PPSU

P P SAVANI UNIVERSITY

SCHOOL OF ENGINEERING

M.TECH. REASERACH IN
(COMPUTER ENGINEERING)

SYLLABUS BOOK

AY 2025-26

INSTITUTE VISION
To be a center of excellence in advanced computing research, nurturing inquisitive minds to push the boundaries of computer engineering and contribute original, impactful solutions to complex real-world problems.

INSTITUTE MISSION	
1.	Foster a research-driven environment that encourages critical thinking, experimentation, and in-depth exploration of emerging fields in computer engineering such as AI, high-performance computing, and system architecture.
2.	Guide students in translating theoretical foundations into innovative applications and prototypes, enabling breakthroughs in both academic and industrial contexts.
3.	Develop scholars who combine technical excellence with ethical responsibility and a long-term vision to address societal, environmental, and global technological challenges.

Graduates will demonstrate ability to:

PEO No	PROGRAMME EDUCATIONAL OBJECTIVES
PEO 1	Solve real-world engineering problems, design and develop innovative and cost-effective solutions exhibiting engineering skills/fundamentals to cater needs of society.
PEO 2	Excel in Industry/technical profession, higher studies, and entrepreneurship exhibiting comprehensive competitiveness.
PEO 3	Exhibit professional ethics & values, effective communication, teamwork, multidisciplinary approach, and ability to relate engineering issues to broader societal framework.

PO No	PROGRAMME OUTCOMES
PO 1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first-principles of mathematics, natural sciences and engineering sciences.
PO 3	Design/Development of Solutions: Design solutions for complex engineering problems and design system-components or processes that meet specified needs with appropriate consideration for public health & safety, cultural, societal and environmental considerations.
PO 4	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis & interpretation of data, and synthesis of information to provide valid conclusions for complex problems.

PO 5	Engineering Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering & IT tools including prediction and modelling to engineering activities, with an understanding of their limitations.
PO 6	The Engineer and The World: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice; understand the impact of engineering solutions in societal and environmental contexts, and demonstrate knowledge of, and need for, sustainable development.
PO 7	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
PO 8	Individual and Collaborative Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 9	Communication: Communicate effectively on engineering activities with the engineering community and with society at large—such as being able to write reports, design documentation, make effective presentations and give/receive instructions.
PO 10	Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work, as a member or leader in a team in a multidisciplinary environment to manage projects.
PO 11	Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO No	**PROGRAMME SPECIFIC OUTCOMES (PSO) COMPUTER ENGINEERING**
PSO 1	Acquire and apply industry-centric skills in Computer Engineering to develop solutions for societal and technological needs.
PSO 2	Develop a research-oriented approach to solve core and interdisciplinary engineering problems at a global level.
PSO 3	Demonstrate the ability to design sustainable and safe engineering solutions considering health, environmental, and societal factors.

Credit Guidelines (General)			
Component	**Hour/Week**	**Credit**	**Total Hours/Semester**
Theory	1	1	15
Practical	2	1	30
Tutorial	1	1	15
Note: In specific cases; extra credits can be granted for specific/important subjects.			

CO-PO Mapping Guidelines		
Mapping Level	**% age Mapping**	**Indicator**
0 / -	0	No Mapping
1	0-33	Low Level (Slightly Mapped)
2	33-66	Medium Level (Moderately Mapped)
3	>66	High Level (Strongly Mapped)

Syllabus Book

M.Tech.(Research)in Computer Engineering

P P Savani University

School of Engineering

CONTENT

Sem	Course Code	Course Title	Course Category	Offered By	Teaching Scheme					Examination Scheme						
					Contact Hours				Credit	Theory		Practical		Tutorial		Total
					Theory	Practical	Tutorial	Total		CE	ESE	CE	ESE	CE	ESE	
1	SECH7010	Research Methodology And IPR	Major/Core	CH	3	0	2	5	5	40	60	0	0	40	60	200
	SECE7910	Research Project-I	RP/OJT	CE	0	10	0	10	10	0	0	80	120	0	0	200
		Elective Course-I	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
		Elective Course-II	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
							Total	**25**	**25**							**800**
2	SECE7010	Mathematical and Numerical Technique in Research	Major/Core	CE	3	0	2	5	5	40	60	0	0	40	60	200
	SECE7920	Research Project-II	RP/OJT	CE	0	10	0	10	10	0	0	80	120	0	0	200
		Elective Course-III	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
		Elective Course-IV	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
							Total	**25**	**25**							**800**
3	SECH8010	Scientific Communication	Major/Core	CH	3	0	2	5	5	40	60	0	0	40	60	200
	SECE8910	Research Project-III	RP/OJT	CE	0	10	0	10	10	0	0	80	120	0	0	200
		Elective Course-V	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
		Elective Course-VI	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
							Total	**25**	**25**							**800**
4	SECE8920	Major Research Project	RP/OJT	CE	0	25	0	25	25	0	0	200	300	0	0	500
							Total	**25**	**25**							**500**
							Grand Total	**100**	**100**							**2900**
		Elective Courses														

1	SECE7510	Artificial Intelligence Search Methods For Problem Solving	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
1	SECE7520	Reinforcement Learning	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
1	SECE7530	Applied Natural Language Processing	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
1	SECE7540	Machine Learning for Engineering and Science Applications	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
1	SECE7550	Deep Learning	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
1	SECE7560	Cloud Computing	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
2	SECE7570	Blockchain and its Applications	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
2	SECE7580	Introduction To Internet Of Things	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
2	SECE7590	Deep Learning for Natural Language Processing	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
2	SECE7600	Computer Vision And Image Processing - Fundamentals And Applications	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
2	SECE7610	Introduction To Industry 4.0 And Industrial Internet Of Things	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
2	SECE7620	Cryptography and Network Security	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
3	SECE8510	Matlab Programming for Numerical Computation	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
3	SECE8520	Quantum Algorithms and Cryptography	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
3	SECE8530	Introduction to Embedded System Design	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
3	SECE8540	High Performance Scientific Computing	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
3	SECE8550	GPU Architectures and Programming	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200
3	SECE8560	Data Analytics with Python	Minor	CE	3	0	2	5	5	40	60	0	0	40	60	200

FIRST YEAR M.TECH.

