



Marathwada Shikshan Prasarak Mandal's

DEOGIRI INSTITUTE OF ENGINEERING AND MANAGEMENT STUDIES

(An Autonomous Institute)

Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad B.Tech. MTech.

Affiliated to Dr. Babasaheb Ambedkar Marathwada University, CSN MBA Approved

by AICTE/UGC-Govt. of India & DTE-Govt. of Maharashtra

Deogiri College Campus, Railway Station Road, Chhatrapati Sambhajinagar- 431 005 (M.S.)

DTE CODE : 2114

☎ 0240-2367567, 2367577

🌐 www.dietms.org

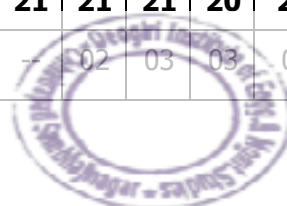
✉ director@dietms.org

B.TECH. (COMPUTER SCIENCE AND ENGINEERING) PROGRAM STRUCTURE (2025-29)

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course	BSC/ESC	08	07	--	--	--	--	--	--	15
Engineering Science Course		08	07	--	--	--	--	--	--	15
Program Core Course (PCC)	Program Courses	--	02	10	10	10	10	12	--	54
Program Elective Course (PEC)		--	--	--	--	04	06	04	06	20
Vocational Courses (Industrial Collaboration Course)	Skill Courses	--	--	--	--	--	--	02	--	10
Skill Enhancement Course (Professional Development)		01	01	01	01	02	02	--	--	
Ability Enhancement Course (AEC -01, AEC-02) (Ex. Language Lab, CS, EEE)	Humanities Social Science and Management (HSSM)	02	--	--	02	--	--	--	--	04
Entrepreneurship/Economics/ Management Courses		--	--	02	02	--	--	--	--	04
Indian Knowledge System (IKS)		--	02	--	--	--	--	--	--	02
Value Education Course (VEC) (Ex. UHV-II, Environmental Courses)		--	--	02	02	--	--	--	--	04
Constitution of India	Experiential Learning Courses	--	--	--	--	--	AU	--	--	AU
Do It Yourself (DIY)		AU	AU	01	01	01	01	01	--	05
Problem/Project Based Learning (PBL)		01	01	01	01	01	01	01	--	07
Internship/On Job Training (OJT)	Liberal Learning Courses	--	--	--	--	--	--	--	12	12
Co-curricular Courses (CC) (NSS / YOGA/ Health & Wellness)		01	01	--	--	--	--	--	--	02
Open Elective (OE)		--	--	04	02	02	--	--	--	08
Total Credits (Major)		21	21	21	21	20	20	20	18	162
Multidisciplinary Minor (MDM)	Multidisciplinary Courses	--	--	02	03	03	03	03	--	14

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• (B.E./ B.Tech. or Equivalent) in Engineering/ Technology with Multidisciplinary Minor • Major + MDM = 162+14 = 176 Credits										176
Honors and Multidisciplinary Minor	-	-	0	0	0	0	0	0	--	18
• 4 Year Bachelor's degree (B.E. / B.Tech. or Equivalent) in Engineering /Technology - Honors and Multidisciplinary Minor • Major + Honors + MDM = 162+18+14 = 194 Credits • Students with minimum CGPA of 7.5 without backlog courses at the end of Second semester and should have earned 42 credits are eligible for admission to the UG Bachelor's Degree with Honours										194
Honors with Research and Multidisciplinary Minor	-	-	--	--	--	--	0	8	1	18
• 4 Year Bachelor's degree (B.E. / B.Tech. or Equivalent) in Engineering /Technology - Honors with Research and Multidisciplinary Minor • Major + Research MDM = 162+18+14 = 194 Credits • Students with minimum CGPA of 7.5 without backlog courses at the end of Sixth semester and should have earned 124 credits are eligible for admission to the UG Bachelor's Degree with Research										194
Double Minors (Multidisciplinary and Specialization Minors)	-	-	0	0	0	0	0	0	--	18
• 4 Year Bachelor's degree (B.E. / B.Tech. or Equivalent) in Engineering /Technology – Major Engineering Discipline with double Minor (Multidisciplinary and Specialization Minors) • Major + MDM + Specialized Minor = 162+14+18 = 194 Credits • Students with minimum CGPA of 7.5 without backlog courses at the end of Second semester and should have earned 42 credits are eligible for admission to the UG Bachelor's Degree with Double Minor										194

Note:

1. Multiple entry & exit criteria will be in accordance with the AICTE/UGC/DTE/NEP-2020 guidelines.
2. For Audit course (AU), participation is mandatory but not include in grade calculations.
3. The Honours and Specialization Minor (Double Minor) offered by the program is exclusively for the Computer Science and Engineering students. Only students with minimum CGPA of 7.5 and no backlog at the end of Second Semester are eligible. Students must maintain a minimum CGPA of 7.5 and remain without backlog throughout the program. To earn the Honours and Specialization Minor (Double Minor), students must complete all the courses offered by the Department / Program.
4. Honours and Specialization Minor (Double Minor) courses shall be offered through the SWAYAM / NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards

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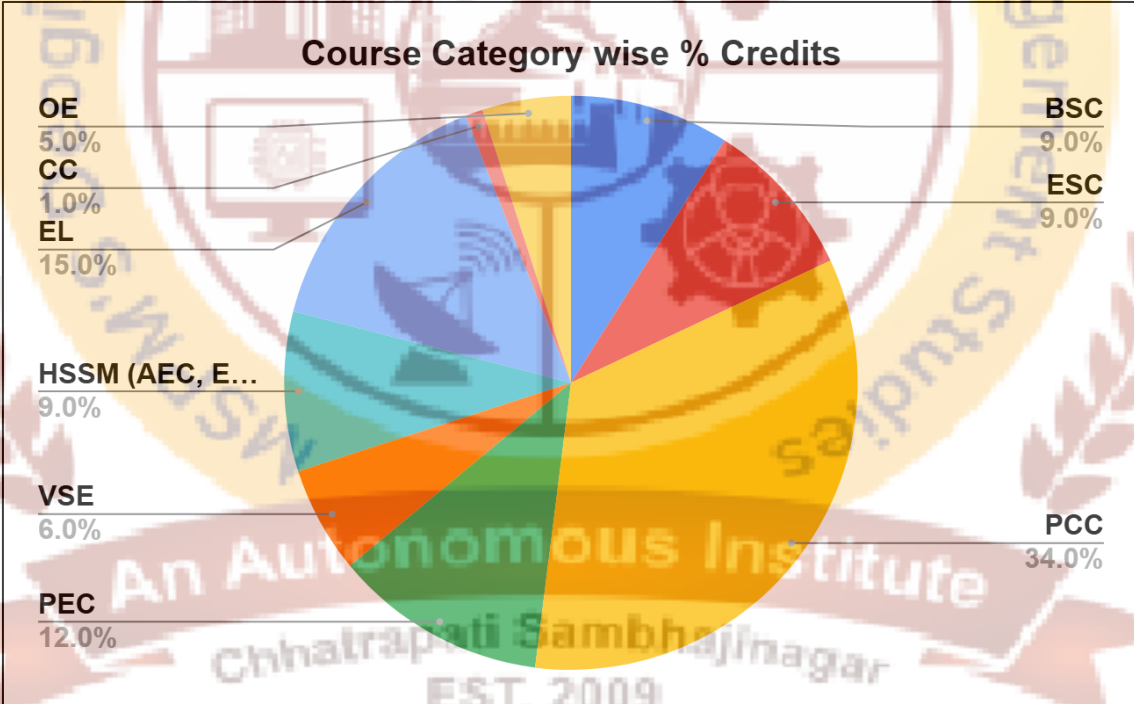
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B.Tech. in Computer Science and Engineering		
Course Category	Credits	% Credits
Basic Science (BSC)	15	9%
Engineering Science (ESC)	15	9%
Program Core Courses (PCC)	54	34%
Program Elective Courses (PEC)	20	12%
Vocational & Skill Enhancement (VSE)	10	6%
Humanity, Social Science & Management (AEC, EM, IKS, VEC) HSSM	14	9%
Experiential Learning (EL)	24	15%
Co-Curriculum Courses (CC)	02	1%
Open Electives (OE)	08	5%
Total Credits	162	



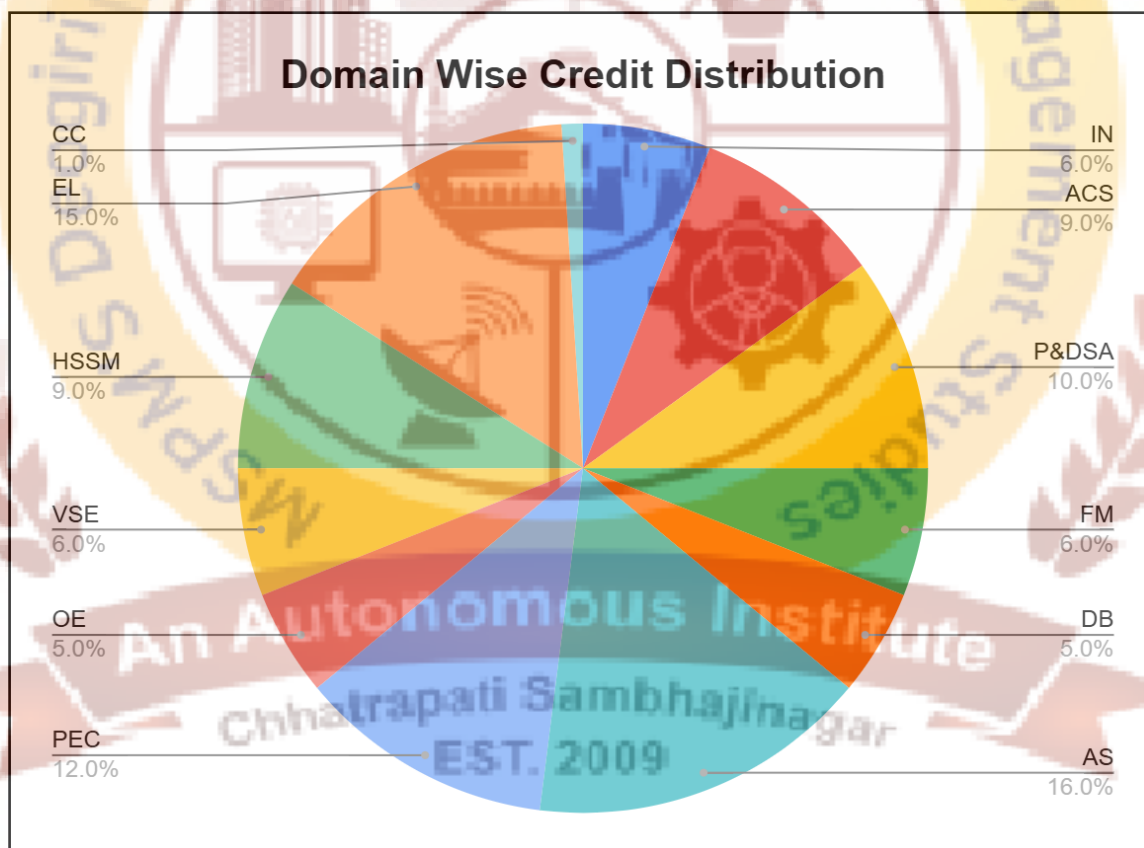
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B.Tech. in Computer Science and Engineering		
Domain	Credits	% Credits
Infrastructure and Networking (IN)	10	6%
Allied CS Courses (ACS)	15	9%
Programming and DSA (P&DSA)	16	10%
Formal Methods (FM)	09	6%
Database (DB)	08	5%
Allied Science (AS)	26	16%
Program Elective Courses (PEC)	20	12%
Open Electives (OE)	08	5%
Vocational & Skill Enhancement (VSE)	10	6%
Humanity, Social Science & Management (AEC, EM, IKS, VEC) HSSM	14	9%
Experiential Learning (EL)	24	15%
Co-Curriculum Courses (CC)	02	1%
Total Credits	162	



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SEMESTER I													
Category	Course Code	BOS	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
				L	T	PR	Total	CA-I	CA-II	MSE	ESE	Total	
BSC	CK251001	BSH	Engineering Mathematics I	3	1		4	10	10	20	60	100	4
BSC	CK251002	BSH	Applied Science I	3			3	10	10	20	60	100	3
ESC	GE251101	ME	Engineering Graphics	3			3	10	10	20	60	100	3
ESC	GE251102	ET	Basic Electronics and Electrical Engineering	3			3	10	10	20	60	100	3
HSSM-AEC	GE251701	BSH	Modern Indian Language I	2			2	10	10	20	60	100	2
BSC	CK251003	BSH	Applied Science I Lab			2	2	15	15		20	50	1
ESC	GE251103	ME	Engineering Graphics Lab			2	2	15	15		20	50	1
ESC	CK251104	ME	Workshop Practices			2	2	15	15		20	50	1
LLC	GE251902	BSH	Sports			2	2	25	25			50	1
ELC	GE251801	-	PBL: Design Thinking Lab			2	2	15	15		20	50	1
ELC	GE251804	ET	Do It Yourself II			2	2	25	25			50	AU
SE-SEC	GE251601	-	Professional Development I			2	2	15	15		20	50	1
Total				14	1	14	29					800	21

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SEMESTER II

Category	Course Code	BOS	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
				L	T	PR	Total	CA-I	CA-II	MSE	ESE	Total	
BSC	CK252004	BSH	Engineering Mathematics II	3			3	10	10	20	60	100	3
BSC	CK252005	BSH	Applied Science II	3			3	10	10	20	60	100	3
ESC	CK252105	CS	Programming for Problem Solving	3			3	10	10	20	60	100	3
ESC	CK252106	CE	Engineering Mechanics	3			3	10	10	20	60	100	3
PCC	CS252201	CS	IT Workshop	2			2	10	10	20	60	100	2
HSSM-IKS	GE252702	BSH	Indian Knowledge System	2			2	10	10	20	60	100	2
BSC	CK252006	BSH	Applied Science II Lab			2	2	15	15		20	50	1
ESC	CK252107	CS	Programming for Problem Solving Lab			2	2	15	15		20	50	1
LLC	GE252901	BSH	NSS			2	2	25	25			50	1
ELC	GE252803	-	PBL: Engineering Exploration Lab			2	2	15	15		20	50	1
ELC	GE252802	ME/C E	Do It Yourself I			2	2	25	25			50	AU
SC-SEC	GE252602	-	Professional Development II			2	2	15	15		20	50	1
Total				16		12	28					850	21

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SEMESTER III													
Category	Course Code	BOS	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
				L	T	PR	Total	CA-I	CA-II	MSE	ESE	Total	
PCC	CS253202	CS	Discrete Mathematics and Statistics	3			3	10	10	20	60	100	3
PCC	CS253203	CS	Data Structures	3			3	10	10	20	60	100	3
PCC	CS253204	CS	Operating System	3			3	10	10	20	60	100	3
#HSSM-EEMC	CS253703	CS	Financial Management	2			2	10	10	20	60 [#]	100	2
#HSSM-VEC	GE253704	BSH	Universal Human Values II	2			2	10	10	20	60 [#]	100	2
*OE	CS253501	CS	Open Elective I	4			4	10	10	20	60	100	4
PCC	CS253205	CS	DS and OS Lab			2	2	15	15		20	50	1
SC-SEC	GE253603	CS	Professional Development III			2	2	15	15		20	50	1
ELC	CS253805	CS	Do It Yourself III			2	2	15	15		20	50	1
ELC	CS253806	CS	PBL: Problem based Learning			2	2	15	15		20	50	1
Total for Major				17		8	25					900	21
*MDM	CS253401	CS	MDM I	2			2	10	10	20	60	100	2
Total for Major with Multidisciplinary Minor (Mandatory Credits)													23
HMM	CS253206	CS	HMM I	2			2	10	10	20	60	100	2
OR (Students will be allotted for either HMM or DM as per defined criteria)													
DM	CS253207-208	CS	DM I	2			2	10	10	20	60	100	2
Total for Major with MDM + (HMM/DM)				21		8	29					1100	25

*Courses offered by the Computer Science and Engineering department for other department students.

#End semester Evaluation will be done at department level.

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SEMESTER IV													
Category	Course Code	BOS	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
				L	T	PR	Total	CA-I	CA-II	MSE	ESE	Total	
PCC	CS254209	CS	Object Oriented Programming using JAVA	3			3	10	10	20	60	100	3
PCC	CS254210	CS	Computer Architecture and Organization	3			3	10	10	20	60	100	3
PCC	CS254211	CS	Database Management System	3			3	10	10	20	60	100	3
#HSSM-AEC	GE254705	BSH	Modern Indian Language II	2			2	10	10	20	60 [#]	100	2
\$HSSM-EEMC	CS254706	CS	Entrepreneurship Development	2			2	10	10	20	60 ^{\$}	100	2
#HSSM-VEC	CS254707	CS	Environmental and Sustainable Engineering	2			2	10	10	20	60 [#]	100	2
*OE	CS254502	CS	Open Elective II	2			2	10	10	20	60	100	2
PCC	CS254212	CS	OOPJ and DBMS Lab			2	2	15	15		20	50	1
SC-SEC	CS254604	CS	Professional Development IV			2	2	15	15		20	50	1
ELC	CS254807	CS	Do It Yourself IV			2	2	15	15		20	50	1
ELC	CS254808	CS	PBL IV: Problem to Project based Learning			2	2	15	15		20	50	1
Total for Major				17		8	25					900	21
*MDM	CS254402	CS	MDM II	3			3	10	10	20	60	100	3
Total for Major with Multidisciplinary Minor (Mandatory Credit)													24
HMM	CS254213	CS	HMM II	4			4	10	10	20	60	100	4
OR (Students will be allotted for either HMM or DM as per defined criteria)													
DM	CS254214-215	CS	DM II	4			4	10	10	20	60	100	4
Total for Major with MDM + (HMM/DM)				23		8	31					1100	28

* Courses offered by the Computer Science and Engineering Department for Other Departments Students.

