AC Item No.-5.6
30/04/2026

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 Computer Science and Engineering (Data Science)

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

(Effective from Academic year 2026-27)

Signed by

Dean Academics **Chairman: Academic Council**

Contents

Nomenclature

CSE: Computer Science and Engineering (Data Science)

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 exposure 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 Computer Science & Engineering (Data Science)

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 front-runner in future tech and data-driven innovation through an interdisciplinary excellence in Computer Science and Engineering with a focus on Data Science.

Mission of The Department

1. To provide an environment for learning data science, fostering expertise and innovation.
2. To promote interdisciplinary innovations in emerging data technologies.
3. To foster Quality education, ethical values, meeting personal, professional, and societal needs on a holistic level.

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 to 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. To apply the knowledge of Data science to analyze, design and implement application specific problems with modern AI tools.
2. To analyze problems and design applications to forecast, predict and decision-making using IoT, Big data analytics, Artificial Intelligent, Machine learning technologies.

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)	Applied Mathematics -I	3
		Physics for Computing & Communication	2
		Engineering Chemistry	2
		Applied Mathematics -II	3
		Elective Physics	2
		Elective Chemistry	2
BSL:4(2) Lab	Basic Science Lab (BSL)	Physics for Computing & Communication Lab	0.5
		Engineering Chemistry Lab	0.5
		Elective Physics Lab	0.5
		Elective Chemistry Lab	0.5
ESC:2(06) (check page 11)	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)	Computer Organisation and Architecture	3
PCL:1(1)	Program Core Lab (PCL)	Computer Organisation and Architecture Lab	1
LLC: 2(4)	Liberal Learning Course	LLC-I	2
		LLC-II	2
		TOTAL CREDITS	**47**

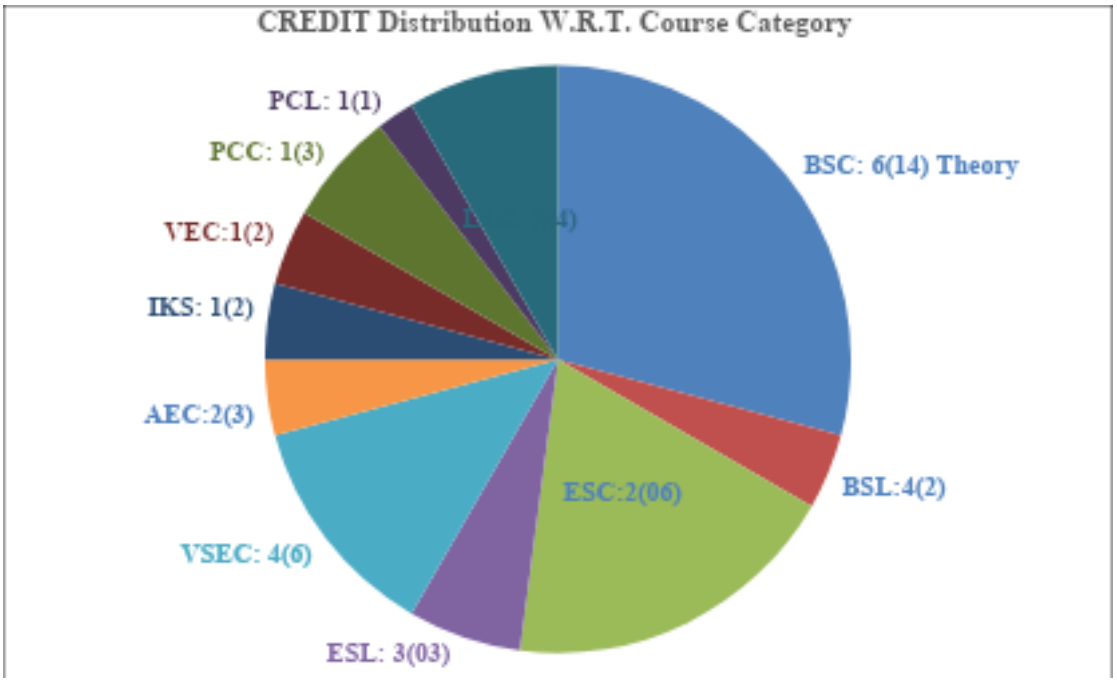

Figure 1: Pie-chart of vertical-wise allocation of credits

The F.Y. B. Tech. Curriculum Structure and Syllabus presented herein has been meticulously developed by the Board of Studies, Department of Computer Science & Engineering Data Science 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 Computer Science and Engineering (Data Science) 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	CSEBSC101	Applied Mathematics -I	3	-	-	2	3	20	20	60	2	-	-	100
BSC	CSEBSC102	Physics for Computing & communication	2	-	-	2	2	10	10	30	1	-	-	50
BSC	CSEBSC103	Engineering Chemistry	2	-	-	2	2	10	10	30	1	-	-	50
ESC	CSEESC104	Basic Electrical & Electronics Engineering	3	-	-	3	3	20	20	60	2	-	-	100
ESC	CSEESC105	Engineering Mechanics	3	-	-	3	3	20	20	60	2	-	-	100
BSL	CSEBSL101	Physics for Computing & communication Lab	-	-	1	-	0.5	-	-	-	-	25	-	25
BSL	CSEBSL102	Engineering Chemistry Lab	-	-	1	-	0.5	-	-	-	-	25	-	25
ESL	CSEESL103	Basic Electrical & Electronics Engineering Lab	-	-	2	-	1	-	-	-	-	25	25	50
ESL	CSEESL104	Engineering Mechanics LAB	-	-	2	-	1	-	-	-	-	25	25	50
VSEC	CSEVSEC105	Programming in C	-	-	2*+2	-	2	-	-	-	-	25	25	50
VSEC	CSEVSEC106	Basic Engineering skills & Practices -I	-	-	2	-	1	-	-	-	-	25	-	25
VEC	CSEVEC107	Universal Values for Personal & Professional Excellence	2#	-	-	-	2	-	-	-	-	25	-	25
LLC	CSELLC108	LLC-I	2#	-	-	-	2	-	-	-	-	25	-	25
		TOTAL	**17**	**-**	**12**	**12**	**23**	**80**	**80**	**240**	**08**	**200**	**75**	**675**

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.

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	CSEBSC201	Applied Mathematics-II	3	-	-	2	3	20	20	60	2	-	-	100
BSC	CSEBSC202	Elective Physics	2	-	-	2	2	10	10	30	1	-	-	50
BSC	CSEBSC203	Elective Chemistry	2	-	-	2	2	10	10	30	1	-	-	50
AEC	CSEAEC204	Professional Communication Skills	2	-	-	2	2	20	20	60	2	-	-	100
PCC	CSEPCC205	Computer Organisation & Architecture	3	-	-	3	3	20	20	60	2	-	-	100
BSL	CSEBSL201	Elective Physics Lab	-	-	1	-	0.5	-	-	-	-	25	-	25
BSL	CSEBSL202	Elective Chemistry Lab	-	-	1	-	0.5	-	-	-	-	25	-	25
AEL	CSEAEL203	Professional Communication Skills Lab	-	-	2	-	1	-	-	-	-	25	-	25
PCL	CSEPCL204	Computer Organisation & Architecture Lab	-	-	2	-	1	-	-	-	-	25	-	25
ESL	CSEESL205	Engineering Graphics & Visualizations Lab	-	-	4	-	2	-	-	-	-	50	50	100
VSEC	CSEVSEC206	Elective Skill Enhancement	-	-	2*+2	-	2	-	-	-	-	25	25	50
VSEC	CSEVSEC207	Basic Engineering skills & Practices -II	-	-	2	-	1	-	-	-	-	25		25
IKS	CSEIKS208	Indian knowledge system	2#	-	-	-	2	-	-	-	-	25	-	25
LLC	CSELLC209	LLC-II	2	-	-	-	2	-	-	-	-	25	-	25
			16	**-**	**16**	**11**	**24**	**80**	**80**	**240**	**08**	**250**	**75**	**725**