P P Savani University
School of Engineering
Department of Chemical Engineering

Course Code: SECH7010
Course Name: Research Methodology And IPR
Prerequisite Course(s): -

Teaching & Examination Scheme

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:

- To develop a strong foundation in mathematical modeling techniques that enable students to represent, analyze, and solve complex engineering and research problems using analytical and computational approaches.
- To equip students with advanced numerical methods for solving algebraic, differential, and partial differential equations that arise in real-world engineering systems and simulations.
- To enable the application of optimization techniques and data-driven modeling for research-based decision-making and process/system performance improvement in diverse engineering domains.
- To familiarize students with modern computational tools and software such as MATLAB, Python, Aspen Plus, and scientific libraries for effective simulation, analysis, and visualization of mathematical models.
- To enhance students' ability to apply statistical, probabilistic, and data analysis techniques for experimental data interpretation, hypothesis testing, and uncertainty quantification in engineering research.

Course Content:

Module	Content	Hour	Weightage In %
1	**Introduction to Research and Research Process** Meaning and objectives of research, Types of research: Fundamental, applied, exploratory, and empirical Research process and research problem formulation Criteria for good research	5	10
2	**Literature Survey and Research Ethics** Sources of literature and techniques for literature review, Use of databases and citation indexing (Scopus, Web of Science, Google Scholar), Research ethics and ethical codes, Plagiarism and tools for detection (Turnitin, Grammarly, etc.)	7	20
3	**Research Design and Methodology** Research design types: Descriptive, analytical, experimental, Sampling techniques and hypothesis formulation, Measurement scales and data collection methods, Case studies and surveys in research	5	10
4	**Data Analysis and Interpretation**	5	10

	Statistical analysis of data (mean, median, mode, standard deviation, etc.), Hypothesis testing, confidence intervals, p-values, Correlation and regression analysis, Data visualization and interpretation using software (Excel, SPSS, R, Python)		
5	**Technical Writing and Research Documentation** Research paper, thesis, dissertation structure and formatting Referencing styles: IEEE, APA, MLA, Writing abstracts, technical reports, conference papers, Use of LaTeX, MS Word, and reference managers (Mendeley, Zotero)	5	10
6	**Introduction to IPR and Patent System** Overview of Intellectual Property Rights, Types: Patents, copyrights, trademarks, industrial designs, trade secrets Importance of IPR in research and innovation, Indian and international patent systems (WIPO, PCT)	8	20
7	**Patent Filing and Commercialization** Patent drafting, claims, and specification, Filing procedure in India and abroad, Patent search databases (Espacenet, USPTO, InPASS), Technology transfer and commercialization of IPR	5	10
8	**Case Studies and Contemporary Issues in IPR** Case studies of patent infringement and IP litigation, IPR in academia and industry collaborations, Startups and IP strategies, Future trends: AI and IP, Open Innovation, Creative Commons	5	10
	Total	45	100

List of Tutorials

Tutorial	Content	Duration (Hours)
1	Overview of research meaning, objectives, types (fundamental, applied, exploratory, empirical); research process	2
2	Steps in research problem formulation; criteria for good research	2
3	Sources of literature; techniques for literature review using databases (Scopus, Web of Science, Google Scholar)	2
4	Research ethics, ethical codes, plagiarism, tools (Turnitin, Grammarly)	2
5	Research design types (descriptive, analytical, experimental); sampling techniques	2
6	Hypothesis formulation; measurement scales and data collection methods	2
7	Statistical measures (mean, median, mode, standard deviation); hypothesis testing	2
8	Correlation, regression, confidence intervals, p-values; visualization using Excel, SPSS, R, Python	2
9	Structure and formatting of research papers, theses; referencing styles (IEEE, APA, MLA)	2
10	Writing abstracts, technical reports, conference papers; LaTeX, Mendeley, Zotero	2
11	Overview of IPR (patents, copyrights, trademarks, designs, trade secrets); importance in research	2
12	Indian and international patent systems (WIPO, PCT); patent filing basics	2
13	Patent drafting, claims, specifications; filing procedures; databases (Espacenet, USPTO, InPASS)	2
14	Technology transfer; commercialization of IPR	2
15	Patent infringement, IP litigation, academia-industry collaborations, startups, AI and IP, Open Innovation, Creative Commons	2

	TOTAL	**30**

Text Book:

Title	Author(s)	Publication
Research Methodology: Methods and Techniques	C. R. Kothari, Gaurav Garg	New Age International Publishers

Reference Books:

Title	Author(s)	Publication
Research Methodology: A Step-by-Step Guide for Beginners	Ranjit Kumar	SAGE Publications
Intellectual Property Rights: Unleashing the Knowledge Economy	Prabuddha Ganguli	Tata McGraw-Hill

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks with a duration of 1 hour.
- Faculty Evaluation consists of 10 marks, as per the guidelines provided by the Course Coordinator.
- End Semester Examination will consist of a comprehensive 60 marks theory exam.

Tutorials:

- Continuous Evaluation consists of the performance in tutorials, which should be evaluated out of 10 marks for each tutorial in the next session. The average of these will be converted to 10 marks.
- Internal Viva component of 10 marks based on tutorial understanding and application.
- Tutorial-based assignment/quiz/problem-solving test of 20 marks during the End Semester Evaluation.
- Viva/Oral performance during the End Semester Evaluation carrying 10 marks.

Course Outcome(s):

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

SECH7010	**Research Methodology And IPR**
CO 1	Identify appropriate research problems and design suitable methodologies for academic and industrial research.
CO 2	Conduct comprehensive literature reviews using standard databases and apply ethical practices in research and writing.
CO 3	Analyze, interpret, and validate experimental data using statistical tools and visualization techniques.
CO 4	Prepare well-structured research documents and understand the publication process and citation ethics

CO 5	Demonstrate understanding of Intellectual Property Rights and patent systems to protect, manage, and commercialize research innovations effectively.

