I
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	IAT	CIAL	ESE	CIAL	PR
MEESL105	2	--	--	4	--	--	--	50	50

Lab Objectives:

- To impart and inculcate proper understanding of the theory of projection.
- To impart the knowledge to read and interpret a drawing.
- To improve the visualization skill.
- To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size and orientation.
- To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.
- To impart basic AutoCAD skills.

Lab Outcomes:

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

LO1: Understand the basic concepts of geometrical constructions to create engineering curves.
LO2: Apply the basic principles of projections to construct basic geometric objects.
LO3: Apply the basic principles of projections in projection of regular solid objects.
LO4: Apply the basic principles of projections in converting pictorial views into orthographic views.
LO5: Analyse the 2D pictorial views and convert into orthographic views using First Angle Method.
LO6: Create Isometric views / 3D models from the given Orthographic Views using First Angle Method.

Lab Prerequisite:

1. Knowledge of basic geometrical shapes
2. Knowledge of handling drawing instruments

Unit No.	Description	Hrs	LO Mapping
1	Construction of plain and diagonal scales for simple applications. Construction of basic engineering curves like cycloid, involutes and helix (cylinder only). **Self-Learning:** Study scale applications (map/site-plan reduction)	02	LO1
2	Projections of Lines Simple problems to apply the concept of projections of lines inclined to both the reference planes. Projections of Planes Problems on projections of planes inclined to both the reference planes. **Self-Learning:**Case Study: Relate Plane Projections to Roof Trusses/Geological Strata	04	LO2
3	Projections of Solids Problems on projections of solids with the axis inclined to one and both reference planes. Use auxiliary plane method. Sections of Solids Problems on sections of solids cut by plane perpendicular to at least one reference plane. Use auxiliary plane method. Development of Surfaces Development of lateral surface (only) of prism, pyramid and cylinder. **Self-Learning:** Build a paper model from a developed surface and fold it back to verify	04	LO3

4	Orthographic Projections Construction of orthographic views from pictorial view of an object. Use of proper dimensioning technique for dimensioning the drawn views. Sectional Orthographic Projections Construction of orthographic views (with section) from pictorial view of an object. Location of section plane in concerned views **Self-Learning:**Study BIS/ISO (SP-46) dimensioning & hatching conventions	**04**	**LO4**
5	Conversion of orthographic views to isometric views **Self-Learning:** Compare isometric scale vs. true scale, Practice freehand isometric sketching	**02**	**LO5**
6	Overview of Computer Graphics Covering: Basic information about the drafting software (CAD). Demonstrating knowledge of the theory of CAD software such as: Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable),The Status Bar, Different methods of zoom as used in CAD, Select and erase objects. Customization & CAD Drawing: Consisting of set up of the drawing page and the printer including scale settings, setting up of units and drawing limits, ISO and ANSI standards for coordinate dimensioning. Annotations, layering & other Functions Covering: Applying dimensions to objects, applying annotations to drawings, setting up and use of layers, layers to create drawings, Create, edit and use customized layers, changing line lengths through modifying existing lines (extend/lengthen). **Self-Learning:** Explore a 3D modelling tool (Fusion 360/SolidWorks) as a CAD/CAM bridge	**08**	**LO6**

Textbooks:

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd.

2. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.

Reference Books:

1. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publisher.

2. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "(CAD Soft Technologies).

3. Auto CAD 2012 (For engineers and Designers)", Dreamtech Press NewDelhi.

4. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.

Online Resources

Sr. No.	Website Name
1.	https://archive.nptel.ac.in/courses/112/105/112105294/
2.	https://nptel.ac.in/courses/112103019
3.	https://archive.nptel.ac.in/courses/112/102/112102304/

List of laboratory experiments:

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Two problems on Scale and two problems on Engineering Curves to be drawn on drawing sheet.	2	1
2	Minimum four problems on Projection of Lines to be drawn on drawing sheet	2	2
3	Minimum four problems on Projection of Planes to be drawn on drawing sheet	2	2
4	Minimum of two problems on Projection of Solids to be drawn on drawing sheet. Out of two problems one should be on the prism category (includes cylinder) and other should be on the pyramid category (includes cone).	2	3
5	Minimum of two problems on Sections of Solids to be drawn on drawing sheet. Out of two problems one should be on the prism category (includes cylinder) and other should be on the pyramid category (includes cone).	2	3
6	Minimum two problems on Development of Surfaces to be drawn on drawing sheet. Out of two problems one should be on the prism category (includes cylinder) and other should be on the pyramid category (includes cone)	2	3
7	Two problems on Orthographic Projections (without section) using drafting software.	2	4,6
8	Two problems on Orthographic Projections (with section) using drafting software.	2	4,6
9	Minimum of two problems on Isometric Projections to be drawn on drawing sheet. Out of the two problems, one should include a circular portion and one problem should have a sloping surface. Also, one problem should be solved by natural scale and another problem should be solved by isometric scale.	2	5
10	Minimum two problems on Isometric Projections using drafting software.	2	5,6
11	Introduction to Solid Modelling	2	6

* Out of four problems from practical numbers 4 and 5 at least one problem should be on cone and cylinder each.
* All printouts to be taken in the CAD Laboratory. Preferably, use A3 size sheets for print out.

Assessment

Continuous Internal Assessment-Lab (CIAL):

a) CIAL: CIAL shall consist of all the above mentioned practical and will also include the A3 size sketch book. Problems taught in theory class in A3 size sketch book may be considered. Alternatively subject teacher may give problems on each topic to be solved by students as home assignments in the same A3 size sketch book.

CIAL Marks: 50 Marks a) Drawing Sheets + CAD printout = 25 Marks b) Theory Class A3 size Sketch Book = 20 Marks c) Attendance = 5 Marks

b) Practical Exam: (2 hours/ 50 Marks)

End semester Practical exam will be held using CAD software only. This exam will be based on the following syllabus. 1. Isometric projections. (One problem, compulsory) 2. Orthographic Projection

(without section) 3. Orthographic Projection (with section)

* The examiners may decide the weightage of the questions asked in the practical exam.

* Printout of the answers have to be taken preferably in A3 size sheets and should be assessed by external examiner only.

* Knowledge of AutoCAD software, concepts of Engineering Graphics related to specified problem and accuracy of drawing should be considered during evaluation.

LO-PO-PSO Mapping (Engineering Graphics & Visualization Lab)

Lab Outcomes (LO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
LO1	3	2	-	-	-	-	-	2	2	-	2	2	2
LO2	3	2	-	-	-	-	-	2	2	-	2	3	2
LO3	3	2	-	-	-	-	-	2	2	-	2	3	2
LO4	3	2	-	-	3	-	-	2	2	-	2	3	3
LO5	3	2	-	-	3	-	-	2	2	-	2	3	3
LO6	3	2	-	-	3	-	-	2	2	-	2	3	3

Program	F. Y. B. Tech Mechanical Engineering								
Course	Programming in C						Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
MEVSEC106	2	L	T	P	CIA		ESE	CIAL	PR/OR
					IAT	CIAT			
		--	--	2*+2	--	--	--	25	25

Lab Prerequisites:
Basic understanding of logical reasoning, algorithms, and flowcharts is desirable.

Lab Objectives:

1. To Develop problem-solving skills using structured programming in C and learn fundamental concepts used in computer programming.
2. To apply different data types and operators effectively in C programming.
3. To design and implement programs using decision-making statements, loops, and functions.
4. To develop programs using arrays, strings, and structures for solving computational problems.
5. To demonstrate the use of pointers to understand dynamic memory access and manipulation.
6. To Implement basic data storage and retrieval using structures and file handling in C.

Lab Outcomes:
After successful completion of the course, the learner will be able to:

LO1. **Illustrate** the fundamental concepts of C programming and apply appropriate data types to solve simple computational problems.
LO2. Demonstrate programs using control flow structures for decision making in programming.
LO3. Demonstrate modular programs using user-defined functions.
LO4. Apply the concepts of arrays and strings to solve programming problems.
LO5. Use pointers to demonstrate and manage dynamic memory access in programs.
LO6. Implement programs using structures and file handling for basic data storage and management.

Syllabus

Unit No.	Description	Hrs.	LO Mapping
1	**Introduction, Fundamental of C Programming:** Introduction to concept of computer programming, Algorithm and Flowchart, Structure of C program, C Tokens: Keywords, Identifiers Constants and Variables, Expressions, Datatypes in C, Operators and Precedence of Operators, In- built Functions, Pre-processor Directives, library, Header Files, Compiler vs Interpreter. **Self-Learning:** Type conversion or type casting.	4	1
2	**Control Structure:** Introduction to Control Structures: If statement, If-else statement, Nested if-else, else-if Ladder, Switch statement, For loop, while loop, do while loop, nested loops **Self-Learning:** break, continue and goto statements	5	2
3	**Functions**: Introduction to functions: Function prototype, Function declaration, Function definition, scope of variables, Parameter passing to function: Call by Value and Call by reference, Recursive function. Storage Classes: Auto, Extern, Static, Register **Self-Learning:** Adding Functions to the Library	4	3

4	**Array and Strings:** Introduction to Arrays: Declaration and initialization, 1-dimensional and 2- dimensional arrays, Introduction to Strings: String functions. Arrays and Functions. **Self-Learning:** Three-Dimensional Array	5	4
5	**Pointers:** Fundamentals of pointers, Declaration, Address Operator, Pointer Variables,Pointer arithmetic, Pointers with Array, Pointers and functions: Pointers as parameter to function **Self-Learning:** Pointers to Pointers (Double Pointers)	4	5
6	**Structure:** Concept of Structure: Declaration and Initialization of structure, Array of Structures, Pointer to structures, Structure and Functions File Handling in C: fopen, fclose, fprintf, fscanf. **Self-Learning:** Dynamic Memory Allocation functions malloc() and calloc()	4	6

Laboratory Programming Environment:

The laboratory sessions will be conducted in a standard programming environment using C language. Students will use a suitable compiler and integrated development environment (IDE) for writing, compiling, debugging, and executing C programs such as: GCC (GNU Compiler Collection) or Turbo C.

List of laboratory experiments:

(Practical list for journal shall consist of at least 10 to 12 experiments based on the below list.)

Sr No	Suggested List of Experiments	Unit No
1	Program to demonstrate basic input-output functions. Operators Data Input and Output getchar( ), putchar( ), scanf( ), printf( ), gets( ), puts( )	**1**
2	Program to demonstrate different types of Operators -Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators.	
3	Program to Swap Two Numbers (using third variable and without using third variable)	
4	Program to find ASCII Value of a Character.	
5	Program to demonstrate Branching - If statement, If-else Statement, else-if ladder.	**2**
6	Program to demonstrate Switch-case and break.	
7	Programs to demonstrate a. while loop b. do-while loop c. for loop d. nested loops	
8	Program to find Armstrong Number.	
9	Program to demonstrate Function, Passing Arguments to a Function (call by value)	**3**
10	Program to compute the factorial/Fibonacci series using an iterative approach.	
11	Program to compute the factorial/Fibonacci series using a recursive function.	
12	Program to demonstrate Storage Classes Auto, Extern, Static, Register	
13	Program to demonstrate Array 1D (Finding smallest/largest array element)	
14	Program to demonstrate Array 2D (Matrix Addition)	

15	Program that accepts a string from the user and performs the following string operations- a. Calculate length of string b. String reversal c. Equality checks of two Strings d. Check substring.	
16	Program to demonstrate in-built functions for strings: strlen(), strcpy(), strcmp(), strcat().	
17	Program to demonstrate the use of arrays of strings.	
18	Program to find the largest number between two numbers using pointers.	**5**
19	Program to demonstrate pointers and function i.e. call by reference (Swapping of two numbers)	
20	Program to find string length using pointer.	
21	Program to reverse a sentence using pointer.	
22	Program to demonstrate Structure Write a program to store and display information of a student/employee etc. using structures. a. Define a structure. b. Read and store details. c. Display the stored information.	**6**
23	Program to demonstrate Structure and pointers Write a program to store and display information of a student/employee etc. using structures and pointers. a) Define a structure. b) Read and store details. c) Display the stored information.	
24	Program to read data from one file and write it into another file.	
25	Program to demonstrate files handling for record management. Write a program to maintain a simple student/employee etc. database using file handling. a) Open a file to store student records. b) Implement functions to add, update, and display records.	

Learning Resources

Textbooks:

1. E. Balaguruswamy, Programming in ANSI C, McGraw-Hill
2. KanetkarYashwant, “Let Us C”, BPB Publication.
3. Pradeep Day and ManasGosh ,“Programming in C”, Oxford University Press
4. Kernighan , Ritchie, “The C programming Language”, Prentice Hall of India

Online Resources

1. C Programming for Problem Solving, Prof. Satyadev Nandakumar, Dept of Computer Science and Engineering IIT Kanpur on NPTEL (https://nptel.ac.in/courses/106104128)
2. Introductory C Programming Specialization by Duke University on coursera (https://www.coursera.org/specializations/c-programming)

Assessment :

Continuous Internal Assessment-Lab (CIAL):

CIAL Marks: 25 Marks (Total marks) = 10 Marks (Experiment/Journal) + 10 Marks (CIA Tools) + 5 Marks (Attendance Theory + Practical)

Practical & Oral Exam: An Oral & Practical exam will be held based on the above syllabus.

Lab Outcomes (LO)	LO-PO-PSO Mapping (Programming in C)												
	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
LO1	3	2	-	-	2	-	-	2	3	-	-	2	2
LO2	3	3	-	-	3	-	3	2	2	-	-	2	2
LO3	3	3	-	-	3	-	-	2	3	-	3	2	2
LO4	3	3	-	-	2	-	-	3	2	-	2	2	2
LO5	2	2	-	-	2	-	-	2	2	-	-	-	-
LO6	2	2	-	-	3	-	-	2	2	-	-	-	-

Program	F. Y. B. Tech Mechanical Engineering								
Course	Basic Engineering Skills & Practices-I						Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
					CIA		ESE	CIAL	PR/OR
		L	T	P	IAT	CIAT			
MEVSEC107	1	--	--	2	--	--	--	25	--

Lab Objectives:

1. To identify and describe the function of hardware components of a PC and peripheral devices.
2. To install and configure the various operating systems and application software.
3. To set up and configure a small LAN and troubleshoot common network issues.
4. To familiarize students with reading and interpreting technical drawings related to fitting trade.
5. To understand the use of various fitting tools and measuring devices.
6. To apply electrical safety and wiring practices.
7. To understand electrical systems and motors.

Lab Outcomes:

After successful completion of the lab, the learner will be able to:

LO1: Understand computer hardware architecture, install operating systems and application software.
LO2: Identify network components and produce basic networking and crimping.
LO3: Design and implement a basic LAN network and troubleshoot common hardware and networking problems.
LO4: Develop the necessary skills to identify and use the various hand tools and measuring instruments in fitting shop.
LO5: Read and interpret technical drawings related to fitting trade.
LO6: Produce various basic prototypes in the trade of fitting such as Square, Hexagonal and V Male-Female joint.
LO7: Develop the necessary skills to identify and use the various tools and measuring instruments in fitting shop
LO8: Perform Basic Electrical Wiring and Protection with safety practices.
LO9: Understand the various types of motors and energy storage with applications.
LO10: Understand types of welding process and their applications.
LO11: Perform the welding process as per the given drawing.

Lab Prerequisites:

Basic knowledge of science and mathematics.

