

Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 41104

(An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune)



Curriculum Structure and Syllabus

Of

**First Year B. Tech. Computer Science and Engineering
(AI & ML)**

(Regulations 2026)



Effective from Academic Year 2026-27

Institute Vision

To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, and Knowledge for self-sustenance through Quality Education.
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with an ability to think and act independently in demanding situations.

EOMS Policy

“We at PCCOE are committed to offer exemplarily Ethical, Sustainable and Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders.

We shall strive for technical development of students by creating globally competent and sensible engineers, researchers and entrepreneurs through Quality Education.

We are committed for Institute’s social responsibilities and managing Intellectual property.

We shall achieve this by establishing and strengthening state-of-the-art Engineering Institute through continual improvement in effective implementation of Educational Organizations Management Systems (EOMS).”

Course Approval Summary

Board of Studies - Department of Applied Sciences and Humanities:

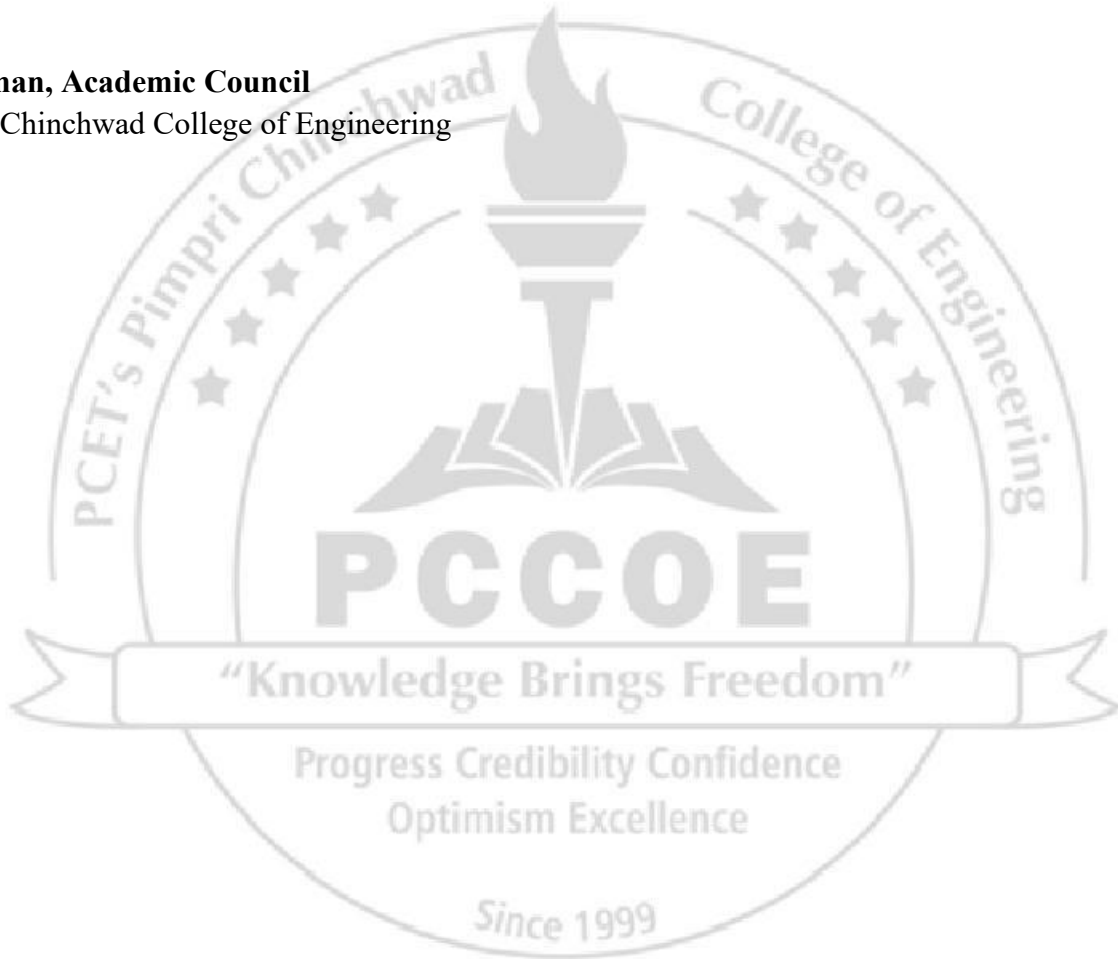
Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1.	Linear Algebra & Univariate Calculus	BSH31BS01	11	
2.	Linear Algebra & Univariate Calculus – Laboratory	BSH31BS02	12	
3.	Engineering Physics	BSH31BS03	14	
4.	Engineering Physics Laboratory	BSH31BS04	17	
5.	Constitution of India	BSH31VE01	26	
6.	AEC-I-(Communicative English)	BSH31AE01	28	
7.	Life Skills 1	BSH31CC01	31	
8.	Multivariate Calculus	BSH32BS12	35	
9.	Multivariate Calculus laboratory	BSH32BS13	36	
10.	Engineering Chemistry	BSH32BS09	38	
11.	Engineering Chemistry Laboratory	BSH32BS10	41	
12.	Universal Human Values	BSH32VE02	53	
13.	AEC-II-(Professional English / German /Japanese /Business storytelling)	BSH32AE02/ 03/04/05	56/58/60/62	
14.	Indian Knowledge System	BSH32IK02	64	
15.	Life Skills 2	BSH32CC02	66	

Board of Studies - Department of Computer Science and Engineering (AI&ML)

Sr. No	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1.	Discrete Mathematics	BCS31ES01	18	
2.	Digital Electronics and Computer Organization	BCS31ES02	20	
3.	Digital Electronics & Computer Organization Laboratory	BCS31ES03	22	
4.	Problem Solving with C programming	BCS31VS01	24	
5.	Data Science	BCS32ES04	42	
6.	Data Science Laboratory	BCS32ES05	44	
7.	Software Engineering	BCS32ES06	47	
8.	Object Oriented Programming using C++	BCS32VS02	49	

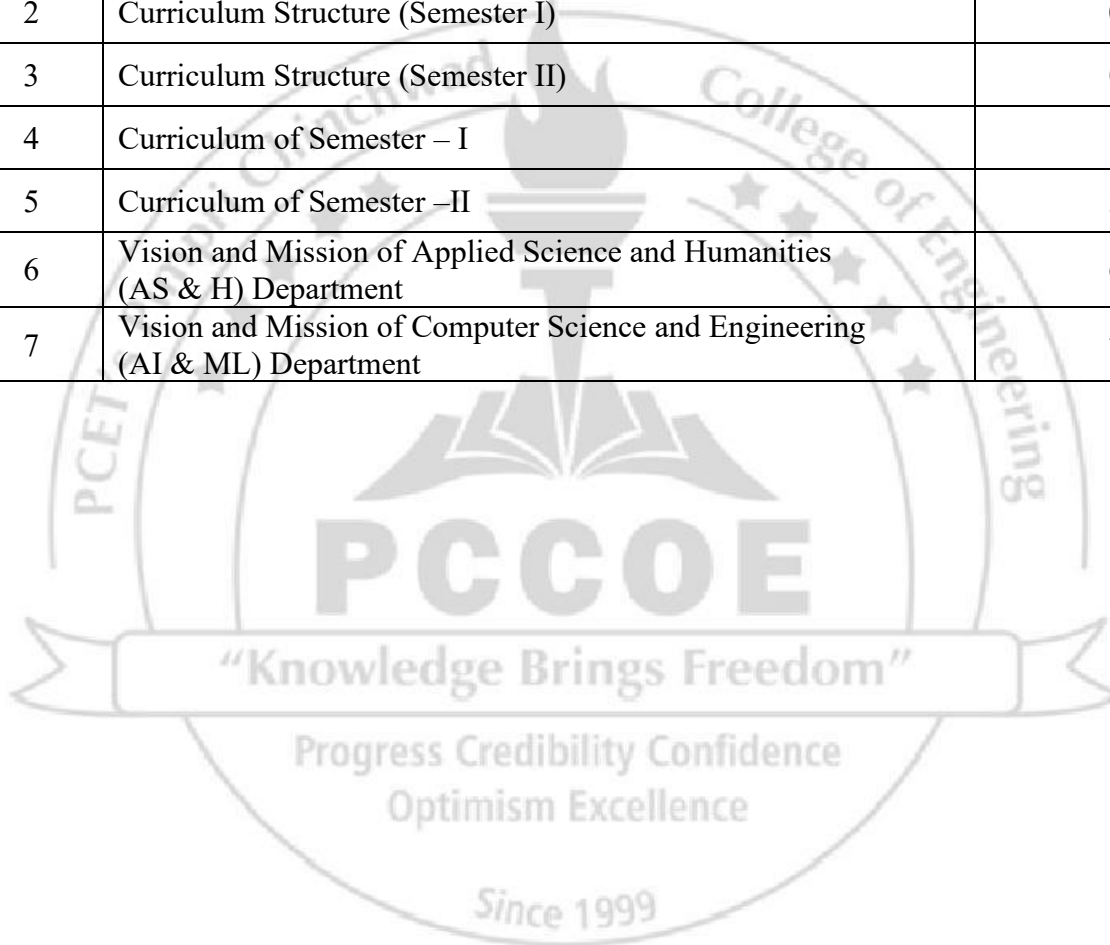
Approved by Academic Council:

Chairman, Academic Council
Pimpri Chinchwad College of Engineering



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7	Vision and Mission of Computer Science and Engineering (AI & ML) Department	70



CURRICULUM FRAMEWORK

(2026 Course)

LIST OF ABBREVIATIONS

Sr. No.	Abbreviation	Type of Course
1	BSC	Basic Science Course
2	ESC	Engineering Science Course
3	PCC	Programme Core Course
4	PEC	Programme Elective Course
5	MDM	Multidisciplinary Minor
6	OEC	Open Elective Course
7	VSEC	Vocational and Skill Enhancement Course
8	AEC	Ability Enhancement Course
9	EEM	Entrepreneurship/Economics/Management Course
10	IKS	Indian Knowledge System
11	VEC	Value Education Course
12	ELC	Experiential Learning Courses
13	LLC/CC	Liberal Learning Courses/Co-Curricular

COURSE WISE CREDIT DISTRIBUTION

Sr. No.	Type of Course	No. of Courses	Total Credits	
			NO.	%
1	Basic Science Course	8	14	35
2	Engineering Science Course	6	12	30
3	Vocational and Skill Enhancement Course	2	4	10
4	Ability Enhancement Course	2	2	5
5	Indian Knowledge System	1	2	5
6	Value Education Course	2	4	10
7	Co-Curricular Courses	2	2	5
Total		23	40	100

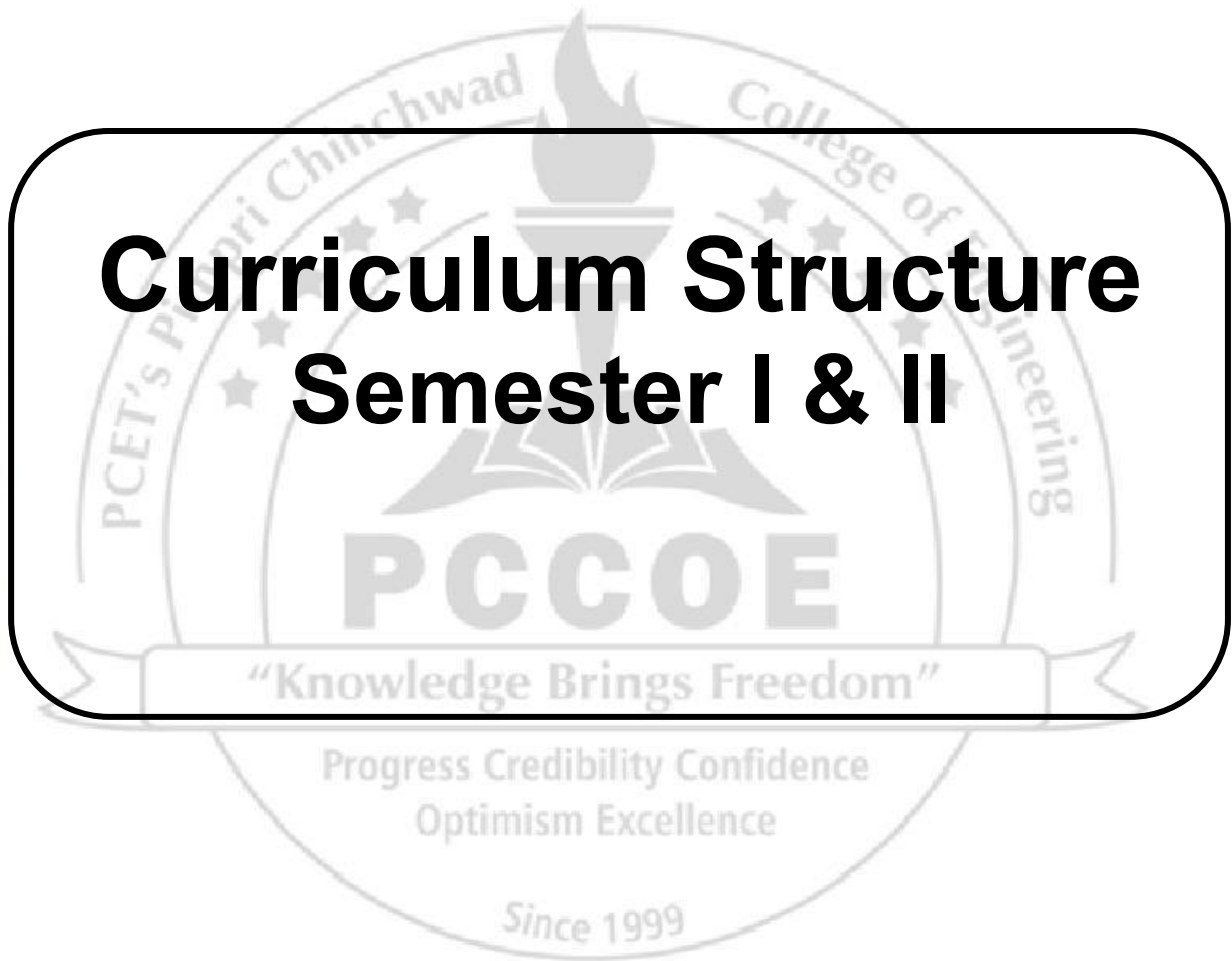
SEMESTER-WISE COURSE DISTRIBUTION

Course Distribution: Semester Wise										
Sr. No.	Type of Course	No. of Courses / Semester								Total
		1	2	3	4	5	6	7	8	
1.	Basic Science Course	4	4							8
2.	Engineering Science Course	3	3							6
3.	Vocational and Skill Enhancement Course	1	1							2
4.	Ability Enhancement Course	1	1							2
5.	Indian Knowledge System	1	-							1
6.	Value Education Course	1	1							2
7.	Co-Curricular Courses	1	1							2
Total		12	11							23

SEMESTER-WISE CREDIT DISTRIBUTION

Credit Distribution: Semester Wise										
Sr. No.	Type of Course	No. of Credits / Semester								Total
		1	2	3	4	5	6	7	8	
1.	Basic Science Course	7	7							14
2.	Engineering Science Course	6	6							12
3.	Vocational and Skill Enhancement Course	2	2							4
4.	Ability Enhancement Course	1	1							2
5.	Indian Knowledge System	-	2							2
6.	Value Education Course	2	2							4
7.	Co-Curricular Courses	1	1							2
Total		19	21							40

Curriculum Structure Semester I & II



CURRICULUM STRUCTURE

First Year B. Tech Computer Science and Engineering (AI & ML) (Academic Regulations 2026)

(With effect from Academic Year 2026-27)

Semester I

Course Type	Course Code	Course Name	Credit Scheme				Teaching Scheme (Hrs./Week)					Evaluation Scheme and Marks						
			L	P	T	Total	L	P	T	O	Total	FA		SA	TW	PR	OR	Total
												FA1	FA2					
BSC	BSH31BS01	Linear Algebra & Univariate Calculus	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	50
BSC	BSH31BS02	Linear Algebra & Univariate Calculus - Laboratory	-	1	-	1	-	2	-	-	2	-	-	-	50	-	-	50
BSC	BSH31BS03	Engineering Physics	3	-	-	3	3	-	-	1	4	20	20	60	-	-	-	100
BSC	BSH31BS04	Engineering Physics Laboratory	-	1	-	1	-	2	-	-	2	-	-	-	50	-	-	50
ESC	BCS31ES01	Discrete Mathematics	3	-	-	3	3	-	-	-	3	20	20	60	-	-	-	100
ESC	BCS31ES02	Digital Electronics and Computer Organization	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	50
ESC	BCS31ES03	Digital Electronics & Computer Organization Laboratory	-	1	-	1	-	2	-	-	2	-	-	-	50	-	-	50
VSEC	BCS31VS01	Problem Solving with C programming	-	2	-	2	-	4	-	-	4	-	-	-	50	50	-	100
VEC	BSH31VE01	Constitution of India	2	-	-	2	2	-	-	-	2	25	25	-	-	-	-	50
AEC-I	BSH31AE01	Communicative English	-	1	-	1	-	2	-	-	2	-	-	-	30	-	20	50
CC	BSH31CC01	Life Skills 1	-	1	-	1	-	2	-	-	2	-	-	-	50	-	-	50
Total			12	7	0	19	12	14	0	3	29	85	85	180	280	50	20	700

L-Lecture, P-Practical, T-Tutorial, O-Other, i.e., self-directed learning (self-study), FA-Formative Assessment, SA-Summative Assessment, TW-Term Work, OR-Oral, PR-Practical

Note: Refer to the separate document. Exit Policy (If required)

CURRICULUM STRUCTURE

First Year B. Tech Computer Science and Engineering (AI & ML) (Academic Regulations 2026)

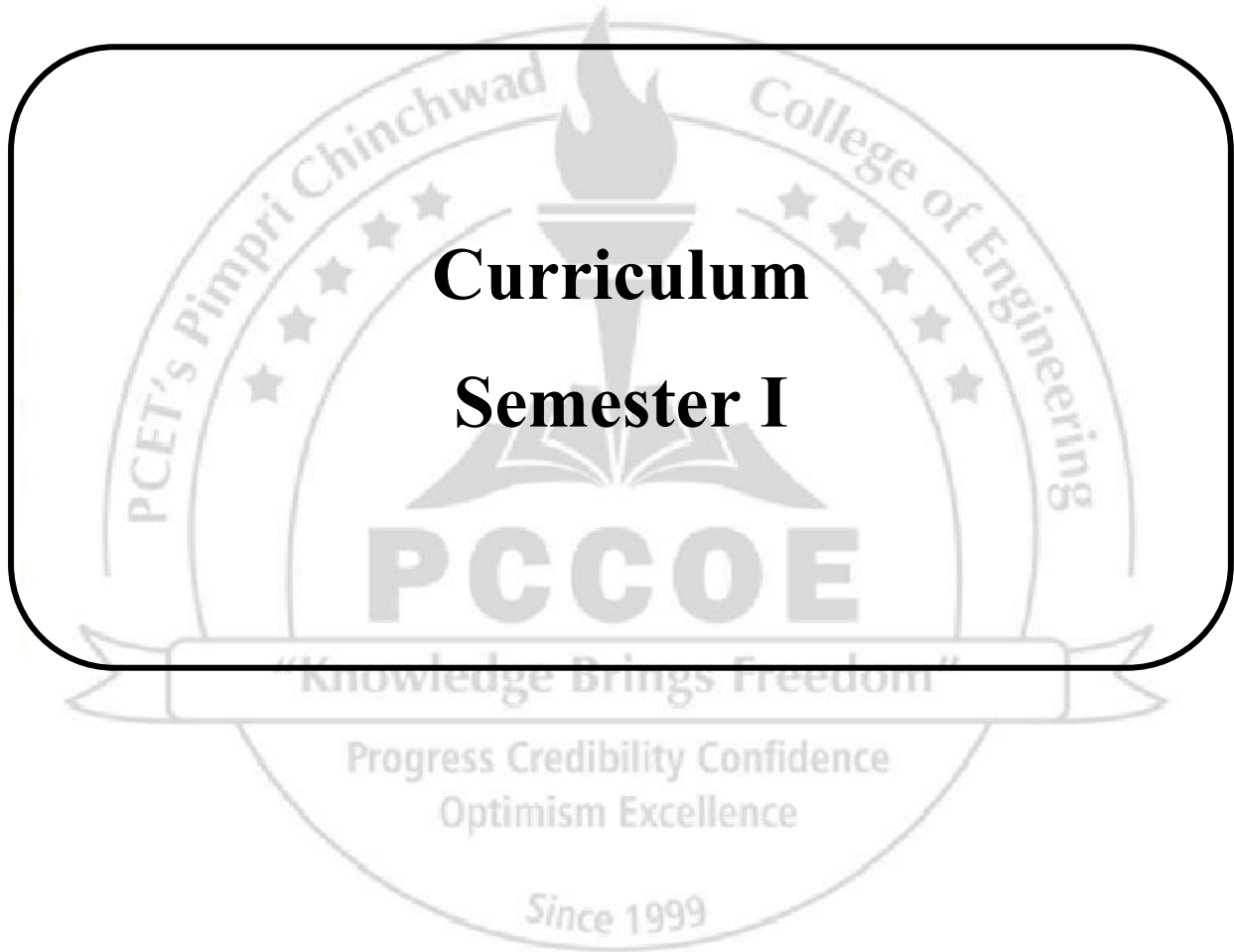
(With effect from Academic Year 2026-27)