End semester evaluation will be done at departmental level

\$ End semester evaluation will be done at departmental level by open book examination

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Open Elective Bucket Offered by All Departments						
Department	OE I (SEM III)		OE II (SEM IV)		OE III (SEM V)	
	Credit: 4		Credit: 2		Credit: 2	
	Course code	Course Name	Course code	Course Name	Course code	Course Name
Mechanical	ME253501	Mechatronics	ME254504	3D Printing Technologies	ME255507	3D Printing and Rapid Prototyping
	ME253502	Project Management for Engineers	ME254505	Robotics and Automation	ME255508	EV Technology
	ME253503	Numerical Methods in Engineering	ME254506	Energy Storage and Management Systems	ME255509	Renewable Energy Sources
Civil	CE253501	Environmental Impact Assessment	CE254504	Remote Sensing and Geographic Information Systems	CE256507	Interior Designs and Drawing
	CE253502	Experimental Stress Analysis	CE254505	Town Planning	CE256508	Development Engineering
	CE253503	Composite Materials	CE254506	Operation Research	CE256509	Planning for Sustainable Development
E&TC	ET253501	Digital Electronics	ET254504	Sensors and Actuators	ET255507	Internet of Things
	ET253502	Signals & Systems	ET254505	Electrical Machines	ET255508	Instrumentation Engineering
	ET253503	Electronic Devices and Circuits	ET254506	Computer Architecture	ET255509	Wireless Communication Basics
CSE*	CS253501	C Programming	CS254504	Object Oriented Programming using Java	CS255507	Advanced JAVA
	CS253502	Data Science and Analytics	CS254505	Fundamentals of Machine Learning	CS255508	Artificial Intelligence and Applications
	CS253503	Open Source and Software Technology	CS254506	Web Development Technologies	CS255509	Computer Network and Security
AIML	AI253501	Python Programming	AI254504	Cyber Security Fundamentals	AI255507	Internet of Things
	AI253502	Prompt Engineering	AI254505	Artificial Intelligence &	AI255508	Autonomous Intelligent

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				Data Science		System
	AI253503	Components and Applications of the Internet of Things	AI254506	Ethical Hacking	AI255509	Quantum Computing

***The Open Elective (OE) courses offered by the Department of Computer Science and Engineering are exclusively intended for students of other departments and are not open to students of the Computer Science and Engineering Department.**




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Multidisciplinary Minor (MDM) Courses Offered by All Departments										
Department	MDM-I (SEM III)		MDM-II (SEM IV)		MDM- III (SEM V)		MDM- IV (SEM VI)		MDM-V (SEM VII)	
	Credit: 2		Credit: 3		Credit: 3		Credit: 3		Credit: 3	
	Course code	Course Name	Course code	Course Name	Course code	Course Name	Course code	Course Name	Course code	Course Name
Mechanical	ME253401	Basic Mechanical Engineering	ME254402	Metrology and Mechanical Measurements	ME255403	Product Design and Development	ME256404	Smart Materials	ME257405	Automobile Engineering
Civil	CE253401	Basic Civil Engineering	CE254402	Building Construction and Materials	CE255403	Building Planning & Drawing	CE254404	Building Estimates & Tendering	CE254405	Construction Management
E&TC	ET253401	Basic Electronics and Communication Engineering	ET254402	Digital Electronics and Logic Design	ET255403	Microprocessors and Microcontrollers	ET256404	Communication Systems and Networking	ET257405	Embedded Systems
CSE*	CS253401	Introduction to Computer Systems	CS254402	Computational Statistics Fundamental for AI	CS255403	Predictive Analytics and Visualization Fundamentals	CS256404	Machine Learning Fundamental	CS257405	Introduction to Prompt Engineering
AIML	AI253401	Database Systems	AI254402	Computational Statistics for AI	AI255403	Predictive Analytics and Visualization	AI256404	Advanced Machine Learning	AI257405	Prompt Engineering

***The MDM courses offered by the Department of Computer Science and Engineering are exclusively intended for students of other departments and are not open to students of the Computer Science and Engineering Department.**

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****Honors**

Semester	Code	BOS	Courses	No. of Credits
SEM III	CS253206	CSE	SWAYAM/NPTEL	2
SEM IV	CS254213	CSE	SWAYAM/NPTEL	4

****Specialization Minor (Double Minor)**

Semester	No. Of Credits	Programing Track		Full Stack Development Track
SEM III	2	DM I		
		Course Code	CS253207	CS253208
		BOS	CSE	CSE
		Course	SWAYAM/NPTEL	SWAYAM/NPTEL
SEM IV	4	DM II		
		Course Code	CS254214	CS254215
		BOS	CSE	CSE
		Course	SWAYAM/NPTEL	SWAYAM/NPTEL

**The Honors and Specialization Minor (Double Minor) offered by the Department of Computer Science and Engineering is exclusively for Computer Science and Engineering students. Only students with a minimum CGPA of 7.5 and no backlogs at the end of the Second Semester are eligible. Students must maintain a minimum CGPA of 7.5 and remain without backlogs throughout the program. To earn the Specialization Minor (Double Minor), students must complete one specialization track in a Computer Science and Engineering domain offered by the Department. These courses shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards.

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Course Title: Discrete Mathematics and Statistics Course Code: CS253202			Course Category: PCC
Teaching Scheme		Examination Scheme	
Lectures: 03 hrs. / week		CA-1	10 Marks
Tutorial: –		CA-2	10 Marks
Credits: 03		MSE	20 Marks
Semester: Second Year (Semester III)		ESE	60 Marks
Course Prerequisite: • Basic Mathematics – Arithmetic operations, fractions, percentages, ratios, algebraic manipulation. • Basic Statistics – Mean, median, mode, probability basics.			
Course Description: This course introduces core concepts of discrete mathematics and statistics designed for Computer Science, AI/ML, and Data Science applications. It develops logical reasoning through propositional logic, predicates, and inference techniques used in algorithms and intelligent systems. The course covers sets, functions, relations, graphs, and trees, forming the foundation for data structures, networks, and machine learning models. It also introduces statistical methods, probability, and distributions essential for data analysis and predictive modeling. Further, it focuses on inferential statistics and hypothesis testing for data-driven decision-making and model evaluation.			
Course Objectives: 1. To develop logical reasoning skills using propositional logic, predicates, and rules of inference for solving computational problems. 2. To understand fundamental concepts of sets, functions, relations, graphs, and trees for their applications in computer science and data structures. 3. To introduce statistical methods and probability theory for analyzing data and understanding uncertainty in real-world scenarios. 4. To apply inferential statistical techniques, including hypothesis testing, for data-driven decision making and evaluation of models in AI/ML and data science.			

Course Outcomes:		
COs	After completion of the course students will be able to	Bloom's Level
CO1	Recall fundamental concepts of propositional logic, set theory, graph theory, statistics, probability, and hypothesis testing.	Remember (Level 1)
CO2	Explain principles of logical reasoning, set operations, functions, graph structures, statistical measures, probability distributions, and hypothesis testing procedures.	Understand (Level 2)
CO3	Demonstrate logical rules, set operations, graph algorithms, statistical measures, and probability concepts to solve computational and data analysis problems.	Apply (Level 3)
CO4	Examine complex problems using logical inference, graph-based models, statistical methods, and hypothesis testing techniques for data-driven decision making.	Analyze (Level 4)

CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	–	–	–	–	–	–	–	–	2	1	1
CO2	3	2	1	1	–	–	–	–	–	–	2	2	1
CO3	3	3	2	2	2	–	–	–	–	1	2	3	2
CO4	3	3	2	3	2	1	–	–	–	1	3	3	2

Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test etc.
MSE (c)	Subjective Test

Course Contents		
Unit 1	Introduction to Propositional Logic Propositions, truth values, truth tables for operators, truth tables of compound propositions, precedence of logical operators. Propositional equivalences: logical equivalences, constructing new logical equivalences, normal forms. Predicates and quantifiers, universal and existential, nested quantifiers, order of quantifiers, negating nested quantifiers. Rules of inference: valid arguments in propositional logic, Rules of inference for propositional logic, using rules of inference to build arguments, resolution, fallacies.	6 Hrs.
Unit 2	Basic Discrete Structures Sets: Venn diagrams, subsets, size of a set, power sets, cartesian products, set operations, Function: subjective, injective, bijective and inverse functions, composition of function, relation and its properties, equivalence and partial order relations, Pigeonhole principle, permutation and combination	6 Hrs.
Unit 3	Graph and Trees Basic terminology, multi graphs and weighted graphs, Paths and circuits, shortest path problems, Euler and Hamiltonian paths, representation of graphs, isomorphic graphs, planar graphs, connectivity, matching coloring. Trees: Rooted trees, Path length in rooted tree, Binary search trees, spanning trees and cut set, Minimal spanning trees, Kruskal's and Prim's algorithms for minimal spanning tree.	6 Hrs.
Unit 4	Introduction to Statistics Introduction to statistics, population and sample, Types of statistical data- categorical, numerical (Continuous), ordinal, interval, ratio, univariate and bivariate analysis, measures of central tendency: mean, median, mode, harmonic mean, measures of dispersion - variance, standard deviation and coefficient of variation, outliers, data visualization- line graph, scatter, box plots, histogram.	6 Hrs.

Unit 5	Probability and Distributions Basics of probability- random experiments, sample space, events, axioms of probability, addition and multiplication laws of probability, conditional probability and independence, Bayes' theorem, discrete vs continuous random variables, Introduction to inferential statistics, what is distribution, concept of probability distributions, expectation(mean) and variance, skewness and interpretations, kurtosis.	6 Hrs.
Unit 6	Hypothesis Testing and Statistical Tests Typical analysis procedures, introduction to inferential statistics, point estimation, confidence intervals, hypothesis testing concept, null and alternative hypotheses, Type I and Type II errors, rejection region, level of significance, p-value, one-tailed and two-tailed tests, tests on numerical data- distribution of sample mean, comparison of two groups- Z-test. Real-world case study on hypothesis testing in data-driven decision making.	6 Hrs.

Sr. No.	Textbooks
1.	S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, 7th Revised and Enlarged Edition, 2016.
2.	C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2008.
Sr. No.	Reference Books
1.	Kishor S. Trivedi, Probability, Statistics with Reliability, Queuing and Computer Science Applications, Wiley India Pvt. Ltd, 2nd Edition, 2001.
2.	Murray Spiegel, John Schiller, R. ALU Srinivasan, Probability and Statistics, Schaum's Outlines, 4th Edition, 2013.
3.	Kenneth H. Rosen, Discrete Mathematics and its Applications, McGraw-Hill Publication, 6th Edition, 2010
4.	Lipschutz, Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2009
Sr. No.	Web Resources
1.	NPTEL - Discrete Mathematics (IIT Ropar) https://onlinecourses.nptel.ac.in/noc26_cs68/
2.	NPTEL - Introduction to Probability and Statistics (IIT Madras) https://onlinecourses.nptel.ac.in/noc26_mg59/
3.	Udemy - Discrete Mathematics 1 https://www.udemy.com/courses/search/?q=discrete+mathematics&src=sac&kw=discrete+Mathema
4.	Coursera -Probability & Statistics for Machine Learning & Data Science https://www.coursera.org/learn/machine-learning-probability-andstatistics

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R. Arul
Chairman, BoS
CSE Engg.

Course Title: Data Structures Course Code: CS253203			Course Category: PCC
Teaching Scheme		Examination Scheme	
Lectures: 03 hrs. / week		CA-1	10 Marks
Tutorial: -		CA-2	10 Marks
Credits: 03		MSE	20 Marks
Semester: Second Year (Semester III)		ESE	60 Marks
Course Prerequisite: • Programming Languages fundamentals: Familiarity with data types, variables, operators, Input/output statements, conditional and control statements, Pointers, Arrays, Strings • Problem-Solving Skills: Logical thinking and algorithmic approach to solving problems, Ability to write simple algorithms or flowcharts.			
Course Description: This course introduces fundamental data structures and their applications in efficient problem solving. Students learn arrays, linked lists, stacks, queues, trees, and graphs, along with algorithm design, complexity analysis, and memory management. Emphasis is placed on implementation, performance tradeoffs, and real-world use cases to develop logical thinking and programming skills for scalable software development in modern computing environments today.			
Course Objectives: 1. Explain fundamental concepts of data, data types, data structures, and Abstract Data Types (ADT), and analyze algorithms in terms of time and space complexity. 2. Solve computational problems by applying appropriate data structures such as arrays, hash tables, stacks, queues, and linked lists. 3. Implement tree and graph data structures, including binary trees, binary search trees, heaps, and adjacency matrix representations, and perform related operations and traversals. 4. Demonstrate proficiency in searching and sorting algorithms, including sequential, binary search, skip lists, insertion sort, selection sort, and radix sort. 5. Select and implement suitable data structures and algorithms to develop efficient, maintainable, scalable software solutions.			

Course Outcomes:		
COs	After completion of the course: Students should be able to	Bloom's Level
CO1	Identify fundamental concepts of data structures, abstract data types (ADTs), algorithm design principles and their classifications.	Remember (Level 1)
CO2	Explain the representation and types of linear and nonlinear data structures.	Understand (Level 2)
CO3	Demonstrate the operations of linear and non-linear data structures, including arrays, linked lists, stacks, queues, trees, and graphs.	Apply (Level 3)
CO4	Examine the efficiency of algorithms and data structures using time and space complexity	Analyze (Level 4)
CO5	Implement and explore data structure operations and algorithms (such as traversal, insertion, deletion, searching, and sorting) to solve real-world problems effectively.	Analyze (Level 4)

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CSE Engg.

CO-PO-PSO Mapping

CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	–	–	–	–	–	–	–	–	1	2	1
CO2	3	2	–	–	–	–	–	–	–	–	–	2	1
CO3	2	2	1	–	–	–	–	–	–	–	–	2	1
CO4	3	3	–	1	–	–	–	–	–	–	1	3	1
CO5	3	2	2	1	–	–	–	1	1	–	1	3	1

Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test etc.
MSE (c)	Subjective Test

Course Contents		
Unit 1	Introduction Data, Data types, Data structure, Classification of Data Structures, Abstract Data Type (ADT), representation of Information, Characteristics of algorithm, Analyzing programs, Performance Analysis of Algorithms, Types of Algorithms Analysis, Asymptotic Notations.	6 Hrs.
Unit 2	Arrays and Hash Tables Introduction, Array Operations, representation of Arrays in Memory, Implementation of One- & Two-Dimensional Arrays in Memory, Concept of sequential organization, Linear and non-linear data structures, Storage representation, Array processing, Sparse matrices, Transpose of sparse matrices, Hash table, Direct address tables, Hash tables, Hash functions, Open addressing, Perfect hashing.	6 Hrs.
Unit 3	Linked list Concept of linked organization, Singly and doubly linked list, Circular linked list, Operations such as insertion, deletion, concatenation, traversal of linked list, dynamic memory allocation concepts, garbage collection and memory management basics.	6 Hrs.
Unit 4	Stacks and Queues Introduction, stack and queue as ADT, Representation and implementation of stack and queue using Sequential and linked allocation, Circular queue and its implementation, Priority queue. Application of stack for expression evaluation and expression conversion, Recursion.	6 Hrs.

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Unit 5	Trees and Graphs Basic terminology, Binary trees and its representation, Insertion and deletion of nodes in binary tree, Binary search tree and its traversal, Threaded binary tree, Heap, Balanced Trees, Terminology and representation of graphs using adjacency matrix, Warshall's algorithm.	6 Hrs.
Unit 6	Searching and Sorting Sequential, Binary searching, Skip lists – dictionaries, Skip list representation, operations – insertion, deletion, searching, Insertion sort, Selection sort, Radix sort, Merge sort.	6 Hrs.

Sr. No.	Textbooks
1.	Weiss, Data structures and algorithms analysis in C++, Pearson Education, 4th Edition, 2013
2.	Horowitz and Sahani, Fundamentals of Data Structures, Universities Press, 2nd Edition, 2008
Sr. No.	Reference Books
1.	S. Lipschutz, Data Structures, McGraw-Hill Publication, Revised 1st Edition, 2014
2.	Y. Langsam, M. Augenstein, A. Tanenbaum, Data Structure using C and C++, Prentice Hall India Learning Private Limited, 2nd edition, 1998
3.	Thomas Cormen, Introduction to Algorithms, PHI Publication, 2nd Edition, 2002
4.	Venkatesan & Rose, Data Structures, Wiley Publication, 1st Edition, 2015
5.	Goodrich & Tamassia, Data Structure & Algorithm in C++, Wiley Publication, 2nd Edition, 2011.
Sr. No.	Web Resources
1.	NPTEL course: Programming, data structures and algorithms using Python (IITM): https://onlinecourses-archive.nptel.ac.in/noc18_cs34/

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R. M. Arora
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CSE Engg.