List of laboratory experiments: (*Any Eight Experiments)*

Sr. No.	Name of the Experiment	Trades	Hrs	LO Mapping
1	To identify the components of personal computers and laptops.	Computer Hardware & Networking	2	1
2	To perform basic troubleshooting and maintenance of personal computers and laptops.		2	1
3	To install the windows and Linux operating system.		2	1
4	To practice crimping of network wire and router configuration.		1	2
5	To set up functional networking for a small office (Group Project).		3	3
6	To diagnose and troubleshoot common networking		2	3

	problems/issues.			
7	To identify the different tools used for fitting shops with their applications.	Fitting	2	4
8	To read technical drawing and schematics for fitting job.		1	5
9	To fabricate a composite job which includes various fitting processes.		9	6
10	To identify and use of appropriate tools to measure voltage, current, resistance and frequency.	Basic Electrical workshop	2	7
11	To study Single phase and three phase supply.		2	8
12	To study different types of cables and wiring diagram.		2	8
14	To draw a technical drawing for Godown wiring and demonstrate the godown wiring.		2	8
14	To study different types of motors and their applications.		2	9
15	To study different types of energy storage systems.		2	9
16	To study different types of welding processes and safety precautions during welding process.	Welding	4	10
17	To fabricate a lap joint and identify the welding defects.		6	11

Learning Resources

Textbooks:

1. Ajay Rana, Ajit Mittal, “Mastering PC hardware & Networking” Khanna publishing house
2. James K L, “Computer hardware: installation, interfacing, troubleshooting and maintenance” PHI Learning
3. P. N. Rao, “Workshop Technology”, Volume-I, McGraw Hill Publication
4. S.K. Hajra Choudhury, A K Hajra Choudhury, Nirjar Roy, “Elements of Workshop Technology”, Vol-I, Media Promoters & Publishers Pvt Ltd
5. B. L. Theraja, A. K. Theraja, “A Textbook of Electrical Technology” Volume – I Basic Electrical Engineering, S Chand Publication.

Online Resources

1. https://youtu.be/vgisbCjtHz4?si=-spsjj1zsrBprLJA
2. https://youtu.be/K92bYXyZSdM?si=hryQzT2EDjskj-bW
3. https://youtu.be/cX4s-bxn4fs?si=g_BvHAP9bWZeJ9cP
4. https://youtu.be/6H5vtu5_SF4?si=_6UUzoXTshpCMafN
5. https://youtu.be/f_PnNImR1ns?si=bwu7XxE98LzRSGj5

Assessment:

Continuous Internal Assessment- Lab (CIAL):

CIAL shall consist of at least 8 practical based on the above list.

CIAL Marks : 25 Marks (Total marks)
Experiments : 20 Marks
Attendance, Journal and active participation : 05 Marks

LO-PO-PSO Mapping (Basic Engineering Skills & Practices-I)													
Lab Outcomes (LO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
LO1	3	-	-	-	-	2	2	2	-	-	2	2	2
LO2	3	-	-	-	-	2	2	2	-	-	2	2	2
LO3	3	-	-	-	-	2	2	2	-	-	2	2	2
LO4	3	-	-	-	-	2	2	2	-	-	2	2	2
LO5	3	-	-	-	-	2	2	2	-	-	2	2	2
LO6	3	-	-	-	-	2	2	2	-	-	2	2	2
LO7	3	-	-	-	-	2	2	2	-	-	2	2	2
LO8	3	-	-	-	-	2	2	2	-	-	2	2	2
LO9	3	-	-	-	-	2	2	2	-	-	2	2	2
LO10	3	-	-	-	-	2	2	2	-	-	2	2	2
LO10	3	-	-	-	-	2	2	2	-	-	2	2	2

Program	F. Y. B. Tech Mechanical Engineering								
Course	Universal Values for Personal and Professional Excellence						Semester		I
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA (20)		ESE	CIAL	PR/OR
					IAT	CIAT			
MEVEC108	2	2#	-	-	--	--	-	25	--

Course Prerequisites:
No prerequisites

Course Objectives:
1. Develop self-awareness and clarity about human values
2. Enable students to understand harmony at different levels (self, family, society, nature)
3. Build ethical competence in professional and personal decision-making
4. Promote responsible and sustainable living
5. Encourage inner peace and emotional balance

Course Outcomes:
After successful completion of the course, the learner will be able to:
CO1: Understand the importance of human values in personal and professional life
CO2: Demonstrate self-awareness and emotional regulation
CO3: Apply values like respect, honesty, and responsibility in relationships and teamwork
CO4: Analyze ethical dilemmas in engineering and propose value-based solutions
CO5: Practice sustainable and socially responsible behavior
CO6: Integrate universal human values into daily life through self-reflection, personal value systems, and lifelong value-based living.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Introduction to Human Values:** Meaning and definition of values Types of values: Personal, Social, Professional, Universal Importance of values in engineering education Difference between: Success vs Happiness, Achievement vs Fulfillment Role of values in decision-making	2	1
2	**Self-Awareness and Inner Development**: Understanding the self (I) vs body Nature of thoughts, emotions, and desires Relationship between: Thoughts → Feelings → Actions → Habits Concept of inner stability vs external influence	2	2
3	**Core Human Values**: **Peace** Meaning of inner peace Causes of disturbance: anger, stress, comparison Stability of mind in challenging situations **Respect** Respect for self and others Difference between respect and fear/authority Respect in digital and social environments **Love & Compassion** Difference between attachment and unconditional care Empathy and emotional intelligence	10	3

	Importance in teamwork and leadership **Happiness & Contentment** Internal vs external sources of happiness Impact of consumerism Gratitude and acceptance **Honesty & Integrity** Truthfulness in thoughts, words, actions Academic integrity (plagiarism, cheating) Professional ethics		
4	**Social and Professional Values:** **Responsibility** Personal responsibility Social responsibility Professional responsibility in engineering **Cooperation and Teamwork** Importance of collaboration in engineering Competition vs cooperation Trust and communication **Ethical Decision-Making** Identifying ethical dilemmas Steps in ethical decision-making Case studies from engineering failures	6	4
5	**Sustainable Living and Harmony** Concept of harmony at different levels: Self Family Society Nature Simplicity and minimalism Environmental responsibility Sustainable development and ethical engineering	4	5
6	**Integration and Practice** Integration of all values into daily life Developing a personal value system Role of continuous self-improvement Lifelong learning and value-based living	2	6

Learning Resources

Textbooks:

1. Diane Tillman and Pilar Quera Colomina, “Living Values: An Educational Program”, Health Communications Inc., 2000.
2. Diane Tillman, “Living Values Activities for Young Adults”, Health Communications Inc., 2000.
3. Diane Tillman, “Living Values Educator Training Guide”, Health Communications Inc., 2000.

Reference Books:

1. R. R. Gaur, R. Sangal and G. P. Bagaria, “A Foundation Course in Human Values and Professional Ethics”, Excel Books, 2nd Edition, 2010.
2. R. R. Gaur, R. Sangal and G. P. Bagaria, “Human Values and Professional Ethics”, Excel Books, 1st Edition, 2009.
3. Stephen R. Covey, “The Seven Habits of Highly Effective People”, Free Press, 1989.
4. Viktor E. Frankl, “Man’s Search for Meaning”, Beacon Press, 2006 Edition.
5. Eckhart Tolle, “The Power of Now: A Guide to Spiritual Enlightenment”, New World Library, 1999.
6. Helen Sayers, “Ubuntu!: Re-ignite the Spirit of Humanity”, Living Values Education International, 2012.

Online Resources:

- https:uhv.org.in

Assessment:

Continuous Internal Assessment- (CIAL) for 25 Marks:

The assessment for the course will be based entirely on Continuous Internal Evaluation (CIE) carrying 100% weightage, designed to evaluate students' understanding, reflection, and application of values in real-life contexts. The evaluation will consist of three components: Reflection Journal (40%), where students will maintain regular entries demonstrating self-awareness, depth of reflection, and linkage to core human values; Participation and Activities (30%), which will assess active involvement in class discussions, role plays, group tasks, and respectful engagement; and Case Study / Presentation / Personal Value Project (30%), where students will analyze ethical dilemmas, present value-based solutions, or develop a personal value system project reflecting practical application.

List of Activities:

- Self-reflection: *"What truly matters in my life?"*
- Group Discussions: *"Can success guarantee happiness?"*
- Guided introspection exercise
- Beginning of reflection journal
- Silent sitting / breathing awareness
- Role play on respectful vs disrespectful behavior
- Perspective-taking exercise
- Gratitude journaling
- Case discussion on ethical dilemmas
- Responsibility mapping (self–family–society)
- Group problem-solving exercise
- Case analysis and discussion
- Lifestyle audit (consumption patterns)
- Discussion: *"Technology vs Environment – Conflict or Harmony?"*
- Student presentations: *"My Value Journey"*
- Reflection sharing and course feedback

	CO-PO-PSO Mapping (Universal Values for Personal and Professional Excellence)												
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	2	3	2	2	-	2	-	-
CO2	-	-	-	-	-	2	2	2	2	-	2	-	-
CO3	-	-	-	-	-	2	3	3	2	-	2	-	-
CO4	-	-	-	-	-	2	3	2	2	-	2	-	-
CO5	-	-	-	-	-	2	2	2	2	-	2	-	-
CO6	-	-	-	-	-	3	2	2	2	-	2	-	-

Program	F. Y. B. Tech Mechanical Engineering								
Course	Social Science and Community Services (SCS)						Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA (20)		ESE	CIAL	PR/OR
					IAT	CIAT			
MELLC 109	2	2#	--	--	--	--	-	25	-

Course Prerequisites:

Basic awareness of society and common social issues, along with communication skills. Students should be willing to participate in community activities and work in teams. A basic understanding of health, hygiene, and environmental practices. Interest in social service and readiness to engage in fieldwork.

Course Objectives:

1. Develop an understanding of civic responsibility and the importance of social awareness.
2. Promote health, hygiene, and environmental awareness through practical activities.
3. Identify and analyze major social issues affecting communities.
4. Encourage active participation in community service and social engagement initiatives.

Course Outcomes:

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

CO1: Explain the concepts of civic responsibility and social awareness in the context of society.

CO2: Apply knowledge of health, hygiene, and environmental practices in real-life situations through participation in awareness and community activities.

CO3: Analyze major social issues affecting communities by interpreting data from surveys, case studies, and community interactions.

CO4: Apply skills to actively participate in community service and social engagement initiatives.

Activities and Assignments

SL. No.	Activities	Details of Activity	CO Mapping
1	Group Discussion	Students will participate in group discussions on socially relevant topics such as civic responsibility, role of youth, or current social issues.	1
2	Poster Making	Students will design posters, slogans, or digital content to spread awareness on topics like cleanliness, road safety, or environmental protection.	2
3	Constitution Quiz	Conduct quizzes on fundamental rights , duties , and constitutional values	1
4	Documentary Review	Watch and analyse a documentary on poverty , environment , education or public health	2
5	Community Problem Mapping	Students will identify a local area (campus or nearby community) and map key social or environmental problems such as waste disposal, traffic issues, lack of facilities, etc. They can use simple sketches, photos, or digital tools.	3
6	Case Study	Group task: Students will analyze a real-life social issue in groups by referring to case studies from newspaper articles or social media platforms, identify causes, suggest solutions, and submit a detailed case study report/assignment.	3
7	Survey and Community Interaction	Students will conduct surveys on selected social issues by preparing questionnaires, collecting data, and interacting with local community members to understand real-life challenges and submit a report including findings and suggested solutions.	3,4

8	Awareness Sessions/ Campaigns/ Rally Participation	Students will participate in awareness activities related to hygiene, safety, or environmental issues, and submit a report/assignment documenting their involvement, key observations, and the impact of the activity.	2,4
9	Report writing	Report writing based on participation in social service or community engagement activities such as health camps, donation drives, or awareness programmes.	4
10	Field Visit	Students will visit NGOs or community centers to understand their functioning. **A** detailed field visit report/assignment must be submitted covering observations and insights.	3,4

Assessment:

- CIAL shall consist of any two activities based on the above list. Also, the Activity based Journal must include 4 assignments.
- CIAL Marks: 25 Marks (Total marks) = 10 Marks (Total marks of Activities) +10 Marks (Activity based Journal) + 5 Marks (Attendance)

CO-PO-PSO Mapping(Social Science and Community Services)

Course Outcomes (CO)	Program Outcomes (PO)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	2	2	2	-	2	-	-
CO2	-	-	-	-	-	-	2	2	2	-	2	-	-
CO3	-	-	-	-	-	-	2	2	2	-	2	-	-
CO4	-	-	-	-	-	-	2	2	2	-	2	-	-

Program	F. Y. B. Tech Mechanical Engineering								
Course	Differential Equations & Numerical Analysis						Semester		II
Code	Credits	Teaching Scheme (Hrs./Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA (40)		ESE	CIAL	PR/OR
					IAT	CIAT			
MEBSC201	3	3	--	--	20	20	60	--	--

Course Prerequisites:
Basic knowledge of Integration & Differential equations.

Course Objectives:
To develop strong foundational mathematical concepts that are essential for solving engineering problems. The aim is to equip them with techniques to understand advanced level mathematics and its applications that would enhance analytical thinking useful in Mechanical/Civil Engineering.

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

CO1: Solve Exact Differential Equations using appropriate techniques.
CO2: Apply Linear Differential Equations to solve Complex Engineering Problems.
CO3: **Solve** Higher-order linear differential equations with constant coefficients using appropriate techniques.
CO4: Solve basic partial differential equations using standard analytical methods.
CO5: Apply numerical methods to solve second order partial differential equations.
CO6: Determine approximate solutions of complex engineering problems using Numerical Methods.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Exact Differential Equations** Differential Equations of First Order and First Degree, Exact differential Equations, Equations reducible to exact form by using integrating factors. **Self-Learning:** Applications of First order first degree ODE in Mechanical/Civil Engineering.	6	1
2	**Linear differential equations** Linear differential equations, Equation reducible to linear form, Bernoulli's equation, Equation reducible to linear form by substitution. **Self-Learning:** Applications of First order first degree ODE in Mechanical/Civil Engineering.	6	2
3	**Higher Order Linear Differential equation with constant coefficients.** Linear Differential Equation of higher order with constant coefficient-complementary function, particular integrals of differential equation of type f(D)y = X where X is eax , sin(ax+b) , cos(ax+b), xm .e^ax V. Method of variation of parameters. **Self-Learning:** Cauchy's & Legendre's Differential Equations	8	3
4	**Partial Differential Equation** Introduction of PDE, Order and degree of PDE, Types of PDE Solution of first order linear PDE, Classification of linear PDE **Self-Learning:** Formation of PDE by eliminating arbitrary constants/functions	6	4
5	**Numerical Solution of Partial Differential Equation** Numerical Solution of 2nd order PDE a) Crank Nicholson method b) Bender Schmidt method. **Self-Learning:** Application of Partial Differential Equation in Mechanical Engineering	6	5

6	**Numerical Methods** Numerical Solution of ordinary differential equation using (a) Euler's method (b) Modified Euler method, (c) Runge-Kutta method fourth order. Numerical integration-by (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule (all without proof). Numerical Solution of Algebraic and transcendental Equations. (a)Newton Raphson Method (b) Regula Falsi Method **Self-Learning:** Error Analysis in Numerical Methods (Types of errors, Absolute error, Relative error, Percentage error)	7	6

Learning Resources

Textbooks:

- H K DASS, Advanced Engineering Mathematics. India, S Chand, 2025.
- B. S. Grewal, Higher Engineering Mathematics. India, Khanna Publication ,2024..

Reference Books:

- Erwin Kreyszig, Advanced Engineering Mathematics. United Kingdom, Wiley, 2025.
- B. V. Ramana Higher Engineering Mathematics. India, Tata McGraw Hill, 2010.
- R.K.Jain and S.R.K Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd ,2014.

Online Resources

1. Ordinary and Partial Differential Equations and Applications, Prof. P. N. Agrawal, Prof. D. N. Pandey, IIT Roorkee, NPTEL. https://onlinecourses.nptel.ac.in/noc20_ma12/preview.
2. 2.Numerical methods, Prof. Ameeya Kumar Nayak, Prof. Sanjeev Kumar, IIT Roorkee, NPTEL. https://onlinecourses.nptel.ac.in/noc19_ma21/preview.

List of Assignment: (Sr.1 & 2 are compulsory. Any 6 Assignments from sr. no 3 to 12)

Sr. No.	Name of the Assignment	Hours	CO Mapping
1	Activity-I ("Revision of Prerequisites for the course".)	1	-
2	Activity-II ("Explore the math toolbox: Desmos, GeoGebra etc.")	1	-
3	Exact Differential Equations.	1	1
4	Linear Differential Equations.	1	2
5	Application of First Order and First-Degree Differential Equations.	1	1,2
6	Higher Order Linear Differential Equations with Constant Coefficients.	1	3
7	Application of Higher order Differential Equations.	1	3
8	Analytical Solution of Linear Partial Differential Equations.	1	4
9	Numerical Solution of Partial Differential Equations.	1	5
10	Application of Partial Differential Equations.	1	4, 5
11	Numerical Solution of Ordinary Differential Equations & Definite Integrals.	1	6
12	Numerical Solution of Algebraic and Transcendental Equations.	1	6

Sr No	List of SCILAB Practical	Hrs.
01	Euler's Method and Euler's Modified Method.	4
02	Runge Kutta Method of 4th order.	
03	Numerical Integration	
04	Newton Raphson and Regula Falsi Method	

Assessment:

Internal Assessment Test (IAT) for 20 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. Average of both the tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 20 Marks:

- A total of three CIA components (such as assignments, quizzes, presentations, case studies, etc.) shall be conducted.
- Each component will carry 5 marks, totaling 15 marks.
- Attendance will carry 5 marks.