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

CSEBSC202X	Elective Physics Theory
CSEBSC2021	Physics for Intelligent Systems
CSEBSC2022	Physics of Semi-conductors
CSEBSC2023	Physics of Measurements and Sensors

CSEBSL201X	Elective Physics Lab
CSEBSL2011	Physics for Intelligent Systems
CSEBSL2012	Physics of Semi-conductors
CSEBSL2013	Physics of Measurements and Sensors

Elective Chemistry

CSEBSC203X	Elective Chemistry Theory
CSEBSC2031	Materials Chemistry
CSEBSC2032	Chemistry for Environment and Sustainable Energy

CSEBSL202X	Elective Chemistry Lab
CSEBSL2021	Materials Chemistry Lab
CSEBSL2022	Chemistry for Environment and Sustainable Energy Lab

Elective Skill Enhancement

CSEVSEC206X	Elective Skill Enhancement
CSEVSEC2061	Python Programming
CSEVSEC2062	Object-Oriented Programming with Java
CSEVSEC2063	Object-Oriented Programming with C++

Program	F. Y. B. Tech Computer Science and Engineering (Data Science)								
Course	Applied Mathematics-I						Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
CSEBSC101	3	L	T	P	CIA (40)		ESE	CIAL	PR/OR
					IAT	CIAT			
		3	--	--	20	20	60	--	--

Course Prerequisites:

Basic knowledge of Differentiation, Determinants and Algebra of Matrices, Arithmetic of complex numbers.

Course Objectives:

To develop strong foundational mathematical concepts in matrices, complex numbers and partial derivatives that are essential for solving engineering problems.

Course Outcomes:

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

CO1: Compute the Rank of Matrix using Echelon and PAQ Form of Matrix.
CO2: Solve system of linear simultaneous equations algebraically and numerically.
CO3: Compute the partial derivative of functions of two and three variables**.**
CO4: Apply Partial Differentiation to determine extreme values of a function of two variables.
CO5: Apply the concepts of complex numbers to simplify expressions in engineering mathematics.
CO6: Solve Transcendental equations and definite integral using numerical methods.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Matrices** Types of matrices (Hermitian, Skew-Hermitian, Unitary – properties), Rank of a Matrix: Echelon form, Reduction to normal form, PAQ form. **Self-Learning:** Linear Dependence and Independence of vectors.	6	1
2	**Solution of System of Linear Equation** System of Linear Equation: Homogeneous & non-homogeneous, Numerical methods: Gauss Jacobi Method & Gauss Seidel Method. **Self-Learning:** LU decomposition and Croute's method.	6	2
3	**Partial Differentiation** Functions of two and three variables, Partial derivatives (first and higher order), Chain rule (composite functions), Euler's theorem and its corollaries. **Self-Learning:** Partial differentiation of Implicit function	7	3
4	**Application of Partial Differentiation** Maxima and Minima of functions of two variables. Lagrange's Multiplier method to find extreme values of function of 2 variables. **Self-Learning:** Interpretation in optimization problems	6	4
5	**Complex Numbers** De Moivre's theorem, Roots and powers of complex numbers, Logarithm of Complex Number (Definition & Examples based on Definition), , Hyperbolic functions (Definition & Examples based on Definition)	7	5

	Self-Learning: Application in signal representation		
6	**Numerical Methods** Solution of algebraic equations: Bisection Method, Newton-Raphson method & Regula-Falsi method, Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule. **Self-Learning:** Errors and approximations	7	6

Learning Resources

Textbooks:

1. H K DASS Advanced Engineering Mathematics, India, S Chand, edition 2025.

Reference Books:

1. R.K.Jain and S.R.K.lyengar "Advanced Engineering Mathematics", Alpha science International Ltd. March 25,2020
2. P. V. O'Niel, Advanced Engineering Mathematics, Thomson Learning. (8th edition)
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, Inc (10th edition)
4. Higher Engineering mathematics by b.s. Grewal.(42nd edition)

Online Resources:

1. Numerical Analysis, Prof. S. Bhaskar, IIT Bombay, NPTEL https://onlinecourses.nptel.ac.in/noc26_ma20/preview
2. Advanced Engineering Mathematics, Prof. H S Mahato, IIT Kharagpur, NPTEL https://onlinecourses.nptel.ac.in/noc26_ma37/preview

List of Assignments: Serial No.1 and 2 are compulsory. Any 6 Assignments from serial No.3 to 10.

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	Type of matrices and Rank of Matrices.	1	1
4	Solving system of equations and Numerical Solution of system of linear equations.	1	2
5	Application of Matrices.	1	2
6	Partial Differentiation- Euler's theorem.	1	3
7	Application of Partial Differentiation- Maxima and Minima	1	4
8	Complex Numbers- Finding Roots, Hyperbolic function and Logarithm of Complex numbers.	1	5
9	Application of Complex Numbers.	1	5
10	Solution of algebraic equations and Numerical integration	1	6

Sr No	List of Scilab Practical	Hrs
01	Numerical methods: Gauss Jacobi Method & Gauss Seidel Method.	**04**
02	Solution of algebraic equations: Newton-Raphson method	
03	Solution of algebraic equations: Regula-Falsi method	
04	Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule	

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

- The question paper shall consist of six questions, carrying 10 marks each.
  - Question No. 1 shall be set from CO1.
  - Question No. 2 shall be set from CO2.
  - Question No. 3 shall be set from CO3.
  - Question No. 4 shall be set from CO4.
  - Question No. 5 shall be set from CO5.
  - Question No. 6 shall be set from CO6.
- Each question shall have two options – Option A and Option B, and both options must be set from the same module.
- The options should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within each question, ensuring both options cover the same module.
- Students will attempt all questions.

CO-PO-PSO Mapping (Applied Mathematics-I)

Course Outcomes (CO)	Program Outcomes (PO)												
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	2	-	2	-	2	2	-
CO2	3	2	-	-	2	-	2	-	2	-	2	2	-
CO3	3	2	-	-	-	-	-	-	2	-	-	1	-
CO4	3	2	-	-	-	-	-	-	2	-	-	2	-
CO5	2	1	-	-	-	-	-	-	2	-	-	1	-
CO6	3	2	-	-	2	-	-	-	2	-	-	1	-

Program	F. Y. B. TechComputer Science and Engineering (Data Science)							
Course	Physics for Computing and Communication						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			
CSEBSC102	2	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 for Computing:** 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:

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

Program	F. Y. B. TechComputer Science and Engineering (Data Science)							
Course	Physics for Computing and Communication Lab						Semester	I
Code	Credits	Teaching Scheme (Hrs./Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
CSEBSL101	0.5	--	-	1	--	--	--	25	--

Lab Objectives:

1. To study the application of lasers and calculate optical properties like numerical aperture.
2. To study the behavior of a particle due to the tunnelling effect.
3. 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:

1. Fundamentals of optics, including reflection, refraction, interference, and diffraction.
2. Basic principles of laser and fiber optics, quantum physics.
3. Knowledge of graph plotting, data evaluation, and result interpretation.
4. 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 (Physics for Computing and Communication 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 Computer Science and Engineering (Data Science)							
Course	Engineering Chemistry						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			
CSEBSC103	2	2	--	--	10	20	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: 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.	8	2

	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: Indigo dye, Adipic acid, Carbaryl, Green solvents: Characteristics and applications of supercritical solvents and ionic liquids, Green fuels: Synthesis and advantages of: Biodiesel, Ethanol **Self-Learning:** Principles of Green Chemistry	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. Green Chemistry: V. K. Ahluwalia, Narosa publishing house

Online Resources:

1. Introduction to Polymer Science, IIT Kharagpur : https://nptel.ac.in/courses/104105124
2. Corrosion - Part I By Prof. Kallol Mondal|IIT Kanpur : https://onlinecourses.nptel.ac.in/noc22_mm17/preview
3. 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	-	-
CO2	3	2	-	-	-		-	-	2	-	-	-	-
CO3	2	-	-	-	-	2	-	-	-	-	-	-	**2**