Mapping of CO with PO

SECH7010	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	2	3	2	3	2						2
CO 2	1	2		2	1		3		2		3
CO 3	2	3		3	3				1		2
CO 4		1			1		3		3		2
CO 5			2		1	2	2		1	2	2

Mapping of CO with PSO

SECH7010	PSO1	PSO2	PSO3
CO 1	3	2	2
CO 2	2	3	1
CO 3	3	3	2
CO 4	2	2	1
CO 5	3	2	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
01	Introduction to Research and Research Process	3,5
02	Literature Survey and Research Ethics	1,4
03	Research Design and Methodology	1,3
04	Data Analysis and Interpretation	2,6
05	Technical Writing and Research Documentation	1,5
06	Introduction to IPR and Patent System	3,4
07	Patent Filing and Commercialization	2,4
08	Case Studies and Contemporary Issues in IPR	3,4

P P Savani University
School of Engineering
Department of Computer Engineering

Course Code: SECE7910
Course Name: Research Project-I
Prerequisite Course/s: -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
-	10	-	10	-	-	80	120	-	-	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:
To help learners to

- To engage students in identifying, formulating, and solving real-world research problems.
- To encourage independent and original thinking in designing, implementing, and evaluating computational systems.
- To promote the use of research methodology, scientific writing, and effective communication of results.

List of Practical's:

Sr. No.	Name of Practical	Hours
1.	Orientation, topic finalization, and problem statement definition.	10
2.	Literature review using IEEE/ACM/ScienceDirect databases.	20
3	Identification of research gap and formulation of research objectives.	10
4	Selection of methodology, tools, and technologies.	10
5	Initial prototype design or dataset collection/preprocessing.	10
6	Core development: algorithm/model/system design begins.	10
7	Implementation continues with performance testing.	30
8	Experimentation, result collection, tuning.	20
9	Result validation (graphs, statistical methods, comparisons).	20
10	Drafting research report/paper, presentation preparation	10
	TOTAL	150

Practical:

- Each student should be assigned a faculty guide.
- Regular weekly review meetings are mandatory.
- Mid-term internal evaluation and final external viva should be scheduled.
- Research should ideally be aligned with current thrust areas: AI, ML, IoT, Cybersecurity, Data Science, Cloud Computing, Blockchain, etc.

Course Outcome(s):
After the completion of the course, the student will be able to

SECE7910	Research Project-I
CO 1	Identify and define a research problem with reference to current trends in Computer Engineering.
CO 2	Analyze relevant literature and select appropriate tools and techniques.
CO 3	Develop and implement innovative solutions or models for real-world problems.
CO 4	Evaluate research findings and present technical documentation and publications.
CO 5	Demonstrate professional ethics, teamwork, and project management skills throughout the research process

Mapping of CO with PO

SECE7910	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	2	3		2							2
CO 2	2	3		2	3						2
CO 3	3	2	3		3						2
CO 4		2		3	1				3		2
CO 5						2	3	3	1	3	2

Mapping of CO with PSO

SECE7910	PSO1	PSO2	PSO3
CO 1	3	2	1
CO 2	2	3	1
CO 3	3	3	2
CO 4	2	2	2
CO 5	2	2	3

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE7510
Course Name: Artificial Intelligence Search Methods for Problem Solving
Prerequisite Course/s: -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	-	02	05	40	60	-	-	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:

To help learners to

- understand the foundational principles of Artificial Intelligence, with a focus on problem-solving through search techniques.
- analyze and classify different types of search problems, including uninformed, informed, and adversarial search.
- apply heuristic techniques and evaluation functions to optimize search processes in AI-driven systems.
- model real-world problems as state-space search problems and apply appropriate search strategies to solve them.
- explore the limitations and computational complexity of search-based methods in AI.
- use search strategies in practical applications, including game playing, robotics, planning, and intelligent decision-making.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Foundations of Artificial Intelligence** Introduction to AI: History and Motivation, Can Machines Think? Turing Test and the Winograd Schema Challenge, Language and Thought, Wheels & Gears Analogy, Philosophy of Mind and Reasoning, Computation and the Dartmouth Conference, The Chess Saga, Epiphenomena in AI	05	10
2.	**Classical Search Methods** State Space Search: Depth First Search, Breadth First Search, Depth First Iterative Deepening, Heuristic Search: Best First Search, Hill Climbing, Solution Space, TSP, Escaping Local Optima, Stochastic Local Search	08	20
3.	**Metaheuristics and Population-Based Search** Introduction to Population-Based Methods, Genetic Algorithms, Solving SAT and TSP with Evolutionary Approaches, Ant Colony Optimization (ACO), Emergent Systems and Collective Intelligence	06	10
4.	**Optimal and Memory-Conscious Search** Optimal Path Finding: Branch and Bound, A* Search, Admissibility and Informed Heuristics, Space-Saving Search Techniques: Weighted A*, Iterative Deepening A* (IDA*), Recursive Best First Search (RBFS), Beam	08	20

	Stack Search, DCFS, SMGS, Sequence Alignment, Monotone Heuristic Condition		
5.	**Planning and Game Playing** Game Theory and Adversarial Search, Game Trees, Minimax, Alpha-Beta Pruning, SSS* Algorithm, Automated Planning: Domain-Independent Planning, Blocks World, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Problem Decomposition: Means-Ends Analysis, Graphplan Algorithm, AO* Algorithm	10	20
6.	**Logic-Based Systems and Constraint Solving** Rule-Based Expert Systems: Production Rules and Systems, Inference Engine Design, Match-Resolve-Execute Cycle, Rete Net, Deductive Reasoning: Deduction as Search, Soundness, Completeness, Propositional and First Order Logic, Forward and Backward Chaining, Constraint Processing: CSP Formulation, Consistency-Based Diagnosis, Backtracking Algorithm, Arc Consistency, Forward Checking Algorithm	08	20
	TOTAL	45	100

List of Tutorials:

Sr. No.	Name of Tutorial	Hours
1.	Depth-First and Breadth-First Search	04
2.	Iterative Deepening & TSP State Space	04
3.	Heuristic Search Techniques	02
4.	Population-Based Search	04
5.	A and Branch & Bound*	02
6.	Space-Conscious Search Techniques	02
7.	Game Trees and Minimax	04
8.	Planning Strategies	02
9.	Rule-Based Systems & Logic Inference	04
10.	Constraint Satisfaction Problems	02
	TOTAL	30

Text Book:

Title	Author(s)	Publication
A First Course in Artificial Intelligence	Deepak Khemani	McGraw Hill Education

Reference Book:

Title	Author(s)	Publication
Heuristic Search: Theory and Applications	Stefan Edelkamp and Stefan Schroedl	Morgan Kaufmann
Artificial Intelligence: The Very Idea, A Bradford Book	John Haugeland	The MIT Press
How to Solve It: Modern Heuristics	Zbigniew Michalewicz and David B. Fogel	Springer
Heuristics: Intelligent Search Strategies for Computer Problem Solving	Judea Pearl	Addison-Wesley

Artificial Intelligence	Elaine Rich and Kevin Knight	Tata McGraw Hill

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average ofthe same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of tutorial which will be evaluated out of 10 marks for each tutorial and average of the same will be converted to 50 marks
- Continuous Evaluation consists of self-performance assignment to 20 marks.
- Internal Viva consists of 30 marks.