Course Title: Operating Systems Course Code: CS253204		Course Category: PCC	
Teaching Scheme		Examination Scheme	
Lectures: 03 hrs / week		CA-1	10 Marks
Tutorial: –		CA-2	10 Marks
Credits: 03		MSE	20 Marks
Semester: Second Year		ESE	60 Marks
Course Prerequisite: Basic understanding of programming (C or any high-level language), Fundamentals of Computer System, Concepts of data structures such as arrays, stacks, queues, and linked lists			
Course Description: This course provides a comprehensive understanding of operating system concepts, design principles, and functionalities. It focuses on process management, scheduling, synchronization, memory management, file systems, and I/O management. The course enables students to understand how operating systems efficiently manage hardware and software resources.			
Course Objectives: 1. To understand fundamental concepts and functions of operating systems 2. To study process management, scheduling, and synchronization mechanisms. 3. To analyze memory management and virtual memory techniques 4. To explore file systems and I/O management 5. To evaluate Operating System performance and resource management strategies			

Course Outcomes:		
COs	After completion of the course students should be able to:	Bloom's Level
CO1	Define fundamental concepts of operating systems including processes, memory, file systems, and Input/output management.	Remember (Level 1)
CO2	Explain the structure, services, and working of operating system components such as scheduling, synchronization, memory, and file management.	Understand (Level 2)
CO3	Implement Operating system algorithms for process and resource management	Apply (Level 3)
CO4	Utilize process management, memory management and virtual memory techniques for efficient resource utilization in operating systems.	Apply (Level 3)
CO5	Compare the performance of operating system techniques including scheduling, synchronization, memory, and disk management.	Analyze (Level 4)
CO6	Select appropriate operating system strategies for efficient system and resource management.	Evaluate (Level 5)

CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	-	-	1	-	-	-	1	-	1	2	3
CO3	3	3	2	1	2	-	-	-	-	-	1	3	2
CO4	3	2	2	1	2	-	-	-	-	-	1	3	2
CO5	3	3	2	2	2	1	-	-	1	-	2	3	2
CO6	3	3	3	2	2	1	1	-	1	-	2	3	2

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Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test etc.
MSE (c)	Subjective Test

Course Contents		
Unit 1	Introduction to Operating System Operating System definition and functions, User view, System view, Operating System structures(Layered, Micro Kernel,Modular), Operating System services, System Calls, Types of system calls, Types of OS: Batch, Multiprogramming, Time sharing, Parallel, Distributed & Real-time, System Design and Implementation, System Generations.	6 Hrs.
Unit 2	Process and CPU Scheduling Process Concept, process State Transition, Process Scheduling, Operation on process, Inter-process Communication, Introduction to threads:Multi threading models, Scheduling Criteria, Types of Scheduling: Preemptive, Nonpreemptive, Long-term, Medium-term, Short-term. Scheduling Algorithms: First Come First Serve(FCFS), Shortest Job First(SJF), Shortest Remaining Job First(SRTF), Priority, Round Robin,etc.	6 Hrs.
Unit 3	Process Synchronization and Deadlock Synchronization: The critical-section problem, Critical regions, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of synchronization, and Monitors Deadlocks: Systems Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined approach to deadlock Handling.	6 Hrs.
Unit 4	Memory Management Logical and Physical address, Memory Allocation, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning,, Fragmentation, Paging, Segmentation, Address translation, Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit.	6 Hrs.
Unit 5	Virtual Memory Concept of Virtual Memory, Swapping, Demand Paging, Page Table (Basic Idea),Translation Lookaside Buffer (TLB),Page Replacement Algorithms (First In First Out, List Recent Use, Optimal),Thrashing and Performance Issues	6 Hrs.
Unit 6	I/O and File Management File concepts, File organization, File operations, File directories, File System Implementation, I/O devices, Types and characteristics of devices, OS design issues for I/O management, Disk Structure, Disk scheduling algorithms: First Come First Serve, Shortest Seek Time First(SSTF), SCAN, C-SCAN, Swap Space Management	6 Hrs.

Sr. No.	Textbooks
1.	William Stallings, Operating Systems: Internals and Design Principles, Pearson Publication, 8th Edition, 2018.
2	Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, Operating Systems: Three Easy Pieces, CreateSpace Publication, 2018.
	Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Operating System Concepts, Wiley Publication, 8th Edition, 2008.
Sr. No.	Reference Books
1.	Andrew S. Tanenbaum, Modern Operating System, PHI Publication, 4th Edition, 2015.
2.	D. M. Dhamdhere, Systems Programming and Operating Systems, McGraw-Hill, 2nd Edition, 1996.
3.	Garry Nutt, Operating Systems Concepts, Pearson Publication, 3rd Edition, 2003.
4.	Harvey M. Deitel, An Introduction to Operating Systems, Addison Wesley Publication, 2nd Edition, 1990.
5.	Thomas W. Doeppner, Operating System in Depth: Design and Programming, Wiley Publication, 2011
Sr. No.	Web Resources
1.	https://archive.nptel.ac.in/courses/106/105/106105214/
2.	https://onlinecourses.nptel.ac.in/noc21_cs72/preview
3.	Coursera:(https://www.coursera.org)
4.	https://codex.cs.yale.edu/avi/os-book/OS8/os8c/slide-dir/

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R. M. Arpaci
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Course Title: Financial Management Course Code: CS253703		Course Category: HSSM-EEMC
Teaching Scheme		Examination Scheme
Lectures: 02 hrs. / week	CA-1	10 Marks
Tutorial: -	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks
Course Prerequisite: • Basic Accounting Knowledge • Mathematics and Analytical Skills, Economics Fundamentals, Business Studies Basics • Computer Literacy and Critical Thinking and Decision-Making Skills.		
Course Description: Financial Management provides a foundational understanding of how to plan, manage, and control an organization's financial resources effectively. The course covers essential topics such as financial analysis, investment and financing decisions, working capital management, and emerging trends in finance. Students will develop analytical and decision-making skills to address financial challenges and optimize organizational performance, preparing them for careers in finance, banking, and entrepreneurship.		
Course Objectives: 1. A comprehensive understanding of financial management concepts and principles. 2. Skills to analyze financial statements for effective decision-making. 3. Techniques for evaluating investment opportunities and understanding risk-return trade-offs. 4. Knowledge of working capital management and financing decisions. 5. Insights into modern financial practices and emerging trends in finance.		

Course Outcomes:		
COs	After completion of the course students will be able to	Bloom's Level
CO1	Explain the fundamental concepts of financial management, including objectives, roles of a finance manager, and key financial decisions.	Understand (Level 2)
CO2	Implement methods using various sources of finance and compute the cost of capital components, including cost of equity, debt, and WACC for decision-making.	Apply (Level 3)
CO3	Examine financial statements to evaluate business performance using ratio analysis techniques such as liquidity, solvency, profitability, and turnover ratios.	Analyze (Level 4)
CO4	Assess investment opportunities and working capital requirements using capital budgeting techniques and working capital management principles.	Evaluate (Level 5)

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CO-PO-PSO Mapping

CO-PO-PSO Mapping													
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	1	-	-	-	-	-	-	1	2	1	1	2
CO2	2	2	1	-	2	-	-	-	-	2	1	2	3
CO3	2	3	-	2	2	-	-	-	1	2	1	2	2
CO4	2	3	2	1	2	1	-	-	1	3	2	2	3

Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test etc.
MSE (c)	Subjective Test

Course Contents		
Unit 1	Finance Management – Conceptual Foundations: Introduction to Business Finance, Objectives of Financial Management, Roles and Responsibilities of Finance Manager, Finance Decisions: Investment Decision; Financing Decisions; and Dividend Decisions, Wealth maximization vs. profit maximization.	4 Hrs.
Unit 2	Planning and Analysis: Meaning and importance of financial planning, Introduction to Income Statement and Balance Sheet, Theoretical overview of Ratio-based analysis: liquidity, solvency, profitability, and turnover ratios.	4 Hrs.
Unit 3	Sources of Finance and Cost of Capital: Internal and External Financing: Concept and difference. Long-term and short-term sources of finance. Concept of cost of capital: cost of equity, cost of debt, preference shares, and weighted average cost of capital (WACC) – theoretical overview	4 Hrs.
Unit 4	Capital Budgeting: Meaning of Capital Budgeting, Nature and Characteristic, Importance, Objective, Capital Budgeting Techniques: Payback Period; Discounted Payback Period; IRR; ARR; NPV, Factors Affecting Capital Budgeting Decisions, Limitations of Capital Budgeting	4 Hrs.
Unit 5	Working Capital: Concept of working capital, operating cycle, Nature of working-capital, Types of Working Capital, Profitability v/s Liquidity, Inventory Management: Types, Motives of holding inventory, Cash Management- Motives of Holding Cash, Factors Determining Cash, Receivables in credit management. Brief overview of credit-policy decisions (collection period, credit terms).	4 Hrs.

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Unit 6	Working Capital Financing: Meaning of Working Capital Financing, Need, Short term and long-term Financing, Trade Credit, Bank credit: OD; Term Loan; CC; Hypothecation Loan; Bill Discounting	4 Hrs.
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Sr. No.	Textbooks
1.	Financial Management I M Pandey (Vikas Publishing House), 11th Edition (2015)
2.	Financial Management -Prassana Chandra (Tata McGraw Hill), 11th Edition (2023)
3.	Financial Management -Rajiv Srivastava and Anil Mishra (Oxford University press), 2 nd Edition (2011)
Sr. No.	Reference Books
1.	Financial Management Theory & Practice and Eugene F. Brigham/Michael C. Ehrhardt's, 17th Edition (2023)
2.	Fundamentals of Financial Management by James C. VanHorne, 13th Edition (2010)
3.	Financial Management: Text and Problems, MY Khan and PK Jain, 8th Edition (2008)
4.	Brealey and Myers., Principles of corporate finance (710h ed.), Tata McGraw Hill, 7 th Edition(2003)
Sr. No.	Web Resources
1.	Corporate Finance---By Prof. Abhijeet Chandra IIT Kharagpur https://onlinecourses.nptel.ac.in/noc21_mg93/preview
2.	Financial Management for Managers—Prof. Anil K Sharma https://onlinecourses.nptel.ac.in/noc20_mg31/preview

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R. Anil Kumar
Chairman, BoS
CSE Engg.

Course Title: Universal Human Values II**Course Code: GE253704****Course Category: HSSM-VEC**

Teaching Scheme	Examination Scheme	
Lectures: 02 hrs. / Week	CA-1	10 Marks
Tutorial: -	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks

Course Prerequisite: Universal Human Values I

Course Description: This course introduces the fundamentals of **value education**, focusing on self-exploration, human aspirations, and continuous happiness. It emphasizes harmony within the individual, in relationships, society, and nature. The course develops understanding of **human values, ethics, and professional responsibility**. It encourages students to adopt a **holistic and sustainable approach** to life and decision-making. Learners are guided to apply these values in personal and professional contexts.

Course Objectives:

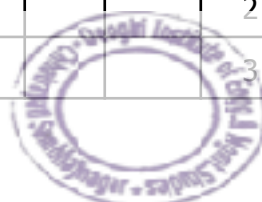
1. Explain the concept of value education, self-exploration, and the relationship between happiness, prosperity, and basic human aspirations.
2. Distinguish between the needs of self and the body and apply methods to achieve harmony within the individual and between the self and the body.
3. Demonstrate understanding of harmony in the family and society by applying foundational values such as trust and respect in human relationships.
4. Analyze the interconnectedness and mutual fulfilment among the four orders of nature and relate it to sustainable living and coexistence.
5. Apply a holistic understanding of human values to professional ethics, decision-making, and strategies for value-based life and profession.

Course Outcomes:

COs	After completion of the course students will be able to	Bloom's Level
CO1	Define the concepts of value education, human aspirations, harmony in human beings, family, society, nature and professional ethics.	Remember (Level 1)
CO2	Explain the role of self-exploration, human values, relationships and harmony in achieving continuous happiness and prosperity.	Understand (Level 2)
CO3	Demonstrate the interrelationship among human beings, society, nature and ethical conduct for universal human order.	Apply (Level 3)
CO4	Distinguish the human values and professional ethics in personal and professional life.	Analyze (Level 4)

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						2	3	1			3		
CO2						2	3	2			3		
CO3						3	3	2			2		
CO4						3	3	3			3		

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Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test
CA-2 (b)	Subjective Test / Assignment/ MCQ Test
MSE (c)	Subjective Test
ESE (d)	Exam

Course Contents		
Unit 1	Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity, the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity, Current Scenario, Method to Fulfill the Basic Human Aspirations.	4 Hrs.
Unit 2	Harmony in the Human Being Understanding human beings as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, Harmony of the Self with the Body, self-regulation, and Health.	4 Hrs.
Unit 3	Harmony in the Family and Society: Harmony in the Family, the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect'– as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order	4 Hrs.
Unit 4	Harmony in Nature (Existence) Understanding Harmony in Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.	4 Hrs.
Unit 5	Implications of Holistic Understanding Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order.	4 Hrs.
Unit 6	Value-Based life and Professional Practices Competence in Professional Ethics- Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.	4 Hrs.

Sr. No.	Textbooks
1.	A Foundation Course in Human Values and Professional Ethics R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Sr. No.	Reference Books
1.	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

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3.	The Story of Stuff (Book).
4.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5.	Small is Beautiful - E. F Schumacher.
6.	Slow is Beautiful - Cecile Andrews
7.	Economy of Permanence - J C Kumarappa
8.	Bharat Mein Angreji Raj - Pandit Sunderlal
9.	Rediscovering India - by Dharampal
10.	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11.	India Wins Freedom - Maulana Abdul Kalam Azad
12.	Vivekananda - Romain Rolland (English)
13.	Gandhi - Romain Rolland (English)
Sr. No.	Web Resources
1.	https://uhv.org.in/UHV-II_Course_Material

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R. Anil Kumar
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Course Title: C Programming
Course Code: CS253501

Course Category: OE

Teaching Scheme	Examination Scheme	
Lectures: 04 hrs. / week	CA-1	10 Marks
Tutorial: –	CA-2	10 Marks
Credits: 04	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks

Course Prerequisite: Basic computer literacy, fundamental mathematical and logical reasoning skills.

Course Description: This course introduces the fundamentals of the C programming language and structured programming concepts. It covers problem-solving techniques using algorithms, flowcharts, control structures, functions, arrays, pointers, structures, and file handling. Students will learn to design, implement, debug, and test C programs for solving computational problems. The course emphasizes modular programming practices and efficient memory management. It provides a strong foundation for advanced programming and software development courses.

Course Objectives:

- To introduce the fundamental concepts of C programming and problem-solving techniques.
- To provide knowledge of control structures, functions, arrays, pointers, and dynamic memory allocation.
- To familiarize students with structures, unions, and file handling for developing modular programs.
- To develop students' programming, debugging, and logical thinking skills for solving computational problems.

Course Outcomes:

COs	After completion of the course: Students should be able to	Bloom's Level
CO1	Explain the fundamentals of C programming, including algorithms, flowcharts, data types, operators, expressions, and control flow statements.	Understand (LEVEL 2)
CO2	Develop C programs using decision-making, looping constructs, functions, recursion, and storage classes to solve computational problems.	Apply (LEVEL 3)
CO3	Implement arrays, strings, pointers, and dynamic memory allocation concepts to design efficient C programs.	Apply (LEVEL 3)
CO4	Investigate real-world problems and identify appropriate data science methodologies for developing effective solutions.	Analyze (LEVEL 4)
CO5	Evaluate programming problems and develop modular C-based solutions using appropriate programming constructs and debugging techniques.	Analyze (LEVEL 4)

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CO-PO-PSO Mapping

CO-PO-PSO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	-	2	2	1
CO2	3	3	2	-	2	-	-	-	-	-	-	2	3	3
CO3	3	3	3	1	3	-	-	-	-	-	-	2	3	3
CO4	3	3	3	2	3	-	-	-	-	-	-	2	3	3
CO5	3	3	3	3	3	-	-	-	1	1				

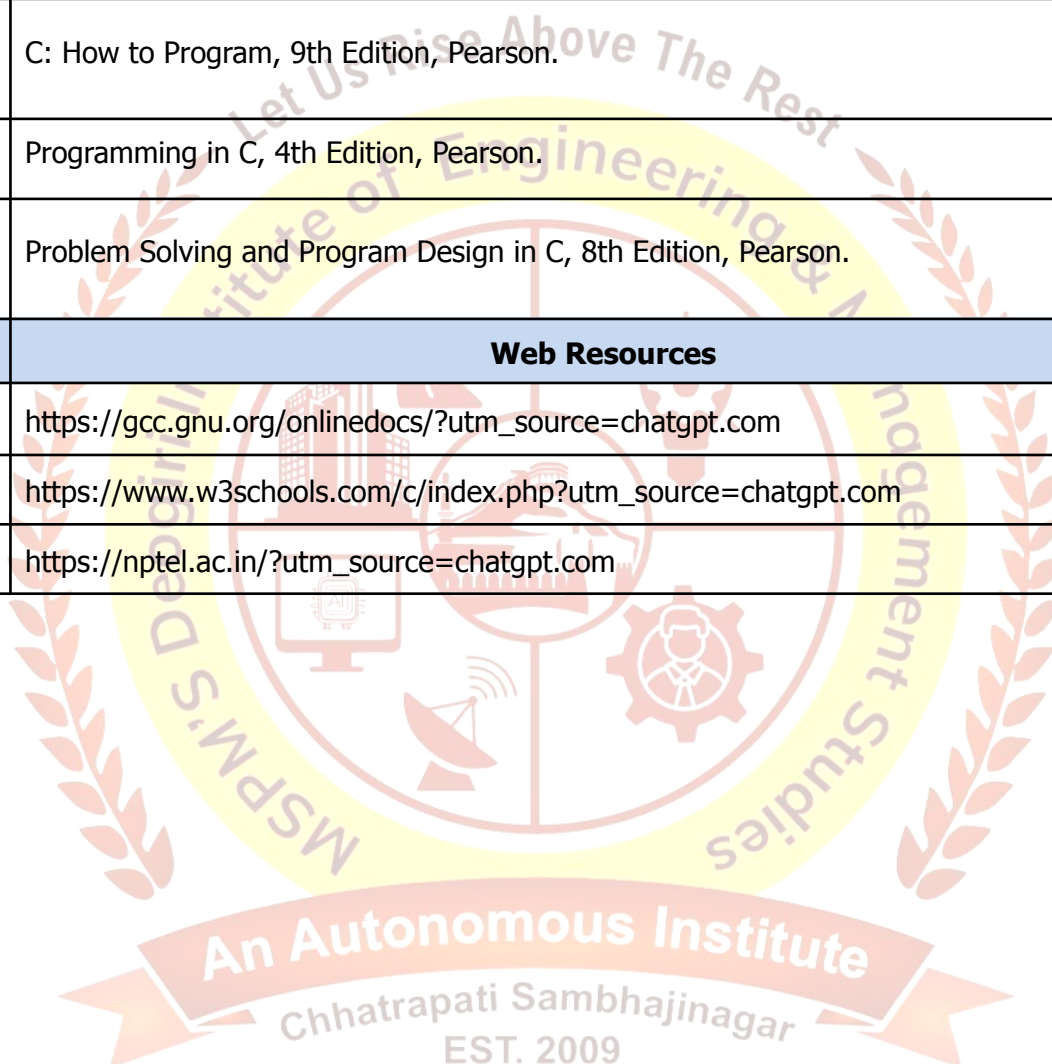
Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test etc.
MSE (c)	Subjective Test

Course Contents		
Unit 1	Introduction to C Programming : Introduction to programming, Problem-solving techniques, Algorithm, Pseudocode, Flowchart, Programming language translation process (Compiler, Interpreter, Assembler), Structure of a C program, Character set, Tokens, Keywords, Identifiers, Variables, Constants, Data Types, Input/Output functions (printf(), scanf()), Operators, Expressions, Operator precedence & associativity, Type conversion.	8 Hrs.
Unit 2	Control Flow Statements : Decision-making statements: if, if-else, Nested if, else-if ladder, switch; Iterative statements: for, while, do-while; Nested loops; Jump statements: break, continue, goto; Development of simple C programs using control statements.	8 Hrs.
Unit 3	Functions and Storage Classes: Modular programming, User-defined functions, Standard library functions, Function declaration, definition and calling, Parameter passing, Call by value, Call by reference using pointers, Recursive functions, Scope and lifetime of variables, Storage classes (auto, register, static, extern), Passing arrays to functions.	8 Hrs.
Unit 4	Arrays and Strings: One-dimensional arrays, Two-dimensional arrays, Multidimensional arrays, Array operations, Introduction to strings, String declaration and initialization, String input/output functions, Standard string manipulation functions (strlen(), strcpy(), strcat(), strcmp(), etc.), String/data conversion functions.	8 Hrs.
Unit 5	Pointers and Structures: Pointer concepts, Pointer arithmetic, Pointers and arrays, Arrays of pointers, Void pointers, Function pointers, Dynamic memory allocation (malloc(), calloc(), realloc(), free()), Structures, Arrays of structures, Nested structures, Pointers to structures, Unions and applications.	8 Hrs.
Unit 6	File Handling in C: File concepts, Types of files (Text and Binary), File opening and closing, File input/output functions (fprintf(), fscanf(), fgetc(), fputc(), fgets(), fputs(), fread(), fwrite()), Error handling functions, File positioning functions (fseek(), ftell(), rewind()), Practical applications of file handling.	8 Hrs.