End Semester Theory Examination (ESE) 60 marks:

Question paper format

Time duration for 60 marks paper is 2 hours

a. The question paper shall consist of six questions, carrying 10 marks each.
   i. Question No. 1 shall be set from CO1.
   ii. Question No. 2 shall be set from CO2.
   iii. Question No. 3 shall be set from CO3.
   iv. Question No. 4 shall be set from CO4.
   v. Question No. 5 shall be set from CO5.
   vi. Question No. 6 shall be set from CO6.

b. Each question shall have two options – Option A and Option B, and both options must be set from the same module.

c. The options should be of comparable difficulty level and should test similar learning outcomes.

d. Internal choice may be provided within each question, ensuring both options cover the same module.

e. Students will attempt all questions.

CO-PO-PSO Mapping (Differential Equations & Numerical Analysis)													
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	3	2	-	-	-	-	3	-	2	-	2	2	-
CO2	3	2	-	-	-	-	3	-	2	-	2	2	-
CO3	3	2	-	-	-	-	3	-	2	-	2	2	-
CO4	3	2	-	-	-	-	-	-	2	-	-	2	-
CO5	2	-	-	-	2	-	-	-	2	-	-	2	-
CO6	2	-	-	-	2	-	-	-	2	-	-	-	-

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Physics for Intelligent Systems						Semester	II
Code	Credits	Teaching Scheme (Hrs./Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA (20)		ESE	CIAL	PR/OR
					IAT	CIAT			
MEBSC2021	2	2	--	--	10	10	30	--	--

Course Prerequisites:
P-n- junction, working principle of optical fiber, Basics of sound, electric field, magnetic field, conductivity, mobility, Basics of Crystal Physics, (Unit cell, Space lattice, Crystal systems), X-rays, Frequency ranges in electromagnetic spectrum, classification of sound, Electrostatic focusing, magneto-static focusing

Course Objectives:
1. To understand the working principles of sensors and MEMS and their applications.
2. To understand image sensing, CCD/CMOS sensors, and color formation and perception.
3. To explain the contribution of solar energy and nanotechnology for energy-efficient data centers and devices.

Course Outcomes:
After successful completion of the course, the learner will be able to:
CO1: Select appropriate sensing technology for physical measurements in real-world applications.
CO2: Apply the principles of image sensing and color formation in imaging systems.
CO3: Discuss the role of solar energy and nanotechnology in improving energy efficiency in data centers and devices.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Physics of Sensors and MEMS** **SENSORS** Working principle of sensors, classification: active and passive, analog and digital, criteria to choose a sensor. **Temperature sensors**: RTD, Thermistors, and thermocouple **Ultrasonic sensor:** Working principle and applications **MEMS:** Microsensors and micro actuators, Intrinsic Characteristics of MEMS: Small size, low power consumption, high sensitivity, and fast response. MEMS-based pressure sensor. **Self-Learning**: Applications of sensors in real-life	8	1
2	**Physics of Image Sensing and Color** **Image sensor terminology**: Dark current, Photo site, Pixel, Fill factor, Quantum efficiency. **Types of Image sensors** : CCD -Construction and working (Charge generation and transfer) CMOS – Construction and Working (Pixel Structure-Photodiode and amplifier). **Image formation** : Monochrome image formation: Light intensity and irradiance, Pixel concept and spatial resolution, Color image formation: RGB model, Color filter array (Basic idea). **Introduction to Color Perception**: Chromaticity diagram, Chromaticity coordinates, Color Measurement & color matching. **Self-Learning:** Comparison between CCD and CMOS Sensors	8	2

3	**Solar energy and Nanotechnology:** **Solar Energy** Energy consumption in electronic systems, Energy requirements of data centers and electronic devices, Conversion of Solar Energy into Electricity: Photovoltaic Effect and working principle of solar cell. **Self-Learning:** Use of solar energy in data centers. **Nanotechnology** Introduction to nanotechnology, Properties: Optical, Electrical, Structural, Mechanical, Importance of surface to volume ratio, Nano computing, Nano computer Introduction, Nano-computer Building block, DNA Carbon nanotubes and nanowires. **Self-Learning:** Applications of Carbon Nanotubes and Nanowires	8	3

Learning Resources

Textbooks:

1. Tapan Bhattacharya, Terrestrial Solar Photovoltaics, Narosa Publication House.
2. Takao Kuroda, Essential Principles of Image Sensors; Reilly Publication.
3. T. Pradeep, A textbook of Nanoscience and Nanotechnology, Tata McGraw- Hill Education.
4. de Silva, Sensors and Actuators: Engineering System Instrumentation Press.

Reference Books:

1. Jacob Fraden, Handbook of Modern Sensors: Physics, Design, and Application, Springer, AIP press.
2. Holst & Lomheim, CMOS/CCD Sensors and Camera Systems
3. Nakamura, Image Sensors and Signal Processing

Online Recourses:

Carbon Nanotubes
https://www.youtube.com/watch?v=nYZyQ7etgc8

Assessment:

Internal Assessment Test (IAT) for 10 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. Average of both the tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 10 Marks:

- A total of minimum 2 CIA components (such as assignments, quizzes, presentations, etc.) shall be conducted.
- Each component will carry 5 marks.

End Semester Theory Examination (ESE) 30 marks:

Question paper format

Time duration for 30 marks paper is 1hour

- Question paper will consist of three compulsory questions, given as below:
  - i. Question No. 1 shall be set from CO1
  - ii. Question No. 2 shall be set from CO2
  - iii. Question No. 3 shall be set from CO3
- Each question shall carry approximately 10 marks.
- Each question may have sub-questions, ensuring coverage of the respective module/COs.

- The questions should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within sub-questions, ensuring both options are from the same module.
- Students will attempt all questions

CO-PO-PSO Mapping (Physics for Intelligent Systems)													
Course Outcomes (CO)	Program Outcomes (PO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	2	2	-	2	2	-

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Physics for Intelligent Systems Lab						Semester	II
Code	Credits	Teaching Scheme (Hrs./Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
MEBSL2011	0.5	--	--	1	--	--	--	25	--

Lab Objectives:
1. To study the relationship between current and voltage in a photovoltaic cell.
2. To study the characteristics of RTD and NTC thermistors.
3. To understand how a color sensor detects and identifies different colors.
4. To study the chromaticity diagram with an RGB LED.

Lab Outcomes:
LO1: **Determine** the temperature dependence of resistance in an NTC thermistor.
LO2: **Verify** the characteristic of RTD using the Wheatstone bridge.
LO3: **Plot** I-V characteristic of Photovoltaic Cell.
LO4: **Identify** different colors using the color sensor.
LO5: **Perform** color matching using a chromatic vision simulator.
LO6: **Demonstrate** the fullerene structure (C-60) using Avogadro Software to draw carbon nano structure.

Lab Prerequisite:
1. Basic knowledge of electronics, sensors, and measurement techniques.
2. Knowledge of graph plotting, data evaluation, and result interpretation**.**
3. Basic computer operation skills**.**

List of laboratory experiments: (*Any six Experiments)*

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Study of temperature dependence of resistance in an NTC thermistor	1	1
2	Measurements of I-V characteristics of Photovoltaic Cell	1	3
3	Study of Color Sensor	1	4
4	Study of the chromaticity diagram with RGB LED.	1	-
5	Study of directivity and frequency response of MEMS microphone	1	-
6	Calibration of PT100	1	2
7	Study of CMOS image sensor and Color calibration	1	-
8	Simulation experiments based on nanotechnology using open-source simulation.	1	6
9	Study of chromaticity and color matching using the chromatic vision simulator	1	5

Mini Project:
Execution of the project as per the plan submitted in semester I. A working model and a study report leading to a conclusion as anticipated in semester I is required to be used for awarding marks.

Assessment:

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 5 to 6 practical based on the above list.
CIAL Marks: 25 Marks (Total marks) = 10 Marks (Average marks of Experiments) + 10 Marks (Mini project work) + 5 Marks (Attendance)

LO-PO-PSO Mapping (Physics for Intelligent Systems Lab)													
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO 2**
LO1	3	2	-	-	-	-	-	2	2	-	-	2	-
LO2	3	2	-	-	-	-	-	2	2	-	-	2	-
LO3	2	2	-	-	-	-	-	2	2	-	-	2	-
LO4	2	2	-	-	-	-	-	2	2	-	-	2	-
LO5	3	2	-	-	-	-	-	2	2	-	-	2	-
LO6	3	2	-	-	-	-		2	2	-	-	2	-

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Physics of Semi-conductor						Semester	II
Code	Credits	Teaching Scheme (Hrs./Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA (20)		ESE	CIAL	PR/OR
					IAT	CIAT			
MEBSC2022	2	2	--	--	10	10	30	--	--

Course Prerequisites:
Band theory of solids, Fermi-Dirac distribution function, Density of states, Intrinsic and extrinsic semiconductors, electrical resistivity and conductivity concepts.

Course Objectives:

- To provide a basic understanding of Semiconductors in the field of engineering.
- To understand the basic importance of p-n junction diodes.
- To learn about a few special diodes and basics of transistors in the field of electronics.

Course Outcomes:
After successful completion of the course, the learner will be able to:
CO1: Determine Hall voltage using the basic concepts of semiconductor physics.
CO2: **Explain** I-V characteristics of P-N junction diode using the concept of barrier potential.
CO3: Explain the working and applications of semiconductor diodes (photodiode, solar cell, varactor diode, Gunn diode), and field-effect transistors (JFET and MOSFET).

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Basics of Semiconductors:** Direct and Indirect Band Gap Semiconductors, Electrical Conductivity of Semiconductors, Drift Velocity, Mobility, and Conductivity in Conductors Fermi- Dirac distribution function, Position of Fermi Level in Intrinsic and Extrinsic Semiconductors, Variation of Fermi level of Extrinsic Semiconductors w.r.t. temperature and Impurity Concentration, Hall Effect, Calculation of Hall Voltage. **Self-Learning**: Applications of Hall Effect	8	1
2	**Semiconductor Junction:** Formation of p-n junction, Calculation of barrier potential, Diode equation, p-n junction in forward Bias, p-n junction in Reverse bias, Current-voltage curve for p-n junction diode. **Self-Learning**: Comparative study of p-n junction diode, LED, and Zener diode.	8	2
3	**Semiconductor Diodes and Devices:** **Semiconductor Diodes:** Working of: Photodiode, solar cell, Varactor diode, Gunn diode. **Semiconductor Devices:** Introduction to FET, types of FET: JFET, MOSFET, Structure and operation of JFET and MOSFET, Enhancement and depletion modes of MOSFET. **Self-Learning:** Role of Solar Cells in Communication and Electronic Systems.	8	3

Learning Resources

Textbooks:

1. Engineering Physics: D.K. Bhattacharya, Poonam Tandon Oxford University Press.
2. Physics of Semiconductor Devices: S.M. Sze John Wiley & Sons.
3. Electronic Devices and Circuit Theory: R. Boylestad, L. Nashelsky Pearson Publication.

Reference Books:

1. Semiconductor Physics and Devices- Basic Principles: Donald Neamen Tata McGraw Hill.
2. Solid State Electronic Devices. G. Streetman Pearson Publication.
3. Electronic Devices and Circuits: Homas Floyd Pearson Publication.

E-books:

1. https://www.optima.ufam.edu.br/SemPhys/Downloads/Neamen.pdf

Assessment:

Internal Assessment Test (IAT) for 10 marks each:

IAT will consist of two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. Average of both the tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 10 Marks:

- A total of minimum 2 CIA components (such as assignments, quizzes, presentations, etc.) shall be conducted.
- Each component will carry 5 marks.

End Semester Theory Examination (ESE) 30 marks:

Question paper format

Time duration for 30 marks paper is 1hour

- Question paper will consist of three compulsory questions, given as below:
  - i. Question No. 1 shall be set from CO1
  - ii. Question No. 2 shall be set from CO2
  - iii. Question No. 3 shall be set from CO3
- Each question shall carry approximately 10 marks.
- Each question may have sub-questions, ensuring coverage of the respective module/COs.
- The questions should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within sub-questions, ensuring both options are from the same module.

Students will attempt all questions.

CO-PO-PSO Mapping (Physics of Semi-conductor)

Course Outcomes (CO)	Program Outcomes (PO)												
	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	-	-	-	-	-	2	2	-	-	2	-
CO3	2	2	-	-	-	-	2	-	-	-	2	2	-

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Physics of Semi-conductor Lab					Semester	II	
Code	Credit	Teaching Scheme (Hrs./Week)			Theory Examination Scheme		Laboratory Examination Scheme	
		L	T	P	CIA (IAT / CIAT)	ESE	CIAL	OR
MEBSL2012	0.5	--	--	1	-- / --	--	25	--

Lab Objectives:

1. To study the Hall effect.
2. To study the relationship between current and voltage in PN junction diode, photodiode, JFET

Lab Outcomes:

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

LO1: Determine Hall coefficient/carrier concentration for the given sample in probe.
LO2: **Determine** the energy band gap of a semiconductor/resistivity by four probe methods.
LO3: Determine I-V characteristics of Zener diode.
LO4: Plot I-V characteristics of a PN junction diode to interpret threshold behavior.
LO5: Examine the I–V characteristics and light response of a photodiode.
LO6: Plot and interpret the output and transfer characteristics of a JFET (simulation).

Lab Prerequisite:

1. Knowledge of basic semiconductor physics.
2. Knowledge of graph plotting, data evaluation, and result interpretation.
3. Basic computer operation skills.

List of laboratory experiments: (*Any six experiments***)**

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Measurement of Hall Voltage	1	1
2	Carrier concentration using Hall Effect.	1	1
3	Determination of resistivity by four probe method.	1	2
4	Determination of energy band gap of a semiconductor.	1	2
5	I-V Characteristics of p-n junction diode.	1	4
6	I-V Characteristics of a photo diode	1	5
7	I-V Characteristics of a Zener diode (RB)	1	3
8	I-V characteristics of JFET.	1	6

Mini Project:

Execution of the project as per the plan submitted in semester I. A working model and a study report leading to a conclusion as anticipated in semester I is required to be used for awarding marks.

Assessment:

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 5 to 6 practical based on the above list.
CIAL Marks: 25 Marks (Total marks) = 10 Marks (Average marks of Experiments) +10 Marks (Mini project work) + 5 Marks (Attendance)

LO-PO-PSO Mapping (Physics of Semi-conductor Lab)												
Lab Outcomes (LO)	**Program Outcomes (PO)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO2**
LO1	3	2	-	-	-	-	-	2	2	-	-	2	-
LO2	3	2	-	-	-	-	-	2	2	-	-	2	-
LO3	3	2	-	-	-	-	-	2	2	-	-	2	-
LO4	2	2	-	-	-	-	-	2	2	-	-	2	-
LO5	3	2	-	-	-	-	-	2	2	-	-	2	-
LO6	3	2	-	-	-	-	-	2	2	-	-	2	-

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Physics of Measurements and Sensors					Semester	II	
Code	Credits	Teaching Scheme (Hrs./Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA (20)		ESE	CIAL	PR/OR
					IAT	CIAT			
MEBSC2023	2	2	--	--	10	10	30	--	--

Course Prerequisites:
Unit And Dimensions, Piezoelectric Effect, Wheatstone Bridge, Potentiometer.

Course Objectives:

1. To provide students with a basic understanding of measurements in the field of engineering.
2. To learn the foundation of transducers in the area of measurements.
3. To understand basic sensing techniques used for measuring physical quantities in modern instrumentation systems.

Course Outcomes:
After successful completion of the course, the learner will be able to:
CO1: Apply statistical methods (mean, standard deviation, and principles of least squares) to minimize errors in measurement.
CO2: Classify different types of transducers based on function, performance, and output.
CO3: Select appropriate sensing technology based on its working principle.