Semester II

Course Type	Course Code	Course Name	Credit Scheme				Teaching Scheme (Hrs./Week)					Evaluation Scheme and Marks						
			L	P	T	Total	L	P	T	O	Total	FA		SA	TW	PR	OR	Total
												FA 1	FA 2					
BSC	BSH32BS12	Multivariate Calculus	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	50
BSC	BSH32BS13	Multivariate Calculus laboratory	-	1	-	1	-	2	-	-	2	-	-	-	50	-	-	50
BSC	BSH32BS09	Engineering Chemistry	3	-	-	3	3	-	-	1	4	20	20	60	-	-	-	100
BSC	BSH32BS10	Engineering Chemistry Laboratory	-	1	-	1	-	2	-	-	2	-	-	-	50	-	-	50
ESC	BCS32ES04	Data Science	2	-	-	2	2	-	-	-	2	10	10	30	-	-	-	50
ESC	BCS32ES05	Data Science Laboratory	-	2	-	2	-	4	-	-	4	-	-	-	50	50	-	100
ESC	BCS32ES06	Software Engineering	2	-	-	2	2	-	-	-	2	10	10	30	-	-	-	50
VSEC	BCS32VS02	Object Oriented Programming using C++	-	2	-	2	-	4	-	-	4	-	-	-	50	50	-	100
VEC	BSH32VE02	Universal Human Values	2	-	-	2	2	-	-	-	2	25	25	-	-	-	-	50
AEC-II	BSH32AE02/03/04/05	Professional English /German/Japanese /Business Storytelling)	-	1	-	1	-	2	-	-	2	-	-	-	30	-	20	50
IKS	BSH32IK02	Indian Knowledge System	2	-	-	2	2	-	-	-	2	25	25	-	-	-	-	50
CC	BSH32CC02	Life Skills 2	-	1	-	1	-	2	-	-	2	-	-	-	50	-	-	50
Total			13	8	0	21	13	16	0	2	31	100	100	150	280	100	20	750

L-Lecture, P-Practical, T-Tutorial, O- Other i.e. self-directed learning, (self- study), FA-Formative Assessment, SA-Summative Assessment, TW-Term Work, OR-Oral, PR-Practical

Note: Refer to the separate document Exit Policy (If required)



Program:	B. Tech. CSE (AI& ML)					Semester: I		
Course:	Linear Algebra & Univariate Calculus					Code:	BSH31BS01	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	CIE		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50
Prior knowledge of								
1. Elementary Mathematics. 2. Elementary Calculus.								
Course Objectives: This course aims at enabling students,								
1. To strengthen the concept of univariate calculus and mathematical modeling of physical systems using ordinary differential equations. 2. To get acquainted with advanced techniques for solving problems related to calculus and ordinary differential equations.								
Course Outcomes: After learning the course, the students should be able to:								
1. Apply the concept of linear algebra to the system of linear equations, linear dependence of vectors, eigenvalues, and eigenvectors. 2. Use successive differentiation in indeterminate forms, Taylor's and Maclaurin's expansions. 3. Solve first-order differential equations and higher-order linear differential equations. 4. Apply first-order differential equations and higher-order linear differential equations to solve problems involving growth and decay, electrical circuits, and one-dimensional heat flow.								
Detailed Syllabus								
Unit	Description							Duration [Hrs.]
I	Matrices: Rank, system of linear equations with applications in electrical circuits, linear dependence and independence, linear transformations, eigenvalues, and eigenvectors.							8
II	Differential Calculus: exponential indeterminate forms, Taylor's series, Maclaurin's series, successive differentiation, and Leibnitz's theorem.							7
III	Ordinary Differential Equations: Exact differential equations and differential equations reducible to exact form. Applications: Growth and decay, Kirchoff's law of electrical circuits (L-R and R-C circuits), and one-dimensional conduction of heat (steady state).							8
IV	Linear Differential Equations: Linear differential equation of nth order with constant coefficients, General method, Shortcut methods, Method of variation of parameters, Application of linear differential equations in engineering, viz., mass-spring system, electrical circuits, etc.							7
Total							30	
Text Books:								
1. Higher Engineering Mathematics by B.V. Ramana , 34e, Tata McGraw-Hill. 2. Advanced Engineering Mathematics, by Peter V. O'Neil, 7e, Thomson Learning.								
Reference Books:								
1. Advanced Engineering Mathematics by Erwin Kreyszig, 9e, Wiley Eastern Ltd. 2. Advanced Engineering Mathematics by S.R.K. Iyengar, Rajendra K. Jain, 4e, Alpha Science International, Ltd. 3. Advanced Engineering Mathematics by M. D. Greenberg, , 2e, Pearson Education. 4. Higher Engineering Mathematics by B. S. Grewal, 43e, Khanna Publication, Delhi								
e-sources:								
1.NPTEL Course lectures links: https://www.youtube.com/watch?v=4QFsiXfgbzM&list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBp15								

Program:	B. Tech. CSE (AI&ML)			Semester: I			
Course:	Linear Algebra & Univariate Calculus Laboratory			Code:	BSH31BS02		
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	50	-	-	50
Prior knowledge:							
1. Elementary Algebra. 2. Elementary Calculus							
Course Objectives: This course aims to enable students,							
1. Apply open-source software to solve engineering problems involving matrices, differential calculus, and ordinary differential equations. 2. Develop skills in applying mathematical concepts to solve real-world problems through project implementation.							
Course Outcomes: After learning the course, the students will be able to:							
1. Develop programs for matrices, differential calculus, and ordinary differential equations 2. Develop project using relevant mathematical concepts to address societal issues.							
Detailed Syllabus							
Expt. No.	List of Experiments using open source software-(16 hrs.)						
1	Conversion of matrices into systems of linear equations.						
2	Conversion and solution of systems of linear equations into matrix form.						
3	Determine linear dependence/independence of vectors and compute eigenvalues and eigenvectors.						
4	Evaluation of Indeterminate Forms.						
5	Expand functions using Taylor's and Maclaurin's series.						
6	Perform successive differentiation of functions.						
7	Solve exact and non-exact differential equations.						
8	Solve higher-order linear differential equations.						
9	Apply differential equation techniques to determine current or charge in electrical circuits.						
10	Apply differential equation methods to analyze temperature distribution based on Fourier's Law of heat conduction.						

Mini Project* - (14 hrs.)

***Mini Project Guidelines:**

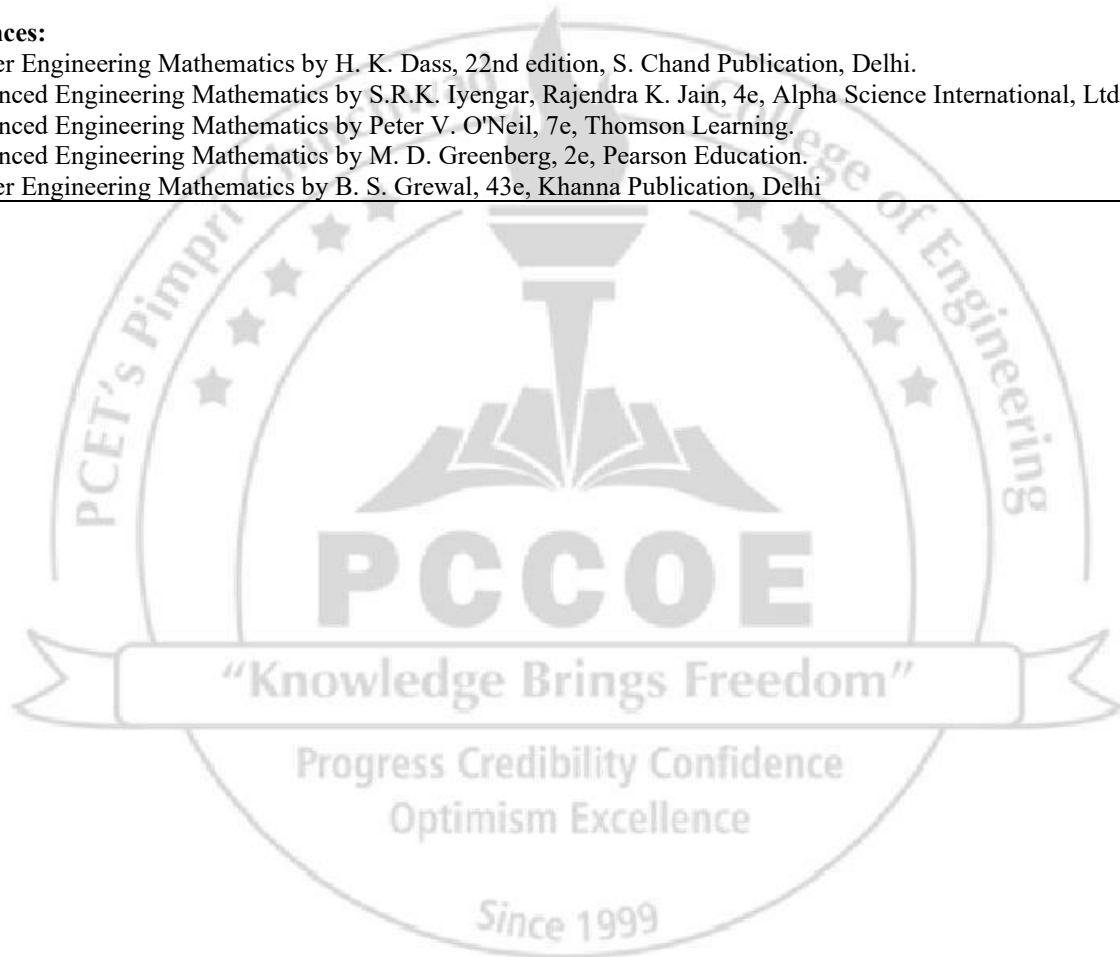
Students must prepare a mini-project based on topics such as matrices, differential calculus, ordinary differential equation, linear differential equation, or other relevant mathematical concepts.

General Guidelines:

1. The project group should consist of not more than 4 students per group.
2. The project report should include mathematical analysis or applications, and, where applicable, software performance parameters.
3. The project output must be submitted in the prescribed standard format.

References:

1. Higher Engineering Mathematics by H. K. Dass, 22nd edition, S. Chand Publication, Delhi.
2. Advanced Engineering Mathematics by S.R.K. Iyengar, Rajendra K. Jain, 4e, Alpha Science International, Ltd.
3. Advanced Engineering Mathematics by Peter V. O'Neil, 7e, Thomson Learning.
4. Advanced Engineering Mathematics by M. D. Greenberg, 2e, Pearson Education.
5. Higher Engineering Mathematics by B. S. Grewal, 43e, Khanna Publication, Delhi

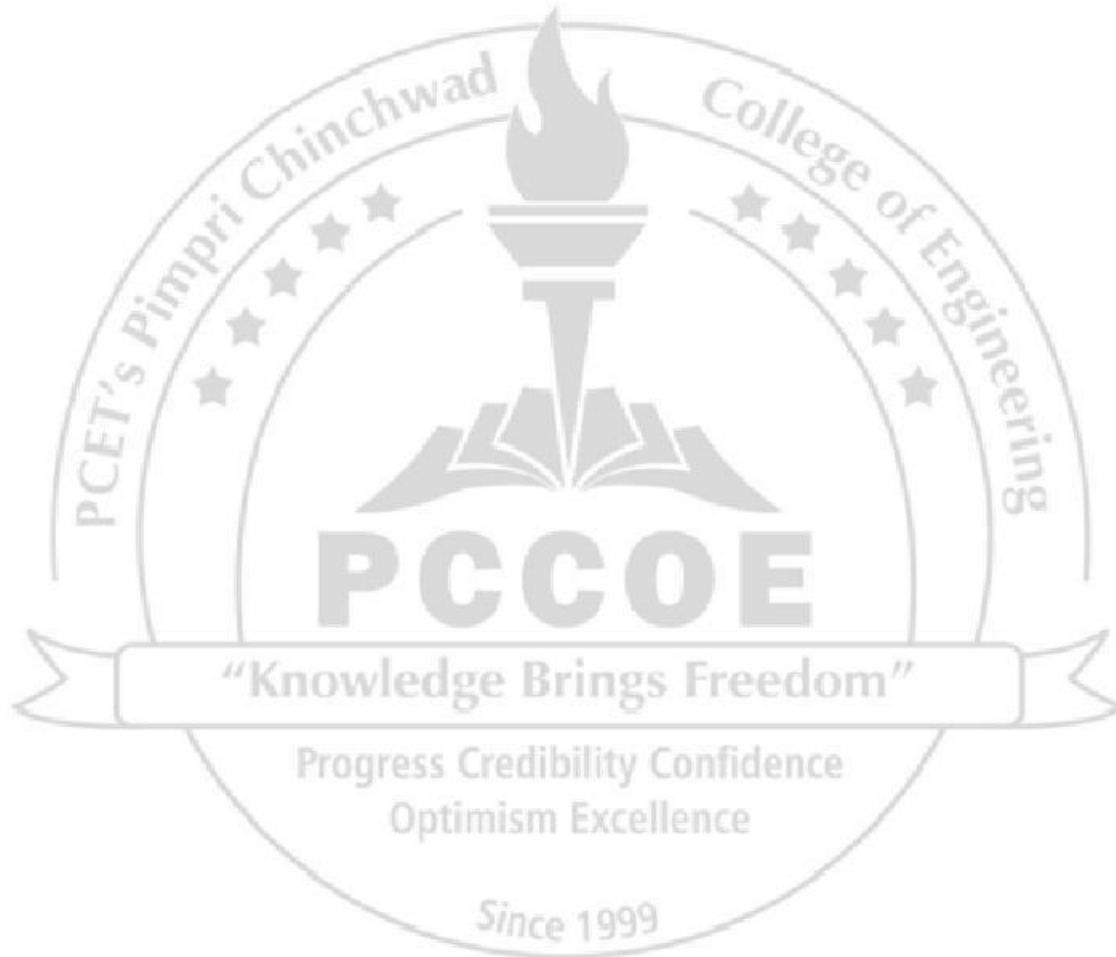


Program:	B. Tech. CSE (AI& ML)					Semester: I		
Course:	Engineering Physics					Code:	BSH31BS03	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Self-Learning	FA		SA	Total
					FA1	FA2		
3	3	-	-	1	20	20	60	100
Prior knowledge of:								
<ol style="list-style-type: none"> 1. Atoms, molecules and nuclei. 2. Current, electricity and magnetism. 3. Electromagnetic induction. 								
Course Objectives: This course aims at enabling students,								
<ol style="list-style-type: none"> 1. Build a strong conceptual understanding of Semiconductor Physics, and Quantum Physics. 2. Introduce recent advances in Physics, including Nanotechnology, Superconductivity and Lasers, Quantum computing 3. Create awareness of the role of Physics principles in various engineering applications. 								
Course Outcomes: After learning the course, the students should be able to:								
<ol style="list-style-type: none"> 1. Illustrate electrical behavior of solids using band theory and charge carriers 2. Apply laser and optical fibre principles to their working and engineering applications 3. Analyse quantum behaviour of particles using wave-particle duality and the Schrödinger equation 4. Use principles of quantum computing to represent quantum states and basic operations 5. Apply concepts of magnetism and superconductivity to magnetic behaviour, phase transitions, and superconducting phenomena with their applications 6. Describe the properties, synthesis methods, and applications of nanomaterials in modern technologies. 								
Detailed Syllabus								
Unit	Description							Duration [Hrs.]
I	Semiconductor Physics Formation of bands in solids, electrical conductivity of conductors (qualitative) and semiconductors (intrinsic and extrinsic with derivation), Hall effect (with derivation) and its applications, Fermi level in metal and semiconductors, Fermi Dirac probability distribution function (at T=0K and T>0K), position of Fermi level (intrinsic and extrinsic), variation of Fermi level with temperature and doping concentration, working of PN junction diode on the basis of energy band diagram, solar cell (principle, working, IV characteristics)							8
II	Laser & Fiber Optics Laser: Introduction, interaction of light with matter- absorption, spontaneous emission, stimulated emission, population inversion, metastable state, active system, resonant cavity, characteristics of laser, semiconductor hetero-junction laser, carbon dioxide laser, applications of laser-industrial, defense & medical; introduction to holography Fiber Optics: Propagation of light in optical fibers, acceptance angle, numerical aperture, modes of propagation, types of fibers- step index, graded index, single mode & multi-mode, losses- attenuation, dispersion, application of optical fiber in communication system							7

III	<p>Quantum Mechanics Wave particle duality of radiation and matter, de Broglie hypothesis, de Broglie wavelength in terms of kinetic energy, concept of wave packet, phase and group velocity (definition), properties of matter waves, Heisenberg's uncertainty principle, wave function and its physical significance, normalization condition, well behaved wave function, Schrödinger's time independent wave equation, applications of independent wave equation to the problem of (i) particle in rigid box, (derivation for energy and wave function), (ii) particle in non-rigid box (qualitative). tunneling effect</p>	8
IV	<p>Quantum Computing Mathematical tools for Quantum computing (complex numbers, Dirac notations, linear algebra, matrix, and probability), inner product, outer product, orthogonality and orthonormality classical bits, qubits- physical realization of superconducting qubits and other architectures, classical gates, Bloch sphere representation of states, quantum computation: single qubit gates, multiple qubit gates, superposition, entanglement, no cloning theorem, bell states and creating bell states, quantum interference, quantum teleportation</p>	7
V	<p>Magnetism and Superconductivity Magnetism: Classification of magnetic materials, temperature dependent magnetic transitions (Curie and Neel temperature), magnetic hysteresis loop, magnetic hysteresis loop, giant magneto-resistance (GMR), magneto caloric effect (only statement), adiabatic demagnetization. Superconductivity: Introduction, critical temperature, properties of superconductors (zero electrical resistance, persistent current, Meissner effect, critical magnetic field, isotope effect), BCS theory, type I and II superconductors, low T_c and high T_c superconductors, Josephson effect, DC-SQUID-construction, working and applications, applications - superconducting magnets, maglev trains</p>	8
VI	<p>Introduction to Nanoscience Introduction, surface to volume ratio, quantum confinement, properties of nanomaterials- optical, electrical, mechanical, magnetic; methods of preparation of nanomaterials- bottom-up and top-down approaches, physical methods- high energy ball milling, physical vapor deposition; chemical method - colloidal route for synthesis of gold nanoparticle, applications of nanomaterials in medical, energy, automobile, space, defense; sensors, nanoparticles as optoelectronic devices</p>	7
Total		45
<p>Text Book</p> <ol style="list-style-type: none"> 1. A Textbook of Engineering Physics – M.N. Avadhanulu & P.G. Kshirsagar 2. Optics and Photonics – R. Murugesan, S. Chand 3. Concepts of Modern Physics – Arthur Beiser, McGraw-Hill (Indian Edition) 4. Nanotechnology: Principles and Practices – Sulabha K. Kulkarni, Springer 		

Reference Book

1. Laser Fundamentals – William Silfvast, Cambridge University Press (India edition)
2. Optical Fiber Communications – Gerd Keiser, McGraw-Hill India
3. Introduction to Quantum Mechanics – David J. Griffiths, Pearson India
4. Quantum Mechanics – G. Aruldas, PHI Learning
5. Fundamentals of Physics- Resnick & Halliday (John Wiley & sons)
6. Nanoscience and Nanotechnology – M.S. Ramachandra Rao, Wiley India
7. Introduction to Superconductivity – Michael Tinkham, Dover India Edition
8. Quantum Computation and Quantum Information by Michael A. Nielsen and Isaac L. Chuang, Cambridge publication



Program:	B. Tech. CSE (AI& ML)				Semester:	I		
Course:	Engineering Physics Laboratory				Code:	BSH31BS04		
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	TW	OR	PR	Total
1	-	2	-	-	50	-	-	50

Prior Knowledge of

1. Basic concepts of optics (reflection, refraction, interference, diffraction).
2. Fundamentals of semiconductor physics (band gap, carriers, conductivity).
3. Basic electricity and magnetism (current, voltage, magnetic fields).
4. Fundamental knowledge of mechanics and sound waves

Course Objectives: This course aims to,

1. Enable students to apply and analyse principles of optics, acoustics, semiconductor, and magnetism through systematic experimentation and measurement.
2. Develop the ability to analyse and interpret experimental data to draw valid conclusions.