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Sr. No.	Textbooks
1.	Programming in ANSI C, E. Balagurusamy , 8th Edition, McGraw Hill Education, 2023.
2.	The C Programming Language, 2nd Edition, Pearson Education.
Sr. No.	Reference Books
1.	Let Us C, 18th Edition, BPB Publications.
2.	Programming with C, 4th Edition, Schaum's Outline Series, McGraw Hill.
3.	C: How to Program, 9th Edition, Pearson.
4.	Programming in C, 4th Edition, Pearson.
5.	Problem Solving and Program Design in C, 8th Edition, Pearson.
Sr. No.	Web Resources
1.	https://gcc.gnu.org/onlinedocs/?utm_source=chatgpt.com
2.	https://www.w3schools.com/c/index.php?utm_source=chatgpt.com
3.	https://nptel.ac.in/?utm_source=chatgpt.com



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Course Title: Data Structures and Operating System Lab		
Course Code: CS253205		Course Category: PCC
Teaching Scheme	Examination Scheme	
Practical/Sessions: 02 hrs. / week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester III)	ESE	20 Marks

Assessment	
CA-I (a) (15M)	As per practical evaluation sheet
CA-II (b) (15M)	As per practical evaluation sheet

Sr. No.	List of Experiments
1.	To design and implement one dimensional and two dimensional arrays to understand traversal, insertion, deletion and its memory address calculation.
2.	To implement a singly linked list and doubly linked list to understand its operations .
3.	To implement a stack using an array and linked list to understand its working principle.
4.	To implement a queue using an array and linked list to demonstrate its operations.
5.	To implement a circular queue using an array and linked list to demonstrate its operations.
6.	To implement operations on binary tree and binary search tree to understand its working principle.
7.	To implement and perform comparison of linear search and binary search to demonstrate the difference of their working.
8.	To implement and perform comparison of selection and insertion sort to understand their working principle.
9.	To study and implement basic system calls such as <code>getpid()</code> and <code>getppid()</code> , and to understand process creation and synchronization using <code>fork()</code> and <code>wait()</code> system calls.
10.	To design and implement CPU scheduling algorithms such as FCFS and SJF to understand process scheduling and performance parameters.
11.	To implement the Producer–Consumer synchronization problem to understand process synchronization using basic variables.
12.	To implement Banker’s Algorithm to understand deadlock avoidance and safe resource allocation.
13.	To design and implement memory allocation algorithms such as First Fit and Best Fit to understand efficient memory utilization.
14.	To implement page replacement algorithms such as FIFO and LRU to understand page faults and memory management techniques.
15.	To study and implement virtualization using a virtual machine to understand resource sharing and system isolation.
16.	To evaluate and compare the features, architecture, and functionalities of Windows and Linux operating systems.

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Course Title: Professional Development III**Course Code: GE253603****Course Category: SC-SEC**

Teaching Scheme	Examination Scheme	
Practicals/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester III)	ESE	20 Marks

Course Prerequisite: Basic Computer Literacy, Mathematical Knowledge, Keyboard Skills.

Course Description: This course introduces students to essential office productivity tools used for professional documentation, presentations, and data management. Students will learn to create and format documents using word processing software, design effective presentations using presentation tools, and organize and analyze data using spreadsheet applications. The course emphasizes hands-on practice with features such as formatting, charts, data validation, pivot tables, and spreadsheet functions. Through practical exercises, students will develop skills in preparing professional documents, visual presentations, and structured data sheets. The course is important for improving digital literacy and enabling students to efficiently handle academic, professional, and workplace documentation tasks.

Course Objectives:

1. To introduce students to the fundamental features and tools of office productivity software used for document preparation, presentations, and spreadsheet management.
2. To provide practical exposure to creating, formatting, and presenting professional documents and presentations using appropriate digital tools.
3. To familiarize students with spreadsheet techniques for organizing, managing, and visualizing data using charts, tables, and formatting tools.
4. To develop digital competency by training students in spreadsheet functions, data validation, pivot tables, and other tools for efficient data handling and analysis in academic and professional environments.

Course Outcomes:

COs	After completion of the course, students will be able to	Bloom's Level
CO1	Recall fundamental concepts, features, and interfaces of office productivity tools including word processing, presentation software, spreadsheets, and professional email communication.	Remember (Level 1)
CO2	Explain the working principles, functionalities, and best practices of word processing, presentation design, spreadsheet operations, and email writing etiquettes for professional communication.	Understand (Level 2)
CO3	Apply office productivity tools to create structured documents, professional emails, effective presentations, and organized spreadsheets using appropriate features and formatting techniques.	Apply (Level 3)
CO4	Analyze and interpret data using spreadsheet techniques such as charts, validation, pivot tables, and functions to support information processing and decision-making in real-world scenarios.	Analyze (Level 4)

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CO-PO-PSO Mapping:

CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	-	-	2	-	-	-	1	-	1	-	1
CO2	1	1	-	-	2	-	1	-	2	-	1	-	2
CO3	2	1	1	-	3	-	1	1	3	1	1	1	3
CO4	2	3	1	2	3	-	-	1	2	1	2	2	3

Assessment	
CA-I (a)	Performance & Evaluation of activities on word & Presentation Module.
CA-II (b)	Performance & Evaluation of activities on spreadsheet Module
ESE (c)	Viva-voce/Activity Evaluation of different module.

Sr. No.	List of Experiments/Activities
1.	To explore word processor interface and navigation tools for efficient document handling and professional drafting.
2.	To apply basic text entry and formatting tools in word processor for creating structured documents.
3.	To apply advanced formatting techniques for consistency and improved presentation of created report.
4.	To create presentations using slides, themes, and multimedia elements for effective communication.
5.	To analyze and modify presentation designs using software tools for improving visual impact.
6.	To perform data entry and worksheet formatting in spreadsheet software for organized data management.
7.	To apply conditional formatting and create charts in spreadsheets for data visualization.
8.	To implement data validation and filtering techniques in spreadsheets for accurate data analysis.
9.	To generate pivot tables using spreadsheet tools for summarizing and analyzing large datasets.
10.	To apply spreadsheet functions (text, date-time, mathematical, statistical, and logical) for data processing and decision-making.
11.	To explore email significance, navigation tools and Id creation to inculcate essential principles.
12.	To compose professional emails using proper email writing etiquettes for effective workplace communication.

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Sr. No.	Textbooks
1.	Abigail Rusu, Andrea Long, Heather Maye, Jennifer Evans, Amy Ledgerwood, and Jeanine Preuss, Introduction to Microsoft Office, Maricopa Millions Grant.
2.	Helen Holding, Clare Martin, Mastering Microsoft Office, Red Globe Press.
3.	R. P. Soni, Harshal Arolkar, Sonal Jain, Working with Personal Computer Software, Wiley India.
	Reference Books
1.	Stephanie Krieger, Documents, Presentations, and Workbooks: Using Microsoft Office to Create Content That Gets Noticed, Microsoft Press.
2.	Marjorie S. Hunt, Barbara Clemens, Illustrated Microsoft Office 365 & Office 2016, Cengage Learning.
3.	Linda Foulkes, Learn Microsoft Office 2019, Packt Publishing.
	Web Resources
1.	Step-by-step learning resources for office software, https://www.tutorialspoint.com/word https://www.tutorialspoint.com/excel https://www.tutorialspoint.com/powerpoint
2.	Spreadsheet concepts and functions tutorials, https://www.w3schools.com/excel

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Course Title: Do It Yourself (DIY)		
Course Code: CS253805		Course Category: ELC
Teaching Scheme	Examination Scheme	
Practical's /Sessions: 02 Hours/Week	CA-I	15 Marks
Credit: 1	CA-II	15 Marks
Semester: III	ESE	20 Marks
Course Prerequisite: Basic knowledge of computer fundamentals, operating system concepts, and elementary networking concepts. Familiarity with handling computer hardware components and basic command-line usage will be helpful. This fits the practical activities on identifying computer components, OS installation, LAN setup, Wi-Fi setup, and Linux challenges.		
Course Description: This course provides hands-on exposure to essential computer systems, operating systems, and networking practices. It includes identification of computer hardware components, formatting storage devices, installation of operating systems, dual-boot setup, LAN cable preparation, peer-to-peer and star network configuration, wireless LAN setup using a Wi-Fi router, and Linux-based problem-solving activities.		
Course Objective: To develop practical skills in computer hardware identification, operating system installation and configuration, basic wired and wireless networking, and Linux-based system handling through activity-based learning.		

Course Outcomes:		
COs	After completion of the course students will be able to	Bloom's Level
CO1	Identify the major components of a computer system and explain their basic functions in system operation.	Understand Level 2
CO2	Perform formatting of storage devices and install/configure single-boot and dual-boot operating systems as per given specifications.	Apply Level 3
CO3	Prepare and configure wired and wireless network setups, including LAN cables, peer-to-peer networks, star topology, switch-based LAN, and Wi-Fi router-based wireless LAN.	Apply Level 3
CO4	Assess and solve basic Linux-based system and networking challenges using appropriate commands, tools, and troubleshooting steps.	Analyze Level 4

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CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	-	-	1	-	2
CO2	2	1	-	-	3	-	-	-	-	1	2	1	2
CO3	2	2	1	1	3	-	-	2	1	1	2	3	2
CO4	2	3	-	2	3	-	-	1	-	-	3	2	2

Assessment	
CA-I (a) (15M)	Students will be assessed on their ability to identify computer system components and perform foundational system-related practical tasks, including formatting of storage devices, installation of operating systems, installation of dual boot operating systems, and preparation of straight-through and crossover LAN cables. Assessment will be based on correctness of procedure, successful execution, understanding of the activity performed, and viva/oral performance related to the practical work.
CA-II (b) (15M)	Students will be assessed on their ability to configure and demonstrate basic networking and Linux-related practical activities, including peer-to-peer network connection and file/folder sharing, implementation of star topology using a switch with resource sharing, physical LAN setup using a switch, wireless LAN configuration using a Wi-Fi router, and Linux-based challenge solving. Assessment will be based on practical execution, configuration accuracy, troubleshooting ability, demonstration of outcomes, and viva/oral performance.

Sr. No.	List of Activities
1.	Identify the different components of the computer system
2.	Demonstrate Formatting of HDD as per the Given Specifications and Installation of an Operating System
3.	Demonstrate Installation of Dual Boot Operating System
4.	Prepare a Straight Through and Crossover LAN Cable
5.	Prepare P2P Network Connection and Sharing of Files and Folders
6.	Prepare a Star Network Using a Switch and Sharing of Resources
7.	Prepare a Physical LAN Using a Switch
8.	Prepare a Wireless LAN Using a Wi-Fi Router
9.	Solving Linux based Challenge Part – 1
10.	Solving Linux based Challenge Part - 2

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Sr. No.	Textbooks
1.	PC Hardware and A+ Handbook – Kate J. Chase
2.	Computer Networks – Andrew S. Tanenbaum
3.	Operating System Concepts – Abraham Silberschatz, Peter B. Galvin, Greg Gagne
4.	Linux Administration: A Beginner's Guide – Wale Soyinka
5.	Data Communications and Networking – Behrouz A. Forouzan
	Reference Books
1.	Upgrading and Repairing PCs – Scott Mueller
2.	UNIX and Linux System Administration Handbook – Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley
3.	The Linux Command Line – William E. Shotts Jr.
4.	Computer Networking: A Top-Down Approach – James F. Kurose, Keith W. Ross
5.	Linux Bible – Christopher Negus
	Web Resources
1.	https://ubuntu.com/tutorials
2.	https://www.linux.org/docs/
3.	https://www.kernel.org/doc/html/latest/
4.	https://www.cisco.com/c/en_in/training-events/networking-academy.html
5.	https://www.gnu.org/software/bash/manual/

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R. V. Apte
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Course Title: PBL: Problem based Learning		
Course Code: CS253806		Course Category: ELC
Teaching Scheme	Examination Scheme (As Applicable)	
Practicals/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester III)	ESE	20 Marks
Course Prerequisite: • Basic Computer Knowledge: Understanding of fundamental computer operations such as file handling, operating systems, and using software applications. Familiarity with concepts like memory, input/output devices, and basic troubleshooting.. • Logical and Analytical Thinking: Ability to think logically and solve problems step-by-step. Basic understanding of algorithms, flowcharts, or problem-solving approaches is helpful. • Familiarity with Text Editors or IDEs: Basic experience using tools like code editors (e.g., Notepad++, VS Code) or any Integrated Development Environment (IDE) is beneficial. • Design Thinking Module		
Course Description: This course enables students to learn engineering concepts through solving real-world course related technical problems at detailed project level. It emphasizes application of domain knowledge, critical thinking, and systematic problem-solving. In this course students will remain engaged in need identification, solution development, prototyping, and validation within given constraints. The course promotes teamwork and hands-on learning. Outcomes are demonstrated through a representational prototype of proposed solution along with detailed documentation. The course coordinators will guide to the students in the journey of problem solving by providing the resources in the lab activity sessions and also monitor the students progress.		
Course Objectives: 1. To enable students to apply domain knowledge for solving real-world course related technical problems through a structured problem-based learning approach. 2. To guide students in analyzing problems, generating feasible solutions, and making informed engineering decisions. 3. To facilitate the development of design, implementation, and testing skills through project-based activities. 4. To cultivate teamwork, communication, and professional skills through continuous mentoring and evaluation.		

Course Outcomes:		
COs	After completion of the course student will be able to	Bloom's Level
CO1	Understand real-world engineering problems by identifying basic requirements, limitations, and relevant knowledge.	L2 Understand
CO2	Apply engineering concepts, tools, and methods to develop a working solution.	L3 Apply
CO3	Analyze engineering problems by connecting theory with practical situations and finding possible solution approaches.	L4 Analyze
CO4	Evaluate different engineering solutions based on factors like feasibility, cost, efficiency, and sustainability.	L5 Evaluate
CO5	Create and present engineering solutions by testing performance and explaining results clearly.	L6 Create

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2		1								2	2
CO2	3	2	2	2	2			2			1	3	2
CO3	3	3	3	1	1			2			1	3	2
CO4	2	2	3	2	2	1		1			1	3	3
CO5			3		2			3	2	2	2		

Assessment	
CA-I (a)	Identify a real-life problem related to your subject. Clearly explain the problem, understand the needs of users, and list the important constraints (such as cost, materials, and time). Study existing solutions for the same problem. Then, generate different possible solutions and select the best one based on practicality, cost, and effectiveness.
CA-II (b)	Based on the selected solution, design and build a representational model of prototype. Prepare a proper plan, use suitable tools and methods to develop it. Make improvements if needed, and finally demonstrate the representational model with clear documentation.
ESE (c)	Assigned Task Completion.

Sr. No.	List of Experiments/Activities
1.	To identify a course-related technical problems.
2.	To define the problem clearly with objectives, basic requirements, and constraints.
3.	To study existing solutions or methods related to the problem and find the gap
4.	To generate different possible solutions using basic engineering concepts.
5.	To select the best solution based on different applicable criteria's i.e. feasibility, simplicity, and cost-effectiveness.

6.	To prepare the design, list of materials and use the required tools for the solution.
7.	To develop a basic representational model of prototype using available resources.
8.	To test the developed solution based on the peer-reviewed feedback.

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9.	To improve the solution based on test results and feedback.
10.	To present the final solution and prepare a simple technical report.