Syllabus

Unit No.	Description	Hr.	CO Mapping
1	**Fundamentals of measurements:** Principle of Measurement, Error of Measurement, Correction, Correctness of Measurement, Reliability of Measurements, Verification, Calibration. Measuring Instruments: Measuring range, Sensitivity, Scale Intervals, Response time, Repeatability, Reproducibility, Inaccuracy, Precision, Accuracy. Sources of Error: Static error, Environmental error, Characteristic error, Dynamic error. Statistical Treatment of Errors: Sample mean, Sample Standard Deviation, Population Mean, Population Standard Deviation, Principles of Least Squares. **Self-Learning**: Importance of precision, accuracy, and error analysis in Engineering	8	1
2	**Transducers:** Classification by function, classification by performance, classification by output. Developments in transducer technology: Solid-state transducer, Optical transducers, Piezoelectric Transducers. **Resistive Transducers:** Potentiometer, Strain Gauges, Resistive Temperature Transducers. **Inductive Transducers:** LVDT, RVDT **Optical measurement systems**: Thermal photodetectors. **Self-Learning**: Applications of transducers	8	2

3	**Sensors** Working principle of sensors, classification: active and passive, analog and digital, criteria to choose a sensor. **Ultrasonic sensors**: Piezoelectric effect and its use as a source in the ultrasonic system, its application in flow measurements, and the ultrasonic distance meter. **Hall sensor**: (Principle of Hall effect, working & Applications) **Temperature sensors**: Pt thermometer, NTC, and PTC thermistors, and thermocouple **Optical sensors**: Photodiode & LDR **MEMS-based pressure sensor**: Microsensors and micro actuators, Intrinsic Characteristics of MEMS: Small size, low power consumption, high sensitivity, and fast response **Self-Learning**: Applications of sensors in real-life.	8	3

Learning Resources

Textbooks:

1. Engineering Metrology by R.K. Jain (Khanna Publication)
2. Sensors and Transducers by D Patranabis PHI
3. Engineering Physics by Dattu R. Joshi McGraw Hill Publication (India) Pvt Limited.

Reference Books:

1. Transducers and Interfacing by Banister B.R. and Whitehead DC
2. Mechatronics by D.A. Bradley et al CRC press Boca Raton London
3. Transducers and Instrumentation by Murty DVS , (Second Edition) PHI

Assessment:

Internal Assessment Test (IAT) for 10 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. Average of both the tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 10 Marks:

- A total of min 2 CIA components (such as assignments, quizzes, presentations, etc.) shall be conducted.
- Each component will carry 5 marks.

End Semester Theory Examination (ESE) 30 marks:
Question paper format

Time duration for 30 marks paper is 1hours

- Question paper will consist of three compulsory questions, given as below:
  - i. Question No. 1 shall be set from CO1
  - ii. Question No. 2 shall be set from CO2
  - iii. Question No. 3 shall be set from CO3
- Each question shall carry approximately 10 marks.
- Each question may have sub-questions, ensuring coverage of the respective module/COs.
- The questions should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within sub-questions, ensuring both options are from the same module.
- Students will attempt all questions

CO-PO-PSO Mapping (Physics of Measurements and Sensors)													
Course Outcomes (CO)	Program Outcomes (PO)												
	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	2	2	-	2	2	-

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Physics of Measurement and Sensors Lab						Semester	II
Code	Credits	Teaching Scheme (Hrs./Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
MEBSL2013	0.5	--	--	1	--	--	--	25	--

Lab Objectives:

1. To understand the effect of errors on experimental results and find uncertainties.
2. To study the relationship between current and voltage in a photodiode.
3. To study Hall effect.
4. To understand the working of a thermocouple.
5. To learn and use virtual labs and simulation tools for experiments

Lab Outcomes:

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

LO1: Apply the mean and standard deviation to estimate uncertainty in time measurements and determine ‘g’ from slope using a simple pendulum.
LO2: Examine the I–V characteristics and light response of a photodiode.
LO3: Determine Hall coefficient for the given sample in probe.
LO4: Compute RTD resistance at different temperatures and verify its linear R–T relationship.
LO5: Identify the relation between thermo-emf and temperature difference using J and K-type thermocouple.
LO6: Determine area and volume of room using an ultrasonic distance meter.

Lab Prerequisite:

1. Basic understanding of measurement, Knowledge of semiconductor physics, and working principles of sensors.
2. Knowledge of graph plotting, data evaluation, and result interpretation
3. Basic computer operation skills.

List of laboratory experiments: (*Any Six Experiments)*

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Measurement of the uncertainty using statistical treatment of errors.	1	1
2	Measurement of Hall Voltage.	1	3
3	Study of the ultrasonic distance meter/ interferometer	1	6
4	Calibration of PT100.	1	4
5	Calibration of J /K type thermocouple	1	5
6	Study of directivity and frequency response of MEMS microphone	1	3
7	I-V characteristic of a photodiode.	1	2
8	Study working principles of LVDT (Simulation)	1	-

Mini Project:

Execution of the project as per the plan submitted in semester I. A working model and a study report leading to a conclusion as anticipated in semester I is required to be used for awarding marks.

Assessment:

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 5 to 6 practical based on the above list.
CIAL Marks: 25 Marks (Total marks) = 10 Marks (Average marks of Experiments) +10 Marks (Mini project work) +5 Marks (Attendance)

LO-PO-PSO Mapping (Physics of Measurements and Sensors Lab)													
Lab Outcomes (LO)	**Program Outcomes (PO)**												
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO2**
LO1	3	2	-	-	-	-	-	2	2	-	-	2	-
LO2	3	2	-	-	-	-	-	2	2	-	-	2	-
LO3	3	2	-	-	-	-	-	2	2	-	-	2	-
LO4	3	2	-	-	-	-	-	2	2	-	-	2	-
LO5	3	2	-	-	-	-	-	2	2	-	-	2	-
LO6	3	2	-	-	-	-	-	2	2	-	-	2	-

Program	F. Y. B. Tech Mechanical Engineering								
Course	Material Chemistry						Semester	II	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA (10)		ESE	CIAL	PR/OR
					IAT	CIAT			
MEBSC2031	2	2	--	--	10	10	30	--	--

Course Prerequisites:

Basic understanding of general chemistry concepts atomic structure, chemical bonding and basic concepts of materials science and properties (density, strength, elasticity).

Course Objectives:

1. To recognize the composition, properties and functions of composite materials.
2. To introduce important properties of plastic and elastomer as Engineering material.
3. To understand the characteristics, classification and application of smart materials.

Course Outcomes:

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

CO1: Use composite materials for specific engineering applications based on their properties.

CO2: Explain the differences between thermoplastics and thermosetting plastics and the basic concepts of elastomers and their processing.

CO3: Explain the principles, types, and properties of smart materials and their applications in specific engineering fields.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Composite Material & Alloy Science** **Composite Material** Introduction and characteristics of composites Constituents of composites: Matrix phase and dispersed phase (definition and functions) Classification and Types: a) Fiber-reinforced composites b) Particulate composites c) Structural composites: Laminar and structural Biomaterials: Concept and need of composites; Bone as a natural composite; Applications in prosthetics and implants **Alloy Science** Alloys: Purpose of making alloys Gibbs' Phase Rule: Statement, terms involved with examples; Application to one-component system Reduced Phase Rule; Two-component system (Pb–Ag); Advantages and limitations of Phase Rule; Eutectic system – Applications and numerical Numerical based on composition, density, and weight of alloys. **Self-Learning: Classification of ferrous and nonferrous alloys**	8	1
2	**Plastics and Elastomers** Plastics: Thermoplastics and thermosetting plastics, Compounding, Numerical (degree of polymerization, density, tensile strength) Fabrication techniques: Compression, Injection, Transfer, and Extrusion molding	8	2

	Elastomers: Natural rubber; Processing;, Vulcanization –Process, Mechanism, and Applications Commercial polymers: Plastics – PTFE, PMMA, Kevlar (preparation, properties, uses) , Elastomers – Polyurethane rubber, Silicone rubber (preparation, properties, uses) Polymeric Biomaterials: Natural polymers – Collagen, Chitosan, Synthetic polymers – Polyethylene, PLA, Biodegradable polymers, Applications in drug delivery and sutures. **Self-Learning:** Drawbacks of natural rubber		
3	**Smart Materials** Introduction - Shape Memory Alloys (SMAs): Shape memory effect; One-way and two-way behavior; Austenite and martensite phases; Properties (e.g., Nitinol); Applications Metallic Biomaterials: Stainless steel, Titanium alloys; Properties and Applications in orthopedic and dental implants. 2.3 Piezoelectric materials: Principle, direct and inverse effects; Materials (Quartz, PZT); Applications Electroactive Polymers (EAP): Types (ionic and electronic); Working principle; Applications (artificial muscles, soft robotics) Nanomaterials: Introduction and Types of nanostructured materials; Graphene, Fullerene and Carbon Nanotubes (SWCNTs and MWCNTs) – Properties and uses. **Self-Learning: Comparison of smart materials vs conventional materials**	8	3

Learning Resources

Textbooks:

1. A Textbook of Engineering Chemistry - Jain & Jain, Dhanpat Rai, 17th Edition 2021-22.
2. A Textbook of Engineering Chemistry – Dara & Dara, S Chand, 1st Edition, reprint 2016.
3. A Textbook of Engineering Chemistry – Shashi Chawla, Dhanpat Rai, 4th Edition, 2016-17.

Reference Books:

1. Wiley Engineering Chemistry, Wiley India, Wiley India Pvt. Ltd. New Delhi, 2nd Edition 2013.
2. Polymer Science by V. R. Gowariker, N.V. Viswanatha & J. Sreedhar, Wiley-Eastern Ltd, 4th Edition 2021.
3. Introduction To Smart Materials Dr. Sandeep Singh Kharb, Dr. Manish Jindal, Abhishek publication.

Online Resources

1. Characterization of Polymers, Elastomers and Composites: https://onlinecourses.nptel.ac.in/noc26_ch29/preview
2. Smart Materials and Intelligent System Design, IIT Kanpur: https://nptel.ac.in/courses/112104251
3. Introduction To Composites By Prof. Nachiketa Tiwari |IIT Kanpur : https://onlinecourses.nptel.ac.in/noc22_me87/preview
4. Nanomaterials and their Properties : https://onlinecourses.nptel.ac.in/noc21_mm38/preview

Assessment:

Internal Assessment Test (IAT) for 10 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. Average of both the tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 10 Marks:

- A total of minimum 2 CIA components (such as assignments, quizzes, presentations etc.) shall be conducted.
- Each component carries 5 marks.

End Semester Theory Examination (ESE) 30 marks:

Question paper format

Time duration for 30 marks paper is 1hour.

- Question paper will consists of compulsory three questions , given as below:
  - i. Question No. 1 shall be set from CO1
  - ii. Question No. 2 shall be set from CO2
  - iii. Question No. 3 shall be set from CO3
- Each question shall carry approximately 10 marks.
- Each question may have sub-topics, ensuring coverage of the respective module/COs.
- The questions should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within sub-topics, ensuring both options are from the same module.
- Students will attempt all questions

CO-PO-PSO Mapping (Material Chemistry)													
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	2	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	2	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	2	-	-

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Material Chemistry Lab						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
MEBSL 2021	0.5	--	--	1	--	--	--	25	--

Lab Objectives:

1. To apply knowledge acquired during the theory class in carrying out the experiments for qualitative and quantitative determination.
2. To understand and apply analytical techniques such as volumetric and Colorimetry methods for estimation of metals.

Lab Outcomes:

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

LO1: Apply standard analytical techniques to determine hardness, PH, COD and chloride content of water.
LO2: Demonstrate synthesis of UF, PF & Biodiesel from vegetable oil**.**
LO3: Apply quantitative analytical techniques to determine % of Fe, Sn and Cu from alloy samples
LO4: Use molecular modeling tools such as Avogadro to construct nanostructures like fullerene (C_{60})
LO5: Apply sustainability concepts to Energy saving appliances and propose effective solutions for environmental challenges.

Lab Prerequisite:

1. Basic knowledge of safety practices in the chemistry laboratory, including handling of chemicals, use of laboratory equipment, and adherence to safety protocols.

List of laboratory experiments: (*Any Ten Experiments)*

Sr. No.	Name of the Experiment	Hrs	LO Mapping
1	Determination of Total, Temporary and Permanent hardness of water by EDTA method	1	1
2	Determination of Chloride content of water	1	1
3	Simulation of Determination of Chemical Oxygen Demand (COD) of Well water, sewage & Carbonated drinks.	1	1
4	Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.	1	1
5	Synthesis of Biodiesel from vegetable oil	1	2
6	Synthesis of Phenol formaldehyde / Urea formaldehyde resin	1	2
7	Determination of Fe / Cu by colorimetry	1	3
8	Determination of % purity of iron	1	3
9	Determination of Sn from solders volumetrically	1	3
10	Molecular Modeling of Fullerene / Graphene using Open-Source Software	1	4
11	Making report on energy saving appliances	1	5
12	Case study based on sustainable development practices	1	5

Sr No	List of Assignments	Hrs
01	Numerical based on eutectic system	**01**
02	Numerical based on density, and weight of alloys	**01**
03	Note on Graphene, Fullerene and CNTs	**01**
04	Synthesis, properties and uses of important polymers	**01**

Assessment :

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 5 to 6 practicals based on the above list. Also, CIAL Journal must include at least 2 assignments.

CIAL Marks: 25 Marks (Total marks) = 15 Marks (Average marks of Experiments) + 5 Marks (Average of 2 LMs) + 5 Marks Attendance

LO-PO-PSO Mapping (Material Chemistry Lab)													
Lab Outcomes (LO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
LO1	3	-	-	-	-	-	-	2	2	-	2	-	-
LO2	3	-	-	-	-	-	-	2	2	-	-	-	-
LO3	3	-	-	-	-	-	-	2	2	-	-	2	-
LO4	3	-	-	-	2	-	-	2	2	-	-	2	-
LO5	3	-	-	-	-	-	-	2	2	-	-	-	-

Program	F. Y. B. Tech Mechanical Engineering								
Course	Chemistry for Environment and Sustainable energy (CESE)						Semester	II	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
MEBSC2032	2	L	T	P	CIA (20)		ESE	CIAL	PR/OR
					IAT	CIAT			
		2	--	--	10	10	30	--	--

Course Prerequisites:

Basic knowledge about differences in Conventional and non-conventional energy sources and about atomic structure, chemical reactions and stoichiometry.

Course Objectives:

1. To identify water pollutants and solid and hazardous waste of different sources and suggest methods for the treatments.
2. To identify air pollutants of different sources and suggest methods for the treatments.
3. To identify different types of non-conventional energy sources

Course Outcomes:

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

CO1. Apply standard monitoring techniques such as hardness, pH, chloride, BOD & COD to determine quality of water and wastewater.

CO2. Calculate carbon footprint using CO_2 equivalent (CO_2e) and emission factors,

CO3. Explain the concepts of green hydrogen and electric vehicles and their role in sustainable energy management.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Wastewater Treatment and Solid Waste Management** **Wastewater Treatment** Introduction and Monitoring techniques: Hardness, pH, dissolved oxygen, chloride (with numerical) Wastewater characteristics: Alkalinity (with numerical), eutrophication, thermal stratification Wastewater treatment methods: Primary, secondary (activated sludge process), tertiary treatment, Biological Oxygen Demand and Chemical Oxygen Demand : Significance and numerical problems **Solid Waste Management** Municipal waste: Introduction, definition, types, and characteristics Waste collection and transportation Processing and resource recovery: Recycling and reuse; Composting (aerobic and anaerobic); Vermicomposting Hazardous waste: Introduction, Hazardous waste management methods: a) Physical –adsorption, ion exchange, electrodialysis, reverse osmosis b) Chemical – Neutralization, chemical precipitation c) Biological treatment methods **Self learning** : Classification of water pollutants	8	1
2	**Air Pollution and Atmospheric Chemistry** Chemistry and mechanisms of global effects of air pollution: a)Acid rain b) Ozone hole c) Photochemical smog Gaseous pollutants: Measurement techniques and control methods for sulphur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), and hydrocarbons Carbon footprint: Introduction; Sources of emissions; Types	6	2

	(primary and secondary); Individual vs organizational footprint; CO_2 equivalent (CO_2e); Emission factors; Basic calculations; Reduction strategies Automotive emission control: Measurement and control; Catalytic converters. **Self-learning:** Introduction to indoor air pollution and its health effects		
3	**Renewable Energy Sources** Energy and sustainability: Demand; Environmental issues; Conventional vs renewable energy ,Solar energy: Principles; Photovoltaic (PV) and thermal systems; Latest technologies (perovskite cells, BIPV). Biomass energy: Sources; Processes (pyrolysis, gasification, anaerobic digestion) Applications Energy storage systems: Need, battery - Modern trends (Li-ion and Zn storage battery) Green hydrogen: Production methods (green, blue, grey); Electrolysis; Applications Electric vehicles and renewable energy integration. **Self learning :** Applications of solar energy	6	3

Learning Resources

Text Books:

1. A Textbook of Engineering Chemistry - Jain & Jain, Dhanpat Rai, 17th Edition 2021-22.
2. A Textbook of Engineering Chemistry – Dara & Dara, S Chand, 1st Edition, reprint 2016.
3. A Textbook of Engineering Chemistry – Shashi Chawla, Dhanpat Rai, 4th Edition, 2016-17.