Course Outcomes:

1. Analyse optical and acoustic parameters of materials using experimental methods
2. Interpret electrical properties of semiconductors and the magnetic susceptibility of a paramagnetic solution using experimental methods

Expt. No.	Detailed List of Experiment [Any 10]
1	Newton's Rings (To determine the radius of curvature of Plano-convex lens)
2	Diffraction Grating (To determine the wavelength of different colours)
3	Double Refraction: Birefringence (To determine refractive indices and type of crystal)
4	LASER (To determine the grating element using LASER)
5	Malus Law (To verify the Malus Law of polarization of light)
6	Ultrasonic Interferometer (To determine the compressibility of given liquid)
7	Solar Cell (To determine Fill Factor using IV characteristics)
8	Energy Band Gap (To determine band gap of given semiconductor)
9	Four Probe Method (To determine the energy band gap & resistivity of a given sample)
10	Hall effect (To determine the Hall coefficient, mobility and charge carrier in a given semiconductor)
11	Quincke's method (To determine the magnetic susceptibility of MnSO ₄ solution)
12	Sound Absorption Coefficient (To determine the sound absorption coefficient of the given materials)
13	Optic Fibre Cable (To determine the numerical aperture and acceptance angle)

Reference Books:

1. Lasers & nonlinear Optics-B. B. Laud-Third edition, New Age International (P)Ltd. Publishers.
2. Fundamentals of Optics- Francis A. Jenkins, Harvey E. White, Fourth edition, McGraw Hill Education Pvt. Ltd.
3. Experiments in Engineering Physics – M.N. Avadhanulu, A.A. Dani, P.M. Pokley,S Chand Publisher.
4. Introduction to solid states Physics - Charles Kittel, Eighth Edition, Wiley India Pvt Ltd.
5. Engineering Physics Laboratory Manual – Jayaraman, Pearson Education Publisher

Program:	B. Tech. CSE (AI& ML)				Semester: I			
Course:	Discrete Mathematics				Code:	BCS31ES01		
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
3	3	-	-	-	20	20	60	100
Prior knowledge of: Linear Algebra and Univariate Calculus is essential.								
Course Objectives: <ol style="list-style-type: none"> 1. To learn the mathematical formulation of problems by using set, function and relations. 2. To learn logic and proof techniques to reason the solutions mathematically. 3. To interpret set theory, graph theory, and algebraic structures. 4. To learn the formal proof techniques in the formulation of problems. 5. To learn probability theory and various distributions. 								
Course Outcomes: After learning the course, students will be able to: <ol style="list-style-type: none"> 1. Perform various set operations and use propositional logic to formulate the problems. 2. Solve the problems logically using functions and relations. 3. Use graph and tree techniques in problem-solving. 4. Identify and apply the basic techniques in counting. 5. Apply probability principles to formulate and solve probabilistic problems. 6. Analyze and solve probabilistic problems by applying suitable probability distributions. 								
Detailed Syllabus								
Unit	Description							Duration [Hrs]
I	Mathematical Reasoning and Set theory Introduction to AI Tools for Graph and trees: Graphviz, Gephi, VisuAlgo, SageMath. Fundamentals of logic: Propositions, Truth Tables, Logical Connectivity, Propositional logic and its applications Set Theory: Introduction, Set Representation, Types of Sets, Set Operations, Laws of set theory, Introduction to Structured sets: group, rings. Mathematical Induction: Introduction, proof technique.							08
	Self-Learning Contents: Case Study on Verification for the correctness of computer program using principle of mathematical induction							02
II	Relations and Functions: Relation: Relation Definition, Properties of Binary Relations, Closure of Relations, Warshall's Algorithm, Equivalence Relations and Equivalence Classes, Partitions, Partial Ordering Relations, Hasse Diagrams and Lattices, Chains and Anti-chains. Function: Function Definition, Composition of Functions, Injective, Surjective and Bijective Function, Inverse of a Function.							07

	Self Learning Contents: Identity function, Partial function, Invertible function, Constant function.	03
III	Graphs and Trees: Graph theory: Basic Terminology, Types of Graphs, Paths and Circuits, Hamiltonian and Euler Paths and Circuits, Isomorphic Graphs, Planar Graph, Dijkstra's Shortest Path Algorithm. Trees: Trees, Rooted Trees, Prefix Codes, Huffman Algorithm for Optimal Tree, Spanning Trees, Minimum Spanning Trees, Kruskal's and Prim's Algorithm.	08
	Self-Learning Contents: Case Study: Use of Graph Theory and Trees in Google Search and Google Maps Navigation.	03
IV	Counting: Introduction, Basic counting principles, principle of inclusion and exclusion, pigeonhole principle, permutations, combinations, binomial theorem.	07
	Self-Learning Contents: Permutations and combinations with repetitions.	03
V	Probability: The axioms of probability, discrete probability, Random variables, discrete random variable, conditional probability, independent events, Bayes' rule, Bernoulli trials, probability mass function, continuous random variable, probability density function.	07
	Self-Learning Contents: Mean and variance of discrete and continuous random variable, Case Study: Predicting Student Performance Using Probability	02
VI	Probability Distribution - Cumulative distribution function, Two-dimensional random variables and their distribution functions, Marginal probability function, Independent random variables. Probability distributions: Gaussian distribution, Binomial Distribution, Poisson Distribution.	08
	Self Learning Contents: Properties of cumulative distribution function.	02
Total		45
Total Self Learning Hours		15
Text Books:		
<ol style="list-style-type: none"> 1. C. L. Liu, "Elements of Discrete Mathematics," Tata McGraw-Hill, 4th Edition, 2017, ISBN 978- 1259006395. 2. Kenneth H. Rosen, "Discrete Mathematics and its Applications," Tata McGraw-Hill, 8th Edition, 2018, ISBN 978 1259676512 		
Reference Books:		
<ol style="list-style-type: none"> 1. Dr. K. D. Joshi, "Foundations of Discrete Mathematics," New Age International Limited Publishers, 2nd Edition, January 2014, ISBN-13: 978-8122435986 2. Nicholas N.N., Nsowah-Nuamah, "Introduction to Probability Theory," Universal Book Stall. 		
e-sources:		
https://onlinecourses.nptel.ac.in/noc20_cs82/preview https://nptel.ac.in/courses/106106094		

Program:	B.Tech. C.S.E.(AI&ML)				Semester:	I		
Course:	Digital Electronics and Computer Organization				Code:	BCS31ES02		
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
02	02	-	-	01	10	10	30	50
Prior knowledge: Boolean Algebra basics								
Course Objectives:								
<ol style="list-style-type: none"> 1. Understand the fundamentals of digital electronics, number systems, Boolean algebra, and combinational logic circuits. 2. Analyze sequential circuits, including flip-flops, registers, and counters for designing digital systems. 3. Explain the organization and functioning of CPU, instruction execution, and register transfer operations. 4. Apply concepts of memory organization, I/O techniques, microcontrollers, and multiprocessor systems in computer architecture with relevance to AI/ML applications. 								
Course Outcomes: After learning the course, the students will be able to								
<ol style="list-style-type: none"> 1. Interpret the concept of number systems, Boolean algebra, and the design of combinational logic circuits. 2. Apply concepts of flip-flops, registers, and counters to analyze and design sequential circuits. 3. Perform CPU operations, register transfer, and instruction execution using RTL concepts. 4. Analyze and apply memory organization, I/O techniques, microcontrollers, and multiprocessor systems in computer architecture with relevance to AI/ML applications. 								
Detailed Syllabus:								
Unit	Description							Duration [Hrs]
I	Unit I: Digital Fundamentals and Data Representation Number Systems: Binary, Octal, Hexadecimal, Signed Number Representation, Boolean Algebra & Logic Gates, Combinational Circuits: Adders, MUX, Encoder/Decoder, Introduction to Sequential Circuits, Basic Flip-Flops: RS, JK, D, T, Truth Tables AI/ML Use cases: Data representation in ML (INT8, FP16), Arithmetic operations in neural networks							6
	Self-Learning Contents: Study quantization in deep learning (INT8 vs FP32)							3
II	Unit II: Sequential Circuits and Memory Elements Flip-Flops: JK, D, T, Excitation Tables, Flip-Flops with Preset & Clear, Registers and Shift Registers, Counters: Asynchronous & Synchronous, Timing Concepts: setup, hold, propagation delay AI/ML Use cases: Data storage and pipelining in processors, Sequential data handling in ML systems							8
	Self-Learning Contents: Study how registers are used in CPUs/GPUs, Explore timing issues in high-speed processors							4

III	Unit III: CPU Organization and Instruction Processing Computer Registers and Stack Organization, Instruction Formats & Instruction Codes, Instruction Cycle (Fetch–Decode–Execute) , Timing & Control, Memory Reference Instructions, Input-Output & Interrupt Operations, Register Transfer Language (RTL), Register Transfer & Bus Transfers, Memory Transfers, Addressing Modes, Data Transfer & Manipulation AI/ML Use cases: How ML programs execute at hardware level, Data movement impact on ML performance	8
	Self-Learning Contents: Explore RTL using Verilog examples, Analyze how CPU handles interrupts in real systems	4
IV	Unit IV: Advanced Computer Organization and AI Systems Data Operations: Arithmetic, Logic, Shift Operations, Arithmetic Logic Shift Unit (ALU), Memory Organization: Cache, Virtual Memory, Input-Output Organization: DMA, Interrupt-driven I/O, Microcontrollers: Basics, Architecture, Applications, Multiprocessors: Characteristics, Interconnection Structures, Communication & Synchronization, Cache Coherence. RISC vs CISC Architecture. AI/ML Use cases: Parallel processing in deep learning (GPU, TPU), Memory bottlenecks in ML, Edge AI using microcontrollers	8
	Self Learning Contents: Study GPU architecture basics (parallel cores), Explore TinyML using microcontrollers (Arduino/ESP)	4
Total		30
Total Self Learning Hours		15
Text Books:		
1. Digital Design, M. Morris Mano and Michael D. Ciletti, Pearson, 6th Edition, 2024 2. Computer Organization and Embedded Systems, William Stallings, Pearson, 11th Edition, 2022		
Reference Books:		
1. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy, Morgan Kaufmann, 6th Edition, 2021 2. Digital System Design with FPGA: Implementation Using Verilog and VHDL, Cem Unsalan and Bora Tar, McGraw Hill, 2nd Edition, 2021 3. Modern Digital Electronics, R. P. Jain, McGraw Hill, 5th Edition, 2023.		
Eresources:		
NPTEL Video Courses:		
1. http://onlinecourses.nptel.ac.in/noc25_cs83/preview 2. http://nptel.ac.in/courses/106102157 3. http://onlinecourses.nptel.ac.in/noc24_cs06/preview		

Program:	B. Tech. CSE (AI & ML)			Semester: I			
Course:	Digital Electronics & Computer Organization Laboratory			Code:	BCS31ES03		
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	50	-	-	50

Prior knowledge of: Boolean Algebra is essential

Course Objectives: The course should enable the students to:

1. Verify and analyze basic logic gates and combinational circuits.
2. Design and implement sequential circuits using flip-flops, registers, and counters.
3. Perform and simulate register transfer operations and basic CPU functions using RTL concepts.
4. Demonstrate and apply memory operations, I/O techniques, and system-level concepts using simulation tools.

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

1. Describe number systems, Boolean algebra, and the design of combinational logic circuits.
2. Apply concepts of flip-flops, registers, and counters to design and analyze sequential circuits.
3. Perform CPU operations, register transfer, and instruction execution using RTL concepts.
4. Analyze memory organization, I/O techniques, microcontrollers, and multiprocessor systems in computer architecture with relevance to AI/ML applications.

Guidelines for Students:

1. Use CircuitVerse for quick verification of basic logic gates, Boolean expressions, and simple circuit designs through a web-based interface.
2. Use Logisim Evolution for implementing combinational and sequential circuits, including flip-flops, registers, counters, and CPU-related designs.
3. Use Digital by H. Neemann for designing and analyzing complex circuits such as ALU, memory units, and bus-based systems.
4. Use the selected simulator to validate circuit functionality by comparing simulated outputs with theoretical results for each experiment.
5. **Perform any twelve assignments.**

Expt. No.	Suggested List of Experiments
1.	Logic Gates Implementation <ul style="list-style-type: none"> ● Implement AND, OR, NOT, NAND, NOR, XOR using ICs / simulator ● Verify truth tables .
2.	Boolean Function Simplification <ul style="list-style-type: none"> ● Simplify given expressions using K-Map ● Implement simplified circuit
3.	Design of Combinational Circuits <ul style="list-style-type: none"> ● Design Half Adder and Full Adder ● Verify using truth table and simulation
4.	Multiplexer/Demultiplexer <ul style="list-style-type: none"> ● Implement 4:1 MUX and 1:4 DEMUX ● Use MUX to implement Boolean function

5.	Encoder and Decoder <ul style="list-style-type: none"> ● Design 4:2 Encoder and 2:4 Decoder ● Study priority encoder
6.	Flip-Flops Implementation <ul style="list-style-type: none"> ● Implement SR, JK, D, T flip-flops ● Verify characteristic tables
7.	Flip-Flop Conversion <ul style="list-style-type: none"> ● Convert JK flip-flop to D and T flip-flop ● Verify using excitation tables
8.	Registers <ul style="list-style-type: none"> ● Design and simulate shift registers (SISO, SIPO, PISO, PIPO)
9.	Counters <ul style="list-style-type: none"> ● Design asynchronous (ripple) counter ● Design synchronous counter
10.	Timing Analysis <ul style="list-style-type: none"> ● Study timing diagrams of flip-flops ● Analyze propagation delay, setup and hold time
11.	Register Transfer Operations <ul style="list-style-type: none"> ● Perform RTL operations using simulation ● Implement bus transfer
12.	Instruction Cycle Simulation <ul style="list-style-type: none"> ● Simulate fetch-decode-execute cycle ● Analyze CPU instruction execution steps
13.	Addressing Modes <ul style="list-style-type: none"> ● Write simple assembly programs to demonstrate addressing modes
14.	Memory Organization <ul style="list-style-type: none"> ● Simulate RAM/ROM operations ● Study memory read/write cycles
15.	I/O and DMA Simulation <ul style="list-style-type: none"> ● Demonstrate programmed I/O vs interrupt-driven I/O ● Study basic DMA operation

Text Books:

1. Digital Design, M. Morris Mano and Michael D. Ciletti, Pearson, 6th Edition, 2024
2. Computer Organization and Embedded Systems, William Stallings, Pearson, 11th Edition, 2022

Reference Books:

1. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy, Morgan Kaufmann, 6th Edition, 2021
2. Digital System Design with FPGA: Implementation Using Verilog and VHDL, Cem Unsalan and Bora Tar, McGraw Hill, 2nd Edition, 2021
3. Modern Digital Electronics, R. P. Jain, McGraw Hill, 5th Edition, 2023.

Eresources:

1. http://onlinecourses.nptel.ac.in/noc25_cs83/preview
2. <http://nptel.ac.in/courses/106102157>
3. http://onlinecourses.nptel.ac.in/noc24_cs06/preview

Program:	B. Tech. CSE (AI& ML)				Semester: I		
Course:	Problem Solving with C programming				Code:	BCS31VS01	
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	50	-	50	100

Prior knowledge: Mathematics and computers are essential.

Course Objectives:

1. To get acquainted with basics of C programming, such as data types, variables, and operators.
2. To learn decision controls and iterations using C programming constructs.
3. To impart the concepts like arrays, strings, pointers, functions, user defined data types and file handling.
4. To develop a simple application using the C language.

Course Outcomes: After learning the course, the students will be able to:

1. Develop a C program using basic elements like data types, variables and operators.
2. Write the conditional blocks and loops in C programs using suitable constructs.
3. Use C programming elements such as array, string, pointers, functions, user defined data types and file handling libraries.
4. Develop an application based on real life examples using "C" construct.

Guidelines for Students:

1. The laboratory assignments are to be submitted by students in the form of a journal.
2. Each assignment write-up should have a title, objectives, outcomes, Theory- Concept in brief, dataset used, data description, conclusion, and assessor's signature.
3. Program codes with sample output of all performed assignments should be submitted.

Guidelines for Laboratory / Term Work Assessment:

1. Continuous assessment of laboratory work is done based on the overall performance and laboratory performance of the students.
2. Each laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each laboratory assignment assessment include- timely completion, performance, innovation, efficiency, punctuality, and neatness.

Guidelines for Laboratory Conduction:

1. The suggested list of assignments is given below. Instructors can frame suitable assignments.
2. All assignments are mandatory.
3. In addition to these, instructors are supposed to assign one real life application in the form of a mini-project based on the concepts learned

Detailed Syllabus

Expt. No.	Suggested List of Experiments
1	Write a C program that uses relational operators to compare the temperatures of two cities to determine which one is hotter, colder, or if they have the same temperature.
2	Consider you have created a website in which you are accepting details of users where you have to take password from the user. Write a C program to accept password from user with following condition: 1. Minimum characters 6 and maximum are 12. 2. At least one digit and one character. At least one special symbol (@, \$, #).
3	Write a C program to 1. Check if the given number is even or odd. 2. Check if the given number is prime or not. 3. Check if the given number is palindrome or not. 4. Print fibonacci series up to n.
4	Write a C program using a while loop to simulate a dice rolling game. In this game, the player rolls a six-sided dice and accumulates points based on the roll until they choose to stop or roll a 1. The goal is to score as many points as possible without rolling a 1.
5	Write a C program to generate a simple calculator that demonstrates the use of decision control structures: switch statement.
6	Write a C program to manage a student's grades using an array. In this program, allow the user to enter the grades of five subjects for a student and then calculate the average grade.
7	Write a C program to find the length of a string, concatenate two strings, copy string using string library functions.
8	Write a C program to swap the values of two variables using pointers. In this scenario, imagine you are a teacher, and you want to swap the positions of two students in a class. You have the student Names and their seat numbers stored in variables, and you want to swap their seats.
9	Write a C program using functions to simulate a simple banking system. Implement functions for depositing, withdrawing, and checking the account balance.
10	Write a C program that uses a structure to model a real-life example of a book record system. Define a structure to represent a book with attributes like title, author, and year of publication. Perform operations like adding a new book, displaying book details, and searching for a book by title.
11	Write a C program to perform file operations like create, open, read, write and close a file.
12	Design a mini project to implement Game, Smart Text editor or various real time applications integrating C programming concepts.
References: 1. Herbert Schildt, "C: The Complete Reference", McGraw Hill, 4th Edition, 2000, ISBN-13: 978-0072121247. 2. Maureen Sprankle, "Problem solving and programming concepts", Pearson, 7th Edition, 2011, ISBN-13: 978-0132492645. 3. R. G. Dromey, "How to Solve it by Computer", Prentice-Hall International, 1st Edition, 1982, ISBN -13: 978-0134340012.	