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)							
Course	Engineering Chemistry Lab					Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme		Laboratory Examination Scheme	
		L	T	P	CIA	ESE	CIAL	PR/OR
					IAT CIAT			
CSEBSL102	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 Prerequisites:

- Knowledge of basic safety practices in the Chemistry Laboratory.
- 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	-	-
LO2	3	-	-	-	-	-	-	2	3	-	3	-	-
LO3	2	-	-	-	-	3	-	2	2	-	2	-	2
LO4	3	-	-	-	-	-	-	3	2	-	2	-	-
LO5	3	-	-	-	-	-	-	2	2	-	2	-	-

Program	F. Y. B. Tech Computer Science and Engineering (Data Science)								
Course	Basic Electrical & Electronics for Computing Systems						Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
CSEESC104	3	L	T	P	CIA (40)		ESE	CIAL	PR/OR
					IAT	CIAT			
		3	--	--	20	20	60	--	--

Course Prerequisites:

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

Course Objectives:

1. To understand number system representations and logic gates.
2. To understand the design and operation of combinational logic circuits.
3. To understand the operation and applications of flip-flops and sequential circuits.
4. To provide knowledge on the fundamentals of DC circuits
5. To provide basic knowledge on the fundamentals of machines.
6. To inculcate fundamental knowledge of Battery Energy Storage Systems.

Course Outcomes:

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

CO1: Apply network theorems to determine the circuit response/behavior.
CO2: Explain DC motors and it's applications.
CO3: Explain the concepts of battery energy storage systems and their applications.
CO4: Apply number system conversions and Boolean algebra to simplify digital logic circuits using logic gates and Karnaugh maps.
CO5: Apply combinational logic to implement arithmetic circuits and Boolean functions.
CO6: Apply flip-flop concepts to design a sequential logic circuit.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Electrical Circuits for Computing Systems**: (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	**Motor Control in Smart Systems**: Construction, working, characteristics, and application of DC machines, Single-phase Induction Motor, Brushless DC machine, Stepper motor. Factors in the selection of the motor and its rating. **Self-Learning**: Hub motor: construction, working principle, and applications	6	CO2
3	**Battery & Energy Systems for Electronics** 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	6	CO3

4	**Number Systems and Logic Gates:** Review of Binary, Octal, and Hexadecimal Number Systems and their conversions. Gray code and BCD code, Binary Addition, Subtraction using 1's and 2's Complement method. Digital logic gates, Universal gates, Realization using NAND and NOR gates, Boolean Algebra, De Morgan's Theorem. Minimization of Boolean expressions: - SOP, POS, and Karnaugh map (up to 4 variables) **Self-Learning**: Applications of Number Systems in Digital Systems and Computers.	**07**	**CO4**
5	**Combinational Logic Design:** Adder, Subtractor, Multiplexer, De-multiplexer, Code Converter, BCD adder, Implementation of Logic functions using Multiplexers, De-multiplexers **Self-Learning**: Introduction to ALU	**06**	**CO5**
6	**Sequential Logic Design:** Flip flops (FF): SR, JK, T, D, Truth table, excitation table, triggering methods, and flip flop conversions. Synchronous and Asynchronous Counters. **Self-Learning**: Applications for Counters in Digital Clocks	**07**	**CO6**

Learning Resources

Textbooks:

1. R.P. Jain, "Modern Digital Electronics", Tata McGraw-Hill Publication, 4th Edition.
2. A. Anand Kumar, "Fundamentals of Digital Circuits", PHI, Fourth Edition (2016).
3. B.R Patil, "Basic Electrical Engineering," Oxford Higher Education.
4. B.L. Theraja "Electrical Engineering "Vol. I and II
5. C.C. Chan and K.T. Chau, *"Modern Electric Vehicle Technology,"* Oxford University Press.
6. Dr. Kumar K. and Dr. V. Lakshmi Devi "Battery Technology Handbook: Classification, Control, and System Integration "

Reference Books:

1. Morris Mano, Michael D. Ciletti, "Digital Design", Pearson Education, Fifth Edition (2013).
2. V. K. Mehta, "Basic Electrical Engineering", S. Chand and Company Ltd., New Delhi.
3. Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals," CRC Press, Second Edition.

Online Resources:

1. 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

- The question paper shall consist of six questions, carrying 10 marks each.
  - Question No. 1 shall be set from CO1.
  - Question No. 2 shall be set from CO2.
  - Question No. 3 shall be set from CO3.
  - Question No. 4 shall be set from CO4.
  - Question No. 5 shall be set from CO5.
  - Question No. 6 shall be set from CO6.
- Each question shall have two options – Option A and Option B, and both options must be set from the same module.
- The options should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within each question, ensuring both options cover the same module.
- Students will attempt all questions.

CO-PO-PSO Mapping (Basic Electrical & Electronics for Computing Systems)

Course Outcomes (CO)	Program Outcomes (PO)												
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	2	-	-	-	-	2
CO3	2	-	-	-	-	2	-	2	-	-	2	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-
CO6	3	2	2	-	-	-	-	-	-	-	-	-	-

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)							
Course	Basic Electrical & Electronics for Computing Systems Lab					Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme
		L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
CSEESL103	1	--	--	1	--	--	--	25	25

Lab Objectives:

1. To explain fundamental electrical circuit laws and network theorems.
2. To study the operation of machines.
3. To understand the characteristics of battery energy storage systems.
4. To provide an understanding of basic logic gates and Boolean laws.
5. To explain the design and operation of combinational logic circuits.
6. To impart the basic concept of the operation of sequential circuits using flip-flops and counters.

Lab Outcomes:

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

LO1: Verify fundamental electrical circuit laws and network theorems
LO2: Demonstrate the basic operation of electrical machines.
LO3: Explain the performance of battery energy storage systems.
LO4: Implement basic logic gates and verify Boolean laws.
LO5: Implement combinational logic circuits.
LO6: Implement sequential circuits using flip-flops and counters.

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	Study of measuring instruments: voltmeter, ammeter, multimeter, oscilloscope. Real- life resistors, capacitors, and inductors	02	LO1
2	Verification of 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	To demonstrate the working of the motor/Machines	02	LO2
6	Study of different types of batteries and measurement of battery Voltage and current under different load conditions	02	LO3
7	Implement and verify truth table of basic gates,	02	LO4
8	Verify operation of NAND and NOR gates as universal gates	02	LO4
9	Verify De Morgan's Theorem using logic gates.	02	LO4

10	Perform binary addition and subtraction using 1's and 2's complement.	02	LO4
11	Implement verification of half- adder circuit.	02	LO5
12	Implement verification of full- adder circuit.	02	LO5
13	Verify operation of 8:1 multiplexer.	02	LO5
14	Verify the truth table of flip-flops.	02	LO6
15	Verify operation of synchronous and asynchronous counters.	02	LO6

Assessment :

Continuous Internal Assessment-Lab (CIAL): CIAL shall consist of at least 10 practicals based on the above list. Also, the CIAL Journal must include at least 3assignments.
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 for Computing Systems Lab)

Lab Outcomes (LO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO 4	PO 5	PO6	PO 7	PO8	PO9	PO1 0	PO11	PSO1	PSO2
LO1	3	-	-	-	-	-	-	2	-	-	-	-	-
LO2	2	-	-	-	-	-	-	2	-	-	2	-	2
LO3	2	-	-	-	-	-	-	2	-	-	-	-	2
LO4	3	2	-	-	-	-	-	2	-	-	-	-	-
LO5	3	-	-	-	-	-	-	2	-	-	-	-	-
LO6	3	2	-	-	-	-	-	2	-	-	-	-	-

Program	F. Y. B. Tech Computer Science and Engineering (Data Science)								
Course	Engineering Mechanics						Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
CSEESC105	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:** 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:** 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) **Friction:**	10	3

	Laws of friction. Cone of friction. angle of repose, equilibrium of bodies on an inclined plane. **Self-Learning:** 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:** 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:** 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:** 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:

1. 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.