Sr. No.	Textbooks
1.	Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers.
2.	Nigel Cross, Engineering Design Methods: Strategies for Product Design, John Wiley & Sons.
	Reference Books
1.	Guerra, Aida, Ulseth, Ronald, Kolmos, Anette, PBL in Engineering Education: International Perspectives on Curriculum Change, Springer, 2017.
	Web Resources
1.	NPTEL Online Courses- Problem Based learning, NITTTR. (https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr20_ed12)

Sr. No.	Textbooks
1.	Henry Korth, Abraham Silberschatz & S. Sudarshan, Database System Concepts, McGraw-Hill Publication, 6th Edition, 2011.
2.	Navathe, Fundamentals of Database System, Addison-Wesley Publication, 6th Edition, 2012.
3.	MongoDB: The Definitive Guide, Kristina Chodorow, O'Reilly Media, 2nd Edition, 2013.
Sr. No.	Reference Books
1.	Thomas M. Connolly, Carolyn E. Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", Addison Wesley, fifth Edition, 2014
2.	Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill Publication, 3rd Edition, 2003
3.	Joel Murach, Murach's Oracle SQL and PL/SQL for Developers, Mike Murach & Associates, 2nd Edition, 2014.
4.	C. J. Date "Introduction to Database Systems", Addison Wesley, Seventh Edition, 2000
5.	Atul Kahate, "Introduction to Database Management System", Third Edition, Pearson Education, 2013
Sr. No.	Web Resources
1.	NPTEL course: Database management system (IITK): https://onlinecourses.nptel.ac.in/noc21_cs04/
2.	https://www.geeksforgeeks.org/dbms/dbms/
3.	NPTEL Course: https://onlinecourses.nptel.ac.in/noc26_cs39/preview

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Course Title: Introduction to Computer System
Course Code: CS253401

Course Category: MDM

Teaching Scheme	Examination Scheme	
Lectures: 02 hrs. / week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks

Course Prerequisite:

- Basic knowledge of computers, including familiarity with computer hardware and software, computer applications and web browsers.

Course Description: This course provides foundational knowledge of computer hardware, software, operating systems, networking, and cybersecurity. It introduces programming fundamentals and basics of Artificial Intelligence along with their applications and limitations. The course will also develop awareness of safe computing practices, AI ethics, responsible technology use, and essential digital skills.

Course Objectives:

- To introduce students to the fundamental concepts of computer hardware, software
- To develop understanding of basic computer networking, Internet technologies, cybersecurity threats, security mechanisms, and safe Internet practices.
- To develop programming skills through algorithms, flowcharts, data types, operators, control structures, functions, and basic data structures.
- To familiarize students with Artificial Intelligence concepts, applications, Machine Learning, Deep Learning, Generative AI, NLP, Computer Vision, and the principles of ethical and responsible AI use.

Course Outcomes:

COs	After completion of the course students should be able to	Bloom's Level
CO1	Recall fundamental concepts of computer hardware and software	Remember (Level 1)
CO2	Explain concepts of computer networks, Internet, networking devices, communication protocols, and cybersecurity practices	Understand (Level 2)
CO3	Use programming fundamentals such as algorithms, flowcharts, code to solve simple problems.	Apply (Level 3)
CO4	Illustrate applications of Artificial Intelligence while recognizing AI ethics and responsible use	Analyze (Level 4)

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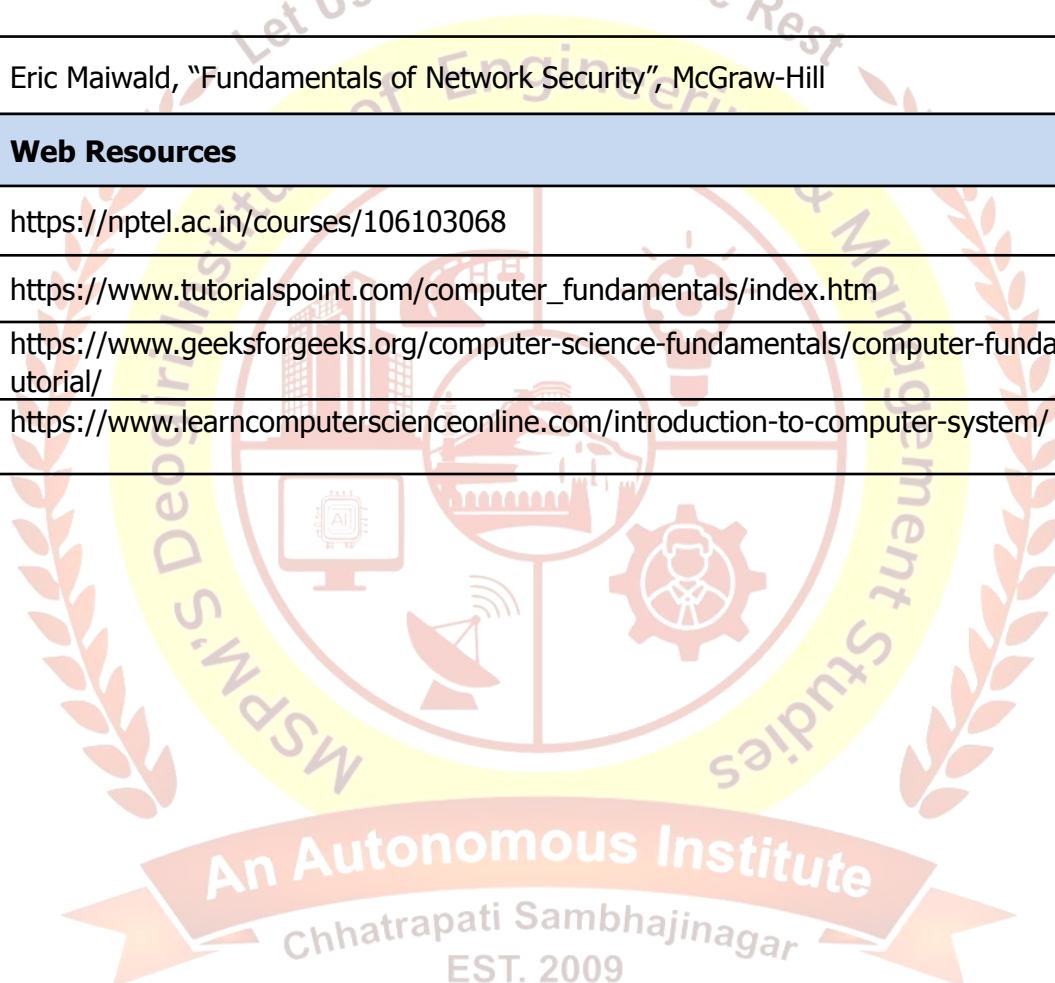
CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	1	1	-	3	-	-	-	-	-	2		
C02	2	2	1	1	3	2	3	1	-	-	2		
C03	3	3	3	2	3	1	1	1	-	-	3		
C04	3	2	2	1	3	3	3	1	-	1	3		

Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test etc.
MSE (c)	Subjective Test

Course Contents		
Unit 1	Hardware Components Introduction to computers and functional units Input devices, CPU: ALU, Control Unit and registers, Primary and secondary memory, RAM, ROM and cache memory, Storage devices, Output devices	4 Hrs.
Unit 2	Software Components Introduction to software, System software and application software, Operating systems, Utility software, Programming languages, Compiler, interpreter and assembler	4 Hrs.
Unit 3	Computer Networking Basics of computer networks, Types of networks: LAN, MAN and WAN, Network topologies, Networking devices, Internet and World Wide Web, IP address and basic network protocols, Email and web browsers.	4 Hrs.
Unit 4	Introduction to Security Basics of computer and cyber security, Security threats and vulnerabilities, Viruses, malware and ransomware, Phishing and social engineering, Password and data security, Antivirus and firewall, Safe Internet practices.	4 Hrs.
Unit 5	Programming Fundamentals Introduction to programming, Algorithms and flowcharts, Variables, constants and data types, Operators and expressions, Input and output, Conditional statements and loops, Functions and basic data structures.	4 Hrs.
Unit 6	Introduction to AI Introduction and history of Artificial Intelligence, AI applications, AI, Machine Learning and Deep Learning, Introduction to Generative AI, Natural Language Processing and Computer Vision, AI in everyday life, Benefits and limitations of AI, Basic AI ethics and responsible use of AI.	4 Hrs.

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Sr. No.	Textbooks
1.	P. K. Sinha & Priti Sinha, "Computer Fundamentals", bpb Publication, 8th Edition.
2.	V. Rajaraman & Neharika Adabala, "Fundamentals of Computers", PHI Learning.
Sr. No.	Reference Books
1.	Peter Norton, "Introduction to Computers", McGraw-Hill, 6th Edition.
2.	E. Balagurusamy, "Programming in ANSI C", McGraw-Hill, 9th Edition
3.	Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson, 3rd Edition
4.	Eric Maiwald, "Fundamentals of Network Security", McGraw-Hill
Sr. No.	Web Resources
1.	https://nptel.ac.in/courses/106103068
2.	https://www.tutorialspoint.com/computer_fundamentals/index.htm
3.	https://www.geeksforgeeks.org/computer-science-fundamentals/computer-fundamentals-tutorial/
4.	https://www.learncomputerscienceonline.com/introduction-to-computer-system/



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Course Title: Object Oriented Programming using JAVA**Course Code: CS254209****Course Category: PCC**

Teaching Scheme		Examination Scheme	
Lectures: 03 hrs. / week		CA-1	10 Marks
Tutorial: -		CA-2	10 Marks
Credits: 03		MSE	20 Marks
Semester: Second Year (Semester IV)		ESE	60 Marks
Course Prerequisite: Programming Fundamentals: Basics of programming language.			
Course Description: This course provides a detailed introduction to Java programming, covering its architecture, object-oriented principles, and features like Java Virtual Machine (JVM), bytecode and Just-In-Time(JIT) compiler. It explores class fundamentals, inheritance, arrays, strings and advanced concepts such as packages, interfaces, and exception handling. Students will learn Java Database Connectivity (JDBC) for database integration. The course includes GUI development using Swing, with a focus on components, containers, event handling and layout management.			
Course Objectives: - To understand the core concepts of Java programming, including object-oriented principles, JVM architecture and key features like bytecode and the JIT compiler. - To develop proficiency in creating and managing classes, objects, inheritance, exception handling for building robust and reusable applications. - To enable students to use Java packages, interfaces and JDBC for modular programming and database connectivity in real-world scenarios. - To equip students with skills to design graphical user interfaces using Swing components, containers and event handling mechanisms.			

Course Outcomes

COs	After completion of the course students will be able to:	Bloom's Level
CO1	Recall and Define fundamental Java concepts	Remember (Level 1)
CO2	Explain arrays, vectors, strings, wrapper classes and package concepts using Java	Understand (Level 2)
CO3	Implement inheritance, method overriding, abstract classes, interfaces, and multiple inheritance concepts to design reusable Java programs	Apply (Level 3)
CO4	Test types of errors and exceptions, analyze exception hierarchy, and implement exception handling using try, catch, finally, throw, and throws	Analyze (Level 4)
CO5	Design and implement database connectivity using JDBC components	Create (Level 6)
CO6	Develop event-driven GUI applications using Java Swing	Create (Level 6)

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Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ Mini Application/ MCQ Test etc.
MSE (c)	Subjective Test

CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	1	3	2
CO2	3	2	-	-	1	-	-	-	-	-	1	3	3
CO3	3	2	2	-	2	-	-	1	-	-	1	3	3
CO4	2	3	-	2	2	-	-	-	-	-	1	3	3
CO5	3	2	3	2	3	1	-	1	-	1	1	3	3
CO6	3	2	3	1	3	1	-	2	-	1	1	3	3

Course Contents		
Unit 1	Introduction to Java Applications Features of Java, Java Virtual Machine, Byte Code, JIT Compiler, Class fundamentals, Declaring Objects, Nested and Inner Classes, Introducing Methods, Constructors, Garbage Collection, Overloading Methods, Using Objects as Parameters, Returning Objects, Access Control.	6 Hrs.
Unit 2	Arrays and Packages Arrays, Vectors, Strings, Wrapper classes, Using Command-Line Arguments, Packages: Defining a Package and types, Finding Packages and CLASSPATH, A Short Package Example, Access Protection, Importing Packages, Study of java.lang & java.util packages.	6 Hrs.
Unit 3	Inheritance and Polymorphism Inheritance Basics, Using Super, Method Overriding, Abstract Classes, Using final Keyword with Inheritance, Interfaces: Defining an Interface, Implementing Interfaces, Variables in Interfaces, Extending Interfaces, Multiple Inheritance.	6 Hrs.
Unit 4	Exception Handling Types of Errors, Exception Hierarchy, Built-in Exceptions, User-defined Exceptions, Arithmetic Exception, InputMismatch Exception, Exception Handling using try, catch, finally, throw and throws keyword.	6 Hrs.

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Unit 5	Java Database Connectivity Introduction, Types of JDBC Drivers, Driver interface and Driver Manager class, Connection Interface, Statement Interface, Prepared Statement, ResultSet, JDBC Program for executing Statements and processing Result Set, Using Prepared Statement.	6 Hrs.
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Unit 6	Swing Introduction to Swing, Swing Architecture, Swing Components: JLabel, JTextField, JTextArea, JButton, JCheckBox, Containers and layout managers FlowLayout, BorderLayout and GridLayout. Event handling: ActionListener, menus, dialog boxes, and basic graphics in Swing.	6 Hrs.
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Sr. No.	Textbooks
1.	E Balagurusamy, Programming with Java, Tata Mc Graw Hill, 4th edition, 2010
2.	Kathy sierra and bert bates, Head first java, Third Edition, 2022
Sr. No.	Reference Books
1.	Herbert Schildt, Java The Complete Reference, McGraw-Hill Publication, 9th Edition, 2014.
2.	Steven Holzner, Java 2 Black Book, DreamTech Press, 2008.
3.	Patrick Niemeyer, Daniel Leuck, Learning Java, O'Reilly Media, 4th Edition, 2013.
4.	Bruce Eckel, Thinking in Java by, 6th Edition, 2006.
Sr. No.	Web Resources
1.	https://www.javatpoint.com/java-swing
2.	https://docs.oracle.com/javase/tutorial
3.	https://www.geeksforgeeks.org/java
4.	https://www.tutorialspoint.com/swing/index.htm

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Course Title: Computer Architecture and Organization Course Code: CS254210			Course Category: PCC
Teaching Scheme		Examination Scheme	
Lectures: 03 hrs. / week		CA-1	10 Marks
Tutorial: -		CA-2	10 Marks
Credits: 03		MSE	20 Marks
Semester: Second Year (Semester IV)		ESE	60 Marks
Course Prerequisite: Fundamentals of Computers			
Course Description: This course offers a comprehensive introduction to computer architecture and organization, enabling participants to understand how computer systems work. Concepts are illustrated using examples from a popular Reduced Instruction Set Computer (RISC) platform. Beginning with fundamentals, the course explores state-of-the-art developments, supported by practical examples and illustrations to effectively convey key concepts and challenges.			
Course Objectives: 1. To understand the fundamentals of computer organization and architecture, including CPU structure and functions. 2. To learn instruction sets, addressing modes, and program execution in RISC and CISC architectures. 3. To gain knowledge of computer arithmetic, memory organization, and storage systems. 4. To understand control units, input/output organization, pipelining, and parallel processing concepts for modern computer systems.			

Course Outcomes:		
COs	After completion of the course students will be able to:	Bloom's Level
CO1	Define the fundamentals of computer organization and CPU architecture	Remember (Level 1)
CO2	Explain instruction sets, addressing modes, and program execution in RISC and CISC architectures	Understand (Level 2)
CO3	Demonstrate concepts of computer arithmetic, memory organization, and storage systems to solve computational problems	Apply (Level 3)
CO4	Examine the structure and performance of control units, I/O organization, pipelining, and parallel processing techniques.	Analyze (Level 4)

CO-PO-PSO Mapping													
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	1	-	-	-	-	-	-	-	-	1	2	1
CO2	3	2	-	-	-	-	-	-	-	-	1	2	1

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C03	3	3	2	1	2	-	-	-	-	-	2	3	2
C04	3	3	2	2	2	1	-	-	-	-	2	3	2

Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test etc.
MSE (c)	Subjective Test / Assignment/ MCQ Test etc.

Course Contents		
Unit 1	Introduction: Concept of computer organization and Architecture, Fundamental unit, Computer function and interconnection, CPU structure and function	6 Hrs.
Unit 2	Instruction Sets: Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Machine state and processor status, Structure of program, Introduction to RISC (Reduced Instruction Set Computer) and CISC (Complex Instruction Set Computer) architecture	6 Hrs.
Unit 3	Computer Arithmetic: The arithmetic and logic Unit, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic, Introduction of arithmetic co-processor	6 Hrs.
Unit 4	Memory Organization: Internal Memory: Semiconductor main memory, Error correction, Advanced DRAM (Dynamic Random Access Memory) organization, Virtual memory systems and cache memory systems. External Memory: Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID (Redundant Array of Independent Disks), Memory controllers.	6 Hrs.
Unit 5	Control Unit: Control unit operation: Micro-operations, Hardwired implementation, Microprogrammed Control Unit, Basic concepts, Micro-instruction sequencing, Micro-instruction execution, Applications of micro-programming.	6 Hrs.
Unit 6	Input/Output Organization: External devices, I/O module, Programmed I/O, Interrupt driven I/O, Direct memory access, I/O channels and processors, External interface, Instruction pipelining: Concepts. Parallel processing: Multiple processor organization, Cache coherence and the MESI protocol.	6 Hrs.

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Sr. No.	Textbooks
1.	William Stalling, Computer Organization and Architecture: Designing for Performance, Prentice Hall Publication, 8th Edition, 2009
2.	Hayes, Computer Architecture and Organization, McGraw-Hill Publication, 3rd Edition, 2012.
3.	Zaky, Computer Organization, McGraw-Hill Publication, 5th Edition, 2011.
Sr. No.	Reference Books
1.	Hennessy and Patterson, Computer Architecture: A Quantitative Approach, Morgan and Kaufman Publication, 4th Edition, 2007
2.	MostafaAbd-El-Barr, Hesham El-Rewini, Fundamentals of Computer Organization and Architecture, Wiley Publication, 1st Edition, 2004.
3.	Miles J. Murdocca, Vincent P. Heuring, Computer Architecture and Organization: An Integrated Approach, Wiley Publication, 1st Edition, 2007
Sr. No.	Web Resources
1.	https://nptel.ac.in/courses/106102157
2.	https://nptel.ac.in/courses/106105163
3.	https://onlinecourses.nptel.ac.in/noc22_cs88

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Course Title: Database Management System**Course Code: CS254211****Course Category: PCC**

Teaching Scheme	Examination Scheme	
Lectures: 03 hrs. / week	CA-1	10 Marks
Tutorial: -	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:

- **Computer Fundamentals:** Familiarity with operating system basics, such as processes and memory management. Understanding of File and file organization
- **Data Structure Basics:** Understanding of fundamental data structures such as arrays, linked lists, stacks, and queues. Knowledge of simple searching and sorting techniques.