Reference Books:

1. Environmental Chemistry, A. K. De, Tenth edition, New Age International,
2. Green Hydrogen Production & Electrolyzer Technologies: Comprehensive Insights into
3. Technologies, Integration, and Industrial Applications, Jorren Halvick
4. Carbon Footprint: Reducing it for a Better Tomorrow, Ramesh Menon, The Energy and
5. Resources Institute, TERI

Online Resources

1. Fundamental of Carbon Capture, Utilization and Storage: https://onlinecourses.nptel.ac.in/noc26_ch04/preview
2. Wastewater : Fundamentals and Applications: https://archive.nptel.ac.in/courses/115/102/115102124/
3. Renewable Energy Engineering: Solar, Wind And Biomass Energy Systems, IIT Guwahati: https://nelda.org.in/sustainable-living-practices/
4. Biomass energy: https://www.researchgate.net/publication/355204245_Biomass_Energy
5. Hydrogen Energy: Production, Storage, Transportation and Safety, IIT Bombay : https://nptel.ac.in/courses/103101215

Assessment:

Internal Assessment Test (IAT) for 10 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. Average of both the tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 10 Marks:

- A total of minimum 2 CIA components (such as assignments, quizzes, presentations etc.) shall be conducted.
- Each component carries 5 mark

End Semester Theory Examination (ESE) 30 marks:

Question paper format

Time duration for 30 marks paper is 1hours

- Question paper will consists of compulsory three questions , given as below:
  - i. Question No. 1 shall be set from CO1
  - ii. Question No. 2 shall be set from CO2
  - iii. Question No. 3 shall be set from CO3
- Each question shall carry approximately 10 marks.
- Each question may have sub-topics, ensuring coverage of the respective module/COs.
- The questions should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within sub-topics, ensuring both options are from the same module.
- Students will attempt all questions

CO-PO-PSO Mapping (Chemistry for Environment and Sustainable energy (CESE))													
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	3	-	-	-	-	2	-	-
CO2	3	2	-	-	-	3	-	2	-	-	-	2	-
CO3	2	-	-	-	-	3	-	-	2	-	-	2	-

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Chemistry for Environment and sustainable Energy (CESE) Lab						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
MEBSL2022	0.5	--	--	1	--	--	--	25	--

Lab Objectives:

1. To apply knowledge acquired during the theory class in carrying out experiments for qualitative and quantitative determination.
2. To understand and apply analytical techniques such as volumetric and Colorimetry methods for estimation of metals.

Lab Outcomes:

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

LO1: Apply standard analytical techniques to determine hardness, PH, COD and chloride content of water.
LO2: Demonstrate synthesis of UF, PF & Biodiesel from vegetable oil**.**
LO3: Apply quantitative analytical techniques to determine % of Fe, Sn and Cu from alloy samples
LO4: Use molecular modeling tools such as Avogadro to construct nanostructures like fullerene (C_{60})
LO5: Apply sustainability concepts to Energy saving appliances and propose effective solutions for environmental challenges.

Lab Prerequisite:

1. Basic knowledge of safety practices in the chemistry laboratory, including handling of chemicals, use of laboratory equipment, and adherence to safety protocols.

List of laboratory experiments: (*Any Ten Experiments)*

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Determination of Total, Temporary and Permanent hardness of water by EDTA method	1	1
2	Determination of Chloride content of water	1	1
3	Simulation of Determination of Chemical Oxygen Demand (COD) of Well water, sewage & Carbonated drinks.	1	1
4	Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.	1	1
5	Synthesis of Biodiesel from vegetable oil	1	2
6	Synthesis of Phenol formaldehyde / Urea formaldehyde resin	1	2
7	Determination of Fe / Cu by colorimetry	1	3
8	Determination of % purity of iron	1	3
9	Determination of Sn from solders volumetrically	1	3
10	Molecular Modeling of Fullerene / Graphene using Open-Source Software	1	4
11	Making report on energy saving appliances	1	5
12	Case study based on sustainable development practices	1	5

Sr No	List of Assignments	Hr
01	Numerical on Carbon footprint	**01**
02	Numerical on determination of hardness of water by EDTA	**01**
03	Numerical on Biological Oxygen Demand and Chemical Oxygen Demand of wastewater	**01**
04	Note on Green hydrogen and its applications	**01**

Assessment :

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 5 to 6 practicals based on the above list. Also, CIAL Journal must include at least 2 assignments.

CIAL Marks: 25 Marks (Total marks) = 15 Marks (Average marks of Experiments) + 5 Marks (Average of 2 LMs) + 5 Marks Attendance

LO-PO-PSO Mapping Chemistry for Environment and sustainable Energy (CESE) Lab

Lab Outcomes (LO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
LO1	3	-	-	-	-	3	-	2	2	-	2	2	-
LO2	3	-	-	-	-	3	-	2	2	-	-	2	-
LO3	3	-	-	-	-	3	-	2	2	-	-	-	-
LO4	3	-	-	-	2	3	-	2	2	-	-	-	-
LO5	3	-	-	-	-	3	-	2	2	-	-	2	-

Program	F. Y. B. Tech Mechanical Engineering								
Course	Engineering Mechanics						Semester	II	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
MEESC204	3	L	T	P	CIA (40)		ESE	CIAL	PR/OR
					IAT	CIAT			
		3	--	--	20	20	60	--	--

Course Prerequisites:

Basic Calculus, Trigonometry, Geometry, Fundamental knowledge of Engineering Mathematics and Physics.

Course Objectives:

1. To acquaint with basic principles of centroid and its application.
2. To provide the fundamental knowledge about Force, Moment, resultant, and Equilibrium of forces to solve the problems.
3. To expose learners to applications of Friction and Equilibrium in real life problems.
4. To impart the knowledge of various types of motion and their analysis for real life problems.
5. To understand the parameters required to quantify the Kinetics of rigid body.
6. To acquaint with the basics of Robot kinematics.

Course Outcomes:

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

CO1: Determine the position of centroid with respect to a given reference axis.
CO2: Apply principles of statics to determine the resultant of various force systems.
CO3: Determine support reactions, frictional forces in various engineering applications using conditions of equilibrium.
CO4: Determine position, velocity and acceleration of particle and rigid body using principles of kinematics.
CO5: Apply the D'Alembert's and Impulse Momentum principle to develop the relation between various forces and motion of a particle.
CO6: Develop the kinematic relation for robot joints.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Centroid** Centroid of plane laminas: Plane lamina consisting of primitive geometrical shapes **Self Learning Topics:** centroid of non-primitive geometrical shapes	3	1
2	**System of Forces** Classification of force systems, Principle of transmissibility, composition and resolution of forces. Resultant of coplanar force system (Concurrent forces, parallel forces and non-concurrent Non-parallel system of forces). Moment of force about a point, Couples, Varignon's Theorem. **Self Learning Topics:** Space forces	8	2
3	**Equilibrium of Force system and Friction** **Equilibrium:** Conditions of equilibrium for concurrent forces, parallel forces and non-concurrent non- parallel general forces and Couples. Equilibrium of rigid bodies with free body diagrams. **Equilibrium of Beams:** Types of beams, simple and compound beams, type of supports and reaction: Determination of reactions at supports for various types of loads on beams. (Excluding problems on internal hinges)	10	3

	Friction: Laws of friction. Cone of friction. angle of repose, equilibrium of bodies on an inclined plane. **Self Learning Topics:** Trusses		
4	**Kinematics of particle and rigid bodies** Motion of particle with variable acceleration. Motion along plane curved path. velocity and acceleration in terms of rectangular components, tangential and normal component of acceleration. Introduction to general plane motion, problem based on Instantaneous center (ICR) method for general plane motion upto 2 linkage mechanism and no relative velocity method. **Self Learning Topics:** Motion curves	8	4
5	**Kinetics of particle** Force and Acceleration: -Introduction to basic concepts, D'Alemberts Principle, concept of Inertia force, Equations of dynamic equilibrium. Principle of linear impulse and momentum. Impact and collision: Law of conservation of momentum, Coefficient of Restitution. Direct Central Impact and Oblique Central Impact. Loss of Kinetic Energy in collision of inelastic bodies. **Self Learning Topics:** Work Energy principle applied to simple systems	7	5
6	**Introduction to Robot Kinematics** Fundamental of Robot Mechanics, Degree of Freedom, D-H Parameters, robot kinematics (Forward), Homogeneous transformation (limited to 2 DOF Serial robot). **Self Learning Topics:** Examples on homogeneous transformation	3	6

Learning Resources

Textbooks:

1. Hibbeler R. C., "Engineering Mechanics - Statics", 14th Ed., Prentice Hall, Hibbeler R. C., Engineering Mechanics - Dynamics", 14th Edition, Prentice Hall
2. Beer F. P., Johnston E. R. et al., "Vector Mechanics for Engineers: Statics & Dynamics", 12th Ed., McGraw-Hill Publication
3. Engineering Mechanics, R. S. Khurmi, S. Chand Publications, 3rd Edition (2019)

Reference Books:

1. Engineering Mechanics, F.L. Singer Harper & Row, Hill Publishers, 3rd Edition (1975)
2. Engineering Mechanics, Meriam and Crage, Wiley Publications, 9th Edition (2020)
3. Engineering Mechanics, Timoshenko and Young, McGraw-Hill Publications, 5th Edition (2013)
4. Introduction of Engineering Mechanics, S. Rajasekaran and G Sankarasubramanian, Vikas Publications, 1st Edition, (2011)
5. Vector Mechanics for Engineers-STATICS, Beer & Johnston, Tata McGraw-Hill Publications, 12th Edition, (2018)
6. Vector Mechanics for Engineers-DYNAMICS, Beer & Johnston, Tata McGraw-Hill Publications, 12th Edition, (2018)
7. Engineering Mechanics: Statics and Dynamics, A. K. Tayal, Unmesh Publications,11th Edition, (2000)

Online Resources

Engineering Mechanics, Prof. K. Ramesh, IITM, NPTEL-NOC-IITM
https://nptel.ac.in/courses/112106286

Assessment:

Internal Assessment Test (IAT) for 20 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. Average of both the tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 20 Marks:

- CIA components (such as assignments, quizzes, presentations, case studies, etc.) shall be conducted.
- Each component will carry 5 marks, totaling 20 marks.

End Semester Theory Examination (ESE) 60 marks:

Question paper format

Time duration for 60 marks paper is 2 hours

a. The question paper shall consist of six questions, carrying 10 marks each.
   i. Question No. 1 shall be set from CO1 & CO6.
   ii. Question No. 2 shall be set from CO2.
   iii. Question No. 3 shall be set from CO3.
   iv. Question No. 4 shall be set from CO3.
   v. Question No. 5 shall be set from CO4.
   vi. Question No. 6 shall be set from CO5.

b. Each question shall have two options – Option A and Option B, and both options must be set from the same module.

c. The options should be of comparable difficulty level and should test similar learning outcomes.

d. Internal choice may be provided within each question, ensuring both options cover the same module.

e. Students will attempt all questions.

CO-PO-PSO Mapping (Engineering Mechanics)

Course Outcomes (CO)	Program Outcomes (PO)												
	PO 1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	2	-	-	3	2
CO2	3	2	-	-	-	-	-	-	2	-	2	3	2
CO3	3	2	-	-	-	-	-	-	2	-	-	3	2
CO4	3	2	-	-	-	-	-	-	2	-	2	3	2
CO5	3	2	-	-	-	-	-	-	2	-	-	3	2
CO6	3	2	-	-	-	-	-	-	2	-	-	3	2

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Engineering Mechanics LAB						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
MEESL203	1	L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
		--	--	2	--	--	--	25	25

Lab Objectives:

1. To familiarize with the concepts of force, moment, resultant and equilibrium of system of coplanar force.
2. To acquaint with the basic concept of friction and its application in real-life problems.
3. To understand the fundamental principles of truss structures and their practical applications.
4. To understand the parameters required to quantify the Kinematics of Particle and Rigid body
5. To understand the parameters required to quantify the Kinetics of rigid body
6. To understand DoF and working of a robotic arm

Lab Outcomes:

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

LO1: Determine the resultant of various force systems.
LO2: Determine the position of centroid with respect to a given reference axis.
LO3: Determine support reactions, frictional forces in various engineering applications using conditions of equilibrium.
LO4: Determine position, velocity and acceleration of particle and rigid body using principles of kinematics.
LO5: Apply the D'Alembert's and Impulse Momentum principle to develop the relation between various forces and motion of a particle.
LO6: Operate Robotic arm.

2. List of laboratory experiments: *(Any four from Sr. No. 1-6 and Any one from Sr. No.9-10. Sr. No. 7 and 8 are compulsory))*

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Verification of the polygon law of forces	2	1
2	Verification of the Principle of Moments (Bell crank lever)	2	2
3	Determination of support reaction of beam using programming language.	2	3
4	Determination of coefficient of friction	2	3
5	Demonstration of curvilinear motion and WEP	2	4
6	Verification of the equations of equilibrium for non-concurrent non-parallel (General)force system	2	1
7	Pick and Place Operation Using a Robotic Arm.	2	6
8	Analysis of a Simple Truss	2	3
9	Collision of elastic bodies (Law of conservation of momentum). Virtual lab - Elastic vs Inelastic Collision: Simulate and compare energy conservation in different collision types https://vlab.amrita.edu/?sub=1&brch=74&sim=189&cnt=1	2	5
10	Kinematics of particles. (Uniform motion of a particle, Projectile motion, motion under gravity) Virtual lab- Projectile Motion Simulator: Explore trajectory, angle, and velocity effects interactively https://vlab.amrita.edu/?sub=1&brch=74&sim=191&cnt=1	2	4

Assessment:

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 7 practicals based on the above list.
CIAL Marks: 25 Marks (Total marks) = 10 Marks (Experiments) + 5 Marks (Assignments) + 5 Marks (Course project with Presentation)+ 5 Marks (Attendance)
Oral Exam: An Oral exam will be held based on the entire syllabus.

LO-PO-PSO Mapping (Engineering Mechanics Lab)

Lab Outcomes (LO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
LO1	3	2	-	-	-	-	-	-	2	-	-	3	2
LO2	3	2	-	-	-	-	-	3	2	-	-	3	2
LO3	3	2	2	-	3	-	-	-	2	-	-	3	2
LO4	3	2	-	-	-	-	-	-	2	-	-	3	2
LO5	3	2	-	-	-	-	-	-	2	-	-	3	2
LO6	3	2	-	-	-	-	-	-	2	-	-	3	2

Program	F. Y. B. Tech Mechanical Engineering								
Course	Elements of Mechanical Engineering						Semester	II	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA (40)		ESE	CIAL	PR/OR
					IAT	CIAT			
MEPCC205	3	3	--	--	20	20	60	--	--

Course Prerequisites:
Knowledge of physics, basic mathematics.