End Semester Theory Examination (ESE) 60 marks:

Question paper format

Time duration for 60 marks paper is 2 hours

- The question paper shall consist of six questions, carrying 10 marks each.
  - Question No. 1 shall be set from CO1 & CO6.
  - Question No. 2 shall be set from CO2.
  - Question No. 3 shall be set from CO3.
  - Question No. 4 shall be set from CO3.
  - Question No. 5 shall be set from CO4.
  - Question No. 6 shall be set from CO5.
- Each question shall have two options – Option A and Option B, and both options must be set from the same module.
- The options should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within each question, ensuring both options cover the same module.
- Students will attempt all questions.

CO-PO-PSO Mapping (Engineering Mechanics)

Course Outcomes (CO)	Program Outcomes (PO)												
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	2	-	-	-	-
CO2	3	2	-	-	-	-	-	-	2	-	2	-	-
CO3	3	2	-	-	-	-	-	-	2	-	-	-	2
CO4	3	2	-	-	-	-	-	-	2	-	2	-	2
CO5	3	2	-	-	-	-	-	-	2	-	-	-	2
CO6	3	2	-	-	-	-	-	-	2	-	-	3	3

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)							
Course	Engineering Mechanics Lab						Semester	I
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme
CSEESL104	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.

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	2	4

	https://vlab.amrita.edu/?sub=1&brch=74&sim=191&cnt=1		

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	-	-	-	-
LO2	3	2	-	-	-	-	-	3	2	-	-	-	-
LO3	3	2	2	-	3	-	-	-	2	-	-	-	2
LO4	3	2	-	-	-	-	-	-	2	-	-	-	2
LO5	3	2	-	-	-	-	-	-	2	-	-	-	2
LO6	3	2	-	-	-	-	-	-	2	-	-	3	3

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)								
Course	Programming in C						Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
CSEVSEC105	2	L	T	P	CIA		ESE	CIAL	PR/OR
					IAT	CIAT			
		--	--	2*+2	--	--	--	25	25

Course 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 Manas Ghosh ,“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.

LO-PO-PSO Mapping (Programming in C)													
Lab Outcomes (LO)	Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
LO1	3	2	-	-	2	-	-	2	3	-	-	1	-
LO2	3	3	-	-	3	-	3	2	2	-	-	2	-
LO3	3	3	-	-	3	-	-	2	3	-	3	2	-
LO4	3	3	-	-	2	-	-	3	2	-	2	2	-
LO5	2	2	-	-	2	-	-	2	2	-	-	1	-
LO6	2	2	-	-	3	-	-	2	2	-	-	2	-

Program	F. Y. B. Tech. Computer Engineering							
Course	Basic Engineering Skills & Practices-I						Semester	I
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
					CIA		ESE		
		L	T	P	IAT	CIAT		CIAL	PR/OR
CSEVSEC106	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		
13	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:

1. R.S. Khandpur," Printed Circuit Boards: Design, Fabrication, Assembly and Testing" McGraw-Hill.
2. Neerparaj Rai, "Arduino projects for Engineers" BPB Publications
3. Yashwanty Kanetkar, Shrirang Korde, "21 IoT Experiments, BPB Publications.
4. 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

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	-	-
LO11	3	-	-	-	-	2	2	2	-	-	2	-	-

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)							
Course	Universal Values for Personal and Professional Excellence					Semester	I	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
CSEVEC107	2	L	T	P	CIA (20)		ESE	CIAL	PR/OR
					IAT	CIAT			
		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 valuesTypes 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 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	10	3

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:

1. 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:

1. Self-reflection: *“What truly matters in my life?”*
2. Group Discussions: *“Can success guarantee happiness?”*
3. Guided introspection exercise
4. Beginning of reflection journal
5. Silent sitting / breathing awareness

6. Role play on respectful vs disrespectful behavior
7. Perspective-taking exercise
8. Gratitude journaling
9. Case discussion on ethical dilemmas
10. Responsibility mapping (self–family–society)
11. Group problem-solving exercise
12. Case analysis and discussion
13. Lifestyle audit (consumption patterns)
14. Discussion: *"Technology vs Environment – Conflict or Harmony?"*
15. Student presentations: *"My Value Journey"*
16. 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. Computer Science and Engineering (Data Science)								
Course	Social Science and Community Services						Semester		I
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
					CIA		ESE	CIAL	PR/OR
		L	T	P	IAT	CIAT			
CSELLC 108	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

Sr. 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	-	2	-	-
CO2	-	-	-	-	-	2	2	2	2	-	2	-	-
CO3	-	-	-	-	-	2	2	2	2	-	2	-	-
CO4	-	-	-	-	-	2	2	2	2	-	2	-	-

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)								
Course	Applied Mathematics-II						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			
CSEBSC201	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.

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

CO1: Solve Exact Differential equations.
CO2: Solve Linear Differential equations of first and higher order.
CO3: Evaluate double integral in different coordinate systems.
CO4: Evaluate triple integration in cartesian coordinate systems.
CO5: Solve differential equations using numerical methods & expand functions in the form of Taylor's & Maclaurin's series.
CO6: Solve the differential equation using Laplace transform.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**Differential Equations-I** First-order differential equations: Exact equations, Integrating factor, Linear & Bernoulli differential equations. **Self-Learning:** Method of Variation of parameters.	6	1
2	**Differential Equations-II** Higher-order linear differential equations, Complementary function, Particular integral, Applications: Modeling examples on population & electrical circuits. **Self-Learning:** Method of Variation of parameters.	7	2
3	**Double Integration** Double integration: Definition and evaluation, Change of order of integration, Evaluation of double integration by changing to polar coordinates . **Self-Learning:** Applications to find area, mass, data accumulation	7	3
4	**Triple Integration** Triple integration: Basic evaluation (Cartesian). Evaluation of triple integration into Spherical co-ordinates & Cylindrical co-ordinates. **Self-Learning:** Applications to find volume	6	4
5	**Advanced Numerical Methods** Numerical solution of differential equations: Euler method, Modified Euler method, Runge-Kutta (4th order), Taylor's and Maclurins series expansion of functions.	6	5

	Self-Learning: Use of expansions of functions to solve integrals.		
6	**Transform Techniques** Laplace Transform: Definition, Properties, Inverse Laplace Transform: Linearity property, Partial Fraction Method and Convolution Theorem. Applications: Solving differential equations using Laplace Transform. **Self-Learning:** Laplace transform of periodic functions, unit impulse & Dirac – Delta functions.	7	6

Learning Resources

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, United Kingdom, Wiley, 2017.
2. B. S. Grewal, Higher Engineering Mathematics, India, Khanna Publication, 1996.

Reference Books:

1. Numerical methods for engineers by Steven C. Chapra, Raymond P. Canale, 6 th edition, 2009.
2. Schaum's Outline of Laplace Transforms by Murray R. Spiegel, 2005
3. Thomas' Calculus by George B. Thomas, Addison-Wesley, Pearson, 13 th edition, 2014.