Course Outcome(s):

After the completion of the course, the student will be able to

SECE7510	**Artificial Intelligence Search Methods For Problem Solving**
CO 1	Describe the fundamental concepts, historical evolution, and philosophical foundations of Artificial Intelligence.
CO 2	Apply uninformed and informed search techniques (e.g., BFS, DFS, A*, Hill Climbing) to solve well-defined AI problems.
CO 3	Analyze the performance and suitability of various search algorithms, including optimal and memory-efficient approaches, for complex problem-solving.
CO 4	Design intelligent agents for planning and adversarial environments using strategies such as Minimax, Alpha-Beta pruning, and Goal Stack Planning.
CO 5	Implement rule-based reasoning and constraint-solving in AI systems involving logic and knowledge representation.

Mapping of CO with PO

SECE7510	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO 1	3	1							1		2
CO 2	3	3		2	3						2
CO 3	2	3		3	2						2
CO 4	3	2	3		3						2
CO 5	3	2		2	3						2

Mapping of CO with PSO

SECE7510	PSO1	PSO2	PSO3
CO 1	2	3	1
CO 2	3	3	2
CO 3	3	3	2
CO 4	3	3	2
CO 5	3	3	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Foundations of Artificial Intelligence	1, 2
2	Classical Search Methods	1, 2, 3,5
3	Metaheuristics and Population-Based Search	2, 3, 4,6
4	Optimal and Memory-Conscious Search	3, 4, 5
5	Planning and Game Playing	3, 4, 6
6	Logic-Based Systems and Constraint Solving	2, 3, 4

P P Savani University
School of Engineering
Department of Computer Engineering

Course Code: SECE7520
Course Name: Reinforcement Learning
Prerequisite Course/s: -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	-	02	05	40	60	-	-	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:

To help learners to

- understand the foundations and motivation behind reinforcement learning.
- analyze and implement bandit algorithms and policy gradient methods.
- formulate sequential decision-making problems using Markov Decision Processes (MDPs).
- apply value iteration, policy iteration, and temporal difference methods for solving MDPs.
- extend reinforcement learning with approximation techniques, deep RL, and hierarchical models.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction to RL & Multi-Armed Bandits** Introduction, Bandit Algorithms – UCB, PAC, Median Elimination, Policy Gradient	8	20
2.	**Markov Decision Processes and Bellman Equations** MDPs & Full RL, Bellman Optimality	10	20
3.	**Planning and Bootstrapping Methods** Dynamic Programming, TD Learning, Eligibility Traces	8	25
4.	**Function Approximation and Deep RL** Function Approximation, Least Squares Methods, Fitted Q, Deep Q-Networks (DQN), Policy Gradients for Full RL	9	15
5.	**Advanced and Hierarchical RL** Hierarchical RL, POMDPs (Partially Observable MDPs)	10	20

List of Tutorials:

Sr. No.	**Name of Tutorial**	**Hours**
1.	Derive the expected reward for a Bernoulli Bandit problem.	2
2.	Implement UCB and compare with ε-greedy on simulated arms.	2
3.	Apply Median Elimination and explain PAC guarantees.	3

4.	Derive the Bellman Expectation and Optimality Equations.	3
5.	Implement Value Iteration and Policy Iteration on GridWorld.	2
6.	Trace TD(0) and TD(λ) updates on a walk-through example.	4
7.	Visualize the effect of eligibility traces with λ = 0 to 1.	2
8.	Implement linear function approximation for Q-learning.	2
9.	Derive and implement LSTD (Least Squares Temporal Difference).	2
10.	Train a Deep Q-Network (DQN) on CartPole using PyTorch / TensorFlow.	4
11.	Design a hierarchical agent.	2
12.	Solve a simple POMDP using belief-state updates or Monte Carlo methods.	2
	TOTAL	30

Text Book:

Title	Author(s)	Publication
Reinforcement Learning - An Introduction	R. S. Sutton and A. G. Barto	MIT Press

Reference Book:

Title	Author(s)	Publication
Deep Reinforcement Learning Hands-On	Maxim Lapan	Packt Publishing
Reinforcement Learning: State-of-the-Art	Marco Wiering, Martijn van Otterlo	Springer

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average ofthe same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of tutorial which will be evaluated out of 10 marks for each tutorial and average of the same will be converted to 50 marks
- Continuous Evaluation consists of self-performance assignment to 20 marks.
- Internal Viva consists of 30 marks.

Course Outcome(s):

After the completion of the course, the student will be able to

SECE7520	Reinforcement Learning
CO 1	Describe and differentiate between exploration-exploitation strategies in bandit problems.
CO 2	Formulate decision-making problems using Markov Decision Processes (MDPs) and solve them analytically.
CO 3	Implement and compare value-based and policy-based RL algorithms on benchmark environments.
CO 4	Analyze convergence and performance of reinforcement learning methods using dynamic programming and TD techniques.

CO 5	Design advanced RL agents using function approximation, deep learning, and hierarchical structures.