Course Objectives:

1. To introduce the scope and applications of mechanical engineering in society and industry.
2. To develop a fundamental understanding of thermodynamics and energy systems.
3. To provide knowledge of engineering materials and manufacturing processes.
4. To introduce principles of industrial engineering and productivity improvement.
5. To familiarize students with basic machine design elements such as clutches, brakes, and bearings.
6. To create awareness about emerging technologies in mechanical engineering

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

CO1: Explain the scope and role of mechanical engineering in society and industry.
CO2: Describe basic thermodynamic concepts and energy systems.
CO3: Explain various manufacturing processes and their applications.
CO4: Apply basic principles of industrial engineering for productivity and efficiency.
CO5: Explain the working and applications of basic machine elements such as clutches, brakes, and bearings.
CO6: Identify emerging technologies and advancements in mechanical engineering..

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	Introduction to mechanical engineering, its role in society and industry, and overview of major domains such as thermodynamics, manufacturing, and design. Introduction to interdisciplinary applications like renewable energy, electric vehicles, robotics, and HVAC systems. Basic engineering concepts **Self-Learning: Basic Engineering Concepts in Daily Life**	6	1
2	**Fundamentals of Thermodynamics and Energy Systems** Basic thermodynamic concepts including system, properties, and laws of thermodynamics, concepts of heat, work, internal energy, and enthalpy, introduction to energy systems such as IC engines, power plants, and renewable energy systems, fundamentals of refrigeration and air conditioning, and concepts of energy conservation. **Self-Learning: Mechanical systems in urban sustainability**	6	2
3	**Manufacturing Process** Basics of material selection, manufacturing processes such as casting, forming, machining, welding, and additive manufacturing, and introduction to modern manufacturing practices including CNC and automation. **Self-Learning: Working principles of 3D printing**	6	3
4	**Fundamentals of Industrial Engineering and Management** Concepts of productivity and efficiency, work study techniques such as method and time study, and plant layout selection. Basics of production planning and control, quality control, lean manufacturing (5S), and safety	6	4

	with ergonomics. **Self-Learning: Case studies from automotive industriesSelf-Learning:** Modern memory technologies: HDD vs SSD, DDR5, HBM (overview)		
5	**Basics of Machine Design** Basic design concepts such as stress, strain, and factor of safety. Concept of interchangeability working and applications of clutches, belt, chain, gear, brakes, and bearings. Concept lubrication and failure of machine elements. **Self-Learning: Types of failures (fatigue, wear, creep)**	6	5
6	**Technological Advancements in Mechanical Engineering** Introduction, automation, robotics, artificial intelligence, IoT. Introduction to electric vehicles, Industry 4.0, digital twin concepts, and sustainable engineering practices including green manufacturing and energy-efficient systems. **Self-Learning: IoT-enabled machines**	6	6

Learning Resources

Textbooks:

1. Elements of Mechanical Engineering, V.K.Manglik
2. Elements of Mechanical Engineering, R.K.Rajput
3. S.Trymbaka Murthy, “A Text Book of Elements of Mechanical Engineering”, 4th Edition 2006, Universities Press (India) Pvt Ltd, Hyderabad

Reference Books:

1. Basic and Applied Thermodynamics, P.K.Nag, Tata McGraw Hill 2nd Ed., 2002
2. Internal Combustion Engine, V Ganesan, TMH
3. Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley
4. Machine Design, V. B. Bhandari, Tata MacGraw Hill

Online Resources

1. https://www.youtube. m/watch?v=O3Ch1J6O-BM
2. https://ocw.mit.edu/ urses/2-72-elements-of-mechanical-design-spring- 2009/pages/syllabus/
3. https://www.youtube. m/playlist?list=PLGiGNMkNq6QtUtjvnbQpKZJQmxP5TKd A_

Assessment:

Internal Assessment Test (IAT) for 20 marks each:

IAT will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II. Average of both the tests will be considered

Continuous Internal Assessment-Theory (CIAT) for 20 Marks:

- A total of three CIA components (such as assignments, quizzes, presentations, case studies, etc.) shall be conducted.
- Each component will carry 5 marks, totaling 15 marks.
- Attendance will carry 5 marks.

End Semester Theory Examination (ESE) 60 marks:
Question paper format
Time duration for 60 marks paper is 2 hours
a. The question paper shall consist of six questions, carrying 10 marks each.
i. Question No. 1 shall be set from CO1.
ii. Question No. 2 shall be set from CO2.
iii. Question No. 3 shall be set from CO3.
iv. Question No. 4 shall be set from CO4.

v. Question No. 5 shall be set from CO5.
vi. Question No. 6 shall be set from CO6.

b. Each question shall have two options – Option A and Option B, and both options must be set from the same module.
c. The options should be of comparable difficulty level and should test similar learning outcomes.
d. Internal choice may be provided within each question, ensuring both options cover the same module.
e. Students will attempt all questions.

CO-PO-PSO Mapping (Elements of Mechanical Engineering)

Course Outcomes (CO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	-	-	-	-	-	-	-	-	-	-	2
CO6	3	2	-	-	-	2	-	2	2	2	2	-	2

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Elements of Mechanical Engineering Lab						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	IAT	CIAL	ESE	CIAL	PR
MEPCL204	2	--	--	2	--	--	--	25	--

Lab Objectives:

1. To provide hands-on exposure to basic mechanical engineering concepts.
2. To familiarize students with materials, manufacturing processes, and machine elements.
3. To develop understanding of industrial engineering practices through experiments.
4. To demonstrate working of thermal and energy systems.
5. To introduce measurement, observation, and reporting skills.
6. To create awareness of modern engineering technologies and practices

Lab Outcomes:

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

LO1: Explain the working and applications of power transmission systems such as belt drives, chain drives, and gear trains.
LO2: Describe the construction, types, and working principles of internal combustion engines.
LO3: Explain the components and working of refrigeration and air conditioning systems.
LO4: Understand the basic structure and operation of CNC machines and automation systems.
LO5: Describe the components, working, and comparison of hybrid and electric vehicles.
LO6: Demonstrate awareness and basic understanding of modern engineering technologies

1.List of laboratory experiments:

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Study of Power Transmission Systems: Belt Drive, Chain Drive, and Gear Train	2	1
2	Study and Demonstration of Internal Combustion Engine Components and Working	2	2
3	Study of Refrigeration System and Vapor Compression Cycle	2	3
4	Study of Air Conditioning System and Its Components	2	3
5	Study and Demonstration of CNC Machine Components and Basic Operation	2	4
6	Study of Automation in Manufacturing Systems	2	6
7	Study of Hybrid Electric Vehicle (HEV) Components and Working	2	5
8	Study of Electric Vehicle (EV) Components and Working	2	5
9	Comparative Study of Hybrid and Electric Vehicles	2	5
10	Mini Project/Case Study on Modern Mechanical Systems or Technologies	2	6

Assessment :

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 7 practicals based on the above list.
CIAL Marks: 25 Marks (Total marks) = 10 Marks (Experiments) + 10 Marks (Course project with Presentation) + 5 Marks (Attendance)
Oral Exam: An Oral exam will be held based on the entire syllabus.

LO-PO-PSO Mapping (Elements of Mechanical Engineering Lab)													
Lab Outcomes (LO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
LO1	3	-	-	-	-	-	-	2	2	-	-	–	2
LO2	3	-	-	-	-	-	-	2	2	-	-	–	2
LO3	3	-	-	-	-	-	-	2	2	-	-	–	2
LO4	3	-	-	-	-	-	-	2	2	-	-	–	2
LO5	3	-	-	-	-	-	-	2	2	-	-	–	2
LO6	3	-	-	-	-	2	-	2	2	-	-	–	2

Program	F. Y. B. Tech. Mechanical Engineering							
Course	Python Programming Lab						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme		Laboratory Examination Scheme	
		L	T	P	CIA	ESE	CIAL	OR
					IAT / CIAT			
MEVSEC2051	2	--	--	2*+2	-- / --	--	25	--

Lab Objectives:

1. To understand and apply basic Python programming concepts, including syntax, data types, and operators.
2. To develop problem-solving skills using control structures and functions for modular and efficient programming.
3. To implement object-oriented programming concepts for designing structured and reusable code.
4. To perform file handling and exception handling operations for data storage and error management.
5. To design and develop GUI-based applications using Python libraries such as Tkinter.
6. To analyze and manipulate data using NumPy and Pandas for basic data processing and analysis tasks.

Lab Outcomes:

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

LO1: Apply Python fundamentals to develop programs using appropriate syntax, data types, and operators.

LO2: Design and implement solutions using control structures and functions to solve computational problems effectively.

LO3: Develop applications using object-oriented programming principles such as classes, inheritance, and polymorphism.

LO4: Perform file operations and handle exceptions for efficient data management and robust program execution.

LO5: Create GUI-based applications using Tkinter with event handling and user interaction.

LO6: Use NumPy and Pandas libraries to perform data manipulation, analysis, and basic data visualization tasks.

Lab Prerequisite:

1. Basics of Computers and Basic Mathematics
2. Fundamentals of Programming Languages like C language
3. Programming concepts such as algorithms, flowcharts, and logic building.

Unit No	Detailed Content	Hrs	Lo Mapping
1	**Basics of Python Programming** Installation and setup of Python environment (IDLE, VS Code, Jupyter Notebook), Python syntax, keywords, identifiers, indentation, variables and data types (int, float, string, boolean, tuple, dictionary, set and list), input and output operations, operators (arithmetic, relational, logical), type casting, basic programs for calculations and user interaction. **Self-Learning**: Python Package Management and Virtual Environments, Interactive Python Programming with Google Colab and Jupyter Notebook	8	LO1
2	**Control Structures and Functions** Conditional statements (if, if-else, if-elif ladder), looping constructs (for loop, while loop), loop control statements (break, continue, pass), functions (definition, calling, return statement), types of arguments (positional, keyword, default, variable-length), lambda functions, recursive functions, writing modular programs using functions. **Self-Learning:** Decorators and Higher-Order Functions in Python, Problem Solving Using Recursion and Dynamic Programming	8	LO2
3	**Object-Oriented Programming (OOP)** Introduction to OOP concepts, classes and objects, constructors and instance variables, methods and self keyword, inheritance (single, multilevel, multiple), encapsulation and polymorphism, method overriding, real-world OOP programs. **Self-Learning:** Abstract Classes and Interfaces (Abstract Base Classes in Python), Object-Oriented Design Principles (SOLID Principles)	6	LO3
4	**File Handling and Exception Handling** File operations (open(), read(), write(), append(), close()), file modes (r, w, a, r+, etc.), working with text files and file processing, exception handling (try, except, finally, else), handling multiple exceptions, programs for file-based data storage and error handling. **Self-Learning:** Working with CSV, JSON, and XML Files in Python, Logging and Debugging in Python	6	LO4
5	**GUI Programming** Introduction to GUI concepts, GUI programming using Tkinter, widgets (Label, Button, Entry, Text, Frame), layout managers (pack(), grid(), place()), event handling and callbacks, development of simple GUI-based applications (calculator, forms, etc.). **Self-Learning:** Advanced GUI Design with Tkinter, Database Integration with Tkinter	6	LO5

	6	**Data Analysis using NumPy and Pandas** Introduction to NumPy arrays, array creation, indexing, slicing, operations, mathematical and statistical functions, introduction to Pandas, Series and DataFrame creation and manipulation, data cleaning and filtering, reading/writing data (CSV, Excel), simple data analysis programs. **Self-Learning:** Data Visualization using Matplotlib and Seaborn, Exploratory Data Analysis (EDA) using Pandas	6	LO6

Textbooks:

1. Eric Matthes, Python Crash Course, 3rd Edition, No Starch Press, 2023.
2. Al Sweigart, Automate the Boring Stuff with Python, 2nd Edition, No Starch Press, 2019.
3. Wesley J. Chun, Core Python Programming, 2nd Edition, Prentice Hall, 2006.
4. Paul Barry, Head First Python, 3rd Edition, O'Reilly Media, 2023.

References:

1. David Beazley, Python Distilled, 1st Edition, Addison-Wesley Professional, 2022.
2. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 6th Edition, O'Reilly Media, 2025.
3. Luciano Ramalho, Fluent Python, 2nd Edition, O'Reilly Media, 2022.

Online Resources:

1. "The Python Tutorial",http://docs.python.org/release/3.0.1/tutorial/
2. https://www.coursera.org/specializations/python
3. https://www.freecodecamp.org/learn

List of laboratory experiments: (Any Ten Experiments)

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Write a Python program to perform basic arithmetic operations (addition, subtraction, multiplication, division) using user input.	2	1
2	Write a program that converts units (e.g., Celsius to Fahrenheit, Kilometers to Miles) using arithmetic operators and type casting.	2	1
3	Implement a program to calculate the area and circumference of a circle, and the volume of a sphere, given a radius.	2	1
4	Develop an application that calculates the total bill amount including tax and tip, then divides it among a specific number of people.	2	1
5	Write a program to demonstrate data types and type casting (int, float, string, boolean).	2	1
6	Write a function that determines if a number is prime and use a loop to print all primes within a user-defined range.	2	2
7	Write a program to simulate an ATM interface (Check balance, Deposit, Withdraw) by using nested if-else and while loops.	2	2
8	Implement both iterative (using loops) and recursive functions to generate the Fibonacci series up to n terms.	2	2
9	Write a program that checks a password's strength based on length, special characters, and digits using a for loop and conditional logic.	2	2
10	Write a program that uses lambda functions with filter() and map() to extract even numbers from a list and square them.	2	2
11	Write a Python program to create a class and object to display student details using constructors.	2	3

12	Create a Book class with attributes and a method to display info; instantiate multiple objects to represent a library shelf.	2	3
13	Define a base class Shape with a method area(); override it in Square, Circle, and Triangle classes.	2	3
14	Write a program to use multiple inheritance to create a SmartPhone class that inherits features from both Camera and Phone classes.	2	3
15	Write a program to demonstrate inheritance and method overriding using a real-world example.	2	3
16	Write a Python program to perform file operations (create, read, write, append).	2	4
17	Write a program that reads a text file and counts the frequency of each word, handling the FileNotFoundError.	2	4
18	Create an input-based calculator that uses exception handling to catch ValueError if the user enters text instead of numbers.	2	4
19	Write a program that takes student data and saves it into a .txt or .csv file in a structured format.	2	4
20	Write a program to demonstrate exception handling (try, except, finally) with multiple exceptions.	2	4
21	Design a grid-based GUI with buttons for digits and operators that updates a central display.	2	5
22	Write a program to use Tkinter’s after() method to create a live-updating digital clock display.	2	5
23	Create a GUI where users can type a task into an Entry widget and click an "Add" button to move it to a Listbox.	2	5
24	Design a form with "Username" and "Password" fields that displays a "Success" or "Failure" message box upon clicking "Submit."	2	5
25	Build an app with sliders or buttons that change the background color of a frame based on user selection.	2	5
26	Write a Python program using NumPy to perform array operations (creation, slicing, mathematical operations).	2	6
27	Generate an array of 100 random numbers and calculate the mean, median, variance, and standard deviation.	2	6
28	Create a DataFrame of employees and filter it to show only those in the "Engineering" department with a salary over 50,000.	2	6
29	Write a program to read a dataset with missing values (NaN) using Pandas and demonstrate techniques to drop or fill those values.	2	6
30	Write a Python program to read a CSV file of sales data, group it by "Region," calculate total revenue per region, and export the summary to an Excel file..	2	6
31	Mini Project	2	1-6

Assessment :

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 5 to 6 practicals based on the above list. Also, CIAL Journal must include at least 4 assignments.
CIAL Marks: 25 Marks (Total marks) = 15 Marks (Average marks of Experiments) + 5 Marks (Mini Project) + 5 Marks (Presentation on Case Study)

LO-PO-PSO Mapping (Python Programming Lab)													
Lab Outcomes (LO)	**Program Outcomes (PO)**												
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
LO1	3	2	-	-	2	-	-	2	2	-	-	1	3
LO2	2	3	-	-	2	-	-	2	2	-	-	2	3
LO3	2	2	-	-	3	-	-	2	2	-	-	2	3
LO4	2	2	-	-	3	-	-	2	2	-	-	1	3
LO5	2	3	-	-	3	-	-	2	2	-	-	1	2
LO6	3	2	-	-	2	-	-	2	2	-	2	3	3

Program	F. Y. B. Tech Mechanical Engineering								
Course	Object-Oriented Programming with JAVA						Semester	II	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA (40)		ESE	CIAL	PR/OR
					IAT	CIAT			
MEVS EC2052	2	2	--	2	--	--	--	25	25

Course Prerequisites:

- Knowledge of Structured Programming language C
- Proficiency in fundamental constructs like data types, operators
- Proficiency in concepts decision making and looping constructs, arrays, string, function and structure.