Program:	B. Tech. CSE (AI& ML)				Semester:	I		
Course:	Constitution of India				Code:	BSH31VE01		
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	25	25	-	50
Course Objectives:								
<ol style="list-style-type: none"> To introduce students to the fundamental principles, philosophy, and key features of the Indian Constitution. To familiarize students with the structure and functioning of government and key constitutional provisions. To enable students to apply constitutional values, rights, and duties in understanding contemporary issues and responsible citizenship. 								
Course Outcomes: After learning the course, the students will be able to,								
<ol style="list-style-type: none"> Explain the fundamental principles and key features of the Indian Constitution, including Preamble, Rights, Duties, and DPSP. Describe the structure and functioning of the Executive, Legislature, and Judiciary, including the law-making process. Illustrate constitutional provisions such as amendments, writs, and citizen mechanisms to address rights and governance issues. Apply constitutional values to evaluate contemporary issues and challenges in civic and professional contexts. 								
Unit	Description							Duration [Hrs]
I	Foundations of the Indian Constitution <ul style="list-style-type: none"> Introduction to the Indian Constitution: brief historical background, making of the Constitution, and its significance The Preamble: ideals, philosophy, and interpretation Salient features of the Indian Constitution: sovereignty, secularism, democracy, federalism, and rule of law Fundamental Rights and Fundamental Duties: concepts and relevance in contemporary society Directive Principles of State Policy (DPSP): objectives and role in governance Relationship between Fundamental Rights, Duties, and DPSP 							7
II	Structure and Functioning of Government <ul style="list-style-type: none"> Union Executive: President, Vice-President, Prime Minister, and Council of Ministers—roles and functions Parliament: composition and functioning of Lok Sabha and Rajya Sabha Legislative process: stages of law-making (bill to act) Judiciary: structure, independence, and concept of judicial review Federalism: Centre–State relations and distribution of powers State Government: role of Governor and State Legislature (overview) 							8

III	Constitutional Mechanisms and Citizen Interface <ul style="list-style-type: none"> ● Amendment process of the Constitution and basic structure doctrine ● Constitutional bodies: Election Commission of India and Comptroller and Auditor General—roles and functions ● Emergency provisions: national, state, and financial emergencies ● Constitutional remedies: writs and judicial remedies for protection of rights ● Public Interest Litigation (PIL): concept and significance ● Introduction to citizen-centric mechanisms: Right to Information (RTI) 	7
IV	Constitution in Contemporary Context <ul style="list-style-type: none"> ● Judicial activism and its role in safeguarding constitutional values ● Contemporary constitutional issues: freedom of speech, right to privacy, gender justice, and environmental protection ● Challenges to constitutional governance: secularism, federalism, and social justice ● Recent constitutional developments and amendments ● Basic comparative perspective: Indian Constitution and selected global practices 	8
Total		30
Text Books: <ol style="list-style-type: none"> 1. E I. Durga Das Basu, —Introduction to the Constitution of India —, Prentice Hall of India, New Delhi, 24th edition, 2020, ISBN-109388548868 2. Clarendon Press, Subhash C, Kashyap, — Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 5th edition, 2014, ISBN-9781107034624 		
Reference Books: <ol style="list-style-type: none"> 1. Maciver and Page, —Society: An Introduction Analysis —, Laxmi Publications, 4th edition, 2007, ISBN 100333916166 2. PM Bhakshi, —The constitution of India, Universal Law Publishing - An imprint of Lexis Nexis, 14th edition, 2017, ISBN-108131262375 3. Indian Constitution by Subhash C. Kashyap, National Book Trust, New Delhi. 4. Constitution of India and Professional Ethics, Dr. G. B. Reddy & Mohd. Suhaib, Dreamtech Press. 		
e-sources: <ol style="list-style-type: none"> 1. https://www.legislative.gov.in/constitution-of-india 2. https://legallaffairs.nalsar.ac.in/ 		

Program:	B. Tech. CSE (AI& ML)			Semester: I			
Course:	Communicative English			Code:	BSH31AE01		
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	30	20	-	50

Prior knowledge of: Basic English communication

Course Objectives: This course aims at enabling students to:

1. Strengthen language skills through grammar, vocabulary, and comprehension activities.
2. Enhance students' ability to communicate ideas clearly in written and spoken forms.

Course Outcomes: After learning the course, the students will be able to:

1. Interpret key ideas from listening and reading tasks to demonstrate comprehension.
2. Develop structured paragraphs and formal emails using grammar, vocabulary and writing techniques.
3. Organize information into a logical presentation framework to highlight clear and structured oral presentations.

Detailed Syllabus

Expt. No	Suggested List of Experiments	Duration (Hrs)
1	Apply Listening for Understanding: Practices listening through IELTS & TOEFL-style audio clips and respond to comprehension-based questions with accuracy.	2
2	Apply Listening for Understanding: Practice listening through audio clips of interviews and podcasts and respond to comprehension-based questions with accuracy.	2
3	Interpret Text through Guided Oral Reading: Read and interpret short story text, <i>The Necklace</i> by Guy De Maupassant with appropriate pronunciation, pauses, and intonation, and answer questions to demonstrate comprehension.	2
4	Apply Analytical Reading Comprehension Techniques: Apply skimming and scanning techniques to understand and interpret unseen passages effectively, for competitive exams.	2
5	Engage in Integrated Comprehension Practice: Listen to audio content and follow the text of Steve Jobs' speech 'Stay Hungry, Stay Foolish' and respond to comprehension questions demonstrating understanding.	2
6	Use Grammar in Context:	2

	Use appropriate grammar structures in contextual sentence-building and short communication tasks; Identify and Correct Common Errors.	
7	Use Functional and Business Vocabulary: Refine Sentence Structures by using appropriate tense, agreement, and sentence patterns to enhance clarity and correctness. Use functional and basic business vocabulary accurately in speaking and writing tasks.	2
8	Practice Note-Taking and Paragraph Writing Skills: Apply note-making techniques to organize ideas and write clear, structured paragraphs. Refine writing style and perform grammar checks with the help of Generative AI tools.	2
9	Apply Email Etiquette and Review Professional Emails: Apply advanced email etiquette by editing and refining emails for clarity, tone, correctness, and professionalism, including peer review and identification of common errors in workplace communication.	2
10	Draft Professional Emails for Workplace Communication: Draft clear and formal emails for internships, job applications, and follow-ups, focusing on appropriate subject lines, structure, tone, and basic professional etiquette.	2
11	Construct Visually Engaging PowerPoint Presentations. Convey ideas concisely in order to create professional decks that support rather than distract from their message.	2
12	Deliver Persuasive Oral Presentations: Practice techniques for maintaining eye contact, vocal variety, managing stage presence and articulating complex ideas clearly to ensure maximum audience engagement and retention.	2
13	Group Discussion Techniques: Examine mock group discussions to see how different roles and structures impact the conversation.	2
14	Express yourself in Group Discussions: Participate in group discussions on technical and general topics, demonstrating clarity, teamwork and communication skills.	2
15	Deliver a Public Speech: Apply voice modulation, paralanguage, and clarity in structured speaking tasks.	2
Total		30

Text Books:

1. *Essential English Grammar, 4th Edition (2015)* – Raymond Murphy, Cambridge University Press
2. Kee, R. (2022, March 5). “Stay Hungry, Stay Foolish”: Steve Jobs 2005 Stanford Commencement Speech (Transcript & Audio) — Roxine Kee. Roxine Kee. <https://www.roxinekee.com/blog/stay-hungry-stay-foolish>
3. De Maupassant, G. & http://www.HorrorMasters.com. (n.d.). *The Necklace*. <https://susannahfullerton.com.au/wp-content/uploads/2019/04/The-Necklace.pdf>

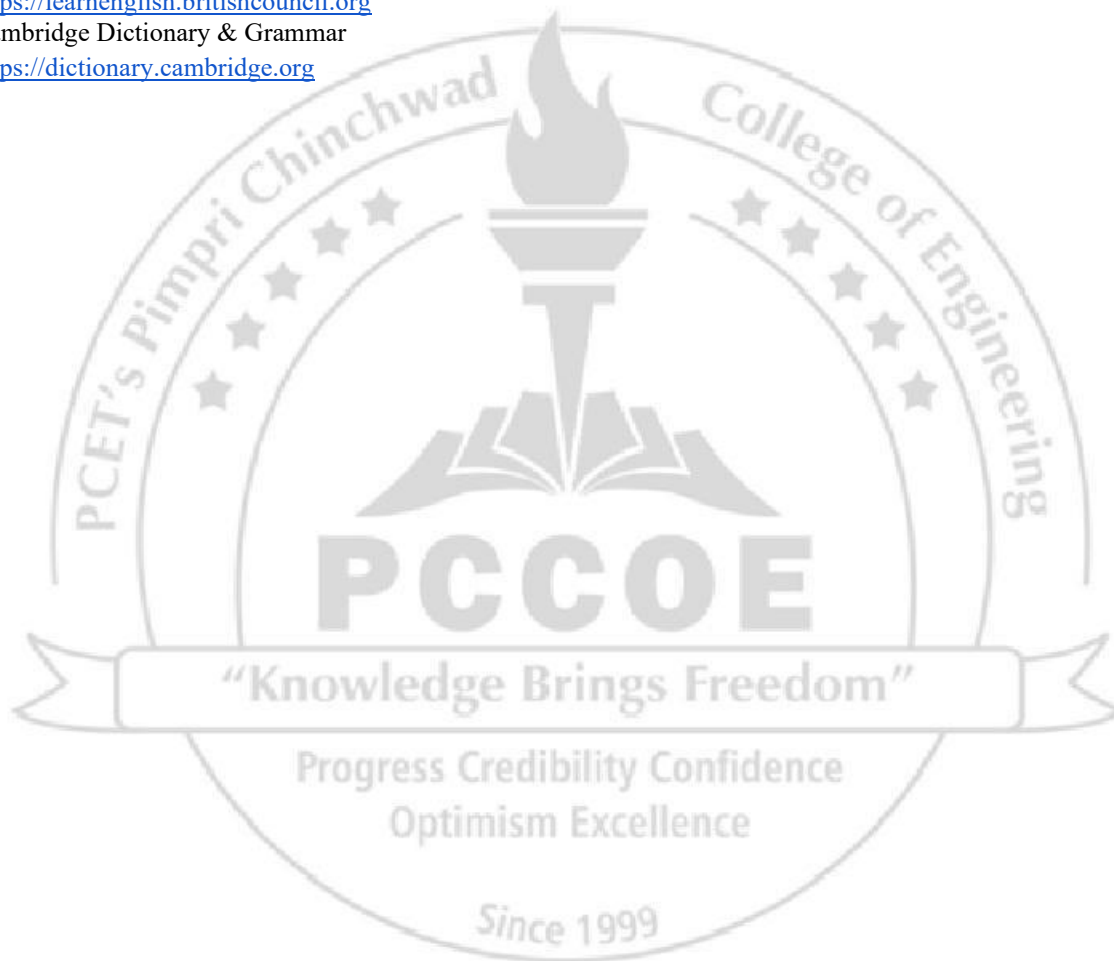
4. *Developing Communication Skills*, Revised Edition (2017) – Krishna Mohan & Meera Banerji, Macmillan Education India

Reference Books:

1. *Practical English Usage*, 4th Edition (2019) – Michael Swan, Oxford University Press
2. *Oxford Guide to English Grammar*, Latest Edition – John Eastwood, Oxford University Press
3. *Better English Pronunciation*, 2nd Edition – J.D. O'Connor, Cambridge University Press

E Resources

- British Council – LearnEnglish (Grammar, Listening, Speaking)
<https://learnenglish.britishcouncil.org>
- Cambridge Dictionary & Grammar
<https://dictionary.cambridge.org>



Program:	B. Tech. CSE (AI& ML)			Semester: I			
Course:	Life Skills 1			Code:	BSH31CC01		
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	50	-	-	50
Prior knowledge of: Nil							
<p>Course Objectives: This course aims at enabling students to:</p> <ol style="list-style-type: none"> 1. To help students understand self-awareness, well-being and emotional regulation for personal growth. 2. To enable students to practice critical thinking, problem-solving and goal-setting skills for academic and life success. 							
<p>Course Outcomes: After learning the course, the students will be able to:</p> <ol style="list-style-type: none"> 1. Identify personal strengths, lifestyle habits and well-being practices using self-assessment and reflective activities. 2. Use emotional intelligence strategies in dynamic social and academic contexts. 3. Apply cognitive thinking and problem-solving strategies to set SMART goals for personal and professional life. 							
Detailed Syllabus							
Expt. No	Suggested List of Experiments						Duration (Hrs)
1.	Developing Self Awareness: Explore personal interests, beliefs, strengths and goals through reflective activities, self-assessment exercises, and group discussions to develop self-understanding.						2
2	Explore Therapeutic Hobbies: Explore creative (art, music, writing) and physical (sports, dance, yoga) hobbies through short activity sessions and reflect on which activities help reduce stress and improve mental clarity.						2
3	Evaluate Holistic Health Habits: Evaluate personal eating patterns and physical activity levels through a lifestyle tracking exercise and design a simple daily routine for healthier living.						2
4	Develop a Personal Well-being Plan: Design a short project outlining a personal well-being strategy that includes hobbies, emotional regulation practices and healthy lifestyle habits.						2
5	Analyze Personal Potential (SWOT Analysis): Analyze personal strengths, weaknesses, opportunities, and threats through a guided SWOT worksheet and group discussion to identify hidden talents and areas for self-improvement.						2

6	Identify Emotional Triggers: Identify situations that cause overthinking, stress, or anxiety by analysing common academic scenarios and discussing emotional responses in small groups.	2
7	Examine Relationship Dynamics: Examine empathy, personal boundaries and attachment styles through role-play activities and reflective discussions on relationship patterns.	2
8	Develop Assertiveness Skills: Develop assertive communication strategies through scenario-based role plays to practice expressing opinions while respecting others.	2
9	Develop Resilience to Peer Pressure: Develop resilience strategies to resist negative peer pressure or addictive behaviours through simulation exercises and discussion of real-life situations.	2
10	Reflect on Personal Learning Journey: Reflect on insights gained from the life skills activities through guided journaling and group sharing to evaluate personal growth.	2
11	Apply Growth Mindset Principles: Apply growth mindset concepts by reflecting on a past failure and reframing it as a learning opportunity through guided journaling and peer discussion.	2
12	Demonstrate Thinking Patterns: Demonstrate convergent and divergent thinking by brainstorming multiple solutions to a simple engineering or real-life problem and analysing the thinking approach used.	2
13	Apply Problem-Solving Frameworks: Apply logical reasoning frameworks to solve case-based academic or ethical problems through structured group problem-solving activities.	2
14	Design SMART Goals: Design personal academic or career goals using the SMART framework and present an action plan to achieve them.	2
15	Present Life Skills Application Project: Present a small group project demonstrating how life skills concepts can be applied to improve personal or academic life.	2
Total		30

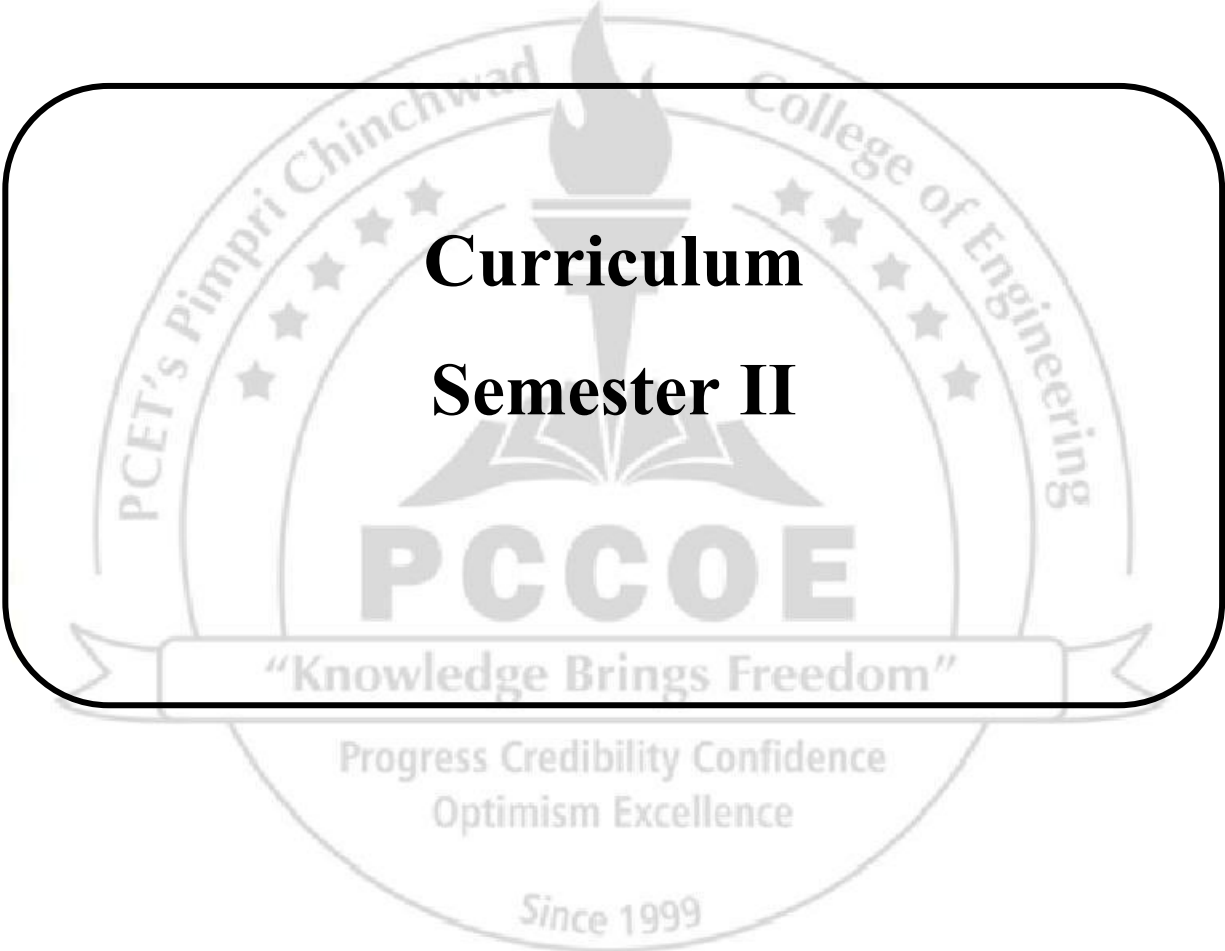
Reference Books:

1. The 7 Habits of Highly Effective Teens" by Sean Covey Publisher: Simon & Schuster, 2017
2. How to Win Friends and Influence People" by Dale Carnegie Publisher: Simon & Schuster. 2020
3. Emotional Intelligence: Why It Can Matter More Than IQ" by Daniel Goleman Publisher: Bantam Books, 2021.
4. Mindset: The New Psychology of Success" by Carol S. Dweck Publisher: Ballantine Books, 2019.
5. The Power of Habit: Why We Do What We Do in Life and Business" by Charles Duhigg Publisher: Random House, 2016

E Sources -

1. Psychology Today (www.psychologytoday.com): Psychology Today publishes articles and insights from psychologists and mental health experts that can be useful for improving life skills and emotional intelligence.
 2. Lifehack (www.lifehack.org): Lifehack shares practical tips, techniques, and advice on personal development, productivity, and life skills improvement.
- Coursera (www.coursera.org): Coursera offers online courses on various life skills topics, often provided by universities and experts, to help individuals develop essential skills





Curriculum Semester II

Program:	B. Tech. CSE (AI& ML)				Semester: II			
Course:	Multivariate Calculus				Code:	BSH32BS12		
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	CIE		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50
Prior knowledge of 1. Elementary Mathematics 2. Elementary Calculus is essential.								
Course Objectives: This course aims at enabling students, 1. To strengthen the concepts of multivariable calculus and its application in maxima & minima, error & approximation area, volume 2. To make students acquainted with advanced techniques to evaluate integrals								
Course Outcomes: After learning the course, the students should be able to: 1. Find composite function's Derivatives, value of Euler's expression, Jacobians, errors and extrema using Partial Differentiation. 2. Represent the Fourier series for continuous functions and discrete periodic time domain functions in signal form. 3. Compute definite improper integrals using Gamma, Beta function and differentiation under the integral sign. 4. Evaluate multiple integral, Area and Volume for curves and Surfaces using the concept of integration techniques.								
Unit	Description							Duration [Hrs]
I	Partial Differentiation and its applications: Partial derivatives, Composite function, Chain Rule, variable to be treated as constant, total derivatives. Euler's theorem for homogeneous functions. Jacobian for explicit function, Errors and Approximations, Maxima and Minima of two variable functions.							8
II	Fourier Series: Definition, Dirichlet's conditions, full range Fourier series, Harmonic analysis, and engineering applications.							7
III	Integral Calculus: Gamma function and Beta function, Differentiation Under the Integral Sign (DUIS).							7
IV	Multiple Integral and its applications: Double integration, conversion into polar form, Triple integration, Dirichlet's theorem, applications of double & triple integration to find area and volume.							8
Total							30	
Text Books:								
1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill) 2. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)								
Reference Books:								
1. Higher Engineering Mathematics, 22e, by H. K. Das (S. Chand Publication, Delhi). 2. Advanced Engineering Mathematics, 4e, by S.R.K. Iyengar, Rajendra K. Jain (Alpha Science International, Ltd) 3. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Thomson Learning) 4. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education) 5. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)								
e-sources:								
1. NPTEL Multivariable Calculus course https://nptel.ac.in/courses/111107108 2. NPTEL Video for Fourier series http://nptel.iitm.ac.in								

Program:	B. Tech. CSE (AI& ML)			Semester: II			
Course:	Multivariate Calculus Laboratory			Code:	BSH32BS13		
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	50	-	-	50
Prior knowledge: 1. Elementary Algebra. 2. Elementary Calculus 3. Basics of Open Source							
Course Objectives: This course aims to enable students, 1. To equip with the ability to apply open-source software for solving engineering problems involving partial differentiation, integral calculus, multiple integrals, and Fourier series. 2. To develop skills in applying mathematical concepts to solve real-world problems through project implementation.							
Course Outcomes: After learning the course, the students will be able to: 1. Develop programs for partial differentiation, integral calculus, multiple integrals, and Fourier series using open-source software. 2. Develop project using relevant mathematical concepts to address societal issues.							
Detailed Syllabus							
Expt . No.	List of Experiments using open source software-(16 hrs.)						
1	Computation of Higher order Partial Derivatives						
2	Evaluation of Maxima and Minima for two variable function						
3	Computation of the Jacobian for Functions of Several Variables						
4	Representation of a periodic function as a Fourier Series						
5	Representation of the Fourier Series through Harmonic Analysis for the given Data						
6	Evaluation of Gamma & Beta function						
7	Evaluation of Integrals using Differentiation Under the Integral Sign (DUIS)						
8	Evaluation of Double and Triple Integrals						
9	Determine the Area of a Region using Double Integrals						
10	Determine the Volume of a Solid using Triple Integrals						

Mini Project* - (14 hrs.)