Course Description: This course introduces the fundamentals of database systems, including data models, and Entity Relationship (ER) modeling. It develops skills in Structured Query Language (SQL) and Procedure Language SQL (PL/SQL) for data management and covers normalization, transaction processing, and concurrency control. The course also provides an overview of NoSQL databases and modern data handling techniques for real-world applications.

Course Objectives:

1. To learn and understand database system architecture, functioning and applications.
2. To understand representation of real life objects or data elements and their relationship for a specified system using (Entity Relationship) ER modeling to conceptualize design for the database.
3. To enable students to write SQL queries for data definition, manipulation, and retrieval.
4. To impart knowledge of normalization and transaction management techniques.
5. To provide exposure to PL/SQL programming and NoSQL databases for modern data management.

Course Outcomes:

COs	After completion of the course students will be able to	Bloom's Level
CO1	Recall basic concepts of database systems, ER modeling, and SQL.	Remember (Level 1)
CO2	Explain database design, normalization, and SQL concepts including PL/SQL, NoSQL.	Understand (Level 2)
CO3	Implement sql queries, joins, subqueries, and PL/SQL constructs to perform data manipulation and database operations.	Apply (Level 3)
CO4	Examine relational schemas using normalization and dependency, and transaction management concepts including concurrency control.	Analyze (Level 4)
CO5	Assess different database models, 2 ACID properties, concurrency techniques, and compare RDBMS with NoSQL databases.	Evaluate (Level 5)
CO6	Design and develop database applications using ER modeling, SQL, PL/SQL, and NoSQL techniques for real-world problems.	Create (Level 6)

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CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	-	-	1	-	-	-	-	-	-	2	-
CO3	3	3	2	-	2	-	-	-	-	-	-	3	1
CO4	3	3	2	2	1	-	-	-	-	-	-	3	1
CO5	2	3		2	1	-	-	-	-	-	-	2	2
CO6	3	3	3	2	2	-	-	1	1	1	1	3	3

Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test etc.
MSE (c)	Subjective Test

Course Contents		
Unit 1	Introduction and Entity Relationship Modeling Database System Applications, Purpose of Database Systems, View of Data, Schemas and Instances, Overview of Database Languages, Database Architecture, Types of Data Models, Entity Relationship (ER) Model, Notation for ER Diagram, Constraints, Super Key, Candidate Key, Primary Key, Weak Entity Sets, Codd's Rule, ER Diagrams, Mapping Cardinality, Extended ER Model, Generalization, Aggregation, Reduction of an ER Diagrams to Tables.	6 Hrs.
Unit 2	Introduction to Structured Query Language Overview of Structured Query Language (SQL), Database Languages, Basic Structure of SQL Queries, Integrity Constraints, Additional Basic Operators, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database, Intermediate SQ : Join Expressions, View, Integrity Constraints, SQL Data Types and Authorization.	6 Hrs.
Unit 3	Relational Database Design Relational database management system (RDBMS) Design Process: Features of Good Relational Designs, Functional Dependencies. Normalization: Normal Forms, First, Second, Third Normal Forms, Boyce-Codd Normal Form (BCNF), Multivalued Dependencies, Fourth Normal Form.	6 Hrs.
Unit 4	Procedural Language / Structured Query Language (PL/SQL) Overview of PL/SQL, Structure of PL/SQL block (DECLARE, BEGIN, EXCEPTION, END), Conditional and Iterative Control Statement (if-else, loop), Concept of Stored Procedures and Functions, Exception Handling, Cursors, Triggers, Assertions, Roles and Privileges.	6 Hrs.
Unit 5	NoSQL Databases Introduction to NoSQL: Need, Features, Consistency, Availability, and Partition Tolerance (CAP) Theorem, Basically Available, Soft state, and	6 Hrs.

	Eventual consistency (BASE) Properties, Types of Data: Structured, Unstructured Data and Semi-Structured Data, Comparative study of SQL and NoSQL. MongoDB (with syntax and usage): Working with Documents and Collections, MongoDB Methods, Indexing, Aggregation, MapReduce. Case Study: Use of NOSQL database for processing of unstructured data from social media.	
Unit 6	Transaction Processing Transaction Concept, A simple Transaction Model, Atomicity, Consistency, Isolation, and Durability (ACID) Properties, ACID and BASE properties. Schedules: Serial schedules, Parallel Schedule. Serializability: View and Conflict, Concurrency Control Techniques: Lock based Protocols, Deadlock Handling, Time stamp-Based Protocols, Recovery System.	6 Hrs.

Sr. No.	Textbooks
1.	Henry Korth, Abraham Silberschatz & S. Sudarshan, Database System Concepts, McGraw-Hill Publication, 6th Edition, 2011.
2.	Navathe, Fundamentals of Database System, Addison-Wesley Publication, 6th Edition, 2012.
3.	MongoDB: The Definitive Guide, Kristina Chodorow, O'Reilly Media, 2nd Edition, 2013.
Sr. No.	Reference Books
1.	Thomas M. Connolly, Carolyn E. Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", Addison Wesley, fifth Edition, 2014
2.	Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill Publication, 3rd Edition, 2003
3.	Joel Murach, Murach's Oracle SQL and PL/SQL for Developers, Mike Murach & Associates, 2nd Edition, 2014.
4.	C. J. Date "Introduction to Database Systems", Addison Wesley, Seventh Edition, 2000
5.	Atul Kahate, "Introduction to Database Management System", Third Edition, Pearson Education, 2013
Sr. No.	Web Resources
1.	NPTEL course : Database management system(IITK): https://onlinecourses.nptel.ac.in/noc21_cs04/
2.	https://www.geeksforgeeks.org/dbms/dbms/
3.	NPTEL Course: https://onlinecourses.nptel.ac.in/noc26_cs39/preview

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Teaching Scheme	Examination Scheme	
व्याख्याने (Lectures): ०२ तास/आठवडा (02 hrs / week)	CA-1	10 Marks
ट्यूटोरियल (Tutorial): -	CA-2	10 Marks
श्रेयांक (Credits): 02	MSE	20 Marks
सत्र (Semester): द्वितीय वर्ष (सत्र ४) (Second Year (Semester IV))	ESE	60 Marks

Course Prerequisite: देवनागरी लिपी वाचण्याचे आणि लिहिण्याचे प्राथमिक ज्ञान

Course Description:

हा अभ्यासक्रम सर्व शाखांच्या अभियंत्यांना मराठी भाषेचे व्यावहारिक आणि उद्योगभिमुख ज्ञान प्रदान करण्यासाठी तयार करण्यात आला आहे. यामध्ये विद्यार्थी मराठी भाषेचा इतिहास आणि व्याकरणाचा भक्कम पाया रचतील आणि त्यानंतर आकलन कौशल्ये व शब्दसंपत्ती वाढवण्यावर लक्ष केंद्रित करतील. हा अभ्यासक्रम प्रामुख्याने व्यावसायिक उपयोजनावर भर देतो, ज्यामध्ये अधिकृत पत्रव्यवहार, इतिवृत्त लेखन आणि अचूक पारिभाषिक व प्रशासकीय संज्ञांचा वापर शिकवला जाईल. याव्यतिरिक्त, तांत्रिक संकल्पनांचे अचूक संप्रेषण सुनिश्चित करण्यासाठी विद्यार्थी इंग्रजी आणि मराठी या दोन्ही भाषांमधील भाषांतर कौशल्ये विकसित करतील. सरतेशेवटी, हा अभ्यासक्रम भावी अभियंत्यांना स्थानिक उद्योग, कॉर्पोरेट क्षेत्र आणि शासकीय कार्यालयांमध्ये आत्मविश्वासाने आणि प्रभावीपणे संवाद साधण्यास सक्षम बनवतो.

Course Objectives:

- विद्यार्थ्यांना मराठी भाषेचा उगम, विकास, देवनागरी लिपी आणि विविध साहित्य प्रकारांची ओळख करून देणे.
- विद्यार्थ्यांना मराठी व्याकरणाचे मूलभूत नियम, शुद्धलेखन आणि अचूक वाक्यरचना यांचे सखोल ज्ञान देणे.
- विद्यार्थ्यांची शब्दसंपत्ती वाढवणे आणि दैनंदिन तसेच व्यावसायिक संवादात वाक्प्रचार व म्हणींचा योग्य वापर करण्यास शिकवणे.
- विद्यार्थ्यांमध्ये तांत्रिक आणि प्रशासकीय उताऱ्यांचे वाचन, विश्लेषण आणि अचूक आकलन करण्याची क्षमता विकसित करणे.
- विद्यार्थ्यांना कार्यालयीन कामकाज, पत्रव्यवहार आणि अभियांत्रिकी क्षेत्रात वापरल्या जाणाऱ्या पारिभाषिक संज्ञांचे व्यावहारिक प्रशिक्षण देणे.
- विद्यार्थ्यांना भाषांतराची तत्वे आणि पद्धती समजावून सांगणे आणि इंग्रजी-मराठी भाषांतराचा (विशेषतः तांत्रिक संदर्भात) सराव करून घेणे.

Course Outcomes:

COs	अभ्यासक्रम पूर्ण झाल्यानंतर विद्यार्थी सक्षम असतील (After completion of the course students will be able to)	Bloom's Level
CO1	मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये यांच्याशी संबंधित मूलभूत तथ्ये, माहिती, नियम आणि मानकांचे स्मरण करणे.	स्मरण Remember (Level 1)
CO2	मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये	मान्यता Understand (Level 2)

	यांच्याशी संबंधित विविध संकल्पना, रचना, आशय आणि कार्यपद्धती स्पष्ट करणे.	Understand (Level 2)
CO3	मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये यांमधील शिकलेल्या नियमांचे, तत्वांचे आणि कौशल्यांचे प्रत्यक्ष कामकाजात उपयोजन करणे.	उपयोजन Apply (Level 3)

CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						1			2		1		
CO2						1			2		1		
CO3						2			2		1		

Assessment	
CA-1 (a)	वर्णनात्मक चाचणी / गृहपाठ / बहुपर्यायी प्रश्न चाचणी इत्यादी. (Subjective Test / Assignment / MCQ Test etc.)
CA-2 (b)	वर्णनात्मक चाचणी / गृहपाठ / बहुपर्यायी प्रश्न चाचणी इत्यादी. (Subjective Test / Assignment / MCQ Test etc.)
MSE (c)	वर्णनात्मक चाचणी (Subjective Test)
ESE (d)	अंतिम सत्र परीक्षा (End Semester Exam)

Course Contents		
Unit 1	मराठीचा इतिहास आणि विकास (History and Literature of Marathi) मराठी भाषेचा उगम (Origin of Marathi Language), मराठी भाषेचा विकास (Development of Marathi Language), विविध मराठी साहित्य प्रकारांचा परिचय (Introduction to Various Marathi Literary Forms), प्रसिद्ध मराठी साहित्यिक (Famous Marathi Authors), निवडक साहित्यकृतींचा परिचय (Introduction to Selected Literary Works).	4 Hrs.
Unit 2	मराठी व्याकरण (Marathi Grammar) मराठी वर्णमाला (Marathi Alphabet), शब्दांच्या जाती (Parts of Speech), काळांचे प्रकार (Types of Tenses), अचूक वाक्यरचना (Correct Sentence Formation), शुद्धलेखनाचे नियम (Rules of Orthography/Spelling), विरामचिन्हांचा योग्य वापर (Proper Use of Punctuation).	4 Hrs.

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Unit 3	शब्दसंपत्ती आणि भाषासमृद्धी (Vocabulary Building) समानार्थी शब्द (Synonyms), विरुद्धार्थी शब्द (Antonyms), शब्दांची उत्पत्ती: तत्सम, तद्भव, देशी शब्द (Word Origin), शुद्ध आणि अशुद्ध शब्दांची ओळख व दुरुस्ती (Identifying and Correcting Spelling Errors), दैनंदिन संवादात म्हणींचा वापर (Use of Proverbs in Daily Communication), वाक्प्रचारांचा वापर (Use of Idioms).	4 Hrs.
Unit 4	आकलन कौशल्ये (Reading & Comprehension) दिलेल्या उताऱ्याचे वाचन, विश्लेषण आणि त्यावरील प्रश्नांची अचूक उत्तरे लिहिणे (Reading, Analysis, and Answering Questions on a Given Passage), तांत्रिक किंवा प्रशासकीय उताऱ्यांचे वाचन आणि सारांश लेखन (Reading technical or administrative passages in Marathi and summarizing them).	4 Hrs.
Unit 5	व्यावहारिक आणि उपयोजित मराठी (Practical & Applied Marathi) औपचारिक पत्रे (Formal Letters), इतिवृत लेखन (Meeting Minutes Writing), पारिभाषिक संज्ञा (Technical Terminology), अभियांत्रिकी कामात वापरले जाणारे इंग्रजी-मराठी शब्द (English-Marathi Words Used in Engineering Work), प्रशासकीय कामात वापरले जाणारे इंग्रजी-मराठी शब्द (English-Marathi Words Used in Administrative Work).	4 Hrs.
Unit 6	भाषांतर कौशल्ये (Translation Skills) भाषांतराची तत्त्वे (Principles of Translation), भाषांतराच्या पद्धती (Methods of Translation), शब्दशः भाषांतर (Literal Translation), आशयनिष्ठ भाषांतर (Contextual/Sense Translation), मराठीतून इंग्रजीत भाषांतर (Marathi to English Translation), इंग्रजीतून मराठीत भाषांतर (English to Marathi Translation).	4 Hrs.

Sr. No.	Textbooks
1.	मो. रा. वाळिंबे, सुगम मराठी व्याकरण व लेखन, नितीन प्रकाशन.
2.	डॉ. ल. रा. नसिराबादकर, व्यावहारिक मराठी, फडके प्रकाशन.
Sr. No.	Reference Books
1.	यास्मिन शेख, मराठी लेखन मार्गदर्शिका, पद्मगंधा प्रकाशन.
2.	डॉ. स्नेहल तावरे, व्यावहारिक मराठी, स्नेहवर्धन प्रकाशन.
3.	भाषा संचालनालय, शासन व्यवहार कोश, महाराष्ट्र शासन.
4.	डॉ. कल्याण काळे, डॉ. अंजली सोमण, भाषांतर मीमांसा, प्रतिमा प्रकाशन
5.	अ. ना. देशपांडे, मराठी साहित्याचा इतिहास (खंड १ आणि २), व्हीनस प्रकाशन.
6.	शब्दकोश आणि शास्त्रीय व तांत्रिक परिभाषा कोश, महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळ.
7.	कृ. पां. कुलकर्णी, मराठी भाषा: उद्गम व विकास, मेहता पब्लिशिंग हाऊस.
Sr. No.	Web Resources
1.	महाराष्ट्र शासन, भाषा संचालनालय (Directorate of Languages, Govt. of Maharashtra): https://languages.maharashtra.gov.in
2.	राज्य मराठी विकास संस्था (RMVS): https://rmvs.maharashtra.gov.in

3.	मराठी विश्वकोश (Marathi Vishwakosh): https://marathivishwakosh.org
4.	भारत वाणी (Bharatvani Portal): https://bharatavani.in
5.	महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळ: https://sahitya.marathi.gov.in



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CSE Engg.

Course Title: Entrepreneurship Development		Course Category:HSSM-EEMC	
Course Code: CS254706			
Teaching Scheme		Examination Scheme	
Lectures: 02 hrs. / week	CA-1	10	Marks
Tutorial: –	CA-2	10	Marks
Credits: 02	MSE	20	Marks
Semester: Second Year (Semester IV)	ESE	60	Marks
Course Prerequisite: Students are expected to have basic knowledge of management principles, economics, and general business environment. Familiarity with problem-solving approaches and analytical thinking will support understanding of entrepreneurial concepts and practices.			
Course Description: This course provides a comprehensive understanding of entrepreneurship, including entrepreneurial characteristics, motivation, and development programs. It emphasizes business idea generation, project planning, feasibility analysis, and financial aspects. The course also covers MSME development, government policies, and societal responsibilities to prepare students for entrepreneurial and managerial roles.			
Course Objectives: • Understand basic concepts and theories of entrepreneurship. • To analyze the entrepreneurial environment and opportunities. • To apply project planning and financial analysis techniques. • To develop business ideas considering MSME and societal aspects.			

Course Outcomes:		
COs	After completion of the course students will be able to	Bloom's Level
CO1	Explain concepts, characteristics, and theories of entrepreneurship and motivation.	Understand (Level 2)
CO2	Implement project planning techniques and evaluate feasibility, profit, and risk of business ideas.	Apply (Level 3)
CO3	Examine entrepreneurial environment, opportunities, and EDPs	Analyze (Level 4)
CO4	Develop business plans considering MSME, government policies, and societal responsibilities.	Create (Level 6)

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CO-PO-PSO Mapping

CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	2	2	-	-	-	2	-	2
CO2	3	3	3	2	2	-	-	-	-	3	-	2	-
CO3	-	3	-	-	-	3	-	2	2	-	3	-	2
CO4	-	-	3	-	-	3	3	2	3	3	2	-	3

Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test etc.
MSE (c)	Subjective Test

Course Contents		
Unit 1	Introduction to Entrepreneurship: Entrepreneurship: concept and importance, Characteristics of successful entrepreneurs, Types of entrepreneurs, Entrepreneur vs Intrapreneur, Role of entrepreneurship in economic development, Basic legal aspects of entrepreneurship.	4 Hrs.