Lab Objectives:

1. To learn the basic concepts of object-oriented programming .
2. To study JAVA programming language
3. To study Inheritance concept
4. To study various concepts of JAVA programming like multithreading
5. To study exception Handling, packages.
6. To study components of GUI based programming

Lab Outcomes:

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

LO1: **Apply** programming constructs of decision making and looping for solving arithmetic problems.
LO2: **Illustrate** the concept of packages, classes and objects
LO3: **Elaborate** the concept of strings, arrays and vectors.
LO4: **Implement** the concept of inheritance and interfaces.
LO5: **Implement** the concept of exception handling and multithreading.
LO6: **Develop** GUI based application

Syllabus

Unit No.	Description	Hrs.	LO Mapping
1	**Introduction to Object Oriented Programming** OOP concepts: Objects, class, Encapsulation, Abstraction, Inheritance, Polymorphism, message passing. Java Virtual Machine Basic programming constructs: variables, data types, operators, unsigned right shift operator, expressions, branching and looping, Input and output in Java, Buffered reader class, Scanner class, Command line arguments. **Self-Learning:** Evolution of Java and its features., Comparison of Java with C	7	1
2	**Class, Object and Packages** Class, object, data members, member functions, access specifiers, Constructors, types of constructors, static members and functions, Method overloading, Packages in java, types of packages, user defined packages. **Self-Learning:** Role of Encapsulation in Secure Software Development.	7	2
3	**Data structures in JAVA** Use of data structures: Array, Strings, String Buffer, Vectors **Self-Learning:** ArrayList and LinkedList, Searching and sorting arrays using Java utility classes.	6	3
4	**Fundamental concept of Inheritance** Types of inheritance, Method overriding, super, abstract class and abstract method, final, extends keyword, Multiple inheritance using	8	4

	interface. **Self-Learning:** Impact of Polymorphism on Software Maintainability**.**		
5	**Exception handling and Multithreading** Exception handling using try, catch, finally, throw and throws, Multiple try and catch blocks, user defined exception. Need of Multithreading, Thread lifecycle, thread class methods, creating threads using extends and implements keyword. **Self-Learning:** Multithreading in Modern Operating Systems and Applications, Comparative Analysis of Thread-Based and Task-Based Programming Models.	6	5
6	**GUI programming in JAVA with database connectivity** AWT / Swing in JAVA: use of GUI components with Event handling. Introduction to JDBC, JDBC-ODBC connectivity, JDBC architecture. **Self-Learning:** Difference between AWT and Swing.	6	6

Suggested List of Experiments

Perform at least 2 experiments per module referring to following list with additional mini project

Note: Two experiments are expected to be completed in each lab session

Sr No	Name of Experiment	Module No	CO
1 a	Write a Java program that uses the Scanner class to accept the marks of 5 students in a subject. The program should: • Calculate the average marks • Identify the highest and lowest marks Display whether the class performance is "Good" (average ≥ 60) or "Needs Improvement" (average < 60).	1	1
b	Write a Java program that uses the BufferedReader class to read an attendance file line by line. The program should: • Count the total number of students • Count how many are Present and Absent Display a summary report of attendance.		
c	Write a Java program that accepts marks of 5 subjects from user using command line arguments and display percentage.		
2 a	Implement a class Calculator with overloaded methods: add(int, int) add(double, double) add(int, int, int) Demonstrate compile-time polymorphism.	2	2
b	Create a package geometry containing a class Circle. Import and use this class in another program to calculate area and circumference.		
c	Develop a student class with attributes (name, marks in 3 subjects). Write a method to calculate the average marks, create objects for 5 students, and display those scoring above average.		
3 a	Write a program to generate a student marksheet. Read student Roll no, name, branch, marks of 5 subjects. Calculate total and percentage. Display student information along with class/grade secured by the student.	3	3
b	Write a Java program that uses the Vector class to store the names of 10 stationery items available in a shop. The program should allow the shopkeeper to perform the following operations: 1. Add items to the vector dynamically. 2. Remove an item from the vector when it is out of stock. 3. Traverse and display all the items currently stored in the vector.		

	The program should demonstrate the dynamic nature of the Vector class and show how elements can be added, removed, and accessed using traversal techniques.		
4 a	Program to implement single, multilevel, and hierarchical inheritance using appropriate class structures.	4	4
b	Program to implement method overriding in derived classes and demonstrate the use of the super keyword to access parent class methods and variables.		
c	Program to implement abstract classes and abstract methods to achieve abstraction in inheritance.		
5 a	A simple login system asks the user to enter their age to verify eligibility for registration. Sometimes users enter text instead of numbers or negative values. Write a Java program that uses multiple try–catch blocks to handle invalid input and display appropriate error messages.	5	5
b	Write a Java program that creates a thread using the Thread class. The thread should display table of numbers from 1 to 5 to demonstrate basic multithreading and thread lifecycle execution.		
6 a	Design a GUI to collect contact details (Name, Phone, Email) and save them into a persistent SQL database upon clicking a "Save" button.	6	6
b	Create an application where typing in a search field dynamically filters and displays product records from a database into a JTable.		
c	Create a drawing canvas where users can click and drag to draw freehand lines, with options to change the stroke color via a color picker button.		
7	Mini Project		

Learning Resources

Textbooks:

1. Herbert Schildt, ‘JAVA: The Complete Reference’, Ninth Edition, Oracle Press
2. E. Balagurusamy, ‘Programming with Java’, McGraw Hill Education.

Reference Books:

1. Ivor Horton, “Beginning JAVA“, Wiley India.
2. Dietal and Dietal, “Java: How to Program“, 8th Edition, PHI.
3. “JAVA Programming“, Black Book, Dreamtech Press
4. “Learn to Master Java programming“, Staredu solutions

Online Resources:

1. www.nptelvideos.in
2. www.w3schools.com
3. www.tutorialspoint.com
4. https://starcertification.org/Certifications/Certificate/securejava

Continuous Internal Assessment Lab (CIAL):

1. CIAL should consist of 12 experiments.
2. Mini Project based on the content of the syllabus (Group of 2-3 students)
3. The final certification and acceptance of CIAL ensures that satisfactory performance of laboratory work and minimum passing marks in CIAL.
4. Total 25-Marks (Experiments: 10-marks, Mini Project: 5-marks, certification/presentation on latest trends and area of use of JAVA/TEST: 5-marks, Attendance: 05-marks)

LO-PO-PSO Mapping (Object-Oriented Programming using JAVA)													
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
LO1	2	2	1	-	2	-	2	2	2	-	-	-	-
LO2	2	2	1	-	2	-	2	2	2	-	-	-	-
LO3	2	2	1	-	3	-	2	2	2	-	-	-	-
LO4	2	2	2	-	3	-	2	2	2	-	-	-	-
LO5	2	3	2	-	3	-	2	2	2	-	-	-	-
LO6	2	3	2	-	3	-	2	2	2	-	2	-	2

Program	F. Y. B. Tech Mechanical Engineering								
Course	Object-Oriented Programming with C++						Semester	II	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA		ESE	CIAL	PR/OR
					IAT	CIAT			
MEVSEC2053	2	--	--	2*+2	--	--	--	25	25

Course Prerequisites:

Prior knowledge of C programming is required. Basic understanding of logical reasoning, algorithms, and flowcharts is desirable.

Lab Objectives:

1. To introduce the fundamentals of procedural and object-oriented programming concepts using C and C++.
2. To develop logical problem-solving skills using control structures, arrays, and strings.
3. To provide understanding of pointers and their applications in memory management.
4. To enable the use of classes and objects for implementing object-oriented solutions.
5. To impart knowledge of inheritance and its role in code reusability and program structure.
6. To introduce advanced object-oriented concepts such as function overloading, operator overloading, and polymorphism.

Lab Outcomes:

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

LO1: Implement programs using C and C++ and identify the differences in their programming paradigms.
LO2: Apply fundamental C++ constructs to design and implement logical problem-solving strategies.
LO3. Apply pointers effectively for data handling and dynamic memory management.
LO4: Formulate and implement solutions using classes and objects based on object-oriented principles.
LO5: Apply inheritance in C++ to implement reusable and hierarchical class structures.
LO6: Implement function overloading and operator overloading to achieve compile-time polymorphism in C++.

Syllabus

Unit No.	Description	Hrs.	LO Mapping
1	**Introduction** Procedure Oriented Programming (POP) vs Object Oriented Programming (OOP), Difference between C and C++, Data Types, Type Compatibility, Declaration of Variables, Type Casting, Structure of a C++ Program: Basic Input/Output Operators (cin, cout), Basic I/O functions, Simple C++ programs.	4	1
2	**Logic Building** Arrays: 1-D, 2-D, 3-D. Problem Solving using Loops and Conditions, Pattern-Based Logic Building, String Operations: Core string operations, Basic string logic problems, Number-Based Logic Building: Number extraction, Basic number problems, Digit-based problems. Array-Based Logic Building: Core array operations, Array transformation, Searching and Sorting. **Self-learning:**2D Prefix Sums, 2D Difference Arrays, Z-Algorithm, Hashing.	5	2
3	**Pointers** Introduction to Pointers. Reference vs. Pointer, Pointer to Structures, Pointers to Arrays, Pointer to Functions. Pointer Arithmetic, Dynamic Memory Allocation (new, delete), Dangling Pointer, NULL Pointer. Pointers to Strings, The const Qualifier with Pointers.	4	3

	Self-learning: Memory optimizations, Function Pointers & Callback Routing, Pointer Type Punning & Bit Manipulation		
4	**Object-Oriented Programming Concepts** OOP Principles: Defining a Class, Creating Objects. Accessing Data Members using Objects. Calling Member Functions using Objects. Advanced Class Concepts: Array of Objects, Objects as Parameters & Return Type, new operator, this pointer, Scope Resolution Operator (::). Static Members: Data and functions. Constructors and Destructors: Default Constructor, Parameterized Constructor, Copy Constructor, Destructor **Self-learning:** Class mixins, Copy Constructor, Move Constructor.	5	4
5	**Inheritance** Definition and Advantages, Types of Inheritance: Single, Hierarchical, Multilevel, Multiple, Hybrid. Access Specifiers: public, private, protected. Function Overriding, is-A vs has-A, Object slicing, constructor order, destructor order, virtual destructors. **Self-learning:** Private Inheritance, Protected Inheritance,	4	5
6	**Advanced OOP Concepts** Function Overloading and Operator Overloading. Virtual Functions and Pure Virtual Functions, Dynamic Polymorphism: virtual tables, virtual pointers. Friend Function and Friend Classes. Abstract Classes: Concept of Abstract Classes, Implementation and Use. Application of classes and objects to solve simple problems. **Self-learning:** Object slicing, Covariant Return Types, Virtual Destructors..	4	6

Self-Learning Component:

Students are encouraged to undertake self-learning to deepen their understanding of programming concepts and improve analytical skills. Self-learning activities may involve coding practice on online platforms, formulating real world entities as objects, and implementing small applications, thereby promoting independent learning and continuous skill development.

Laboratory Programming Environment:

The laboratory sessions will be conducted in a standard programming environment using C++ language. Students will use a suitable compiler and notepad for writing, compiling, debugging, and executing C programs such as: GCC (GNU Compiler Collection) or G++

List of laboratory experiments:

Sr No	Suggested List of Experiments	
1	Write programs to demonstrate use of— ● Implicit type casting ● Explicit type casting	1
2	Write programs to evaluate any expression using Input / Output functions.	
3	Write a program to count vowels, consonants, digits, spaces, and special characters in a string. Also check whether the string is a palindrome.	2
4	Write a program to perform matrix addition, subtraction, multiplication, and transpose.	
5	Create a menu-driven program for a number to: ● reverse digits ● check palindrome ● check Armstrong number ● find sum of digits	

	• count digits	
6	Input an array and perform: • insertion at a position • Input an array and perform • insertion at a position • Input an array and perform • insertion at a position • Print all the elements that are greater than all the elements to their right	
7	Pointer • sort an array using pointers (Bubble sort) • Create functions like add, subtract, multiply and call them using function pointers. • increment/decrement pointer • demonstrate dangling pointer and Null • Create a 2D array using pointers (int**) dynamically	3
8	Create a class Book or Employee with: • default constructor • parameterized constructor • copy constructor • destructor	4
9	Create a BankAccount class with account number, holder name, and balance. Use static data member balance and static member function to display it.	
10	Create a class Complex or Distance and write member functions to add and compare two objects. Return objects from functions.	
11	Create a base class Person and derived classes such as Student and Teacher. Display inherited members.	5
12	Create a base class and derived class and perform upcasting and downcasting.	
13	Write a program to demonstrate: • function overloading for area calculation • operator overloading for adding two complex numbers	6
14	Create an abstract base class Shape with a pure virtual function area (). Derive classes like Circle, Rectangle, and Triangle and calculate area using runtime polymorphism.	
15	Create a base class Student: private: roll number, protected: marks (3 subjects), public: function to input roll number. Create a derived class Result: Calculate total and percentage using inherited data.	

Learning Resources

Textbooks:

1. E. Balaguruswamy, Object Oriented Programming with C++, Mcgraw Hill
2. Kanetkar Yashwant, Let Us C++, BPB Publication.
3. Slobodan Dmitrovic, Modern C++ for Absolute Beginners, Apress

Online Resources

- https://www.udemy.com/course/beginning-c-plus-plus-programming
- https://www.youtube.com/watch?v=8jLOx1hD3_o

Assessment:

Continuous Internal Assessment-Lab (CIAL): Conduct an internal practical exam after completing the first three modules of the syllabus to assess and ensure the learner's understanding.
CIAL Marks: **25 Marks (Total marks) = 10 Marks (Experiment) + 10 Marks (Internal Practical Exam) + 5 Marks (Assignment)**

Practical & Oral Exam: An Oral & Practical exam will be held based on the above syllabus.

LO-PO MAPPING (Object-Oriented Programming with C++)												
Lourse Outcomes (CO)	**Program Outcomes (PO)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PS O1**	**PS O2**
LO1	3	2	1	–	2	–	2	2	2	–	--	--	--
LO2	3	3	2	–	2	–	2	2	2	–	2	--	2
LO3	3	3	2	–	3	–	2	2	2	–	2	--	2
LO4	3	3	3	–	2	–	2	2	2	–	2	--	2
LO5	3	3	3	–	2	–	2	2	2	–	2	--	2
LO6	2	3	2	–	3	–	2	2	2	–	2	--	2

Program	F. Y. B. Tech Mechanical Engineering							
Course	Basic Engineering Skills & Practices-II						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
					CIA		ESE	CIAL	PR/OR
		L	T	P	IAT	CIAT			
MEVSEC206	1	--	--	2	--	--	--	25	--

Lab Objectives:

1. To impart hands on experience in designing, fabrication and testing process of PCB.
2. Identify components of an Arduino board and understand their functions.
3. Develop basic Arduino programs for controlling LEDs, motors, and sensors.
4. Integrate sensors and actuators to build simple automation and robotic systems.

Lab Outcomes:

After successful completion of the lab, the learner will be able to:

LO1: Design PCB layouts using simulation software and prepare the layout for fabrication.
LO2: Demonstrate PCB fabrication techniques including layout transfer, etching, drilling, tinning, and soldering while following safety procedures.
LO3: Analyse electronic circuits on fabricated PCBs to verify proper functionality and troubleshooting errors if necessary.
LO4: Apply safe soldering practices and assemble basic electronic circuits using appropriate tools and safety measures.
LO5: Design and implement Arduino-based programs to interface LEDs, sensors, and stepper motors for basic automation tasks.
LO6: Develop and test a simple robotic system (such as a line-following robot) by integrating hardware components and embedded programming.
LO7: Describe the working principles and technologies of 3D printing such as FDM, SLA, and SLS.
LO8: Perform the preprocessing and post processing required for 3D printing.
LO9: Fabricate a functional 3D printed component in a group project.
LO10: Develop the necessary skills to identify and use different tools to perform the basic operations.
LO11: Perform basic operations like joints and wood turning practice.

Lab Prerequisites:

Basic knowledge of science and mathematics.