***Mini Project Guidelines:**

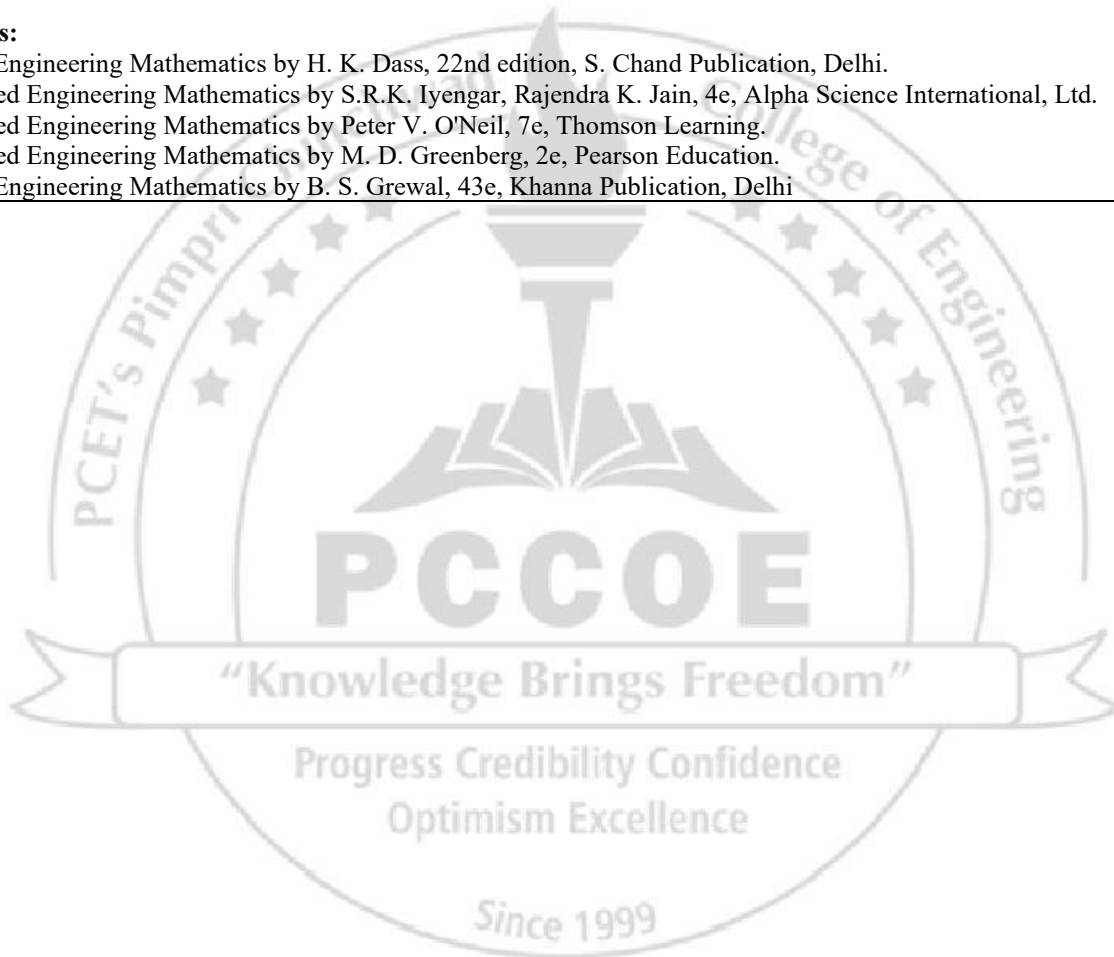
Students must prepare a mini-project based on topics such as partial differentiation, Fourier series, integral calculus, multiple integrals or other relevant mathematical concepts.

General Guidelines:

1. The project group should consist of not more than 4 students per group.
2. The project report should include mathematical analysis or applications, and, where applicable, software performance parameters.
3. The project output must be submitted in the prescribed standard format.

References:

1. Higher Engineering Mathematics by H. K. Dass, 22nd edition, S. Chand Publication, Delhi.
2. Advanced Engineering Mathematics by S.R.K. Iyengar, Rajendra K. Jain, 4e, Alpha Science International, Ltd.
3. Advanced Engineering Mathematics by Peter V. O'Neil, 7e, Thomson Learning.
4. Advanced Engineering Mathematics by M. D. Greenberg, 2e, Pearson Education.
5. Higher Engineering Mathematics by B. S. Grewal, 43e, Khanna Publication, Delhi



Program:	B. Tech. CSE (AI& ML)				Semester: II			
Course:	Engineering Chemistry				Code: BSH32BS09			
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
3	3	-	-	1	20	20	60	100

Prior knowledge of:

1. Structure of water.
2. Volumetric analysis.
3. Fossil and derived fuels.
4. Corrosion and its effects.
5. Electrochemical series.
6. Classification and properties of polymers
7. Basics of Computers.

Course Objectives: This course aims at enabling students,

1. To provide an overview of key computational chemistry methods and their significance in modern chemical research.
2. To familiarize students with instrumental methods for qualitative and quantitative analysis of water and explore the importance of green chemistry.
3. To build consciousness about the recent development in alternative energy sources and batteries
4. To make student acquainted with chemical and electrochemical mechanism of corrosion and corrosion control
5. To lead students to investigate the advancement in engineering materials

Course Outcomes: After learning the course, the students should be able to:

1. Apply computational chemistry tools to model molecular structures and properties.
2. Describe the structure, properties and performance of speciality polymers and nanomaterials in technological applications.
3. Analyze water softening techniques and green chemistry principles for environmental sustainability.
4. Use preventive methods of corrosion in real-life problems.
5. Apply fundamentals of fuel combustion and battery technology to assess their energy efficiency.

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	<p>AI in Engineering Chemistry: For visualising molecules, Understanding DFT, ab initio methods, Hardness & alkalinity calculation, Boiler problem analysis, Green solvent identification, Conducting polymer mechanism, Case study analysis of corrosion, GCV/NCV calculations, Battery reactions (Li-ion, fuel cells) Ethical AI usage. Tools: SMILES, InChI, Wolfram Alpha, ChatGPT, Perplexity AI, Excel + AI, Chem Draw, Molview, Gemini, and Claude.</p> <p>Introduction to Computational Chemistry</p> <p>A] Fundamentals of Computational Chemistry: Definition and scope of computational chemistry, Role in modern chemical research and industry, Overview of computational workflow (input → calculation → output → interpretation). Tools and Methods in Computational Chemistry: Molecular Mechanics (concept of force fields), Semi-empirical methods (basic idea and</p>	10

	<p>applications), Ab initio methods (introductory concept) – basic concept and applications, Comparison of methods (accuracy vs computational cost). Applications: Drug design and discovery, Materials chemistry, Reaction mechanism understanding.</p> <p>B] Introduction to Chemo informatics: Definition and importance in chemical data science, Chemical databases: PubChem, ChemSpider (basic navigation and applications), Representation of molecules: SMILES, InChI, Introduction to molecular descriptors and fingerprints.</p>	
II	<p>Advanced Engineering Materials and Nanotechnology</p> <p>A] Advanced Engineering Materials: Conducting Polymers: Characteristics and classification with examples, mechanism of conduction in <i>trans</i>-polyacetylene and applications of conducting polymers, Structure and properties of Biodegradable Polymers: PHBV, Liquid crystal polymer-Kevlar., E waste management.</p> <p>B] Nanomaterials: Introduction, classification of nanomaterials based on dimensions, structure, properties and applications of graphene and carbon nanotubes, quantum dots (semiconductor nanoparticles), and their applications in sensors, transistors, energy storage, thin film deposition techniques (nanoparticle synthesis), sustainable nanomaterials.</p>	9
III	<p>Water technology & Green Chemistry</p> <p>Hardness & alkalinity of water with their estimation. Boiler troubles: Boiler corrosion, Sludges, Scales, and Caustic embrittlement. External treatment methods- Softening of water by Zeolite & ion-exchange processes. Desalination of water – Reverse osmosis. Green Chemistry: 12 principles, Green solvents in PCB & chips cleaning.</p>	9
IV	<p>Corrosion Science</p> <p>Corrosion: introduction, types of corrosion, mechanism of atmospheric corrosion and wet corrosion. Galvanic series. Factors affecting corrosion: nature of metal and nature of environment. Different types of corrosion: Pitting corrosion, concentration cell corrosion, stress corrosion and soil corrosion. Corrosion control: methods of prevention of corrosion - cathodic and anodic protection, metallic coatings and its types - anodic and cathodic coatings. Methods to apply metallic coatings - hot dipping, cladding, electroplating and cementation. Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods.</p>	8
V	<p>Energy sources and conversion Technologies:</p> <p>a. Fuel and combustion: Calorific value of fuel – GCV, NCV and its relation. Determination of calorific value - Bomb calorimeter, Boy's calorimeter and numericals. Classification- solid fuels: - Coal. Proximate and ultimate analysis of coal and their significance. Liquid fuels–Crude petroleum and its refining. Gaseous fuels – Hydrogen as future fuel, Alternative fuels: Power alcohol and biodiesel, their synthesis and advantages. Combustion: chemical reactions, calculations on air requirement for combustion.</p> <p>b. Battery Technology: Electrochemical principles, Li ion, solid state Sodium ion battery, Charging and discharging reaction, fuel cell, battery safety.</p>	9
Total		45
Text Books:		

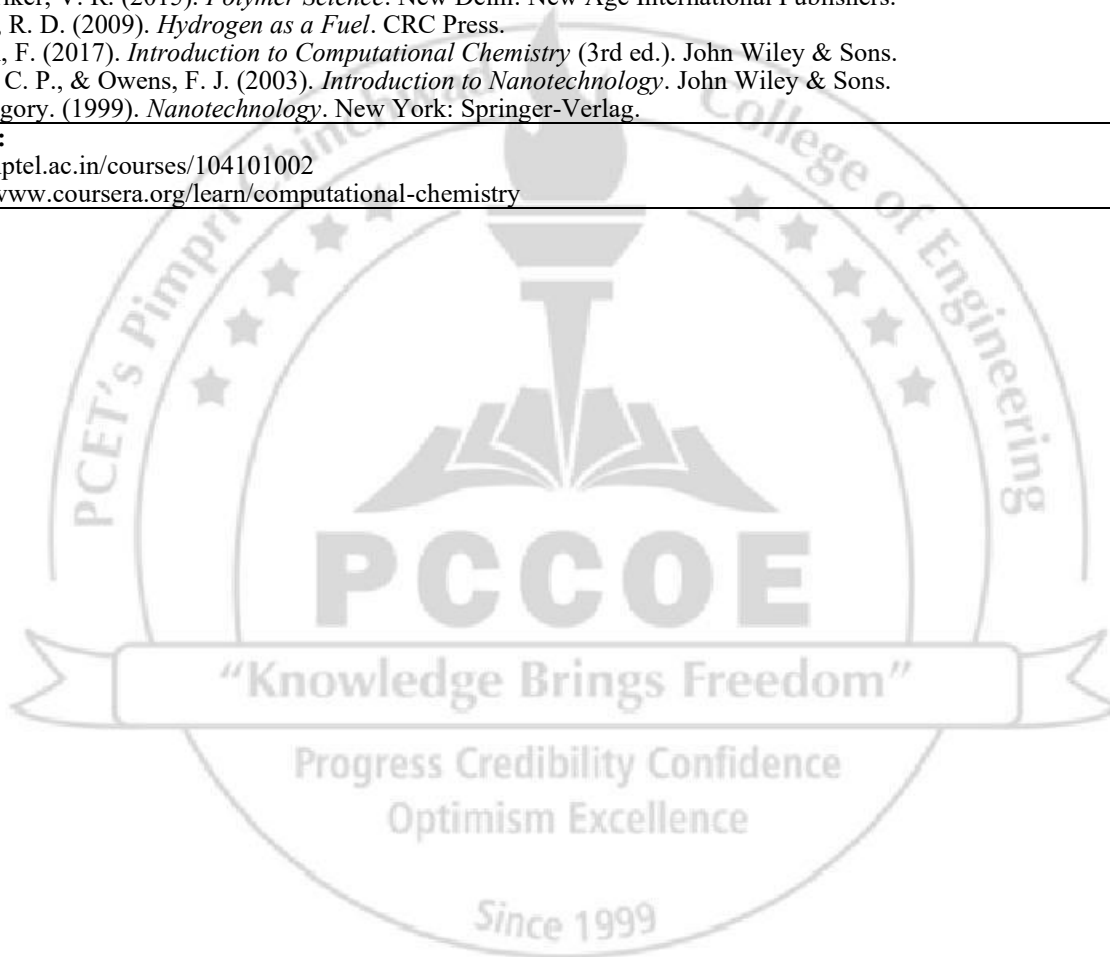
1. Chawla, S. (2015). *A Textbook of Engineering Chemistry*. New Delhi: Dhanpat Rai & Co.
2. Dara, S. S. (2010). *Engineering Chemistry*. New Delhi: S. Chand Publications.
3. Jain, P. C., & Jain, M. (2016). *Engineering Chemistry*. New Delhi: Dhanpat Rai Publishing Co.
4. Jensen, F. (2017). *Introduction to Computational Chemistry* (3rd ed.). John Wiley & Sons.
5. Kulkarni, S. K. (2014). *Nanotechnology: Principles and Practices* (3rd ed.). Springer.
6. Palanna, O. G. (2017). *Engineering Chemistry*. McGraw-Hill Education.
7. Dr. Shikha Baskar, (2012). *Engineering Chemistry*. Wiley India Pvt. Ltd.

Reference Books:

1. Cramer, C. J. (2013). *Essentials of Computational Chemistry: Theories and Models* (2nd ed.). John Wiley & Sons.
2. Gowariker, V. R. (2015). *Polymer Science*. New Delhi: New Age International Publishers.
3. Gupta, R. D. (2009). *Hydrogen as a Fuel*. CRC Press.
4. Jensen, F. (2017). *Introduction to Computational Chemistry* (3rd ed.). John Wiley & Sons.
5. Poole, C. P., & Owens, F. J. (2003). *Introduction to Nanotechnology*. John Wiley & Sons.
6. T. Gregory. (1999). *Nanotechnology*. New York: Springer-Verlag.

e-Sources:

1. <https://nptel.ac.in/courses/104101002>
2. <https://www.coursera.org/learn/computational-chemistry>



Program:	B. Tech. CSE (AI& ML)			Semester: II			
Course:	Engineering Chemistry Laboratory			Code:	BSH32BS10		
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	50	-	-	50
Prior knowledge of							
<ol style="list-style-type: none"> 1. Theory of acids and bases 2. Molarity, normality and molality 3. Titration method 4. Basics of Computer 							
Course Objectives:							
<ol style="list-style-type: none"> 1. To help students procure conceptual clarity in engineering chemistry through laboratory experiments. 2. To develop experimental skills that provide insight into societal and environmental issues. 3. To develop basic understanding of computational chemistry. 							
Course Outcomes: After completion of this course, the students will be able to,							
<ol style="list-style-type: none"> 1. Apply volumetric and instrumental methods for quantitative and qualitative analysis of materials 2. Demonstrate the process of polymer synthesis and corrosion resistance improvement for metals. 3. Construct 2D molecular structures using ChemDraw and Chem 3D tools. 							
Detailed Syllabus							
Expt. No.	List of Experiments						
1	Determination of total hardness of water sample by EDTA method.						
2	Determination of type of alkalinity of given water sample and extent of alkalinity.						
3	To determine Chloride (Cl ⁻) content in given water sample by Argentometric method.						
4	To determine the dissociation constant of a weak acid (acetic acid) using a pH meter.						
5	Titration of mixture of strong acid with strong base using Conductivity meter and determine strength of acid.						
6	Proximate analysis of Coal.						
7	To estimate the amount of Fe (II) present in the given solution potentiometrically.						
8	To determine the maximum wavelength of absorption of KMnO ₄ , verify Beer's law and find concentration of the unknown sample.						
9	To perform electroplating of copper for enhancing corrosion resistivity and determination of its electrochemical equivalent (ECE).						
10	To prepare the Phenol formaldehyde resin.						
11	Molecular Modeling using ChemDraw (Chem3D)						
References:							
<ol style="list-style-type: none"> 1. Mendham, J., Denney, R. C., Barnes, J. D., & Thomas, M. J. K. (2000). <i>Vogel's Textbook of Qualitative Chemical Analysis</i> (6th ed.). Pearson Education Ltd. 2. Virmani, O. P., & Narula, A. K. (2009). <i>Applied Chemistry: Theory and Practice</i> (2nd ed.). New Age International (P) Ltd. 3. Jensen, F. (2017). <i>Introduction to Computational Chemistry</i> (3rd ed.). John Wiley & Sons. 							

Program:	B. Tech. CSE (AI& ML)				Semester: II			
Course:	Data Science				Code:	BCS32ES04		
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	10	10	30	50

Prior knowledge of linear algebra and discrete mathematics is essential.

Course Objectives:

1. Apply data preprocessing operations and demonstrate data visualization and analytics techniques for effective data analysis.
2. Apply concepts of linear algebra and matrices to solve numerical problems and demonstrate the use of mathematical techniques in data science.
3. To explain the theory of statistics and its use in statistical inference.
4. Evaluate regression and classification models using appropriate techniques and performance metrics.

Course Outcomes: After learning the course, the students will be able to:

1. Apply data preprocessing and visualization techniques to prepare and analyze data effectively.
2. Use linear algebra and matrices for problem-solving in data science.
3. Perform statistical analysis to understand the data representation by computing various statistical measures.
4. Interpret evaluation results of regression and classification models.