Mapping of CO with PO

SECE7520	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	2							1		2
CO 2	3	3		2	2						2
CO 3	2	3		3	3						2
CO 4	2	3		3	2						2
CO 5	3	2	3		3						2

Mapping of CO with PSO

SECE7520	PSO1	PSO2	PSO3
CO 1	2	3	1
CO 2	2	3	2
CO 3	3	3	2
CO 4	3	3	2
CO 5	3	3	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction to RL & Multi-Armed Bandits	1, 2, 3, 4
2	Markov Decision Processes and Bellman Equations	1, 2, 3, 4,5
3	Planning and Bootstrapping Methods	1, 2, 3, 4,6
4	Function Approximation and Deep RL	2, 3, 4, 5
5	Advanced and Hierarchical RL	2, 4, 6

P P Savani University
School of Engineering
Department of Computer Engineering

Course Code: SECE7530
Course Name: Applied Natural Language Processing
Prerequisite Course/s: -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	-	02	05	40	60	-	-	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:
To help learners to

- Introduce the fundamental concepts and terminologies of Natural Language Processing (NLP).
- Understand traditional and neural network-based language models and their applications.
- Develop the ability to work with word embeddings and sequence models like RNNs.
- Explore and apply statistical and neural methods for machine translation and conversation modeling.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Introduction to NLP and Representations** NLP basics, terminologies, empirical rules, Text preprocessing, From word to vectors	06	15
2.	**Language Modeling and Probability** Probability in NLP, N-gram models, smoothing, Neural networks for NLP tasks	08	20
3.	**Word Embeddings and Sequence Models** Distributed word vectors (word2vec, GloVe), RNNs and variants (LSTM, GRU), Neural Language Models	08	20
4.	**Machine Translation** Statistical Machine Translation (SMT), Neural Machine Translation (NMT), Attention mechanisms and encoder-decoder architecture	12	25
5.	**Conversational Systems and IR** Dialog agents, chatbots, Question answering and information retrieval, Phrase understanding and analogies	07	10
6.	**Spelling Correction and Course Review** Traditional vs neural spelling correction, Course summary and emerging trends in NLP	04	10
	TOTAL	45	100

List of Tutorials:

Sr. No.	Name of Tutorial	Hours
1.	Text preprocessing and tokenization techniques	02
2.	Vector representation: one-hot, TF-IDF, word2vec	04
3.	Probability concepts in NLP (N-gram modeling)	02
4.	Introduction to neural networks for NLP	02
5.	Word2vec and GloVe hands-on	04
6.	Building RNN and LSTM for text generation	04
7.	Implementing a statistical language model	04
8.	SMT with alignment models and decoding	02
9.	Attention mechanism and encoder-decoder in NMT	02
10.	Chatbot design using sequence-to-sequence models	02
11.	Spelling correction using edit distance and neural networks	02
	TOTAL	30

Text Book:

Title	Author(s)	Publication
Features of a Corpus	Niladri Sekhar Dash and S. Arulmozi	Springer
Foundations of Statistical Natural Language Processing	C.D. Manning et al	The MIT Press

Reference Book:

Title	Author(s)	Publication
Python 3 text processing with NLTK 3 cookbook	Jacob Perkins	Packt Publishing Ltd
Linguistic Structure Prediction. Synthesis Lectures on Human Language Technologies	Noah A. Smith	Morgan and Claypool

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average ofthe same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of tutorial which will be evaluated out of 10 marks for each tutorial and average of the same will be converted to 50 marks
- Continuous Evaluation consists of self-performance assignment to 20 marks.
- Internal Viva consists of 30 marks.

Course Outcome(s):

After the completion of the course, the student will be able to

SECE7530	Applied Natural Language Processing

CO 1	Understand basic NLP terminologies and vector space representations.
CO 2	Apply statistical and neural methods to language modeling and word embeddings.
CO 3	Design and evaluate translation systems using SMT and NMT techniques.
CO 4	Develop simple dialogue systems, chatbots, and neural-based spelling correction systems.
CO 5	Analyze emerging trends and research advancements in NLP for real-world applications.

Mapping of CO with PO

SECE7530	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	1							1		2
CO 2	3	2		2	3						2
CO 3	3	2	3	2	3						2
CO 4	2	2	3		3						2
CO 5	2	1									3

Mapping of CO with PSO

SECE7530	PSO1	PSO2	PSO3
CO 1	3	2	1
CO 2	3	3	1
CO 3	3	3	2
CO 4	3	2	2
CO 5	2	3	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction to NLP & Word Vectors	1, 2
2	Language Modeling & Neural Networks	2, 3,5
3	Word Embeddings & RNNs	2, 3, 4
4	SMT and NMT	3, 4, 5,6
5	Dialog Systems, IR, QA	4, 5, 6
6	Spelling Correction & Wrap-Up	3, 4, 6

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE7540
Course Name: Machine Learning for Engineering and science applications
Prerequisite Course(s): -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- Develop a strong mathematical foundation and Numerical Computation essential for machine learning applications.
- Understand and implement fundamental and advanced ML techniques.
- Explore optimization and training strategies.
- Apply machine learning models to real-world engineering and scientific problems, gaining hands-on experience with practical applications.

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	**Mathematical Basics** Introduction to Machine Learning, Linear Algebra, Probability	5	10
2.	**Computational Basics with Linear and Logistic Regression** Numerical computation and optimization, Introduction to Machine learning packages, Bias/Variance Trade-off, Regularization, Variants of Gradient Descent, MLE, MAP, Applications	11	25
3.	**Neural Networks** Multilayer Perceptron, Back-propagation, Applications, CNN Operations, CNN architectures, Training, Transfer Learning, Applications	6	15
4.	**Classical Techniques** Recurrent Neural Networks RNN, LSTM, GRU, Applications, Bayesian Regression, Binary Trees, Random Forests, SVM, Naïve Bayes, Applications, k-Means, k-NN, GMM, Expectation Maximization, Applications	13	28
5.	**Advanced Techniques** Structured Probabilistic Models, Monte Carlo Methods, Auto-encoders, Generative Adversarial Network	10	22

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	Mathematical Basics and Introduction to Machine Learning.	04
2.	Mathematical Foundations (Linear Algebra, Probability).	04
3.	Computational Basics (Optimization, ML Packages).	04

4.	Regression Techniques (Linear, Logistic).	04
5.	Neural Networks & Deep Learning (CNN, RNN, LSTM).	04
6.	Classical ML Methods (Bayesian Regression, SVM, Random Forests).	04
7.	Advanced ML Techniques (Monte Carlo Methods, Autoencoders, GANs).	06

Text Book(s):

Title	Author/s	Publication
Deep Learning	Goodfellow et al	MIT Press, 20172.

Reference Book(s):

Title	Author/s	Publication
Pattern Recognition and Machine Learning	Christopher Bishop	Springer, 20093.