Online Resources:

1. Prof. Jitendra Kumar (IIT Kharagpur): https://onlinecourses.nptel.ac.in/noc23_ma87/preview
2. Prof. Adrijit Goswami (IIT Kharagpur): https://onlinecourses.nptel.ac.in/noc20_ma03/preview
3. Prof. S. Baskar (IIT Bombay): https://nptel.ac.in/courses/111101003

List of Assignment: (Sr.1 & 2 are compulsory. Any 6 Assignment from sr. no 3 to 11)

Sr. No.	Name of the Assignment	Hours	CO Mapping
1	Activity I (Revision of Prerequisites for the course)	2	-
2	Activity II (Explore the math toolbox: Desmos, Geogebra)	2	-
3	To solve exact, non - exact & Bernoulli's differential equations	2	1
4	To solve first & higher order linear differential equations.	2	2
5	Applications of first order differential equations.	2	1,2
6	Double Integration in Cartesian & Polar form.	2	3
7	Triple Integration in Cartesian & Polar form.	2	4
8	Applications of double & Triple Integration.	2	3,4
9	Numerical solutions of ODE, Numerical Integration & Taylor expansions.	2	4
10	Applications of Taylor & Maclaurin's expansions to evaluate integrals	2	5
11	Laplace Transforms & its applications to LDE	2	6

Sr No	List of SCILAB Practical	Hrs.
01	Numerical Solutions of ODE using SCILAB: Euler's Method	4
02	Numerical Solutions of ODE using SCILAB: Modified Euler's Method	
03	Numerical Solutions of ODE using SCILAB: Runga – Kutta Method of order 4	
04	Numerical Integration using SCILAB	

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

- The question paper shall consist of six questions, carrying 10 marks each.
  - Question No. 1 shall be set from CO1.
  - Question No. 2 shall be set from CO2.
  - Question No. 3 shall be set from CO3.
  - Question No. 4 shall be set from CO4.
  - Question No. 5 shall be set from CO5.
  - Question No. 6 shall be set from CO6.
- Each question shall have two options – Option A and Option B, and both options must be set from the same module.
- The options should be of comparable difficulty level and should test similar learning outcomes.
- Internal choice may be provided within each question, ensuring both options cover the same module.
- Students will attempt all questions.

CO-PO-PSO Mapping (Applied Mathematics-II)													
Course Outcomes (CO)	**Program Outcomes (PO)**												
	PO1	**PO 2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	2	-	2	-	2	2	-
CO2	3	3	-	-	-	-	2	-	2	-	2	2	-
CO3	3	2	-	-	-	-	-	-	2	-	-	-	-
CO4	3	2	-	-	-	-	-	-	2	-	-	-	-
CO5	2	2	-	-	2	-	-	-	2	-	-	-	-
CO6	3	2	-	-	-	-	-	-	2	-	2	2	-

Program	F. Y. B. Tech.Computer Science and Engineering (Data Science)							
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			
CSEBSC2021	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.	8	2

	Self-Learning: Comparison between CCD and CMOS Sensors		
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:

1. 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**	**PSO 1**	**PSO 2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	2	2	-	2	-	2

Program	F. Y. B. Tech.Computer Science and Engineering (Data Science)							
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			
CSEBSL2011	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.Computer Science and Engineering (Data Science)							
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			
CSEBSC2022	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:

1. To provide a basic understanding of Semiconductors in the field of engineering.
2. To understand the basic importance of p-n junction diodes.
3. To learn about 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:
  - Question No. 1 shall be set from CO1
  - Question No. 2 shall be set from CO2
  - 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.Computer Science and Engineering (Data Science)							
Course	Physics of Semi-conductor Lab						Semester	II
Code	Credit	Teaching Scheme (Hrs./Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
CSEBSL2012	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:

- Knowledge of basic semiconductor 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	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 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.Computer Science and Engineering (Data Science)							
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			
CSEBSC2023	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:
  a. Question No. 1 shall be set from CO1
  b. Question No. 2 shall be set from CO2
  c. 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.Computer Science and Engineering (Data Science)							
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			
CSEBSL2013	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. Computer Science Engineering (Data Science)							
Course	Material Chemistry						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			
CSEBSC2031	2	2	--	--	10	20	30	--	--

Course Prerequisites:

Basic understanding of general chemistry concept's 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	Hr	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	8	2

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

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)							
Course	Material Chemistry Lab						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA		ESE	CIAL	PR/OR
					IAT	CIAT			
CSEBSL2021	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 Prerequisites:

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	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	-	-	-	-
LO4	3	-	-	-	2	-	-	2	2	-	-	-	-
LO5	3	-	-	-	-	-	-	2	2	-	-	-	-

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)							
Course	Chemistry for Environment and Sustainable Energy					Semester	II	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme		Laboratory Examination Scheme	
CSEBSC2032	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 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	6	2

	(CO), and hydrocarbons Carbon footprint: Introduction; Sources of emissions; Types (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

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 Text Book 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:
3. https://archive.nptel.ac.in/courses/115/102/115102124
4. Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems, IIT Guwahati: https://nelda.org.in/sustainable-living-practices/
5. Biomass energy: https://www.researchgate.net/publication/355204245
6. 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 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-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)													
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. Computer Science and Engineering (Data Science)							
Course	Chemistry for Environment and Sustainable Energy Lab					Semester	II	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme		Laboratory Examination Scheme	
		L	T	P	CIA (IAT / CIAT)	ESE	CIAL	OR
CSEBSL2022	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 Prerequisites:

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	Hrs
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 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 Computer Science and Engineering (Data Science)								
Course	Professional Communication Skills						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			
CSEAEC204	2	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.

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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	6	1

	Organization Communication: Formal (Upward, Downward, 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	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	-	-	-	-	-	-	-	-	-	-	-	2	2
CO4	-	-	-	-	-	-	-	2	2	-	-	2	2
CO5	-	-	-	-	-	-	-	2	3	-	-	2	2
CO6	-	-	-	-	-	-	-	2	2	-	2	-	-

Program	F. Y. B. Tech Computer Science Engineering (Data Science)							
Course	Professional Communication Skills Lab						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
					CIA		ESE	CIAL	OR
		L	T	P	IAT	CIAT			
CSEAEL203	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:

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	Hours	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)

CO-PO-PSO Mapping (Professional Communication Skills Lab)													
Lab Outcomes (LO)	**Program Outcomes (PO)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
LO1	-	-	-	-	-	-	-	2	2	-	-	-	-
LO2	-	-	-	-	-	-	-	3	3	-	2	-	2
LO3	-	-	-	-	-	2	2	2	2	-	-	-	2
LO4	-	-	-	-	-	-	-	2	3	-	-	-	-

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)								
Course	Computer Organization and Architecture						Semester		II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
					CIA (40)		ESE	CIAL	PR/OR
		L	T	P	IAT	CIAT			
CSEPCC205	3	3	--	--	20	20	60	--	--

Course Prerequisites:

To successfully understand and complete this course, students are expected to have: Basic knowledge of C Programming (variables, data types, control structures, functions); Fundamental understanding of Digital Electronics (logic gates, number systems, basic combinational circuits); Basic mathematical and logical reasoning skills (binary operations, problem-solving ability); Familiarity with using a computer system (compiling and executing simple programs).

Course Objectives:

1. To introduce the fundamental organization of computer systems, data representation techniques, and performance evaluation parameters.
2. To develop understanding of instruction set architecture, CPU organization, and instruction execution mechanisms.
3. To introduce the concepts of control unit design, micro-operations, and pipelined processor organization.
4. To provide knowledge of memory organization, cache mechanisms, and input/output operations in computer systems.
5. To familiarize learners with parallel processing concepts and multicore processor architectures.
6. To introduce GPU architecture and heterogeneous computing models used in modern computing applications.

Course Outcomes:

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

CO1: Apply data representation and performance evaluation techniques in computer systems.

CO2: Explain instruction set architecture, CPU organization, and instruction execution in computer systems.

CO3: Apply pipelining concepts for instruction execution in processors.

CO4: Apply memory organization and cache performance concepts in computer systems.

CO5: Apply parallel processing concepts for multicore computing systems.

CO6: Explain GPU architecture and heterogeneous computing concepts.