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Unit 2	Creativity, Innovation and Opportunity Identification: Creativity and innovation in entrepreneurship, Idea generation techniques, Basic idea screening, Opportunity recognition, Feasibility analysis: market, technical, financial, and legal.	4 Hrs.
Unit 3	Business Plan Development: Business Model Canvas: concept; Value proposition; Customer segments; Revenue streams; Cost structure, Minimum viable product (MVP), Customer validation, Revenue models, Break-even analysis, Introduction to marketing management.	4 Hrs.
Unit 4	Startup Ecosystem and Funding: Startup ecosystem in India, Role of incubators and accelerators, Sources of startup funding: Banks, Bootstrapping; Angel investors; Incubation Programs, Venture capital, Government schemes like Startup India, Pradhan Mantri Mudra Yojana (PMMY), Technology Incubation and Development of Entrepreneurs (TIDE 2.0), Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE).	4 Hrs.
Unit 5	Startup Management and Case Studies: Entrepreneurial leadership and teamwork, Risk and uncertainty in startups, Intellectual property basics, Ethical and sustainable entrepreneurship, Startup pitching, Case studies of successful startups	4 Hrs.
Unit 6	Entrepreneurial Support System: Role of central and state government, District Industries Centre (DIC), Maharashtra Centre for Entrepreneurship Development (MCED), National Institute for Entrepreneurship and Small Business Development (NIESBUD) in Entrepreneurship Development.	4 Hrs.

Sr. No.	Textbooks
1.	Introduction to Entrepreneurship Development – Abhik Kumar Mukherjee & Shaunak Roy, OUP India, 2023.
2.	Vasant Desai, Dynamics of Entrepreneurship Development, Himalaya Publication house, 6 th Edition, 2022.
3.	Taneja, Satish, Entrepreneurship Development, Himalaya Publishing House. 2010.

4.	Khanka S.S., Entrepreneurial Development, S. Chand Co. Ltd., New Delhi, 2001.
Sr. No.	Reference Books
1.	Saravanavel, P.: Entrepreneurial Development, Margham Publication, Chennai. (2020)
2.	Mohanty, Fundamentals of Entrepreneurship, PHI Learning. 2009.
3.	Entrepreneurship: Business and Management – Dr. R.C. Bhatia, Sultan Chand & Sons, 2021.

Sr. No.	Web Resources
1.	https://nptel.ac.in/courses/106105183 Covers OSI model, switching techniques, and performance in detail
2.	https://onlinecourses.nptel.ac.in/noc26_mg11/preview
3.	https://onlinecourses.swayam2.ac.in/e-learning/preview/cec26_cm11

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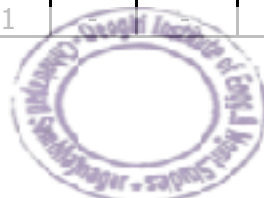
Course Title: Environmental and Sustainable Engineering		
Course Code: CS254707		Course Category: VEC
Teaching Scheme	Examination Scheme	
Lectures: 02 hrs / week	CA-1	10 Marks
Tutorial: -	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks
Course Prerequisite: Basic knowledge of science (physics, chemistry basics) Fundamental understanding of engineering concepts Awareness of environmental issues and energy usage.		
Course Description: This course consists of different energy resources, environmental issues, and sustainable development. It also covers conventional and renewable energy systems, including solar, wind and hydropower, along with their working principles and applications. The course also covers environmental pollution and its causes, effects, and control measures. It also involves solid waste management techniques. Emphasis is given to sustainability concepts such as life cycle assessment, green technologies, and environmental impact assessment. Additionally, the course explores sustainable design practices, energy-efficient systems, e-waste management, and global initiatives like the United Nations Sustainable Development Goals (SDGs).		
Course Objectives: - To introduce concepts of energy resources and environmental impacts. - To understand renewable energy systems and their applications. - To develop knowledge of pollution control and waste management techniques - To familiarize with sustainability principles and assessment tools (EIA) - To promote awareness of sustainable design, green technologies, and SDGs		

Course Outcomes:		
COs	After completion of the course: Students will be able to	Bloom's Level
CO1	Define basic concepts of energy and environment.	Remember (Level 1)
CO2	Identify energy systems, environmental issues, and sustainability principles.	Understand (Level 2)
CO3	Describe methods for renewable energy use and pollution control.	Understand (Level 2)
CO4	Apply methods to address environmental impacts and sustainable solutions.	Apply (Level 3)

CO-PO Mapping

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
CO1	3	1	-	-	-	1	-	-	-	-	1	1	-
CO2	3	2	1	-	-	2	-	-	-	-	1	1	-
CO3	3	3	2	1	-	3	-	1	-	-	2	1	1
CO4	2	3	2	2	-	3	-	1			2	1	-

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Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test/ Case study/ PPT etc.
MSE (c)	Subjective Test
ESE (d)	Exam

Course Contents		
Unit 1	Energy and Environmental Studies Introduction, Renewable and Non-renewable Energy Resources, Global Energy Scenario, Indian Energy Scenario, Energy demand and environmental impacts: Climate Change; Global Warming; Necessity of Decarbonization; Carbon Foot Printing Basics.	4 Hrs.
Unit 2	Solar Energy Systems Introduction, Solar radiation fundamentals and measurement, Operational Principles of Flat-plate and Concentrating Solar Thermal Collectors, Solar photovoltaic (PV) systems: principles and components, Design basics of solar PV systems, Applications: Rooftop Systems; Solar Pumps; Street Lighting.	4 Hrs.
Unit 3	Renewable Energy Sources Introduction, Basic Working Principles and Plant Layout: Wind Energy; Nuclear Energy; Biomass Energy; Hydropower; Geothermal; Tidal Energy.	4 Hrs.
Unit 4	Environmental Pollution and Control Introduction, Environmental Pollution: Definition, Cause, Effects & Control Measures of Air Pollution; Water Pollution; Soil Pollution; Marine Pollution, Solid Waste Management: Landfill; Incineration; Composting.	4 Hrs.
Unit 5	Sustainable Engineering Introduction, Principles of Sustainability, Life Cycle Assessment (LCA), Green Technology and Green Business, Sustainable Materials and Manufacturing, Sustainable Agriculture, Environmental Impact Assessment (EIA).	4 Hrs.
Unit 6	Sustainable Design and Development Introduction, Energy-Efficient Machines and Thermal Systems, E- Waste Reduction and Recycling, Green Computing and Data Center Efficiency , United Nations Sustainable Development Goals (SDGs).	4 Hrs.

Sr. No.	Textbooks
1.	G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers
2.	B. H. Khan, Non-Conventional Energy Resources, McGraw Hill Education
3.	C. S. Rao, Environmental Pollution Control Engineering, New Age International
4.	Bhavik R. Bakshi, Sustainable Engineering: Principles & Practice, Cambridge University Press

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	Reference Books
1.	S. P. Sukhatme and J.K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill
2.	D. P. Kothari, K. C. Singal and Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, PHI Learning
3.	R. C. Gaur, Basic Environmental Engineering, New Age International

4.	D. L. Reeg, Industrial Energy Conservation, Pergamon Press
5.	Catherine N. Mulligan, Sustainable Engineering: Principles & Implementation, CRC Press
6.	Kailas L. Wasewar and Sunita Neti Rao, Sustainable Engineering, Energy & the Environment, CRC Press

	Web Resources
1.	Prof. Vaibhav Vasant Goud and Prof. R. Anandalakshmi, Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems, IIT Guwahati (https://nptel.ac.in/courses/103103206)
2.	Prof. P. Mondal, Basic Environmental Engineering and Pollution Abatement, IIT Roorkee (https://nptel.ac.in/courses/103107215)
3.	Prof. Prasanta Kumar Das and Prof. A Bhattacharya, Energy Conservation and Waste Heat Recovery, IIT Kharagpur (https://nptel.ac.in/courses/112105221)
4.	Prof. Brajesh Kumar Dubey, Sustainable Engineering Concepts and Life Cycle Analysis, IIT Kharagpur (https://onlinecourses.nptel.ac.in/noc21_ce47/preview)

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R. Anand
Chairman, BoS
CSE Engg.

Course Title: Object Oriented Programming using JAVA**Course Code: CS254502****Course Category: OE**

Teaching Scheme	Examination Scheme	
Lectures: 02 hrs. / week	CA-1	10 Marks
Tutorial: --	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:

- Programming Fundamentals: Basics of programming language.
- Concepts of Object Oriented Programming language.

Course Description: This course provides a detailed introduction to Java programming, covering its architecture, object-oriented principles, and features like JVM, bytecode. It explores class fundamentals, arrays, and advanced concepts such as packages. The Course also focuses on advanced topics like inheritance, polymorphism, abstract classes, and interfaces are explored to promote code reusability. Finally, the course introduces exception handling, enabling students to manage errors effectively using try, catch, finally, throw, and throws.

Course Objectives:

1. To understand the core concepts of Java programming, including object-oriented principles, JVM architecture, and key features like bytecode.
2. To enable students to use Java classes, objects, methods, Arrays, and packages
3. To develop proficiency in creating and managing inheritance and polymorphism for building robust and reusable applications.
4. To equip students with skills to test exception handling with try, catch, finally, throw, and throws.

Course Outcomes

COs	After completion of the course students will be able to:	Bloom's Level
CO1	Recall and describe Java fundamentals including features of Java, JVM, bytecode, classes, objects, methods, and constructors.	Remember (Level 1)
CO2	Explain and use arrays, command-line arguments, package, method overloading, and Java API usage	Understand (Level 2)
CO3	Implement inheritance and polymorphism concepts and final keywords to develop reusable Java programs.	Apply (Level 3)
CO4	Test exception handling mechanisms to handle different types of errors.	Analyze (Level 4)

Assessment

CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ Mini Application/ MCQ Test etc.
MSE (c)	Subjective Test

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CSE Engg.

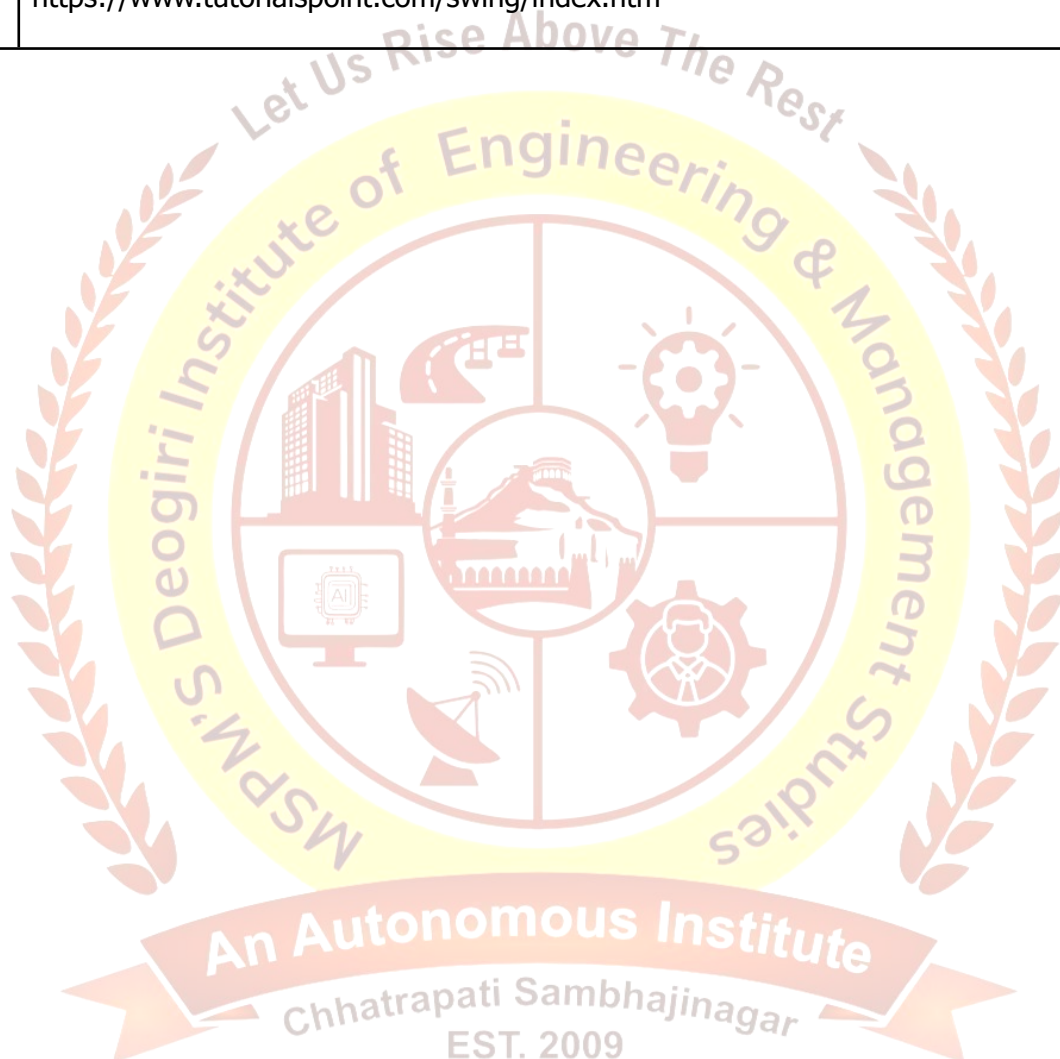
CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-		
CO2	3	2	1	-	2	-	-	-	-	-	-		
CO3	3	2	2	-	3	-	-	1	-	-	1		
CO4	2	3	2	3	3	1	-	1	-	-	2		

Course Contents		
Unit 1	Introduction to Java Programming language Types and Paradigms, History and Features of Java, C++ vs Java, Hello Java Program, Internal: Setting Path, The Java Environment :JDK, JRE, and JVM (Java Virtual Machine), Unicode System, Operators, Keywords, Control Statements like if-else, switch, for loop, while loop.	4 Hrs.
Unit 2	Object Oriented Programming Classes, Objects, Methods and Instance Variables, Declaring a Class with a Method and Instantiating an Object of a Class, Declaring a Method, Instance variables, set Methods and get Methods, Primitive Types vs. Reference type double Types, Initializing Objects with Constructors.	4 Hrs.
Unit 3	Arrays Arrays, Declaring and creating arrays in java, Examples using arrays, assign arrays to methods, multidimensional arrays, variable-length argument lists, using command-line arguments.	4 Hrs.
Unit 4	Modulization in Java using Package Java Package, importing packages, Methods: static methods, static Fields, scope of declaration, method overloading, and Java API packages.	4 Hrs.
Unit 5	Inheritance and Polymorphism in Java Inheritance: Super classes and Subclasses, protected members, relationship between super classes and subclasses, constructors in subclasses, objectclass. Polymorphism: Abstract classes and methods, final methods and classes, polymorphism examples and Interfaces.	4 Hrs.
Unit 6	Exception Handling Types of Errors, Exception Hierarchy, Built-in Exceptions, User-defined Exceptions, Arithmetic Exception, InputMismatch Exception, Exception Handling using try, catch, finally, throw and throws keyword.	4 Hrs.

Sr. No.	Textbooks
1.	E Balagurusamy, Programming with Java, Tata Mc Graw Hill, 4th edition, 2010
2.	Kathy sierra and bert bates, Head first java, Third Edition, 2022
Sr. No.	Reference Books
1.	Herbert Schildt, Java The Complete Reference, McGraw-Hill Publication, 9th Edition, 2014.
2.	Steven Holzner, Java 2 Black Book, DreamTech Press, 2008.

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3.	Patrick Niemeyer, Daniel Leuck, Learning Java, O'Reilly Media, 4th Edition, 2013.
4.	Bruce Eckel, Thinking in Java by, 6th Edition, 2006.
Sr. No.	Web Resources
1.	https://www.javatpoint.com/java-swing
2.	https://docs.oracle.com/javase/tutorial
3.	https://www.geeksforgeeks.org/java
4.	https://www.tutorialspoint.com/swing/index.htm



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Course Title: Object Oriented Programming using JAVA and Database Systems Lab Course Code: CS254212 Course Category: PCC		
Teaching Scheme	Examination Scheme	
Practical/Sessions: 02 Hours/Week	CA-1	15 Marks
Credits: 01	CA-2	15 Marks
Semester: Second Year (Semester IV)	ESE	20 Marks

Assessment	
CA-I (a)	As per practical evaluation sheet
CA-II (b)	As per practical evaluation sheet

Sr. No.	List of Experiments
1.	Write a program to demonstrate basic syntactical constructs of java. A. Operators & Expressions B. Decision Making Statement C. Looping Statement
2.	Write a program to define a class, describe its constructor & overload its constructor.
3.	Write a program to Implement Array & Package.
4.	Write a program to implement different types of inheritances and polymorphism.
5.	Write a program to implement interfaces.
6.	Write a program to implement exception handling using built-in & user defined exceptions.
7.	Develop a Java Program for Handling Database Transactions Using JDBC.
8.	Implementation of a Graphical User Interface (GUI) Application using Java Swing Components and Event Handling.
9.	Study and Implementation of DDL commands and Integrity constraints.
10.	Study and Implementation of DML commands (SELECT/UPDATE/DELETE with GROUP BY, ORDER BY).
11.	Study and Implementation of advanced queries (nested subqueries, set operations, aggregate functions and JOIN).
12.	Create and manipulate Views and implement access control using GRANT and REVOKE (DCL/TCL).
13.	Write PL/SQL programs using conditional statements, loops, and exception handling.
14.	Study and Implementation of Cursors and Triggers.
15.	Install and configure the MongoDB environment. Perform CRUD operations in MongoDB.
16.	Implement Indexing, Aggregation operations, MapReduce operations in MongoDB.

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R. Anil Kumar
Chairman, BoS
CSE Engg.