Web Material Link(s):

- https://onlinecourses.nptel.ac.in/noc25_cs49/preview

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:

- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):

After completion of the course, the student will be able to

SECE7540	Machine Learning for Engineering and science applications
CO 1	Utilize Linear Algebra and Probability theory to understand and develop machine learning models.
CO 2	Use numerical optimization, ML packages, and gradient-based methods for model training and evaluation.
CO 3	Design and train MLPs, CNNs, RNNs, and deep learning models for real-world applications.
CO 4	Employ regression models, decision trees, SVMs, clustering algorithms, and probabilistic approaches for data analysis.
CO 5	Implement structured probabilistic models, Monte Carlo techniques, autoencoders, and GANs for complex learning tasks.

Mapping of CO with PO

SECE3540	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	2							1		2
CO 2	3	3		2	3						2
CO 3	3	2	3	2	3						2
CO 4	3	3		2	3						2

CO 5	3	2	3		3						2

Mapping of CO with PSO

SECE3540	PSO 1	PSO 2	PSO 3
CO 1	1	1	
CO 2	2	2	1
CO 3	3	3	2
CO 4	3	3	3
CO 5	3	3	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Mathematical Basics	1,2,3,4,5,6
2	Regression	1,4,5,6
3	Neural Networks	1,2,3,6
4	Classical Techniques	3,4,5,6
5	Advanced Techniques	3,4,5,6

P P Savani University
School of Engineering

Department of Computer Engineering

Course Code: SECE7550
Course Name: Deep Learning
Prerequisite Course/s: -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	-	02	05	40	60	-	-	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:

To help learners to

- understand the foundations of deep learning and optimization techniques.
- explore deep learning architectures including CNNs, Autoencoders, and RNNs.
- develop effective training strategies for deep neural networks.
- implement and evaluate supervised, unsupervised, and generative deep learning models.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	**Foundations of Deep Learning and Linear Models** Introduction to Deep Learning, Bayesian Learning, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss	05	10
2.	**Optimization and Neural Network Basics** Optimization Techniques, Gradient Descent, Batch Optimization, Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning	08	20
3.	**Unsupervised Learning and CNN Foundations** Unsupervised Learning with Deep Networks, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning	06	10
4.	**Advanced Optimization and Regularization Techniques** Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam, Effective training in Deep Nets - Early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization	08	20
5.	**Advanced Architectures and Supervised Applications** Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN, Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection	10	20
6.	**Sequence Models and Generative Deep Learning** LSTM Networks, Generative Modeling with DL - Variational Autoencoder, Generative Adversarial Network	08	20
	TOTAL	45	100

List of Tutorials:

Sr. No.	Name of Tutorial	Hours
1.	Overview of Deep Learning and Bayesian Learning basics.	02
2.	Implementing Linear Classifiers and Hinge Loss optimization.	03
3.	Gradient Descent variants and Batch Optimization coding.	03
4.	Building and training MLP with Backpropagation from scratch.	02
5.	Unsupervised Learning – Building and training Autoencoders.	02
6.	Constructing and experimenting with basic CNNs and Transfer Learning	04
7.	Implementing Momentum, RMSProp, and Adam optimizers.	02
8.	Early Stopping, Dropout, Batch/Instance/Group Normalization implementation.	03
9.	Building Residual Networks and exploring Skip Connections.	03
10.	Applying CNNs to image denoising, segmentation, and detection tasks	02
11.	Designing and training LSTM models for sequence tasks.	02
12.	Implementing Variational Autoencoders and GANs.	02
	TOTAL	30

Text Book:

Title	Author(s)	Publication
Deep Learning	Ian Goodfelllow, Yoshua Benjio, Aaron Courville	The MIT Press

Reference Book:

Title	Author(s)	Publication
Pattern Classification	Richard O. Duda, Peter E. Hart, David G. Stork	John Wiley & Sons Inc
Deep Learning with Python	François Chollet	Manning Publications
Deep Learning for Computer Vision	Rajalingappaa Shanmugamani	Packt Publishing

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average ofthe same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of tutorial which will be evaluated out of 10 marks for each tutorial and average of the same will be converted to 50 marks
- Continuous Evaluation consists of self-performance assignment to 20 marks.
- Internal Viva consists of 30 marks.

Course Outcome(s):

After the completion of the course, the student will be able to

SECE7550	Deep Learning
CO 1	Explain fundamental concepts of deep learning, Bayesian learning, and linear classifiers.
CO 2	Apply optimization techniques and train neural networks including MLPs and CNNs effectively.
CO 3	Develop unsupervised models like autoencoders and implement transfer learning techniques.
CO 4	Employ advanced regularization and optimization techniques to improve deep network training.
CO 5	Design and implement state-of-the-art architectures including LSTMs and generative models for real-world applications.

Mapping of CO with PO

SECE7550	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	2							1		2
CO 2	3	3		2	3						2
CO 3	3	2		2	3						2
CO 4	2	3		2	2						2
CO 5	3	2	3		3						2

Mapping of CO with PSO

SECE7550	PSO1	PSO2	PSO3
CO 1	2	3	1
CO 2	3	2	2
CO 3	3	3	2
CO 4	3	3	2
CO 5	3	3	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Foundations of Deep Learning and Linear Models	1, 2, 3
2	Optimization and Neural Network Basics	2, 3,5
3	Unsupervised Learning and CNN Foundations	3, 4,5
4	Advanced Optimization and Regularization Techniques	3, 4,6
5	Advanced Architectures and Supervised Applications	3, 4, 6
6	Sequence Models and Generative Deep Learning	2, 3, 4, 5, 6

P P Savani University
School of Engineering
Department of Computer Engineering

Course Code: SECE7560
Course Name: Cloud Computing
Prerequisite Course/s: -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	-	02	05	40	60	-	-	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:
To help learners to

- Understand cloud architecture, service models, and deployment types.
- Implement virtualization and secure cloud environments.
- Analyze fog/edge/cloud trends and use commercial platforms.
- Apply practical skills using AWS, Azure, OpenStack, and simulators.