Syllabus

Unit No.	Description	Hrs.	CO Mapping
1	**UNIT 1: Computer System Overview, Performance & Data Representation** Functional units of a computer: CPU, Memory, Input/Output, Basic computer architectures: Von Neumann and Harvard, Bus structures: Data, Address, Control bus. Overview of instruction execution, Performance metrics: Latency, Throughput, CPI. Introduction to Amdahl's Law, Number systems and base conversions, Signed number representation (2's complement) **Self-Learning:** Evolution of computer architectures and Floating point representation (IEEE 754 basics)	6	CO1
2	**UNIT 2: Instruction Set Architecture & CPU Organisation** Instruction types: Data transfer, Arithmetic, Logical, Control transfer, Instruction formats: Zero, One, Two, Three address, Addressing modes with examples, RISC vs CISC architecture, CPU organization: ALU,	6	CO2

	Control Unit, Registers, Instruction cycle: Fetch–Decode–Execute. **Self-Learning:** Overview of x86, ARM, and RISC-V architectures		
3	**UNIT 3: Control Unit & Pipelining** Control unit: Hardwired and Microprogrammed control (basic idea), Microoperations and Register Transfer concepts, Pipelining: Concept, stages, and speedup, Pipeline hazards: Structural hazards, Data hazards, Control hazards. Hazard mitigation: Forwarding, Stalls, Branch prediction (basic idea) **Self-Learning:** Superscalar processors and Pipeline visualization tools	6	CO3
4	**UNIT 4: Memory Organisation & I/O Systems** Memory hierarchy, Locality of reference, SRAM, DRAM, ROM (overview), Cache memory: Direct mapping, Associative mapping, Set-associative mapping, Cache performance: Hit ratio, Miss ratio, AMAT, Virtual memory and paging, I/O organization: Programmed I/O, Interrupts, DMA. **Self-Learning:** Modern memory technologies: HDD vs SSD, DDR5, HBM (overview)	6	CO4
5	**UNIT 5: Multicore Architectures** Need for parallel processing, Flynn's taxonomy: SISD, SIMD, MIMD, Shared memory vs Distributed memory, Multicore organization, Simultaneous multithreading (basic idea), Parallel speedup using Amdahl's Law **Self-Learning:** Intel, AMD, Apple multicore processors and Performance comparison: Single-core vs multicore	6	CO5
6	**UNIT 6: GPU & Heterogeneous Computing** CPU vs GPU computing, Evolution of GPU computing (basic overview), GPU architecture: Streaming multiprocessors, CUDA cores, SIMT execution model, GPU memory hierarchy (basic idea), Heterogeneous computing: CPU + GPU systems, Applications of GPU in AI and Deep Learning **Self-Learning:** CUDA vs OpenCL and Modern GPUs for AI (e.g., NVIDIA GPUs)	6	CO6

Learning Resources

Textbooks:

1. Computer Organization and Design: The Hardware/Software Interface (RISC-V Edition) – David A. Patterson, John L. Hennessy – Morgan Kaufmann (latest edition).
2. Computer Organization and Embedded Systems – Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian – McGraw Hill, 6th Edition.
3. Computer Organization and Architecture: Designing for Performance – William Stallings – Pearson, 11th Edition

Reference Books:

1. Computer Architecture: A Quantitative Approach – John L. Hennessy, David A. Patterson – Morgan Kaufmann, 6th Edition (covers Flynn's taxonomy, multicore, vector and GPU architectures in depth).
2. Programming Massively Parallel Processors: A Hands-on Approach – David B. Kirk, Wen-mei W. Hwu – Morgan Kaufmann, 4th Edition (covers GPU architecture and CUDA programming).
3. Computer Systems: A Programmer's Perspective – Randal E. Bryant, David R. O'Hallaron – Pearson.
4. Structured Computer Organization – Andrew S. Tanenbaum, Todd Austin – Pearson, 6th Edition.

5. Computer System Architecture – M. Morris Mano – Pearson Education, 3rd Edition

Assessment

Internal Assessment Test (IAT) for 20 marks: IAT will consist of two compulsory internal assessment tests. Approximately 40–50% of the syllabus content must be covered in IAT-I and the remaining 40–50% in IAT-II. Average of both tests will be considered.

Continuous Internal Assessment-Theory (CIAT) for 20 marks: A minimum of three CIA components (assignments, quizzes, presentations, self-learning evaluation) shall be conducted; average will be considered along with attendance.

End Semester Theory Examination (ESE) 60 marks: Question paper will cover all six units. Internal choice may be provided within sub-parts ensuring both options are from the same unit.

Online Resources:

1. NPTEL: Computer Organization and Architecture – IIT Kharagpur https://onlinecourses.nptel.ac.in/noc22_cs88/preview
2. NPTEL: Digital Systems – IIT – Ropar https://onlinecourses.nptel.ac.in/noc21_ee39/preview
3. NPTEL: Computer Architecture – IIT Delhi https://onlinecourses.nptel.ac.in/noc23_cs67/preview

CO-PO-PSO Mapping (Computer Organization and Architecture)

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	–	–	–	–	–	–	–	–	–	2	3
CO3	3	3	–	–	–	–	–	2	2	–	2	2	2
CO4	3	3	–	–	–	–	–	2	2	–	2	2	3
CO5	3	3	–	–	–	–	–	–	–	–	–	2	3
CO6	3	2	–	–	–	–	–	–	–	–	–	-	3

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)							
Course	Computer Organization and Architecture Lab						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	IAT	CIAL	ESE	CIAL	PR
CSEPCL204	2	--	--	2	--	--	--	25	--

Lab Objectives:

1. To understand computer system organization and data representation.
2. To develop skills in assembly language programming.
3. To analyze CPU organization and pipelining concepts.
4. To study memory hierarchy and I/O organization.
5. To introduce multicore and parallel programming concepts.
6. To explore GPU computing fundamentals

Lab Outcomes:

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

LO1: Apply number systems and data representation concepts.
LO2: Implement instruction set architecture using assembly programs.
LO3: Apply pipelining and CPU organization concepts.
LO4: Apply memory and I/O organization concepts.
LO5: Apply parallel programming using multicore systems.
LO6: Implement basic GPU programs.

Lab Prerequisites:

1. Basic knowledge of C programming
2. Fundamentals of digital logic

Unit No.	Description	Hrs	LO Mapping
1	Number system conversion and base conversion using C Signed number representation (2's complement) IEEE 754 floating-point representation	04	LO1
2	Assembly programming (arithmetic, loops, functions) Addressing modes using assembly programs Mapping C constructs to assembly (gcc -S)	06	LO2
3	Booth's multiplication algorithm Pipeline simulation and stages Pipeline hazards and mitigation	06	LO3
4	Cache memory and performance (hit/miss) Programmed I/O vs Interrupt-driven I/O	04	LO4
5	OpenMP: thread basics Parallel array operations Matrix multiplication and speedup	06	LO5
6	CUDA basics and execution model Vector addition using GPU Matrix multiplication using CUDA	04	LO6

List of laboratory experiments:

Sr. No.	Name of the Experiment	Hours	LO Mapping
1	Two programs on number system conversion and 2's complement arithmetic	2	LO1
2	Two programs on IEEE 754 floating-point representation	2	LO1
3	Assembly programs: sum, factorial, largest element	2	LO2
4	Addressing modes using assembly programs	2	LO2
5	Mapping C constructs to assembly	2	LO2
6	Booth's multiplication algorithm	2	LO3
7	Pipeline simulation and execution	2	LO3
8	Pipeline hazards and mitigation techniques	2	LO3
9	Cache memory performance analysis	2	LO4
10	Programmed I/O vs Interrupt-driven I/O	2	LO4
11	OpenMP Hello World program	2	LO5
12	OpenMP array operations with reduction	2	LO5
13	OpenMP matrix multiplication and speedup	2	LO5
14	CUDA vector addition	2	LO6
15	CUDA matrix multiplication	2	LO6

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.

LO-PO-PSO Mapping (Computer Organization and Architecture 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	–	–	3	2
LO2	3	3	–	–	2	–	–	2	2	–	–	2	3
LO3	3	3	–	–	2	–	–	2	2	–	–	2	2
LO4	3	3	–	–	2	–	–	2	2	–	–	2	3
LO5	3	3	–	–	3	–	–	2	2	–	–	2	3
LO6	3	3	–	–	3	–	–	2	2	–	–	-	3

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)							
Course	Engineering Graphics & Visualization Lab						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	IAT	CIAL	ESE	CIAL	PR/OR
CSEPCL205	2	--	--	4	--	--	--	50	50

Lab Objectives:

1. To impart and inculcate proper understanding of the theory of projection.
2. To impart the knowledge to read and interpret a drawing.
3. To improve the visualization skill.
4. To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size and orientation.
5. To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.
6. 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:

a) Knowledge of basic geometrical shapes.
b) 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

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

3. **Practical Exam: (**2 hours/ 25 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	-
LO2	3	2	-	-	-	-	-	2	2	-	2	2	-
LO3	3	2	-	-	-	-	-	2	2	-	2	2	-
LO4	3	2	-	-	3	-	-	2	2	-	2	2	2
LO5	3	2	-	-	3	-	-	2	2	-	2	2	2
LO6	3	2	-	-	3	-	-	2	2	-	2	3	3

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)							
Course	Python Programming						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme
		L	T	P	CIA		ESE	CIAL	OR
					IAT	CIAT			
CSEVSEC 2061	2	--	--	2*+2	--	--	--	25	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 Prerequisites:

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	1
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,	8	2

	recursive functions, writing modular programs using functions. **Self-Learning:** Decorators and Higher-Order Functions in Python, Problem Solving Using Recursion and Dynamic Programming.		
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	3
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	4
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	5
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	6

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.