List of laboratory experiments: (*Any Eight Experiments)*

Sr. No.	Name of the Experiment	Trade	Hrs	LO Mapping
1	Design a simple printed circuit board and create a basic layout using any suitable software	Basic Electronics (PCB)	4	1
2	To simulate the design circuit using software.		4	2
3	To fabricate PCB and test its functionality.		4	3,4
4	Interface of IR and alcohol sensor with Arduino UNO	Basic Robotics & Automation	2	5
5	Interface of stepper motor with microcontroller using driver module		2	5
6	Interfacing of 7 segment display / LED with Arduino UNO		2	5
7	To develop a line follower robot / obstacle detection robot (Group Activity)		6	6
8	To study additive manufacturing methods in rapid prototyping.	3D Printing	2	7
9	To prepare and convert 3D model using software.		4	8
10	To fabricate the model using FDM 3D printer.		4	9
11	To identify the defects and surface quality in 3D printed part.		2	9
12	To identify the different tools used for carpentry shops with their applications.	Carpentry	2	10
14	To read and understand the given object drawing.		1	10
14	To fabricate a wooden DADO joint.		6	10
15	To check the accuracy of joint as per the given drawing.		1	10
16	To demonstrate the use of wood turning lathe machine for fabrication of handle/rolling pin.		2	11

Learning Resources

Textbooks:

- R.S. Khandpur," Printed Circuit Boards: Design, Fabrication, Assembly and Testing" McGraw-Hill.
- Neerparaj Rai, "Arduino projects for Engineers" BPB Publications
- Yashwanty Kanetkar, Shrirang Korde, "21 IoT Experiments, BPB Publications.
- Vineesh Kumar K K, "Make your first Robot" notion press.

Online Resources :

1. https://youtu.be/MsdJgEinb34?si=mDWn_kCNNP5OLnP_
2. https://youtu.be/odEdIcerJMQ?si=qDcwug-nJ80eWDEo
3. https://youtu.be/2vFdwz4U1VQ?si=Fg6Dg0qoLMZXK4kB

Assessment:

Continuous Internal Assessment- Lab (CIAL):

CIAL shall consist of at least 8 practical based on the above list.

CIAL Marks : 25 Marks (Total marks)
Experiments : 20 Marks
Attendance, Journal and active participation : 05 Marks

LO-PO-PSO Mapping (Basic Engineering Skills & Practices-II)													
Lab Outcomes (LO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
LO1	3	-	-	-	-	2	2	2	-	-	2	2	2
LO2	3	-	-	-	-	2	2	2	-	-	2	2	2
LO3	3	-	-	-	-	2	2	2	-	-	2	2	2
LO4	3	-	-	-	-	2	2	2	-	-	2	2	2
LO5	3	-	-	-	-	2	2	2	-	-	2	2	2
LO6	3	-	-	-	-	2	2	2	-	-	2	2	2
LO7	3	-	-	-	-	2	2	2	-	-	2	2	2
LO8	3	-	-	-	-	2	2	2	-	-	2	2	2
LO9	3	-	-	-	-	2	2	2	-	-	2	2	2
LO10	3	-	-	-	-	2	2	2	-	-	2	2	2
LO11	3	-	-	-	-	2	2	2	-	-	2	2	2

Program	F. Y. B. Tech Mechanical Engineering							
Course	Indian Knowledge System						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme		Laboratory Examination Scheme	
MEIKS207	2	L	T	P	CIA (20)	ESE	CIAL	PR/OR
					IAT / CIAT			
		2#	--	--	-- / --	-	25	--

Course Prerequisites:

1. Students should have the foundational knowledge and skills necessary for a comprehensive understanding of IKS.
2. Students should be familiar with the Indian Culture, Language, and History of Science and Technology in India.

Course Objectives:

1. To evaluate the historical and modern educational systems in our country.
2. To explore and understand the evolution of Indian scientific thoughts, art and culture.
3. To understand the principles of good governance.
4. To analyze sustainable practices in ancient India.

Course Outcomes:

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

CO1: Illustrate the differences between the Gurukul system and the modern education system.
CO2: Apply knowledge of Indian scientific thought to explain contributions in mathematics, astronomy, medicine, and technology.
CO3: Show the richness of ancient Indian cultural heritage through its literature, art, music, dance, and architecture.
CO4: Apply knowledge of traditional Indian practices to identify sustainability across agriculture, architecture, and science.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Introduction to Indian Knowledge System:** IKS-an overview, Basic knowledge and scope of IKS, IKS in Ancient India and Modern India, The Gurukul System and Ancient Universities, The Modern Education System.	5	1
2	**Science, Engineering and Technology in IKS**: Ancient Mathematicians and their Contributions, Development of Astronomy in India, Ayurveda and Physiology, Yoga and Meditation, Technology: Metallurgy, Civil Engineering, Textile and Dyeing.	8	2
3	**Ancient Indian Heritage: Arts, Culture and Governance**: Literature: Classical and Philosophical texts Architecture: Temple architecture, Stupas and Monasteries Music, Dance, Painting and Sculpture, Vishva Kalyan through Vasudhaiva Kutumbakam, Principles of Good Governance: *Ramayana*, *Mahabharata* & *Arthashastra.*	8	3
4	**Sustainable Environmental Practices in Ancient India:** Agriculture: organic farming, crop rotation, seed preservation, water conservation; Preservation of Forests & Biodiversity; Waste Management; Urban Planning.	5	4

Learning Resources

Textbooks:

1. B. Mahadevan, V.R. Bhat, and Nagendra Pavana R.N., *An Introduction to Indian Knowledge Systems: Concepts and Applications*2022 (Prentice Hall of India).
2. Kapil Kapoor and A.K. Singh, *Indian Knowledge Systems: Vol I and II*, 2005 (D.K. Print World Ltd).

3. Amit Jha, *Traditional Knowledge Systems in India*

Reference Books:

1. A.K. Bag, *History of Technology in India* (Set 3 vol), Indian National Science Academy, 1997
2. Boski Singh, *Ancient Indian Knowledge: Implications To Education System*, 2019.
3. Suresh Soni, *India's Glorious Scientific Tradition*, 2010 (Ocean Books Pvt. Ltd.)
4. Nirmal Sengupta, *Traditional Knowledge in Modern India*

Online Resources

1. Indian Knowledge System (IKS)- Concepts and Applications in Engineering by Prof. B. Mahadevan, Dr. Vinayak Rajat Bhat, Dr. R Venkata Raghavan
   https://onlinecourses.swayam2.ac.in/e-learning/preview/imb23_mg53
2. Indian Ethos and Knowledge Systems by Prof. Mohammad Shaheer Siddiqui
   https://onlinecourses.swayam2.ac.in/e-learning/preview/ini26_ed10
3. Indian Knowledge System by Dr. Roli Pradhan
   https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr25_ed18

Assessment:

CIAL shall consist of any two activities based on the below list. Also, the Activity based Journal must include 4 assignments.
CIAL Marks: 25 Marks (Total marks) = 10 Marks (Total marks of Activities) +10 Marks (Activity based Journal) + 5 Marks (Attendance

List of Activities:

1. PowerPoint Presentations
2. Group Discussions
3. Case studies
4. Flipped Classroom
5. Roleplay
6. Project-based activities
7. Create and solve MCQ Quizzes
8. 3D model presentation
9. Research Paper Presentation

Additional Activities:

1. "Scientist Spotlight" Presentation

- Each group presents one figure: Examples- Aryabhata, Sushruta, Charaka

2. Build a Sustainable City (Group Activity)

- Use chart / LEGO / digital tools
- Include: Water systems, Waste management, Green spaces

3. Water Conservation Model

- Demonstrate: Stepwell concept, Rainwater harvesting model

4. Field Visit & Report

- Visit: Museum, Temple architecture, Historical site

5. SHARK TANK – ANCIENT INDIA EDITION

- **Task:** Students pitch **ancient Indian innovations as startups**
  - Examples: Ayurveda → wellness startup
    Stepwells → water tech startup
    Yoga → mental health ap
  - **Format:** Pitch (3 min), Jury (classmates) ask questions, Funding decision

6. BUILD & PRESENT (Adds practical and technical angle)

- **Ideas:** Stepwell model, Temple structure**,** Ancient city planning

7. SHORT FILM / REEL CREATION

- **Task:** Create a 2–3 min video.

Examples: Life in Gurukul, Ancient scientist story, Sustainability practices

8. IKS NEWSPAPER CREATION (Creative & writing skill)

Groups create:

- Headlines
- Articles
- Interviews (ancient figures)

9. PROBLEM-SOLVING LAB

Give real problems:

- Water shortage
- Stress in students
- Pollution

Students can solve it using IKS principles.

10. ART INTEGRATION ACTIVITY (Connects culture + creativity)

- Mandala drawing
- Rangoli patterns
- Symbolic art

11. ETHICAL DILEMMA DISCUSSION (Students debate moral choices)

Example:

- Rama's decisions
- Mahabharata war ethics

12. IKS HACKATHON (Idea- prototype- pitch)

Challenge: Solve modern problems using IKS

Themes:

- Smart water conservation (stepwell concept)
- Mental health (yoga + meditation)
- Sustainable cities

13. IKS PODCAST CREATION

Task: Students record: Interview, Discussion**,** Storytelling

Topics: Ancient science, Cultural practices

14. ENERGY FLOW ACTIVITY (YOGA + SCIENCE)

Students perform: Breathing, Simple yoga

Then discuss: Scientific explanation

Sample Case Studies:

1. Mathematics of Madhava, Nilakantha Somayaji
2. Astronomical models of Aryabhata
3. Wootz steel, Aranumula Mirrors, and lost wax process for bronze castings
4. Foundational aspects of Ayurveda
5. Foundational aspects of Ashtanga yoga
6. Foundational aspects of Sangeeta and Natya-shastra

CO-PO-PSO Mapping (Indian Knowledge System)													
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO 1	**PO2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	2	2	2	3	-	2	-	-
CO2	-	-	-	-	-	3	2	2	3	-	2	-	-
CO3	-	-	-	-	-	3	2	2	3	-	2	-	-
CO4	-	-	-	-	-	3	2	2	3	-	2	-	-

Program	F. Y. B. Tech Mechanical Engineering								
Course	German Language Basic Foundation						Semester		II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
MELLC208	2	L	T	P	CIA (25)		ESE	CIAL	PR/OR
					IAT	CIAT			
		2	-	--	--	25	--	--	--

Course Prerequisites:

Basics of English Grammar, Familiarity with general and workplace-related vocabulary, Basic fluency and clarity in verbal expression.

Course Objectives:

1. To introduce the German phonetic system, basic grammatical structures, and essential vocabulary for personal identification.
2. To practice various verb types and understand the relationship between nouns, prepositions, and sentence word order.
3. To transition from basic descriptions to expressing complex needs, spatial relationships, and past events.
4. To develop professional writing skills and the ability to link ideas using subordinate and relative clauses.

Course Outcomes:

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

CO1. Use basic vocabulary to introduce oneself, family, and personal details with accurate pronunciation of German words.

CO2. Apply various verb conjugations and case-driven noun declensions to construct grammatically correct sentences with proper word order.

CO3. Apply correct two-way prepositions and tense schemes to illustrate spatial relationships between objects in various timeframes.

CO4. Create professional documents by constructing complex sentences with subordinate and relative clauses.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**German Essentials & Personal Identity** Alphabets, Compound letters and their pronunciations, Practice pronunciations Abschnitt eins (Conversation), Cases and Personal Pronoun. The Verb: Present Tense (Regular Verbs), The Verb (Special Verbs) sein and haben Abschnitt zwei – Der Unterricht, Possessive Pronoun, Demonstrative Pronoun and Reflexive pronoun, Numbers. Abschnitt drei – Die Zahlen, Frage (Questions), Pronouns: Wer (who) and Was (what), Days, Months, Years, Essay Writing- Myself, Our Family	6	1
2	**Grammar Framework & Daily Interactions** Types of Verbs - Regular Verbs & Irregular Verbs, Transitive & Intransitive Verbs, Strong & Separable Verbs, Modal Verbs Conjugation of Verbs. Abschnitt vier – Eine Reise, Nouns - Declination, Word Order – Sentence formation. Abschnitt fünf – Ein Freund kommt - Prepositions with Dative (Local and Temporal) Prepositions with Accusative (Local and Temporal), Timings	8	2
3	**Advanced Structures & Temporal Expression** Meals and Timings, Modal Verbs in detail Abschnitt sechs – Mein Haus, Prepositions with Dative or Accusative Articles depending on action and / or position (wohin and wo), Describe	8	3

	the picture, Genitive Case.Past Tense (Imperfect), Perfect Tense, Verb Conjugation Schemes (Present – Past – Perfect)		
4	**Professional Competence & Complex Syntax** Daily Routine (Morning till evening), Letter writing, Adjective Declination Ja-nein-doch (Different answers – yes, no), Neben sentences (Composite sentences), Relative Sentences, Colours, Vegetables, fruits. Internet / Computer Vocabulary, Email Writing, Writing Resume (Bio Data)	4	4

Learning Resources

Textbooks:

1. Dora Schulz and Heinz Griesbach, Deutsche Sprachlehre für Ausländer, 10th Edition, Max Hueber Verlag
2. “Netzwerk Deutsch als Fremdsprache A1”, by by Helen Schmitz Stefanie Dengler,Paul Rusch, Langenscheidt; First Indian Edition 2015 edition (2015)
3. Stefanie Dengler, Paul Rusch, Helen Schmitz, and Tanja Sieber, Netzwerk Neu A1: Kurs- und Übungsbuch, 1st Edition, Klett Verlag, 2020.
4. Hermann Funk, Christina Kuhn, and Laura Nielsen, Das Leben A1: Gesamtband Kurs- und Übungsbuch, 1st Edition, Cornelsen Verlag, 2022.

Reference Books:

1. Anne Buscha and Szilvia Szita, Begegnungen Deutsch als Fremdsprache A1+: Integriertes Kurs- und Arbeitsbuch, 3rd Revised Edition, Schubert Verlag, 2021.
2. Silke Hilpert, Marion Kerner, and Angela Pude, Schritte International Neu 1: Kursbuch und Arbeitsbuch, 1st Edition, Hueber Verlag, 2016.

Online Resources

1. Swayam / NPTEL: German – I, by Prof. Milind Brahme from IIT Madras. https://onlinecourses.nptel.ac.in/noc26_hs78/preview
2. Practical communication, listening skills, and free interactive exercises. https://learngerman.dw.com/en/nicos-weg/c-36519789
3. Official certification and professional-grade learning materials. https://www.goethe.de/en/spr/kur/doln.html

Assessment:

Continuous Internal Assessment-Theory (CIAT) for 25 Marks:

CIAL Marks: 25 Marks (Total marks) = 10 Marks (Assignments) + 10 marks (Presentation+Viva) +5 marks (attendance).

- All 4 CIAT components are compulsory.
- Each assignment will carry 10 marks. The average of assignments will be considered.
- Attendance will carry 5 marks.

Sr No	Assignment Topic	List of Assignments
01	Application-based Assignment on Communication Theory	The Impact of Formal vs. Informal Register in German Communication: Analyze the "Du" (informal) vs. "Sie" (formal) culture in Germany.
02	Assignment on Writing Skills: 4 types of letters in	**1. Formal Inquiry:** An email to a German language school in München asking about course fees and timings (Refers to Module 2). **2. Personal Invitation:** An informal letter to a friend inviting them to

	complete block format	your house for a meal (Refers to Module 3). **3. Job Application Cover Letter:** A brief formal letter to a German company expressing interest in an internship (Refers to Module 4). **4. Letter of Complaint/Request:** A formal note to a landlord or hotel manager regarding a missing item or a booking change.
03	Written Record of Presentation	Mein Tagesablauf und Meine Familie (My Daily Routine and My Family)
04	Application-based Assignment on Personality Development	Selected Case Studies on: Intercultural Competence and the 'Lebenslauf' (Resume): Compare a standard Indian Resume with a German "Tabellarischer Lebenslauf."

CO-PO-PSO Mapping (German Language Basic Foundation)													
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	2	2	3	-	2	-	-
CO2	-	-	-	-	-	-	2	2	3	-	2	-	-
CO3	-	-	-	-	-	-	2	3	3	-	2	-	-
CO4	-	-	-	-		-	2	3	3	-	2	-	-