Course Content:

Module No.	Content	Hours	Weightage in %
1.	Cloud Introduction: Evolution, Service Models, Deployment Types	5	9
2.	Cloud Architecture, Resource Management, Multi-tenancy, SLA, Metering	5	9
3.	Virtualization: Hypervisors, Containers, VM Provisioning	6	12
4.	**Security & Compliance:** IAM, Trust Models, Authorization	9	11
5.	**Platforms:** AWS, Azure, OpenStack, Fog & Edge Computing	10	24
6.	Serverless Architecture, FaaS, Case Studies & Industry Applications	10	3524
	TOTAL	45	100

List of Tutorials:

Sr. No.	**Name of Tutorial**	**Hours**
1.	Cloud Basics and Service Models	02
2.	Virtualization & Hypervisor Setup	04
3.	Virtualization & Hypervisor Setup	04
4.	Implementing IAM & Security Policies in Cloud	04
5.	Hands-on with AWS/OpenStack/CloudSim	04
6.	case Study: Residual Network and Transfer Learning	04
7.	Edge/Fog Computing Simulation and Analysis	04

8.	Mini Project: Deployment of a Cloud-based Solution	04
	TOTAL	30

Text Book:

Title	Author(s)	Publication
Cloud Computing: Principles and Paradigms	Rajkumar Buyya, James Broberg, Andrzej M. GoscinskI	Wiley

Reference Book:

Title	Author(s)	Publication
Enterprise Cloud Computing	Gautam Shroff	Cambridge Univ. Press
Cloud Security: A Comprehensive Guide	Ronald Krutz, Russell Vines	Wiley
Cloud Computing Bible	Barrie Sosinsky	WILEY-INDIA

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average ofthe same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of performance of tutorial which will be evaluated out of 10 marks for each tutorial and average of the same will be converted to 50 marks
- Continuous Evaluation consists of self-performance assignment to 20 marks.
- Internal Viva consists of 30 marks.

Course Outcome(s):

After the completion of the course, the student will be able to

SECE7560	Cloud Computing
CO 1	Describe cloud models, architectures, and evolution.
CO 2	Apply virtualization and manage resource provisioning in cloud environments
CO 3	Analyze cloud storage, security, and identity management.
CO 4	Evaluate platforms (AWS, OpenStack) and trends (fog, edge computing).
CO 5	Design real-world applications using serverless and scalable cloud architectures.

Mapping of CO with PO

SECE7560	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	1							1		2
CO 2	3	2		2	3						2
CO 3	2	3		2	3	2	2				2
CO 4	2	2			3						3
CO 5	3	2	3		3					2	2

Mapping of CO with PSO

SECE7560	PSO1	PSO2	PSO3
CO 1	2	3	1
CO 2	3	3	2
CO 3	3	3	2
CO 4	3	3	2
CO 5	3	3	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Cloud Introduction:	1, 2
2	Cloud Architecture	2, 3
3	Virtualization	3, 4,5
4	Security & Compliance	2, 4, 5
5	Platforms	3, 5, 6
6	Serverless Architecture	4, 5, 6

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE7010

Course Name: Mathematical and Numerical Technique in Research

Prerequisite Course(s): -

Teaching & Examination Scheme

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:

- To develop a strong foundation in mathematical modeling techniques that enable students to represent, analyze, and solve complex engineering and research problems using analytical and computational approaches.
- To equip students with advanced numerical methods for solving algebraic, differential, and partial differential equations that arise in real-world engineering systems and simulations.
- To enable the application of optimization techniques and data-driven modeling for research-based decision-making and process/system performance improvement in diverse engineering domains.
- To familiarize students with modern computational tools and software such as MATLAB, Python, Aspen Plus, and scientific libraries for effective simulation, analysis, and visualization of mathematical models.
- To enhance students' ability to apply statistical, probabilistic, and data analysis techniques for experimental data interpretation, hypothesis testing, and uncertainty quantification in engineering research.

Course Content:

Module	Content	Hour	Weightage In %
1	**Foundations of Mathematical Modeling in Research** Fundamentals of model formulation and validation, Classification of models: deterministic vs. stochastic, static vs. dynamic, Dimensional analysis and similarity, Applications in chemical process design and computational algorithms	5	10
2	**Advanced Linear Algebra and Its Applications** Vector spaces, inner product spaces, Gram-Schmidt orthogonalization, Eigenvalue problems, diagonalization, Jordan forms, Applications in Principal Component Analysis (PCA), process control, and machine learning, Numerical solutions to large systems: Jacobi, Gauss-Seidel methods	7	20
3	**Advanced Calculus and Differential Equations** Higher-order ODEs and systems of ODEs, Stability analysis and phase portraits, Laplace transforms and their applications,	5	10

	Applications in reaction kinetics, control theory, and dynamic system modeling		
4	**Partial Differential Equations and Their Numerical Solutions** Heat, wave, and Laplace equations, Method of separation of variables, Fourier and finite difference methods, Finite Volume and Finite Element Methods (FVM, FEM) – introduction and comparison, Applications in mass transfer, CFD, and neural PDE solvers	5	10
5.	**Numerical Techniques and Scientific Computing** Numerical differentiation and integration: Trapezoidal, Simpson's rule, Root-finding techniques: Newton-Raphson, Secant, Broyden's method, Interpolation and curve fitting, Software implementation using MATLAB, Python, Octave	5	10
6.	**Optimization Techniques in Research** Classical and non-classical optimization, Linear, Non-linear, Constrained, and Unconstrained optimization, Metaheuristic algorithms: Genetic Algorithms, PSO, Simulated Annealing, Multivariable optimization problems in process design and machine learning	8	20
7.	**Probability, Statistics, and Data-Driven Modeling** Probability distributions and random variables, Estimation, hypothesis testing, confidence intervals, Regression modeling, ANOVA, Bayesian inference, Applications in process monitoring, reliability engineering, and AI/ML	5	10
8.	**Computational Tools and Research Applications** Research-centric use of MATLAB, Python (NumPy, SciPy, SymPy, Pandas, Scikit-learn), Aspen Plus, ANSYS Fluent; TensorFlow, PyTorch , Error analysis, reproducibility, and scientific documentation Capstone Project: Solving a real-life or simulated research problem	5	10
	Total	45	100