Course Title: Professional Development-IV**Course Code: CS254604****Course Category: SC-SEC**

Teaching Scheme	Examination Scheme	
Practical/Sessions: 02 hrs. / week	CA-1	15 Marks
Credits: 01	CA-2	15 Marks
Semester: Second Year (Semester IV)	ESE	20 Marks

Course Prerequisite:

- Basic programming.
- Problem-solving skills.
- Understand OOP fundamentals.
- Familiarity with Online Coding Platforms.

Course Description: This course focuses on developing problem-solving skills using fundamental data structures and algorithms through hands-on coding practice. It covers key concepts like arrays, strings, recursion, stacks, queues, linked lists, and sorting/searching techniques. Students learn to write efficient programs by understanding time and space complexity. Practical implementation using platforms like HackerRank enhances coding proficiency and logical thinking.

Course Objectives:

1. To strengthen students programming and problem-solving skills through structured coding practice.
2. To introduce fundamental data structures such as arrays, stacks, queues, and linked lists.
3. To develop understanding of recursion, searching, and sorting algorithms.
4. To enable students to analyze program efficiency using time and space complexity.
5. To provide hands-on experience in solving real-world problems using platforms like HackerRank.

Course Outcomes:

COs	After completion of the course students will be able to	Bloom's Level
CO1	Explain basic programming concepts such as if-else, loops, arrays, strings, and simple problem-solving techniques.	Understand [Level 2]
CO2	Implement recursion, string methods, and array operations for solving structured programming problems efficiently.	Apply [Level 3]
CO3	Analyze data structures like stack, queue, and linked list along with their operations and use cases.	Analyze [Level 4]
CO4	Evaluate efficient solutions using searching & sorting algorithms, time-space complexity, BST, file handling, and STL concepts.	Evaluate [Level 5]

CO-PO-PSO Mapping:

CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	1	-	1	2	2
CO2	3	2	1	-	3	-	-	1	1	-	1	2	2
CO3	3	3	2	2	2	-	-	1	1	-	2	3	2
CO4	3	3	2	3	3	1	-	-	1	1	2	3	2

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CSE B&E

Assessment	
CA-1 (a)	CA-1 evaluates students' understanding of basic programming, arrays, strings, and recursion through practical coding tasks.
CA-2 (b)	CA-2 assesses students ability to implement data structures and apply sorting and searching techniques efficiently.
ESE (c)	ESE evaluates overall understanding through viva-voce and practical problem-solving activities.

Sr.No.	List of Activities
1.	To understand programming concepts, OOPJ, and time-space complexity through basic warm-up exercises like if-else, loops, digit counting, patterns, and string reversal for problem-solving skills.
2.	To implement array operations like removing duplicates, element deletion, string reversal, and single number identification on HackerRank for improving problem-solving skills.
3.	To apply string and string methods for efficient text manipulation and problem-solving.
4.	To implement recursion techniques for solving problems such as Fibonacci series, factorial, and palindrome checking to enhance logical thinking and problem-solving skills.
5.	To implement stack operations and explore types of queues with their operations for understanding linear data structures and their applications.
6.	To understand and implement different types of linked lists and their operations for efficient dynamic data management.
7.	To implement and analyze searching and sorting algorithms along with file handling and binary search tree operations for efficient data organization and problem-solving.
8.	To explore Standard Template Library components such as containers and iterators for efficient data storage and manipulation.

Sr. No.	Text Books
1.	"Data Structures and Algorithms Made Easy" – Narasimha Karumanchi.
2.	"Data Structures Using C" – Reema Thareja.
3.	"Introduction to Algorithms" – Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
Sr. No.	Reference Books
1.	"Fundamentals of Data Structures in C" – Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed.
2.	"Data Structures and Algorithm Analysis in C" – Mark Allen Weiss.
3.	"Data Structures and Algorithms in C++" – Robert Lafore.
Sr. No.	Web Resources
1.	HackerRank – https://www.hackerrank.com
2.	LeetCode – https://leetcode.com
3.	GeeksforGeeks – https://www.geeksforgeeks.org
4.	Programiz – https://www.programiz.com
5.	W3Schools – https://www.w3schools.com

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R. Aravind
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CSE Engg.

Course Title: Do It Yourself (DIY)		
Course Code: CS254807		Course Category: ELC
Teaching Scheme	Examination Scheme	
Practical's /Sessions: 02 Hours/Week	CA-I	15 Marks
Credit: 1	CA-II	15 Marks
Semester: IV	ESE	20 Marks
Course Prerequisite: Basic knowledge of computer networks, operating systems, IP addressing, web technologies, and information security fundamentals. Familiarity with Linux commands and basic command-line tools will be helpful.		
Course Description: This course provides hands-on exposure to ethical hacking concepts, tools, and techniques used for identifying, analyzing, and reporting security vulnerabilities in systems and networks. It includes foot printing, scanning, enumeration, vulnerability assessment, password security testing, wireless security basics, web application testing, system hardening, and security reporting. The course emphasizes legal and authorized security testing practices.		
Course Objective: To develop practical skills in ethical hacking methodology, vulnerability discovery, basic penetration testing, and responsible security assessment using standard tools and controlled laboratory activities.		

Course Outcomes:		
COs	After completion of the course students will be able to:	Bloom's Level
CO1	Explain the ethical hacking process, laboratory setup, legal scope, and basic reconnaissance techniques used in authorized security assessment.	Understand Level 2
CO2	Perform host discovery, port scanning, service enumeration, and vulnerability scanning using standard security tools in a controlled environment.	Apply Level 3
CO3	Assess password security, basic web application vulnerabilities, wireless security weaknesses, and system security issues in a legal laboratory setup.	Analyze Level 4
CO4	Prepare a structured ethical hacking report that documents scope, methodology, tools used, findings, risk levels, and remediation recommendations.	Create Level 6

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
CO1	2	2	-	-	2	1	3	-	-	-	1	1	2
CO2	2	3	1	2	3	1	2	1	-	-	2	2	2
CO3	2	3	1	2	3	2	2	1	-	-	2	3	2
CO4	1	2	1	1	2	1	3	1	3	1	2	1	2

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Assessment	
CA-I (a) (15M)	Students will be assessed on their understanding of ethical hacking laboratory setup and authorized scope definition, along with their ability to perform footprinting, reconnaissance, host discovery, port scanning, and service and operating system enumeration in a controlled environment. The assessment will consider procedural correctness, appropriate use of tools, interpretation of results, and viva/oral performance based on the practical activities carried out.
CA-II (b) (15M)	Students will be assessed on their ability to perform vulnerability scanning, password security testing, basic web application security assessment, and wireless and system security review in an ethical and controlled laboratory environment. Assessment will also include evaluation of their skill in documenting findings through a structured security report, explaining observed vulnerabilities and countermeasures, and answering questions in viva/oral related to the practical work performed.

Sr. No.	List of Activities
1.	Study and identify the components of an ethical hacking lab setup, including attacker machine, target machine, virtual machines, network configuration, and legal scope definition.
2.	Perform foot printing and reconnaissance using public information gathering techniques such as WHOIS lookup, DNS lookup, and search-engine-based enumeration.
3.	Conduct host discovery and port scanning on a target system using standard network scanning tools.
4.	Perform service enumeration to identify open ports, running services, operating system details, and possible exposed resources.
5.	Carry out vulnerability scanning on a test machine or vulnerable lab environment and record the identified weaknesses.
6.	Demonstrate password security testing in a controlled lab using password auditing tools and analyze password strength and common weaknesses.
7.	Perform basic web application assessments such as identifying input validation issues, weak authentication, exposed directories, and common OWASP-related flaws in a legal lab environment.
8.	Study basic wireless security by identifying Wi-Fi security modes, weak configurations, and methods of securing wireless access points.
9.	Analyze system security by reviewing user accounts, permissions, unnecessary services, firewall status, and patch/update condition on a lab machine.
10.	Prepare a professional ethical hacking report containing scope, methodology, tools used, findings, risk level, screenshots, and remediation recommendations.

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Sr. No.	Textbooks
1.	CEH Certified Ethical Hacker All-in-One Exam Guide – Matt Walker
2.	Penetration Testing: A Hands-On Introduction to Hacking – Georgia Weidman
3.	Ethical Hacking and Penetration Testing Guide – Rafay Baloch
4.	The Basics of Hacking and Penetration Testing – Patrick Engebretson
5.	Network Security Assessment – Chris McNab
	Reference Books
1.	The Web Application Hacker's Handbook – Dafydd Stuttard and Marcus Pinto
2.	Hacking: The Art of Exploitation – Jon Erickson
3.	Network Security Essentials – William Stallings
4.	Metasploit: The Penetration Tester's Guide – David Kennedy, Jim O'Gorman, Devon Kearns, Mati Aharon
5.	Practical Malware Analysis – Michael Sikorski and Andrew Honig
	Web Resources
1.	https://owasp.org/
2.	https://nvd.nist.gov/
3.	https://www.cisa.gov/
4.	https://www.kali.org/docs/
5.	https://docs.rapid7.com/metasploit/

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Course Title: PBL: Problem to Project based Learning		
Course Code: CS254808		Course Category: ELC
Teaching Scheme	Examination Scheme (As Applicable)	
Practicals/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester IV)	ESE	20 Marks
Course Prerequisite: Use of analytical skills and drawing tools, Design Thinking Module, Course Level-Problem Based Learning.		
Course Description: This course extends problem-based learning into project realization, where students convert identified problems into working engineering solutions. It emphasizes design, development, and validation of mini-project prototypes using domain knowledge. Students apply systematic engineering approaches to build functional systems within constraints. The course promotes innovation, teamwork, and hands-on skills. Outcomes are demonstrated through a working prototype and technical presentation. The course coordinators will guide to the students in the journey of problem solving by providing the resources in the lab activity sessions and also monitor the students progress.		
Course Objectives: 1. To guide students in transforming identified problems into implementable engineering solutions. 2. To facilitate the design, development, and testing of working prototypes using domain knowledge. 3. To mentor students in applying systematic engineering and project management approaches. 4. To develop students technical competency, teamwork, and communication through mini-project execution.		

Course Outcomes:		
COs	After completion of the course: Student will be able to	Bloom's Level
CO1	Interpret engineering problems and establish solution requirements in a practical context	L2 Understand
CO2	Apply suitable tools and techniques to develop a working model or prototype.	L3 Apply
CO3	Analyze and formulate solution strategies using relevant engineering principles	L4 Analyze
CO4	Evaluate alternative approaches and select appropriate design solutions	L5 Evaluate
CO5	Develop a functional working prototype using suitable tools and techniques	L6 Create

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CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2		1								2	2
CO2	3	2	2	2	2			2			1	3	2
CO3	3	3	3	1	1						1	3	2
CO4	2	2	3	2	2	1		1			1	3	3
CO5			3		2			3	2	2	2		

Assessment	
CA-I (a)	Identify a real-life problem related to the course, clearly explain it with its needs and limitations, study existing solutions, suggest different possible solutions, and choose the best one based on cost, simplicity, and practicality.
CA-II (b)	Design a working model using suitable tools, test its performance, improve it based on results, and finally present the working solution with a simple report.
ESE (c)	Assigned Task Completion.

Sr. No.	List of Experiments/Activities
1.	To identify an open-ended problem related to the course for the mini-project.
2.	To define the problem with its objectives, basic requirements, and limitations.
3.	Literature review/survey of existing solutions and understand their drawbacks.
4.	To identify different possible solutions using course-related concepts.
5.	To select the best solution based on different criteria i.e. simplicity, cost, and practicality.
6.	To prepare the design, list of materials and use the required tools for the solution.
7.	To build a basic working model or prototype using available resources.

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8.	To test the model and check whether it meets the expected results.
9.	To improve the model based on testing results and feedback.
10.	To present the final mini-project with a simple report including method, results, and conclusion.

Sr. No.	Textbooks
1.	Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers.
2.	Karl T. Ulrich, Steven D. Eppinger, Product Design and Development, McGraw-Hill Education.
Reference Books	
1.	Mahnaz Moallem Woei Hung Nada Dabbagh, The Wiley Handbook of Problem-Based Learning, Wiley, 2019.
2.	Kothari, C. R., & Garg, Research Methodology: Methods and Techniques, 2nd Revised Edition, 2019- New Age International Publishers, New Delhi.
Web Resources	
1.	NPTEL Online Courses- Problem Based learning, NITTTR. (https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr20_ed12)

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Course Title: Computational Statistics for AI		
Course Code: CS254402		Course Category: MDM-II
Teaching Scheme		Examination Scheme
Lectures: 02 hrs. / week	CA-1	10 Marks
Tutorial: -	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks
Course Prerequisite: ● Mathematical Foundations: elementary mathematics, algebra, and functions, logical reasoning, mean, median, mode, probability basics. ● Basics of Python: Basic computer skills, basic programming tools.		
Course Description: This course introduces fundamental concepts of statistics and probability for data analysis and artificial intelligence applications. It covers data types, descriptive statistics, and visualization techniques to summarize and interpret real-world datasets. The course develops a strong foundation in probability theory, random variables, and probability distributions for modeling uncertainty. It further explores statistical modeling techniques, including correlation and regression, for analyzing relationships between variables. The course also focuses on inferential statistics and hypothesis testing to support data-driven decision making in practical scenarios.		
Course Objectives: 1. To introduce fundamental concepts of statistics, data types, and data visualization for effective data understanding and analysis. 2. To develop a strong foundation in probability theory, including conditional probability and Bayes’ theorem, for modeling uncertainty in data science applications. 3. To understand probability distributions and statistical modeling techniques, including regression and correlation, for analyzing real-world datasets. 4. To apply inferential statistical methods such as hypothesis testing and confidence intervals for data-driven decision making and evaluation of models.		

Course Outcomes:		
COs	After completion of the course: Students should be able to	Bloom's Level
CO1	Recall fundamental concepts of statistics, probability theory, probability distributions, statistical modeling, and hypothesis testing.	Remember (Level 1)
CO2	Explain data types, descriptive statistics, probability laws, distributions, regression models, and hypothesis testing procedures used in data analysis.	Understand (Level 2)
CO3	Interpret statistical measures, probability concepts, distributions, regression techniques, and hypothesis testing methods to analyze real-world datasets and solve data-driven problems.	Apply (Level 3)
CO4	Examine data using statistical and probabilistic models, evaluate relationships between variables, and interpret hypothesis testing results for informed decision making.	Analyze (Level 4)

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CO-PO-PSO Mapping

CO-PO-PSO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	–	–	–	–	–	–	–	–	2	1	1
CO2	3	2	1	1	–	–	–	–	–	–	2	2	1
CO3	3	3	2	2	2	–	–	–	–	–	2	3	2
CO4	3	3	2	3	2	1	–	–	–	–	3	3	2

Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test etc.
MSE (c)	Subjective Test

Course Contents		
Unit 1	Introduction to Statistics About statistics, population vs sample, types of statistical data- categorical, numerical (continuous), ordinal, interval, ratio, univariate and bivariate analysis, Measures of central tendency: mean, median, mode, harmonic mean, Measures of dispersion - variance, standard deviation and coefficient of variation, outliers, data visualization- line graph, scatter, box plots, histogram. Case Study on real estate company dataset to measures of central tendency and dispersion.	4 Hrs.
Unit 2	Probability Theory Introduction to probability and its role in data science, Basics of probability- random experiments, sample Space, events, axioms of probability, addition and multiplication laws of probability, Conditional probability and independence, Bayes' theorem, discrete vs continuous random variables. Case Study on Customer Conversion Analysis for e-commerce site using Bayes' theorem.	4 Hrs.
Unit 3	Data Modeling using Distributions Introduction to inferential statistics, what is distribution, concept of probability distributions, expectation(mean) and variance, Skewness and interpretations, kurtosis, Central limit theorem. Case study on distribution analysis and sampling behavior interpretation using real estate company dataset.	4 Hrs.
Unit 4	Theoretical Distributions Discrete distributions– Bernoulli distribution, Binomial distribution and Poisson distribution, Uniform distribution, Normal distribution. Case study on modeling the customer arrivals using appropriate distributions and its visualization.	4 Hrs.

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Unit 5	Statistical Modeling Covariance and correlation, interpretation of correlation, Correlation coefficient, simple linear regression, multiple linear regression, concept of overfitting, model assumptions, estimation of regression coefficients, Error metrics– Mean Square Error. Case study on real-world housing dataset to analyze the relationship between property features.	4 Hrs.
Unit 6	Hypothesis Testing and Statistical Tests Typical analysis procedures, introduction to inferential statistics, point estimation, confidence intervals, hypothesis testing concept, Null and Alternative hypotheses, Type I and Type II errors, Rejection region, level of significance, p-value, one-tailed and two-tailed tests, Tests on numerical data– distribution of sample mean, Comparison of two groups– Z-test. Case study on hypothesis testing in data-driven decision making.	4 Hrs.

Sr. No.	Textbooks
1.	Joel Grus, Data Science from Scratch, O'Reilly Media, ISBN- 9781491901427
2.	S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, 7th Revised and Enlarged Edition, 2016.
Sr. No.	Reference Books
1.	Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, First Edition, O'Reilly Media, ISBN- 978-1-491-95296-2.
2.	Claus Weihs, Olaf Mersmann, Uwe Ligges, Foundations of Statistical Algorithms, CRC Press, ISBN- 978-1-4398-7887-3.
3.	Kishor S. Trivedi, Probability, Statistics with Reliability, Queuing and Computer Science Applications, Wiley India Pvt. Ltd, 2nd Edition, 2001.
4.	Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh, An Introduction to Probability and Statistics, Wiley. Third Edition, ISBN:9781118799642
Sr. No.	Web Resources
1.	NPTEL course: Statistics for Data Science, IITM: https://study.iitm.ac.in/ds/course_pages/BSMA1002.html
2.	NPTEL course: Statistical Methods for Scientists and Engineers, IITKGP: https://nptel.ac.in/courses/111/105/111105077/#
3.	NPTEL course: Essential Mathematics for Machine Learning, IIT Roorkee: https://nptel.ac.in/courses/111/107/111107137/#
4.	Coursera -Probability & Statistics for Machine Learning & Data Science https://www.coursera.org/learn/machine-learning-probability-and-statistics

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