Detailed Syllabus

Unit	Description:	Duration [Hrs]
I	<p>Introduction to Data Science: Data Science Life Cycle; Data Analytics and Types; and Key Performance Indicators of Data Science Projects.</p> <p>Data Preprocessing: Need preprocessing techniques for handling redundant data, data transformation, replacing or handling missing data, and handling data inconsistency.</p> <p>Data Visualisation: Introduction and need of data visualisation techniques: line plot, scatter plot, histogram, box plot, bar plot, pie chart, and heatmap.</p> <p>Introduction to AI tools: Grafana, WEKA</p>	8
	<p>Self-Learning Contents: A case study on student performance analysis and sales analysis and prediction using data science techniques.</p>	3
II	<p>Mathematics for data Science</p> <p>Vectors: Vector space and working with vectors.</p> <p>Matrices: Types of matrices, addition of matrices and their properties, matrix multiplication and their properties, linear combination as a matrix-vData Science vector product, Matrix Transformations, Eigenvalues and Eigenvectors</p>	7
	<p>Self-Learning Contents: Case study on various matrix operations such as Student Marks Analysis using Matrix Operations, Image Processing using matrix transformation, and recommendation systems using matrix factorisation</p>	4

III	Statistics & Inferences Statistics: Measures of central tendency (mean, median, mode); measures of variability (standard deviation, variance, quartiles, interquartile range); skewness. Sampling & Inference: Sampling: Introduction, types of sampling, hypothesis testing, types of errors, level of significance, and tests of hypotheses: z-test and Chia Square test	8
	Self-Learning Contents: numerical practice on tests of hypotheses: t-test and Anova test. Correlation Analysis: Pearson’s correlation coefficient.	4
IV	Data Analytics and Model Evaluation Introduction to Data Analytics: Classification and regression problems in data science. Naive Bayes classifier. Linear Regression, Logistic Regression Model Evaluation and Selection: Holdout method, cross-validation. The model's parameter tuning and optimization. Performance metrics, confusion matrix, AUC-ROC.	7
	Self-Learning Contents: Problems on classification and Regression	4
Total Theory hours		30
Total self-learning hours		15
Text Books: 1. Thomas Nield, “Essential Math for Data Science”, O’Reilly Media Inc., October 2022, ISBN: 9781098102869. 2. Data Science and Big Data Analytics, EMC education services, Wiley publication, 2015, ISBN: 9781118876138. 3. Cathy O’Neil, Rachel Schutt, “Doing Data Science”, O’Reilly Media Inc., Updated editions/reprints (post-2020 use in curriculum), ISBN: 9781449358655. 4. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, “Mathematics for Machine Learning”, Cambridge University Press, 2020, ISBN: 9781108455145.		
Reference Books: Peter Bruce, Andrew Bruce, Peter Gedeck, “Practical Statistics for Data Scientists”, O’Reilly Media, 2nd edition, May 2020, ISBN: 9781492072942. 2. Norman Matloff, “Probability and Statistics for Data Science”, CRC Press, 2019, ISBN:9780429687112. 3. Yap Bee Wah, Dhiya Al-Jumeily, Michael W. Berry (Eds.), “Data Science and Emerging Technologies: Proceedings of DaSET 2024”, Springer, 2025, ISBN: 9789819677481. 4. Ilke Demir et al. (Eds.), “Advances in Data Science”, Springer, 2021, ISBN: 9783030798901.		
e-sources: 1. NPTEL Course on “Python for Data Science” : https://onlinecourses.nptel.ac.in/noc22_cs74/preview 2. NPTEL Course on “Data Science for Engineers” : https://onlinecourses.nptel.ac.in/noc22_cs72/preview		

Program:	B. Tech. CSE (AI& ML)				Semester: II		
Course:	Data Science Laboratory				Code:	BCS32ES05	
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	50	-	50	100

Prior knowledge: Computer Programming & Problem Solving are essential

Course Objectives:

1. To develop the ability to implement data preprocessing techniques on real-world datasets for handling missing values, outliers, and inconsistencies and for performing data transformation and normalization.
2. To enable students to create effective data visualizations for identifying patterns, trends, relationships, and outliers in datasets.
3. To build competency in applying statistical methods for computing descriptive measures and conducting hypothesis testing for data interpretation.
4. To equip students with skills to analyze and evaluate predictive models using regression and classification techniques for data-driven decision making

Course Outcomes: After learning the course, the students will be able to:

1. Implement data preprocessing techniques.
2. Apply visualization techniques to analyze data representations.
3. Implement statistical methods to compute descriptive measures and perform hypothesis testing.
4. Develop predictive models using regression and classification techniques.

Guidelines for Students:

The suggested list of assignments is given below.

Instructors can frame suitable 13 assignments based on scenarios.

Students should perform all assignments compulsorily using Python.

As per assignment requirement, an open-source data can be downloaded from the web (Kaggle, github, UCI ML repository, OpenML, Datahub, Data.gov, etc).

Guidelines for Laboratory / Term Work Assessment:

1. Continuous assessment of laboratory work is done based on the overall performance and laboratory performance of the students.
2. Each laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each laboratory assignment assessment include- timely completion, performance, innovation, efficiency, punctuality, and neatness.

Expt. No.	Suggested List of Experiments
1	Write programs using Python language constructs. Suitable 2 assignments will be framed based on topics such as: Data types and data structures in Python– lists, array, dictionary, tuple, etc. Reading data from files. Different types of language constructs: operators, control structures, functions. Python libraries like pandas, NumPy, etc. Suggested list is as follows: a. Write a python program to create a list of random numbers in normal distribution and display the frequency of each value. b. Write a python program to print the odd and even numbers from a given range taken as per

	<p>user input and display the prime numbers from the first 20 odd numbers.</p> <p>c. Write a python program to read any .csv file as per user-provided input and display its content.</p>
2	<p>Write programs using Python language constructs. Suitable 2 assignments will be framed based on topics such as: Data types and data structures in Python– lists, array, dictionary, tuple, etc. Reading data from files. Different types of language constructs: operators, control structures, functions. Python libraries like pandas, NumPy, etc. Suggested list is as follows:</p> <p>a. To reverse the tuple or unpack the tuple into multiple variables or access a specific value from tuple</p> <p>b. To merge two dictionaries or create a dictionary by extracting only key values from any given dictionary.</p>
3	<p>Write programs using Python language constructs and Python libraries like NumPy to perform linear algebra operations. Suitable any 2 assignments can be framed. The suggested list is as follows:</p> <p>a. To perform addition and subtraction of matrices</p> <p>b. To perform multiplication and division of matrices</p> <p>c. To find the transpose of a matrix</p> <p>d. To solve linear systems of equations by implementing matrices and vectors</p>
4	<p>Perform the following data preprocessing operations using Python and pandas on any open-source dataset.</p> <p>a. Data preprocessing operations: check for missing values, noisy data, null values, etc. and handle those.</p> <p>b. Data Integration and Data Normalization: Summarize the types of variables by checking the data types (i.e., character, numeric, integer, factor, and logical) of the variables in the data set. If variables are not in the correct data type, apply proper type conversions. Perform data transformations suitably like normalization, standardization, etc. Turn categorical variables into quantitative variables</p>
5	<p>Create an “Academic performance” dataset of students and perform the following operations using Python.</p> <p>a. Scan all variables for missing values and inconsistencies. If there are missing values and/or inconsistencies, use any of the suitable techniques to deal with them.</p> <p>b. Scan all numeric variables for outliers. If there are outliers, use any of the suitable techniques to deal with them.</p>
6	<p>Create an “Academic performance” dataset of students and perform the following operations using Python.</p> <p>a. Apply data transformations on suitable variables. The purpose of this transformation should be one of the following reasons: to change the scale for better understanding of the variable, to convert a non-linear relation into a linear one, or to decrease the skewness and convert the distribution into a normal distribution.</p>
7	<p>Write a program for Data Visualization using IRIS flower dataset or any other suitable public dataset .</p> <p>a. Create a histogram for each feature in the dataset to illustrate the feature distributions. Plot each histogram.</p> <p>b. Create a boxplot for each feature in the dataset. All of the boxplots should be combined into a single plot. Compare distributions and identify outliers.</p>
8	<p>Write a program for Data Visualization to create any 6 types of graphs. Select the right chart for data visualization as per requirements like visualization required for comparisons,</p>

	identification of relationships, identification of trends over time, part of a whole, understanding the distribution of data values, etc. Create graphs among types such as Line plot, Scatter plot, bar plot, Density plot, pie chart, bubble plot, heat maps, tree map, correlation matrices, dendrograms, etc. Use Pima Indians Diabetes dataset or time series data or any other suitable public dataset.
9	Write a python program to perform descriptive statistics to compute various statistical measures by using Pandas library. Use IRIS flower dataset or any other suitable public dataset.
10	Write a program to perform hypothesis testing for a suitable dataset. Select appropriate hypothesis testing strategies such as t-test, z test, chi-square test, ANOVA test, etc.
11	Write a program to implement Linear Regression using a suitable public dataset. Use the BigMart Sales Dataset to perform prediction of store sales based on given features and analyzes the predicted output.
12	Write a program to implement Logistic Regression using any suitable public dataset. Perform classification by predicting categorical outcomes based on input features and evaluate the model using appropriate test data.
13	Write a program to perform classification using Naïve Bayes classifier. Calculate the probabilities by implementing the Bayes theorem using Pima Indians Diabetes dataset or any other suitable public dataset. Measure the performance of the classifier for separate test and training data using various metrics.
14	Develop a predictive analytics solution using the BigMart Sales Dataset or any suitable retail dataset to analyze factors influencing sales, perform data preprocessing and exploratory data analysis, build a regression-based prediction model, and generate meaningful insights to support effective business decision-making.
15	Develop a predictive analytics solution using a suitable agriculture dataset to analyze factors affecting crop yield (such as rainfall, temperature, soil nutrients, etc.), perform data preprocessing and exploratory data analysis, build a prediction model, and generate insights to support efficient farming and decision-making. Crop Recommendation Dataset https://www.kaggle.com/datasets/atharvaingle/crop-recommendation-dataset

References:

1. Peter Bruce, Andrew Bruce, Peter Gedeck, “Practical Statistics for Data Scientists”- · 2020 , ISBN:9781492072898, 1492072893 ,Published:10 April 2020 , Publisher:O'Reilly Media.
2. Norman Matloff, “Probability and Statistics for Data Science” - Norman Matloff · 2019, ISBN:9780429687112, 0429687117 , CRC Press, Published:21 June 2019
3. Chirag Shah, “A Hands-On Introduction To Data Science”, Cambridge University Press,(2020), ISBN : ISBN 978-1-108-47244-9.
4. Wes McKinney, “Python for Data Analysis”, O' Reilly media, ISBN : 978-1-449-31979-3.
5. Python Data Science Handbook – Jake VanderPlas::<https://jakevdp.github.io/PythonDataScienceHandbook/>
6. Chirag Shah, A Hands-On Introduction to Data Science, Cambridge University Press. Available online at: <https://www.cambridge.org/>

Program:	B. Tech. CSE (AI& ML)					Semester: II		
Course:	Software Engineering					Code:	BCS32ES06	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-		-	10	10	30	50
Prior knowledge of Computer Programming and Problem Solving is essential.								
Course Objectives:								
<ol style="list-style-type: none"> 1. To introduce the foundational principles of Software Engineering and familiarize students with various software development process models. 2. To develop the ability to analyze software requirements and understand structured methods for designing effective software solutions. 3. To provide knowledge of agile methodologies and enable students to understand their application in real-world software development. 4. To equip students with fundamental concepts, techniques, and processes of software testing for ensuring software quality and reliability. 								
Course Outcomes: After learning the course, students will be able to:								
<ol style="list-style-type: none"> 1. Comprehend the principles of Software Engineering and apply appropriate process models. 2. Analyze software requirements and use design methods for software solutions. 3. Apply the agile software development methodologies. 4. Design test cases using appropriate testing techniques. 								
Detailed Syllabus								
Unit	Description							Duration [Hrs]
I	Introduction and Software Process Models :							08
	Introduction to AI Tools in Software Engineering / Key AI tools: GitHub Copilot, OpenAI Codex, Cursor, Qodo, Testim Software Engineering, Myths, Software Process, Software development life cycle, Work Products, Importance of Software Engineering, Standard for Software Process, Waterfall Model, Prototyping Model, Iterative Enhancement Model, Spiral Model, RAD model, 4th Generation models. Case Study: Introduction to Safe Home.							
	Self Learning Contents: Risk Management - Risk Identification and Mitigation.							04
II	Software Requirement Specification, Design and Coding: Requirements Engineering- Problem analysis, Establishing the Groundwork- Eliciting Requirements, Requirements Analysis-Requirements Modeling Strategies. Design Concepts, Modularity, Architectural design, Coupling and Cohesion, Top-down and bottom-up design, Software Design Document, Coding styles and documentation. Computer Aided Software Engineering (CASE) : Scope, Architecture, support in Software Life Cycle, Component Based Software Engineering							07

	Self Learning Contents: Upper CASE and Lower-CASE tools	04
III	Agile development: Agile Process- Extreme Programming in agile development, Pair Programming in agile development, Agile software development process Models: SCRUM, Sprint Cycle, Sprint Cycle Stages, SCRUM master, Software Cost Estimation- COCOMO model.	07
	Self-Learning Contents: Comparison of Agile with Conventional process models, Kanban Boards and Methodology, Agile Project Management Tools: Jira, Trello.	05
IV	Software Testing : Introduction to Software Testing- Definition, Importance, Error, Fault and Failure, Objectives of Testing, Testing Principles, Levels of Testing, Types of Testing- Functional and Non-Functional Testing, Testing Techniques, Test Case Design, Software Testing Life Cycle (STLC), Defect Management- Defect Life Cycle,	08
	Self Learning Contents: Testing Tools Overview- Selenium, JUnit.	04
Total		45
Total Self Learning Hours		15
Textbooks:		
<ol style="list-style-type: none"> 1. Roger S. Pressman, "Software Engineering – A Practitioner’s Approach," Pearson Education, 8th Edition, 2010. 2. Ian Sommerville, "Software Engineering," 9th edition, 2010. 3. N.S. Gill, Software Engineering, Khanna Publishing Co., Delhi, 2018. 4. Software Engineering (3rd ed.), by K.K. Aggarwal & Yogesh Singh, New Age International Publishers, 2007. 5. Desikan Srinivasan and Gopaldaswamy Ramesh, “Software Testing: Principles and Practices”, Pearson Education India, 2006, ISBN: 978-8177581218. 		
Reference Books:		
<ol style="list-style-type: none"> 1. Carlo Ghezzi, "Fundamentals of Software Engineering," Prentice Hall India, ISBN 10: 0133056996, 2002. 2. Rajib Mall, "Fundamentals of Software Engineering," Prentice Hall India, ISBN 13: 978-8120348981, 2014. 3. Pankaj Jalote, "An Integrated Approach to Software Engineering," Springer, ISBN 13: 9788173192715, 2010. 		
e-sources:		
https://nptel.ac.in/courses/106105087 https://nptel.ac.in/courses/106105182		

Program:	B. Tech. CSE (AI& ML)			Semester: II			
Course:	Object Oriented Programming using C++			Code:	BCS32VS02		
Credits	Teaching Scheme (Hrs. /Week)			Evaluation Scheme and Marks			
	Theory	Practical	Tutorial	TW	OR	PR	Total
02	–	04	–	50	–	50	100
Prior knowledge: Computer Programming and Problem Solving is essential.							
Course Objectives: This course aims at enabling students, <ol style="list-style-type: none"> 1. To develop solutions by using various OOP features for various applications. 2. To strengthen problem-solving ability by using the characteristics of an object-oriented approach. 3. To develop programming skills using Object oriented concepts. 							
Course Outcomes: After learning the course, the students will be able to: <ol style="list-style-type: none"> 1. Apply various object-oriented concepts for problem-solving. 2. Apply inheritance and polymorphism to write object-oriented programs. 3. Develop the solutions using generic templates, exception handling, and STL. 4. Write programs to perform file-handling operations. 							
Guidelines for Laboratory Conduction: <ol style="list-style-type: none"> 1. Instructor is expected to teach Object oriented programming concepts before conducting assignments. 2. Assignments should be implemented in C++ language. 3. Operating System recommended: - 64-bit Open source Linux or its derivative. 4. Programming tools recommended: - G++/GCC, Eclipse, VS Code, QT creator. 5. All Assignments are compulsory. 							
ExptNo.	Suggested List of Experiments						
1	Concepts: variables and constants, Class – Data members, Member Functions, and class as abstract data type, Object Visibility Modes, Array of Objects. Assignments: Write a program Illustrating Class Declarations, Definition, and Accessing Class Members. <ol style="list-style-type: none"> 1. Write a C++ program to implement a class called Circle that has private member variables for radius. Include member functions to calculate the circle's area and circumference.(Class, Object, Member Function and Access specifier) 2. Create a class 'Student' with three data members which are name, age and address. The constructor of the class assigns default values to name as "unknown", age as '0' and address as "not available". It has two functions with the same name, 'setInfo'. First function has two parameters for name and age and assigns the same whereas the second function has three parameters, which are assigned to name, age and address respectively. Print the name, age and address of 10 students.(array as object) 						

2	<p>Friend Class, Friend Function, Static data Members, Static Function, Inline Function: Write a Program Using following concepts:</p> <p>a. Friend Class, b. Friend Function, c. Static data Members, d. Static Function, e. Inline Function</p> <ol style="list-style-type: none"> 1. Create a class called Box with a variable: width of type double. Inside the class define a constructor and a friend that prints the width value(printWidth). In the main() define a Box instance, set values and call printWidth. (Friend Function) 2. Design a class A and a class B. Make class B a friend of class A. Implement member functions in both classes to demonstrate the use of friend class. 3. Develop a class Counter to count the number of objects created. Use a static data member to keep track of the count. Implement member functions to increment and display the count. 4. Create a class Math with static functions for addition, subtraction, multiplication, and division. Demonstrate the use of static functions to perform mathematical operations without creating an object of the class.
3	<p>Constructor: Default constructor, parameterized constructor and copy constructors and Destructor, Order of Constructor and Destructor Call.</p> <p>Assignments:</p> <ol style="list-style-type: none"> 1. Write a program and input two integers in main and pass them to default constructor of the class. Show the result of the additon of two numbers. (Default Constructor) 2. Create a class called Rectangle.It should contain a constructor for width and height, a function that returns the area and a friend fuction that duplicate the rectangle's dimensions. In the main, creaaate a rectangle instance, duplicate it and print out the area. (Parameterized and Copy Constructor) 3. Write a program to illustrate default constructor, parameterized constructor and copy constructors. Program should illustrate the order of execution of constructors and destructors when a new class is derived from more than one base class.
4	<p>Inheritance and its Types: Simple, Multilevel, Hierarchical, Multiple and Hybrid, Ambiguity in multiple inheritance.</p> <p>Assignments:</p> <p>Write C++ programs that illustrate how the following forms of inheritance are supported:</p> <ol style="list-style-type: none"> a. Single inheritance b. Multiple inheritance c. Multilevel inheritance d. Hierarchical inheritance. <ol style="list-style-type: none"> 1. Write a program with a mother class and an inherited daughter class.Both of them should have a method void display ()that prints a message (different for mother and daughter).In the main, define a daughter and call the display() method on it. 2. Write a program with a mother class animal. Inside it define a name and an age variables, and set_value() function.Then create two bases variables Zebra and Dolphin which write a message telling the age, the name and giving some extra information (e.g. place of origin).