Reference Books:

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 (Attendance)

LO-PO-PSO Mapping (Python Programming)

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	3	2	-	2	-	-	2	2	-	-	2	2
LO3	3	3	2	-	3	-	-	2	2	-	-	3	3
LO4	3	3	3	-	2	-	-	2	2	-	-	2	2
LO5	3	3	3	-	2	-	-	2	2	-	-	2	2
LO6	3	3	2	-	3	-	-	2	2	-	2	3	3

Program	F. Y. B. Tech. Computer Science and Engineering (Data Science)								
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			
CSEVSEC2062	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.

Laboratory 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

Laboratory 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 Interface. **Self-Learning:**Impact of Polymorphism on Software Maintainability.	8	4
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
Sr No	Suggested List of Experiments (Perform **12-15t of 30)** ***Note: Two experiments are expected to be completed in each lab session***	**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 generate 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.		
b	Program to implement method overriding in derived classes and demonstrate the use of the super keyword to access parent class methods and variables.	4	4
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):

- CIAL should consist of 12 experiments.
- Mini Project based on the content of the syllabus (Group of 2-3 students)
- The final certification and acceptance of CIAL ensures that satisfactory performance of laboratory work and minimum passing marks in CIAL.
- 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)

CO-PO-PSO Mapping (Object-Oriented Programming with JAVA)													
Course Outcomes (CO)	Program Outcomes (PO)												
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	2	-	2	2	2	-	-	2	2
CO2	2	2	-	-	2	-	2	2	2	-	-	2	2
CO3	2	2	-	-	3	-	2	2	2	-	-	2	2
CO4	2	2	-	-	3	-	2	2	2	-	-	2	2
CO5	2	3	-	-	3	-	2	2	2	-	-	2	2
CO6	2	3	-	-	3	-	2	2	2	-	2	2	2

Program	F. Y. B. Tech Computer Science and Engineering (Data Science)							
Course	Object-Oriented Programming with C++						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme		Laboratory Examination Scheme	
CSEVSEC2063	2	L	T	P	CIA	ESE	CIAL	PR/OR
					IAT / CIAT			
		--	--	2*+2	-- / --	--	25	25

Course Prerequisites:

Proficiency in C programming fundamentals, including data types, operators, decision-making and looping constructs, arrays, strings, functions, and structures.

Lab Objectives:

1. To introduce the fundamentals of object-oriented programming and differentiate it from procedural programming.
2. To develop programming skills using C++ constructs, input/output operations, and control structures.
3. To enable the design of modular programs using functions, classes, and object-oriented principles.
4. To provide understanding of memory management using pointers and dynamic allocation
5. To introduce concepts of inheritance and polymorphism for developing reusable and extensible programs.
6. To enable data processing using file handling and Standard Template Library (STL) components.

Lab Outcomes:

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

LO1. Develop C++ programs using fundamental constructs, input/output operations, and control structures.

LO2. Design and implement class-based solutions using encapsulation, constructors, and member functions.

LO3. Apply functions, arrays, strings, and pointers to develop structured and efficient programs.

LO4. Apply inheritance concepts to develop reusable and hierarchical object-oriented programs.

LO5. Implement compile-time and run-time polymorphism using function overloading, operator overloading, virtual functions, and dynamic binding.

LO6. Apply file handling techniques and STL components for data storage, retrieval, and basic data proces.

Syllabus

Unit No.	Description	Hrs.	LO Mapping
1	**C++ basics and OOP Overview** Procedure Oriented Programming (C) vs Object Oriented Programming (C++); Data types and type compatibility; Declaration of variables and type casting; Structure of a C++ program; Input/output using cin and cout; Basic I/O functions; Namespace management **Self-Learning:**Namespaces in depth — creating custom namespaces and using using directives Comparison of C++ I/O streams vs C's printf/scanf Type conversion rules and implicit/explicit casting pitfalls History and evolution of C++ standards (C++11 to C++20)	4	1
2	**Classes, Objects and Data Modelling.** Class and Object: Introduction, defining a class, access specifiers; Member functions: inside and outside class definition; Object creation and memory allocation; Special operators in C++: scope resolution operator; Memory management operators; Manipulators; Function overloading and operator overloading (introduction) **Self- Learning topics:** Access specifiers and encapsulation best practices Static vs dynamic memory allocation for objects Manipulators (setw, setprecision, endl, etc.) for formatted output Function overloading vs operator overloading — rules and ambiguity resolution.	5	2

3	**Functions, Arrays, Strings, Pointers.** Inline functions; Static data members and static member functions; Friend functions (using member and non-member functions); Strings using string class Arrays of objects and objects as function arguments; Constructors and Destructors: Types of constructors, constructor overloading, constructors with default arguments, Destructors; Pointers: Reference vs pointer, Pointer declaration and operators, Pointer arithmetic, Pointer to object and this pointer, Dynamic memory allocation (new, delete), Dangling pointer and null pointer, Pointers with strings and const qualifier **Self- Learning topics:** Constructor delegation and initialization lists Smart pointers (unique_ptr, shared_ptr) as a modern alternative to raw pointers Friend functions vs member functions — design trade-offs String class methods beyond basics (find, substr, replace)	6	2, 3
4	**Inheritance** Concept of inheritance; Types of inheritance: single, multilevel, hierarchical, multiple, hybrid; Access specifiers: public, private, protected; Constructor execution in inheritance (basic concept) **Self- Learning topics:** Diamond problem in multiple inheritance and virtual base classes Order of constructor/destructor calls in multilevel and hierarchical inheritance Access control changes across inheritance (public/private/protected) Composition vs inheritance — when to use which	4	4
5	**Advanced OOP Concepts** Friend classes; Virtual functions; Dynamic polymorphism; Abstract classes; Use of override and final specifiers. **Self- Learning topics:** Virtual function tables (vtable) — how dynamic binding works internally Pure virtual functions and designing abstract interfaces override and final specifiers — preventing accidental overriding Runtime Type Identification (RTTI) using typeid and dynamic_cast	3	4, 5
6	**File Handling & Standard Template Library (STL) for Data Processing** File handling: ifstream, ofstream, fstream File open modes (ios::in, ios::out, ios::app) Read and write operations Standard Template Library (STL) (introductory): vector, pair, map Iterators (basic concept) Basic algorithms (sort, count) **Self- Learning topics:** STL containers beyond vector/map — set, list, stack, queue Lambda expressions and their use with STL algorithms Exception handling (try, catch, throw) in file operations Binary file handling vs text file handling	4	2, 5, 6

List of laboratory experiments:

<table>
<tr><th>Sr No</th><th>(Perform 20 out of 30)
Note: Two experiments are expected to be completed in each lab session</th><th>Module No (Exp. To be conducted</th><th>LO</th></tr>
<tr><td>1</td><td>Write programs to evaluate any expression using Input / Output functions</td><td rowspan="4">1
(Any 3)</td><td rowspan="4">1</td></tr>
<tr><td>2</td><td>Write programs to demonstrate use of Implicit type casting Explicit type casting</td></tr>
<tr><td>3</td><td>Write a C++ program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.</td></tr>
<tr><td>4</td><td>Write a C++ program to find the sum of individual digits of a positive integer.</td></tr>
<tr><td>5</td><td>Write a Program to Implement a class STUDENT with appropriate data members and access specifiers, and display the records 4 students:
<table>
<tr><td>Member</td><td>Description</td></tr>
<tr><td colspan="2">Data members</td></tr>
<tr><td>sname</td><td>Name of the student</td></tr>
<tr><td>Marks array</td><td>Marks of the student</td></tr>
<tr><td>total</td><td>Total marks obtained</td></tr>
<tr><td>tmax</td><td>Total maximum marks</td></tr>
</table>
<table>
<tr><td colspan="2">Member functions</td></tr>
<tr><td>Member</td><td>Description</td></tr>
<tr><td>assign()</td><td>Assign Initial Values</td></tr>
<tr><td>compute()</td><td>to Compute Total, Average</td></tr>
<tr><td>display()</td><td>to Display the Data.</td></tr>
</table></td><td rowspan="4">2
(Any 3)</td><td rowspan="4">2</td></tr>
<tr><td>6</td><td>Write a program to demonstrate function overloading for area calculation</td></tr>
<tr><td>7</td><td>Write a program to demonstrate Operator overloading for adding two complex numbers</td></tr>
<tr><td>8</td><td>Write a program to demonstrate function outside the class using scope resolution operator</td></tr>
<tr><td>9</td><td>Write programs to implement inline function</td><td rowspan="10">3
(Any 5)</td><td rowspan="10">3</td></tr>
<tr><td>10</td><td>Create a BankAccount class with account number, holder name, and balance. Use static data member balance and static member function to display it.</td></tr>
<tr><td>11</td><td>Write programs for Default constructor Parameterized constructor Copy constructor Multiple constructors in one class</td></tr>
<tr><td>12</td><td>Write a program to demonstrate constructor overloading and call its destructor at the end for efficient memory management.</td></tr>
<tr><td>13</td><td>Write a program to demonstrate array of objects</td></tr>
<tr><td>14</td><td>Write a Program to demonstrate parameters passing to function via by value and by reference.</td></tr>
<tr><td>15</td><td>Write a program to demonstrate dynamic memory allocation</td></tr>
<tr><td>16</td><td>Write a program demonstrates string class and its method for initialization, concatenation, modification, and searching.</td></tr>
<tr><td>17</td><td>Write a program to implement Pointer to object and 'this' pointer</td></tr>
<tr><td>18</td><td>Write programs to demonstrate new and delete operator</td></tr>
<tr><td>19</td><td>Write C++ programs that illustrate how the following forms of inheritance are supported: a) Single inheritance b) Multiple inheritance</td><td rowspan="4">4
(Any 3)</td><td rowspan="4">4</td></tr>
<tr><td>20</td><td>Write C++ programs that illustrate how the following forms of inheritance are supported: a) Multi level inheritance b) Hierarchical inheritance</td></tr>
<tr><td>21</td><td>Write a Program to Invoke derived class member functions through base class pointers using virtual functions.</td></tr>
<tr><td>22</td><td>Write a C++ program that illustrates the order of execution of</td></tr>
</table>

	constructors and destructors when new class is derived from more than one base class.		
23	Write a program to demonstrate Friend Function and Friend Class	5 (Any 2)	5
24	Write a program to demonstrate virtual function and pure virtual function		
25	Write a program to demonstrate Abstract class		
26	Write a program to demonstrate use of final keyword		
27	Write programs to write and read data from a text file using file stream	6 (Any 2)	6
28	Write programs to copy the content of one file into another file using formatted input/output functions		
29	Write a program to demonstrate dynamic arrays using vector in STL		
30	Write a program to demonstrate map using STL		

Learning Resources

Textbooks:

1. "C++ How to Program", Paul Deitel, Harvey Deitel, Pearson Education, Latest Edition.
2. "C++ Programming: An Object-Oriented Approach", Forouzan, B. A., & Gilberg, R. F., McGraw-Hill, Latest Edition.

Reference Books:

1. **"**The C++ Programming Language", Bjarne Stroustrup, Addison-Wesley, Latest Edition.
2. "Programming: Principles and Practice Using C++", Bjarne Stroustrup, Addison-Wesley, Latest Edition.
3. "C++ Primer", Stanley B. Lippman, Josée Lajoie, Barbara E. Moo, Addison-Wesley, Latest Edition.
4. "Object-Oriented Programming with C++", A. N. Kamthane, Pearson Education, Latest Edition.
5. "Let Us C++", Y. P. Kanetkar BPB Publications, Latest Edition.

Online Resources:

1. https://www.coursera.org/learn/c-plus-plus-object-oriented-programming?utm_source=chatgpt.com
2. https://www.udemy.com/course/cpp-deep-dive/?utm_source=chatgpt.com
3. https://www.edx.org/learn/c-programming/codio-c-programming-object-oriented-design?utm_source=chatgpt.com
4. https://onlinecourses.nptel.ac.in/noc26_cs52/preview

Online Competitive Coding Platforms (Optional but Desirable Self-Learning & Practice)

Students are strongly encouraged to practice competitive programming and problem-solving on online coding platforms such as HackerRank, LeetCode, CodeChef, HackerEarth, Codeforces, AtCoder, TopCoder, GeeksforGeeks, etc.

Students should:

- Solve regular programming problems related to arrays, strings, and basic data structures
- Practice at least 2–3 problems per week

Assessment:

Continuous Internal Assessment Lab (CIAL): CIAL shall consist of at least 20 practicals based on the above list. CIAL Marks: 25 Marks (Total marks) = 10 Marks (Average marks of Experiments) +10 Marks (Internal Practical Exam, after completion of 3 module) + 5 Marks (Attendance)

End Semester Practical Examination (ESPE): Students are required to appear for the practical examination based on the above syllabus at the end of the semester.

LO-PO-PSO MAPPING (Object-Oriented Programming with C++)												
Lab Outcomes (LO)	Program Outcomes (PO)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
LO1	3	2	1		2	–	2	2	2		--	2	2
LO2	3	3	2		2	–	2	2	2		2	2	2
LO3	3	3	2		3	–	2	2	2		2	3	3
LO4	3	3	3		2	–	2	2	2		2	2	2
LO5	3	3	3		2	–	2	2	2		2	2	2
LO6	2	3	2		3	–	2	2	2		2	3	3

Program	F. Y. B. Tech . Computer Engineering							
Course	Basic Engineering Skills & Practices-II						Semester	II
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
					CIA		ESE		
		L	T	P	IAT	CIAT		CIAL	PR/OR
CSEVSEC207	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		3	3

	(Group Project).			
6	To diagnose and troubleshoot common networking problems/issues.		2	3
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
13	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

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	-	-
LO5	3	-	-	-	-	2	2	2	-	-	2	-	-
LO6	3	-	-	-	-	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	-	-
LO10	3	-	-	-	-	2	2	2	-	-	2	-	-
LO11	3	-	-	-	-	2	2	2	-	-	2	-	-

Program	F. Y. B. Tech Computer Science Engineering (Data Science)								
Course	Indian Knowledge System						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			
CSEIKS208	2	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:

4. Headlines
5. Articles
6. Interviews (ancient figures)

9. PROBLEM-SOLVING LAB

Give real problems:

4. Water shortage
5. Stress in students
6. 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 Computer Science Engineering (Data Science)								
Course	German Language Basic Foundation						Semester	II	
Code	Credits	Teaching Scheme (Hrs/Week)			Theory Examination Scheme			Laboratory Examination Scheme	
		L	T	P	CIA (25)		ESE	CIAL	PR/OR
					IAT	CIAT			
CSELLC209	2	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 the picture, Genitive Case. Past Tense (Imperfect), Perfect Tense, Verb Conjugation Schemes (Present – Past – Perfect)	8	3

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. 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: Analyse the "Du" (informal) vs. "Sie" (formal) culture in Germany.
02	Assignment on Writing Skills: 4 types of letters in complete block format	**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 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	-	-