5	<p>Polymorphism : Operator Overloading : Unary and Binary, Virtual Function, Function Overloading</p> <p>Assignments:</p> <ol style="list-style-type: none"> 1. Implement a class Complex, which represents the Complex Number data type. Implement the following operations: <ol style="list-style-type: none"> a. Constructor (including a default constructor which creates the complex number 0+0i). b. Overloaded operator + to add two complex numbers. c. Overloaded operator * to multiply two complex numbers. d. Overloaded << and >> to print and read Complex Numbers.(Operator Overloading) 2. Write a program defining class Distance that stores feet and inches. Overload operator + to add two instances of class Distance and return the result in another instance. Overload comparison operator < which will compare two instances of class Distance and return true or false. Overload += to add two distances and store the result in the one of them. Overload = operator to assign one distance to the other. (Operator Overloading) 3. Write a C++ program to implement a class called Shape with virtual member functions for calculating area and perimeter. Derive classes such as Circle, Rectangle, and Triangle from the Shape class and override virtual functions accordingly. (Virtual Function) 4. Implement a class StringOperations with overloaded functions to concatenate two strings, to concatenate a string with an integer, and to reverse a string. Test these functions with various inputs to demonstrate their versatility.
6	<p>ADT Using Class, Pure virtual function, Abstract class.</p> <ol style="list-style-type: none"> 1. Write a C++ program to implement the matrix ADT using a class. The operations supported by this ADT are: <ol style="list-style-type: none"> a. Reading a matrix. b. Addition of matrices. c. Printing a matrix. d. Subtraction of matrices. e. Multiplication of matrices.
7	<p>Generic Programming: Class Template and Function Template, Class template with Multiple parameters</p> <p>Assignments:</p> <p>Write a class template to represent a generic vector. Include member functions to perform the following tasks:</p> <ol style="list-style-type: none"> a. To create the vector. b. To modify the value of a given element. c. To multiply the vector by a scalar value. d. To display the vector in the form (10, 20, 30)

8	<p>Exception Handling: Fundamentals multiple catching nested try statements uncaught exceptions throw and rethrow</p> <ol style="list-style-type: none"> 1. Write a C++ program that takes two numbers as input from the user and performs division. Implement exception handling to catch division by zero errors and prompt the user to enter valid inputs. 2. Write a C++ to handle the exception if account balance is less than minimum balance. 3. Write a program that prompts the user to enter their age. Implement exception handling to ensure that the input is a valid integer and handle any ValueError exceptions that may occur.
9	<p>File Handling:</p> <p>Write a program to maintain an employee database in a binary file with employee information such as empId, name, age, department, post and salary. Write function for adding new records, displaying all records, searching for a particular employee, updating employee salary and post.</p>
10	<p>Standard Template Library: Stack, Queue, Map</p> <ol style="list-style-type: none"> 1. Write a C++ program using STL to perform various stack and queue operations. 2. Write C++ program using STL map for managing Person Records (Name, birth date, telephone no). Perform operations – add, display, search, delete, and update. 3. Write C++ program using STL to add binary numbers (assume one bit as one number); use STL stack.
<p>References:</p> <ol style="list-style-type: none"> 1. Herbert Schildt, “C++: The Complete Reference”, McGraw Hill Education, 4th Edition, July 2017, ISBN-10 : 007053246X (ISBN-13 : 978-0070532465). 2. BjarneStroustrup, “The C++ Programming language”, Pearson Education , Third edition, 2008, ISBN 9780201889543. 	

Program:	B. Tech. CSE (AI& ML)				Semester:		II	
Course:	Universal Human Values				Code:		BSH32VE02	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	25	25	-	50

Course Objectives: This course aims at enabling students,

1. To appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
2. To facilitate the development of a holistic perspective among students to lead their personal and professional lives in an ethical way.
3. To highlight plausible implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour, and mutually enriching interaction with nature.

Course Outcomes: After learning the course, the students should be able to:

1. Illustrate the relevance of Universal Human Values using real-life examples from personal, social, and professional contexts.
2. Interpret a human being as the co-existence of 'Self' and 'Body'.
3. Apply the concept of harmony in family and society to given scenarios with appropriate value-based actions.
4. Apply Universal Human Values to promote coexistence with nature in personal and professional life.

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	Introduction to Value Education: <ul style="list-style-type: none"> • Understanding Value Education • Self-exploration as the Process for Value Education • Continuous Happiness and Prosperity • Right Understanding • Current Scenario • Method to fulfil the Basic Human Aspirations 	4
	Sharing Session: <ul style="list-style-type: none"> • Sharing about Oneself • Exploring Human Consciousness • Exploring Natural Acceptance 	3
II	<ul style="list-style-type: none"> • Harmony in the Human Being: • Human being: the Co-existence of the Self and the Body • Needs of the Self and the Body • The Body as an Instrument of the Self • Understanding Harmony in the Self • Harmony of the Self with the Body • Programme to Ensure Self-Regulation and Health 	4

	<ul style="list-style-type: none"> • Sharing Session: • Exploring the Difference between Needs of Self and Body • Exploring Sources of Imagination in the Self • Exploring Harmony of Self with the Body • AI Integration: Personal Habit Analysis 	4
III	<p>Harmony in the Family and in Society:</p> <ul style="list-style-type: none"> • Harmony in the Family • 'Trust'—the Foundational Value in Relationship • 'Respect'—the Right Evaluation • Other feelings (Values) in Human-to-Human Relationship • Understanding Harmony in Society • Vision for the Universal Human Order • Five Dimensions of Human Order 	4
	<p>Sharing Session:</p> <ul style="list-style-type: none"> • Exploring the Feeling of Trust • Exploring the Feeling of Respect and Exploring Systems to • Fulfil Human Goal 	3
IV	<p>Harmony in Nature/Existence:</p> <ul style="list-style-type: none"> • Understanding Harmony in Nature, • Realizing Existence as Coexistence at All Levels • The Holistic Perception of Harmony in Existence <p>Implications of Holistic Understanding: A Look at Professional Ethics:</p> <ul style="list-style-type: none"> • Definitiveness of (Ethical) Human Conduct • Humanistic Constitution and Universal Human Order • Competence in Professional Ethics • Holistic Technologies, Production Systems and Management <p>Models -Typical Case Studies</p> <ul style="list-style-type: none"> • Strategies for Transitioning towards Value-Based Life and Profession. 	4
	<p>Sharing Session:</p> <ul style="list-style-type: none"> • Exploring the Four Orders of Nature • Exploring Co-existence in Existence • Exploring AI for Holistic Technologies • Exploring Humanistic Models in Education • Exploring Steps of Transition towards Universal Human Order 	4
Total		30
Text Books:		
1. R R Gaur, R Sangal, G P Bagaria, 2019, A Foundation Course in HUMAN VALUES and Professional Ethics- Presenting a universal approach to value education through self-exploration, Excel Books		
Reference Books:		
1. P.L. Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.		
2. A. Nagaraj, 1999, JeevanVidya: EkParichaya, JeevanVidyaPrakashan, Amarkantak,		
3. A. N. Tripathy, 2003, Human Values, New Age International Publishers.		
4. E. G. Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers , Oxford University Press		
5. M. Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics and Human Values, Eastern Economy Edition, Prentice Hall of India Ltd.		
6. B. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books.		
7. B. L. Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.		

e-sources:

1. <http://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/>
2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
3. <https://youtu.be/OgdNx0X923I>



Program:	B. Tech. CSE (AI& ML)			Semester: II			
Course:	Professional English			Code:	BSH32AE02		
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	30	20	-	50
Prior knowledge of: Basic English communication							
Course Objectives: This course aims at enabling students to: <ol style="list-style-type: none"> 1. Apply professional branding principles to technical career documentation and digital profiles 2. Employ strategic oral communication tactics during formal recruitment and networking scenarios. 							
Course Outcomes: After learning the course, the students will be able to: <ol style="list-style-type: none"> 1. Network professionally by applying self-introduction, profile building, and workplace communication etiquette. 2. Compose professional career documents such as resumes, cover letters, and workplace reports using appropriate language and format. 3. Articulate ideas clearly across contexts such as debates, interviews and presentations by analyzing own and peer performance. 							
Detailed Syllabus							
Expt. No	Suggested List of Experiments						Duration (Hrs)
1	Develop a Self-Introduction and Elevator Pitch: Develop and deliver a structured self-introduction suitable for professional networking.						2
2	Write a Professional ‘About Me’ Column: Write a well-structured “About Me” section in correct and formal language for a professional profile, ensuring clarity, coherence, and appropriate tone.						2
3	Create a Complete Skills Profile for Professional Networking: Draft a complete ‘Skills’ profile by effectively presenting strengths and achievements; critically evaluate peer profiles against recruiter checklists.						2
4	Display Professional Tact and Diplomacy in Workplace Interactions: Role-play scenarios: delivering constructive criticism on a peer's work, responding to negative feedback from a supervisor, communicating a project setback to a client. Analyse language choices for tone and professionalism.						2
5	Telephone & Video Call Etiquette for the Workplace: Practise professional communication in phone calls and virtual meetings (Teams/Zoom): opening and closing calls, active listening without visual cues, handling technical difficulties gracefully and maintaining politeness & professionalism in hybrid work environments.						2
6	Analyse Resume/CV Drafts: Evaluate resumes based on clarity, relevance, formatting, and use of action verbs,						2

	and suggest improvements. Understand what develops ATS friendly resumes.	
7	Construct a Professional Resume/CV: Construct a structured and well-formatted resume that highlights educational background, technical skills, projects, and achievements using appropriate language and formatting conventions.	2
8	Construct a Role-Specific Cover Letter: Construct a tailored cover letter aligning personal skills and experiences with job requirements using persuasive language.	2
9	Learn Strategies for Workplace Meetings & Minutes: Participate in a simulated team meeting; practise agenda-setting and turn-taking. Write formal minutes from the discussion.	2
10	Draft Technical & Business Reports: Practise writing short technical reports, progress reports, and business memos tailored to engineering workplace contexts. Focus on structure, objectivity, conciseness, and appropriate use of data/visuals in written communication.	2
11	Using English effectively in Debates: Participate in debates to express and justify opinions logically and confidently	2
12	Interview Techniques (STAR Method): Apply structured interview techniques to respond effectively to questions with clarity and relevance.	2
13	Mock Interviews: Evaluate interview responses based on clarity, confidence, and content, and provide constructive feedback.	2
14	Deliver a Short Talk on a Given Topic: Deliver a structured short talk on a general or technical topic, focusing on content organisation, clarity of expression, confidence, and effective verbal and non-verbal communication.	2
15	Present an Integrated Professional Task: Present a business proposal or idea and participate in a group demonstrating integrated communication skills.	2
Total		30
Text Books:		
<ol style="list-style-type: none"> Sharma, S. D. <i>A Text-Book of Professional Communication Skills and ESP for Engineers and Professionals</i>. Sarup & Sons, 2021. Bovee, Courtland L., and John V. Thill. <i>Business Communication Today</i>. 14th ed., Pearson Education, 2022 <i>Communication Skills in English for Engineers and Technologists</i>, Latest Edition (2025/26) – Arati A. Agrawal, CBS Publishers & Distributors Pvt. Ltd. 		
Reference Books:		
<ol style="list-style-type: none"> <i>The Handbook of Communicating Science and Engineering</i>, 2023 Edition – Felice Frankel, MIT Press <i>Business Communication Today</i>, 14th Edition (2022) – Courtland L. Bovee & John V. Thill, Pearson Education <i>Professional Engineering Communication</i>, Latest Edition (IEEE PCS Series), IEEE Press / Wile 		
E Resources		
<ul style="list-style-type: none"> "Learn English: Careers." <i>British Council</i>, 2026, https://learnenglish.britishcouncil.org/careers. "Resumes, CVs and Cover Letters." <i>Engineering Career Resource Center</i>, University of Michigan, 2026, https://career.engin.umich.edu/resumes-cvs-cover-letters/. 		

Program:	B. Tech. CSE (AI& ML)				Semester: II			
Course:	German				Code:	BSH32AE03		
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	TW	OR	PR	Total
1	-	2	-	-	30	20	-	50

Prior knowledge of: English Language is essential.

Course Objectives: This course aims at enabling students to,

1. Get familiar with the basics of German language and develop their interest in the language.
2. Develop basic German language skills for understanding and using simple expressions in everyday situations.
3. Use digital and AI-supported tools to practice German and support independent learning.

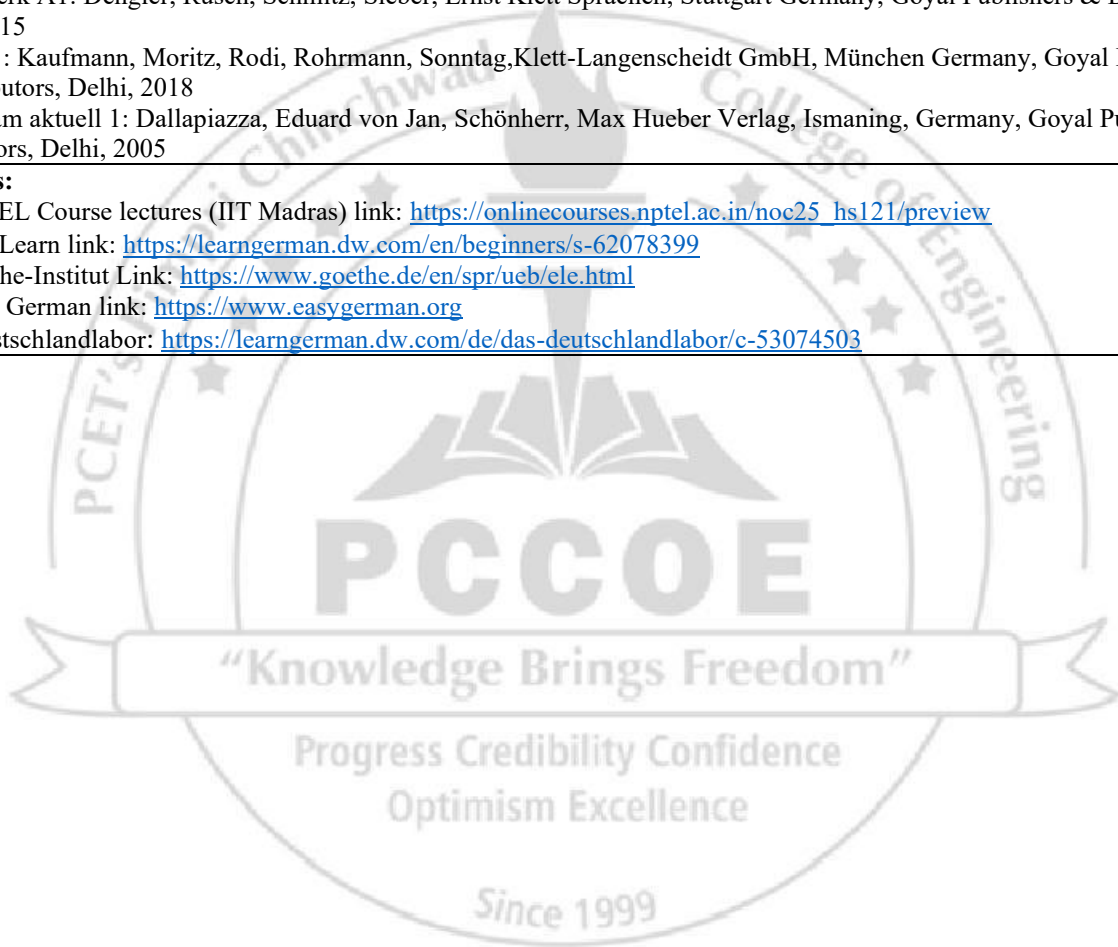
Course Outcomes: After learning the course, the students should be able to:

1. Interpret relevant information from spoken and written German communication.
2. Construct simple German sentences using basic vocabulary and grammatical structures.
3. Apply digital and AI-assisted tools for German phonetic skills.

Detailed Syllabus

Lab	Activities	Duration (Hrs)
1	Reading and Matching: Identify and match German words and expressions with pictures, practice pronunciation, and use the vocabulary in simple spoken and written sentences.	2
2	Listening for Key Information: Listen to short conversations multiple times, note key details, verify answers in pairs, and respond to follow-up comprehension tasks.	2
3	Pronunciation Practice: Practice German sounds through guided repetition, reading aloud, peer correction, and short speaking exercises.	2
4	True/False Comprehension: Read short texts, evaluate statements, justify answers, and reformulate incorrect statements correctly.	2
5	Reading and Form Completion: Read personal profiles or short texts, extract relevant information, and complete structured forms followed by discussion.	2
6	Vocabulary Mind Map: Collect topic-based vocabulary, organize it into mind maps, and use the words in short oral or written tasks.	2
7	Grammar Gap-Fill Task: Complete grammar exercises, identify rules used, and apply structures in new example sentences.	2
8	Sentence Construction Activity: Construct sentences using target verbs, expand them with additional information, and practice speaking in pairs.	2
9	Error Detection and Correction: Analyze sentences, identify grammatical errors, correct them, and explain the corrections collaboratively.	2
10	Self-Introduction Presentation: Prepare, practice, and present a short self-introduction followed by peer interaction and feedback.	2
11	Question–Answer Interaction: Practice asking and answering personal questions through guided drills, pair conversations, and role-switch activities.	2
12	Dialogue Role-Play: Read model dialogues, adapt them to new situations, rehearse, and perform role-plays in groups.	2
13	Pronunciation Practice using AI: Record speech using AI tools, compare feedback, improve pronunciation, and perform short speaking tasks.	2

14	Dialogue Building Using AI: Generate dialogues using AI support, edit language structures, rehearse, and perform communicative role-plays.	2
15	AI-Supported Profile Writing: draft a short profile, review AI suggestions critically, revise the text, and share final versions for discussion.	2
Total		30
Text Books:		
1. Menschen A1.1: Sandra Evnas, Angela Pude, Franz Pecht, Hueber Verlag Ismaning Germany, 2016		
Reference Books:		
1. Netzwerk A1: Dengler, Rusch, Schmitz, Sieber, Ernst Klett Sprachen, Stuttgart Germany, Goyal Publishers & Distributors, Delhi, 2015		
2. Linie 1: Kaufmann, Moritz, Rodi, Rohrmann, Sonntag, Klett-Langenscheidt GmbH, München Germany, Goyal Publishers & Distributors, Delhi, 2018		
3. Tangram aktuell 1: Dallapiazza, Eduard von Jan, Schönherr, Max Hueber Verlag, Ismaning, Germany, Goyal Publishers & Distributors, Delhi, 2005		
e-sources:		
1. NPTEL Course lectures (IIT Madras) link: https://onlinecourses.nptel.ac.in/noc25_hs121/preview		
2. DW Learn link: https://learngerman.dw.com/en/beginners/s-62078399		
3. Goethe-Institut Link: https://www.goethe.de/en/spr/ueb/ele.html		
4. Easy German link: https://www.easygerman.org		
5. Deutschlandlabor: https://learngerman.dw.com/de/das-deutschlandlabor/c-53074503		



Program:	B. Tech. CSE (AI& ML)			Semester:	II			
Course:	Japanese			Code:	BSH32AE04			
Teaching Scheme (Hr/Week)				Evaluation Scheme				
Credit	Lecture	Practical	Tutorial	FA		TW	Oral	Total
				FA1	FA2			
1	-	2	-	-	-	30	20	50

Prior Knowledge of: 1. English/Marathi/Hindi language for learning Japanese language.

Course Objectives: This course aims at enabling students

1. To be aware of Japanese Scripts (Hiragana, Katakana) and basic Kanjis
2. To express themselves using basic sentences and develop cross cultural skills and understanding of gestures, family and community, perceptions.
3. To develop language skills namely Listening, Speaking, Reading and Writing skills for socializing, at basic level.

Course Outcomes: After learning the course, the students will be able to

1. Identify Japanese scripts through oral and written communication.
2. Demonstrate the basic Kanjis with meanings in the given sentence.
3. Construct simple demonstrative sentences for daily use.

Unit	Description	Hrs.
I	Introduction to Japanese Scripts: 'Hiragana', 'Katakana' Practice Hiragana characters using stroke order sheets and guided writing exercises.	12
II	Introduction to basic Kanjis: Write basic Kanji with stroke order, meaning, and On/Kun readings.	8
III	Basic Grammar: Use of grammar and vocabulary.	10

Practical/Lab sessions

Lab sessions	Activities	Duration (Hrs)
1	Introduction to 'Hiragana'	2
2	Hiragana practice	2
3	Hiragana listening practice	2
4	Introduction to Katakana	2
5	Katakana practice	2
6	Vocabulary practice	2
7	Introduction to Kanjis	2
8	Kanji practice	2
9	Recognizing Kanjis.	2
10	Kanji chart preparation	2
11	Introduction to Basic Grammar	2
12	Vocabulary Development	2

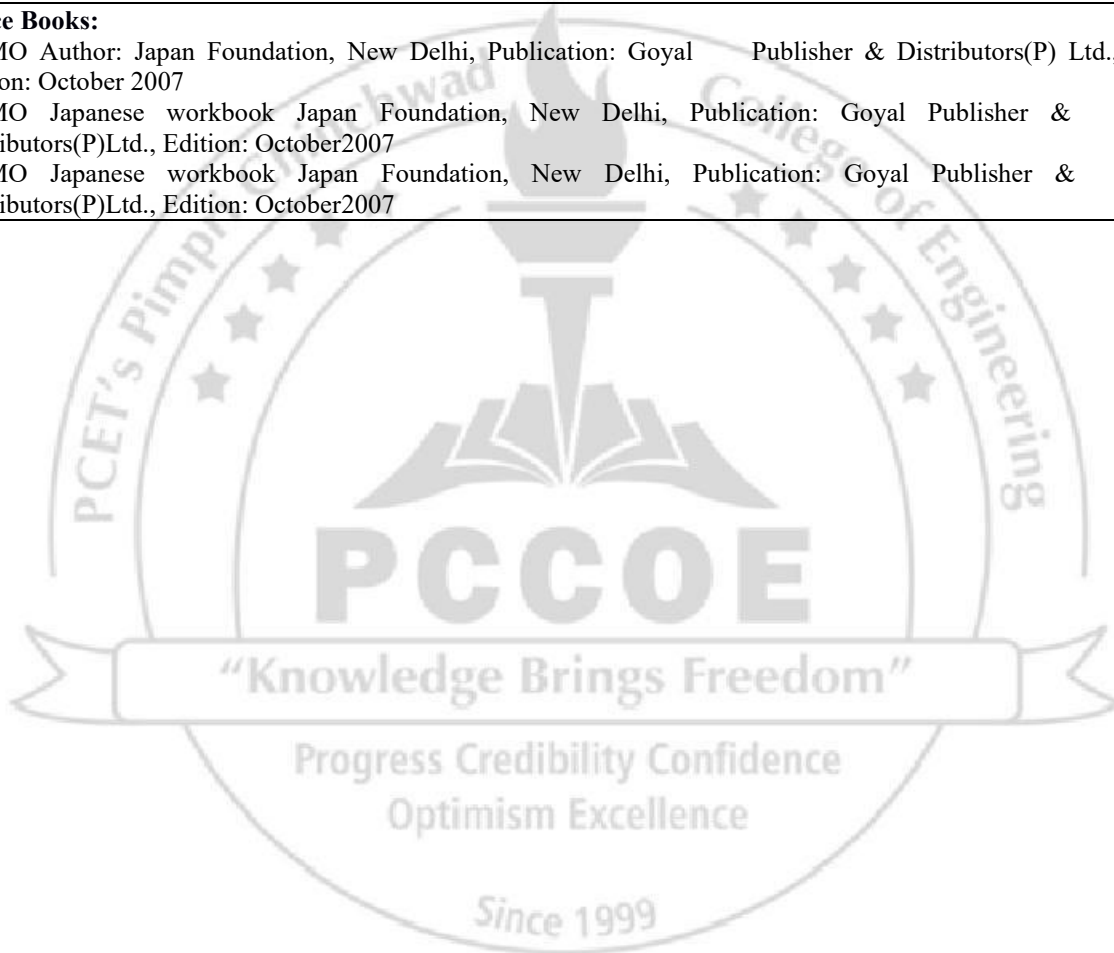
13	Sentence Construction	2
14	Dialogue Practice	2
15	Reading and Grammar Identification	2
Total		30

Textbook:

1. Minna no Nihongo Part I and II Publication: GOYAL PUBLISHERS & DISTRIBUTORS PVT. LTD., Author: Tsuru Yoshiko (Compiled), Edition:2018
2. Nihongo Shoho Publication: JALTAP, Author: JALTAP (With permission of Japan Foundation, Tokyo), Edition: April 2008

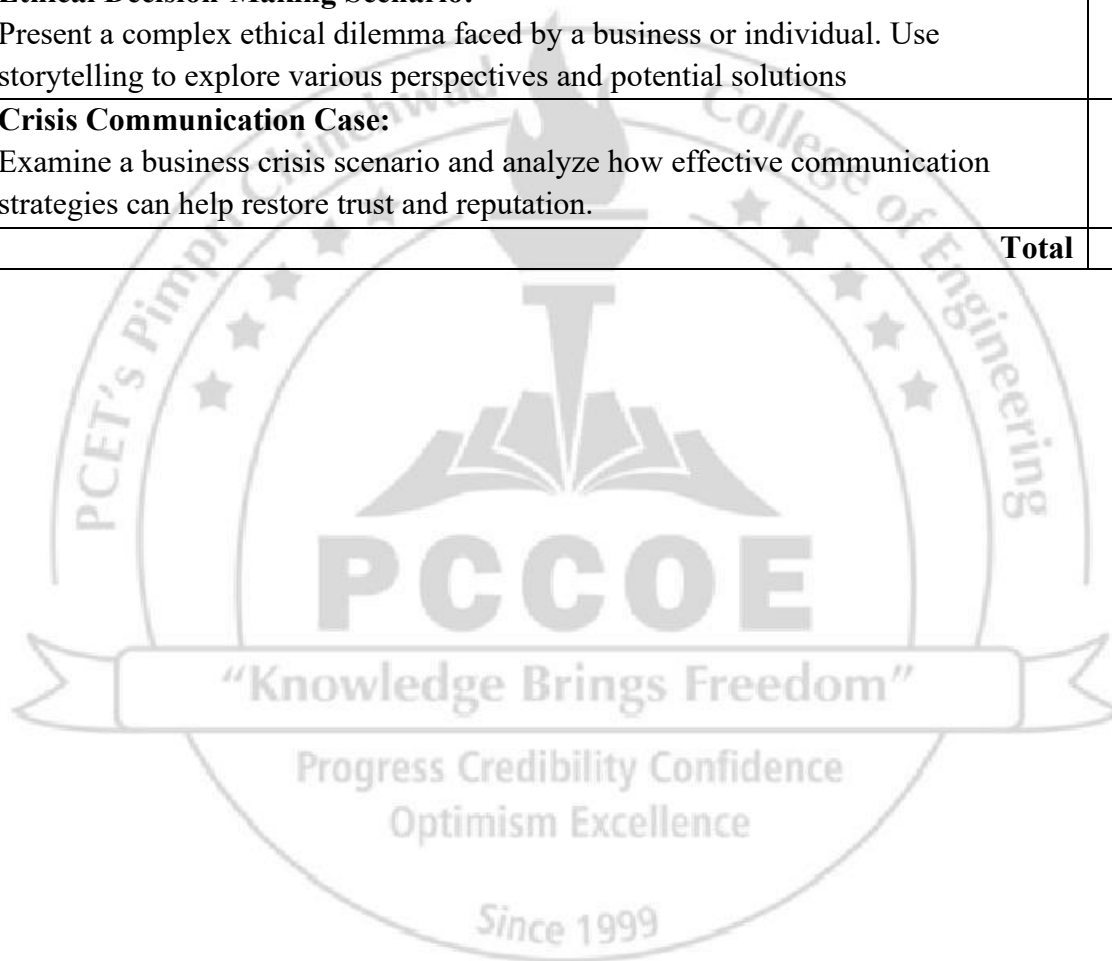
Reference Books:

1. MOMO Author: Japan Foundation, New Delhi, Publication: Goyal Publisher & Distributors(P) Ltd., Edition: October 2007
2. MOMO Japanese workbook Japan Foundation, New Delhi, Publication: Goyal Publisher & Distributors(P)Ltd., Edition: October2007
3. MOMO Japanese workbook Japan Foundation, New Delhi, Publication: Goyal Publisher & Distributors(P)Ltd., Edition: October2007



Program:	B. Tech. CSE (AI& ML)			Semester: II			
Course:	Business Storytelling			Code:	BSH32AE05		
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	30	20	-	50
Prior knowledge of: Basic knowledge of the English language is essential.							
Course Objectives: This course aims at enabling students: 1. To develop understanding of storytelling elements and communication techniques. 2. To enable effective communication of ideas through creative writing and storytelling activities.							
Course Outcomes: After learning the course, the students will be able to 1. Illustrate storytelling elements and techniques to improve comprehension. 2. Construct business narratives to present products, services, and organizational initiatives. 3. Analyze storytelling strategies impacting communication and decision-making in business contexts.							
Sr. No.	Suggested List of Experiments/Activity						Duration [Hrs]
1	The Bridging Session: Discuss storytelling elements with reference to the short story <i>The Bet</i> by Anton Chekhov to illustrate their role in story writing.						2
2	Rewriting a Turning Point: Draft an alternate version of the given story by changing just that part.						2
3	Basics of Storytelling: Using Five Senses in a storytelling activity and elements of storytelling						2
4	Dialogue Writing: Writing dialogues for given situations to practice creating natural conversations that reveal character emotions and advance the narrative.						2
5	What Else?: Analysis of a self-written story using AI for perspective, detail and improvement.						2
6	Story from News: Convert a news headline into a narrative.						2
7	Product Journey Story: Journey of a product from Idea, Design, Market Launch, Failure/Success to Customer Feedback.						2
8	Customer Success Story: Craft a narrative that showcases a customer's journey with your fictional business.						2
9	Business Origin Story: Research and narrate a significant origin of a well-known business, focusing on how storytelling played a role in shaping its image in public.						2
10	Social Impact Story: Develop a story that demonstrates how a business initiative or project positively impacted a community or addressed a social issue.						2

11	Data to Story: Convert statistical data into narrative	2
12	Analysis of Story of Leaders: Highlight a leader's ability to motivate, inspire, and guide a team toward success.	2
13	Technical Narration: Simplify technical concepts through storytelling for non-technical audiences.	2
14	Ethical Decision-Making Scenario: Present a complex ethical dilemma faced by a business or individual. Use storytelling to explore various perspectives and potential solutions	2
15	Crisis Communication Case: Examine a business crisis scenario and analyze how effective communication strategies can help restore trust and reputation.	2
Total		30



Program:	B. Tech. CSE (AI& ML)					Semester: II		
Course:	Indian Knowledge System (IKS)					Code:	BSH32IK02	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	25	25	-	50
Prior knowledge: NIL								
Course Objectives: This course aims at enabling students, 1. To familiarize with the concepts of Indian Knowledge System 2. To get acquainted with the applications of Indian Knowledge System								
Course Outcomes: After learning the course, the students should be able to: 1. Explain the historical evolution, institutional frameworks, and modes of transmission of the Indian Knowledge System. 2. Describe key scientific and technological contributions of ancient India. 3. Apply ethical and leadership insights from Indian literary and art traditions. 4. Use traditional ecological knowledge to promote sustainable practices.								
Detailed Syllabus								
Unit								Duration [Hrs]
I	Unit 1: History and Development of the Indian Knowledge System <ul style="list-style-type: none"> ● Origins and Evolution: Vedic, Post-Vedic, Classical, and Medieval contributions to IKS ● Introduction to Vedas and ShadDarshanas as foundational sources of Indian philosophy, ● Transmission of Knowledge: Oral tradition, Shruti-Smriti, Guru Shishya Parampara, and Early Texts ● Institutional Framework: Ancient Indian universities (Takshashila, Nalanda, Vikramshila, Vallabhi) ● Revival: Modern relevance and efforts towards restoration 							7
II	Unit 2: Scientific and Technological Contributions of IKS <ul style="list-style-type: none"> ● Contributions to Mathematics (Baudhayana, Aryabhata, Brahmagupta, and Bhaskaracharya II) ● Astronomy and Cosmology (Surya Siddhanta, Jyotish Shastra, Astronomical Observatories) ● Metallurgy, Material Science, and Engineering (Iron Pillar, Wootz Steel, Zinc Distillation) ● Civil Engineering and Architecture (Vastu Shastra, Water Management Systems, Temple and City Planning) ● Yoga, Ayurveda and Traditional Healthcare Systems 							8

III	Unit 3: Literary, Performing and Artistic Traditions and festivals of India <ul style="list-style-type: none"> Contributions of Indian Literature to Ethics and Leadership (Ramayana, Mahabharata, Panchatantra & Nitishastra) Folk Traditions and Oral Narratives: Preserving local culture and wisdom Performing Arts and Knowledge Expression (Natya Shastra, Temple Art, Music and Dance Forms) Indian festivals as vibrant expressions of cultural values, community bonding, and sustainable environmental practices 	7
IV	Unit 4: Indigenous Technologies, Sustainability, and Ecology in IKS <ul style="list-style-type: none"> Environmental Ethics and Sustainability Practices in Ancient India Techniques for Conserving Water (Stepwells, Temple Tanks, and Dams) Agricultural Knowledge Systems (Crop Rotation, Indigenous Seeds, Zero Budget Natural Farming) Indigenous Knowledge in Disaster Management and Climate Adaptation Insights from IKS for Contemporary Sustainable Development 	8
Total		30
Textbooks: <ol style="list-style-type: none"> Mahadevan, B., Bhat, Vinayak Rajat, Nagendra Pavanan R.N. (2022), "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd., Delhi. Dharampal (2021), "Indian Science and Technology in the Eighteenth Century", ISBN10:8175310936. 		
Reference Books: <ol style="list-style-type: none"> Kapil Kapoor, Avadhesh Kumar Singh.(2005), "Indian Knowledge Systems" (Vol. 1 and Vol.2), ISBN-10:9788124603369. 		
E-sources: <ol style="list-style-type: none"> https://onlinecourses.swayam2.ac.in/ntr24_ed78/preview https://onlinecourses.swayam2.ac.in/imb24_mg20/preview https://iksindia.org/ 		

Program:	B. Tech. CSE (AI& ML)			Semester: II			
Course:	Life Skills 2			Code:	BSH32CC02		
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	50	-	-	50

Prior knowledge of: Basic understanding of concepts covered in Life Skills I.

Course Objectives: This course aims at enabling students to:

1. To introduce students to adaptability, inclusive behaviour, social responsibility and professional etiquette.
2. To enable students to practice ethical decision-making, life management skills and career planning strategies for effective professional development.

Course Outcomes: After learning the course, the students will be able to:

1. Describe the role of adaptability, social responsibility, and professional etiquette in academic and workplace situations.
2. Apply ethical reasoning, time management and basic financial planning to achieve academic and personal goals.
3. Prepare a structured career development plan according to the industry trends through professional networking

Detailed Syllabus

Expt. No	Suggested List of Experiments	Duration (Hrs)
1	Demonstrate Learning Agility: Demonstrate adaptability by responding to changing scenarios through simulation activities and reflection.	2
2	Practice Social Responsibility: Participate in eco-friendly or community service activities and study the Goonj case study to promote sustainable practices and community responsibility.	2
3	Learn Inclusive Behaviour: Engage in role plays and discussions to respect cultural and individual differences.	2

4	Demonstrate Workplace Etiquette: Demonstrate punctuality, accountability and professional communication through simulated workplace scenarios.	2
5	Collaborate on a Sustainability Challenge: Work in teams to design a small eco-friendly initiative while demonstrating inclusive behaviour, adaptability and professional communication.	2
6	Analyze Ethical Decision-Making: Analyze ethical dilemmas through case studies to identify fair and responsible decisions.	2
7	Organize Tasks Using Time Management Techniques: Organize academic tasks using priority-setting tools such as schedules or to-do lists.	2
8	Implement Anti-Procrastination Strategies: Practice habit stacking and the 5-minute rule to overcome procrastination.	2
9	Demonstrate Financial Literacy Skills: Demonstrate basic financial management through budgeting exercises and use AI tools to analyse spending patterns and digital transactions.	2
10	Life Management Scenario: Work in groups to solve a real-life scenario involving ethical choices, task planning, budgeting and managing procrastination.	2
11	Develop Strategic Professional Identity: Develop a short professional self-introduction highlighting personal strengths and professional skills.	2
12	Map Professional Relationships: Identify mentors, peers and career connections through a network map to see how relationships create opportunities.	2
13	Examine Industry Trends: Examine emerging industry trends and relate them to personal career goals.	2
14	Design a Personal Career Development Plan: Design a project outlining career goals and skill development strategies.	2
15	Present a Professional Development Portfolio: Present a portfolio demonstrating the role of adaptability and ethics in professional life.	2
Total		30

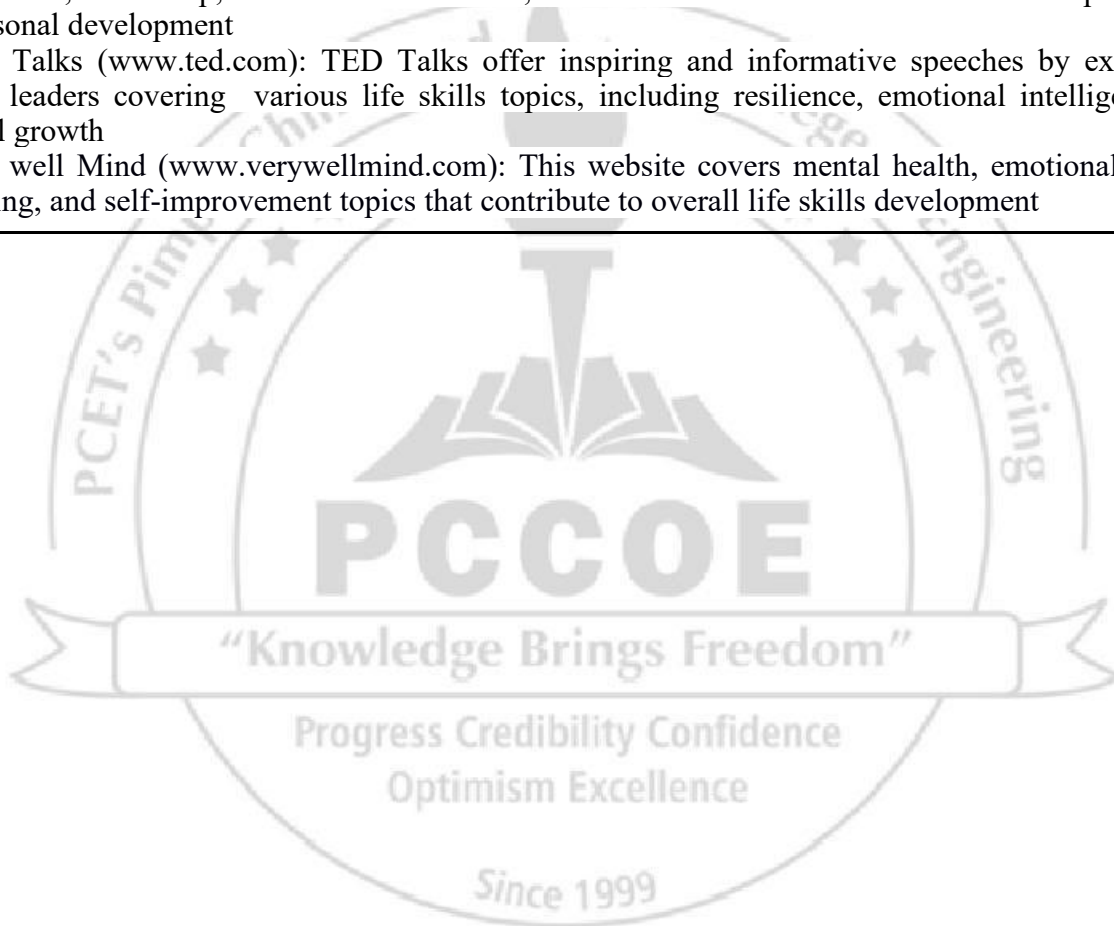
Reference Books:

1. "Mindset: The New Psychology of Success" by Carol S. Dweck Publisher: Ballantine Books

2. "The Financial Diet: A Total Beginner's Guide to Getting Good with Money" by Chelsea Fagan and Lauren VerHage 3. "Grit: The Power of Passion and Perseverance" by Angela Duckworth
Publisher: Scribner, 2018

E Sources -

1. Skills You Need (www.skillsyouneed.com): This website offers comprehensive information and practical guidance on a wide range of life skills, including communication, time management, problem-solving, and more
2. Mind Tools (www.mindtools.com): Mind Tools provides resources on personal effectiveness, leadership, communication skills, and other essential life skills to enhance professional and personal development
3. TED Talks (www.ted.com): TED Talks offer inspiring and informative speeches by experts and thought leaders covering various life skills topics, including resilience, emotional intelligence, and personal growth
4. Very well Mind (www.verywellmind.com): This website covers mental health, emotional well-being, and self-improvement topics that contribute to overall life skills development



Vision and Mission of Applied Sciences and Humanities (AS & H) Department

Vision

To provide value-added quality education that promotes essential technical skills, critical-thinking, communication skills and human values to make impactful contributions to the society.

Mission

Being a student-centric department, our mission is –

1. To develop a strong base of engineering sciences through innovative and experiential learning.
2. To provide excellent harmony of conducive environment and moral support for joyful learning.
3. To strive for overall development of students by providing the right platform to nurture all personality traits.
4. To create research attitude and endeavor innovation, creativity.

Vision and Mission of Computer Science and Engineering (AI&ML) Department

Vision

To provide value-based technical Education in Computer Science and Engineering with specialization in Artificial Intelligence and Machine Learning

Mission

M1: To develop technically competent and innovative computer science engineers with in-depth knowledge of Artificial Intelligence and Machine Learning.

M2: To build ethically responsible, knowledgeable and skilled engineers to serve the needs of industry and society at large.

M3: To provide conducive environment and opportunities for holistic development of students