List of Tutorials

Tutorial	Content	Duration (Hours)
1	Fundamentals of model formulation and validation; classification of models (deterministic vs. stochastic, static vs. dynamic)	2
2	Dimensional analysis, similarity; applications in chemical process design and computational algorithms	2
3	Vector spaces, inner product spaces, Gram-Schmidt orthogonalization	2
4	Eigenvalue problems, diagonalization, Jordan forms; applications in PCA and process control	2
5	Higher-order ODEs, systems of ODEs; stability analysis and phase portraits	2
6	Laplace transforms; applications in reaction kinetics and control theory	2
7	Heat, wave, and Laplace equations; method of separation of variables	2
8	Fourier, finite difference, FVM, FEM methods; applications in mass transfer and CFD	2
9	Numerical differentiation, integration (Trapezoidal, Simpson's rule); root-finding (Newton-Raphson, Secant)	2
10	Interpolation, curve fitting; implementation in MATLAB, Python, Octave	2

11	Classical and non-classical optimization; linear and non-linear optimization	2
12	Metaheuristic algorithms (Genetic Algorithms, PSO, Simulated Annealing); multivariable optimization	2
13	Probability distributions, random variables; estimation, hypothesis testing	2
14	Regression modeling, ANOVA, Bayesian inference; applications in process monitoring	2
15	MATLAB, Python (NumPy, SciPy, Pandas, Scikit-learn), Aspen Plus, ANSYS Fluent; capstone project	4
	Total	30

Text Book:

Title	Author(s)	Publication
Numerical Methods for Engineers	Steven C. Chapra, Raymond P. Canale	McGraw Hill Education

Reference Books:

Title	Author(s)	Publication
Applied Numerical Methods with MATLAB for Engineers and Scientists	Steven C. Chapra	McGraw Hill Education
n Introduction to Statistical Learning: with Applications in R	Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani	Springer

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks with a duration of 1 hour.
- Faculty Evaluation consists of 10 marks, as per the guidelines provided by the Course Coordinator.
- End Semester Examination will consist of a comprehensive 60 marks theory exam.

Tutorials:

- Continuous Evaluation consists of the performance in tutorials, which should be evaluated out of 10 marks for each tutorial in the next session. The average of these will be converted to 10 marks.
- Internal Viva component of 10 marks based on tutorial understanding and application.
- Tutorial-based assignment/quiz/problem-solving test of 20 marks during the End Semester Evaluation.
- Viva/Oral performance during the End Semester Evaluation carrying 10 marks.

Course Outcome(s):

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

SECE7010	Mathematical and Numerical Technique in Research
CO 1	Apply advanced mathematical modeling techniques to represent and analyze complex research problems in various engineering domains.

CO 2	Implement and evaluate various numerical methods for solving linear and nonlinear equations, differential equations, and optimization problems using appropriate computational tools.
CO 3	Analyze and interpret experimental or simulated data using statistical and probabilistic methods for informed decision-making in research applications.
CO 4	Develop and validate research-oriented computational models using modern software platforms (e.g., MATLAB, Python, Aspen Plus) and communicate findings effectively through technical documentation and presentations.
CO 5	Integrate interdisciplinary approaches, ethical practices, and sustainability principles in developing innovative mathematical and computational research solutions.

Mapping of CO with PO

SECE7010	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	3		2							2
CO 2	3	3		2	3						2
CO 3	3	3		3	2						2
CO 4	2	2		2	3				3		2
CO 5	2		2			3	3	2		2	2

Mapping of CO with PSO

SECE7010	PSO1	PSO2	PSO3
CO 1	3	2	2
CO 2	3	3	2
CO 3	2	3	2
CO 4	3	3	2
CO 5	2	3	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
01	Foundations of Mathematical Modeling in Research	3,5
02	Advanced Linear Algebra and Its Applications	1,4
03	Advanced Calculus and Differential Equations	1,3
04	Partial Differential Equations and Their Numerical Solutions	2,6
05	Numerical Techniques and Scientific Computing	1,5
06	Optimization Techniques in Research	3,4
07	Probability, Statistics, and Data-Driven Modeling	2,4
08	Computational Tools and Research Applications	3,5

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE7920
Course Name: Research Project-II
Prerequisite Course/s: -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
-	10	-	10	-	-	80	120	-	-	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:

To help learners to

- To engage students in identifying, formulating, and solving real-world research problems.
- To encourage independent and original thinking in designing, implementing, and evaluating computational systems.
- To promote the use of research methodology, scientific writing, and effective communication of results.

List of Practical's:

Sr. No.	Name of Tutorial	Hours
1.	Orientation, topic finalization, and problem statement definition.	10
2.	Literature review using IEEE/ACM/ScienceDirect databases.	20
3	Identification of research gap and formulation of research objectives.	10
4	Selection of methodology, tools, and technologies.	10
5	Initial prototype design or dataset collection/preprocessing.	10
6	Core development: algorithm/model/system design begins.	10
7	Implementation continues with performance testing.	30
8	Experimentation, result collection, tuning.	20
9	Result validation (graphs, statistical methods, comparisons).	20
10	Drafting research report/paper, presentation preparation	10
	TOTAL	150

Practical:

- Each student should be assigned a faculty guide.
- Regular weekly review meetings are mandatory.
- Mid-term internal evaluation and final external viva should be scheduled.
- Research should ideally be aligned with current thrust areas: AI, ML, IoT, Cybersecurity, Data Science, Cloud Computing, Blockchain, etc.

Course Outcome(s):

After the completion of the course, the student will be able to

SECE7920	Research Project-II
CO 1	Identify and define a research problem with reference to current trends in Computer Engineering.
CO 2	Analyze relevant literature and select appropriate tools and techniques.
CO 3	Develop and implement innovative solutions or models for real-world problems.
CO 4	Evaluate research findings and present technical documentation and publications.
CO 5	Demonstrate professional ethics, teamwork, and project management skills throughout the research process

Mapping of CO with PO

SECE7920	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO 1	2	3		2							2
CO 2	2	3		2	3						2
CO 3	3	2	3		3						2
CO 4		2		3	1				3		2
CO 5						2	3	3	1	3	2

Mapping of CO with PSO

SECE7920	PSO1	PSO2	PSO3
CO 1	3	2	1
CO 2	2	3	1
CO 3	3	3	2
CO 4	2	2	2
CO 5	2	2	3

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE7570
Course Name: Blockchain and its Applications
Prerequisite Course(s):

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- Understand Block-chain Fundamentals and the core principles of block-chain technology
- Explore Block-chain Evolution and Consensus Models
- Develop Hands-on Experience with Smart Contracts
- Analyse Block-chain Applications in Various Domains

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	**Introduction** Introduction to Block-chain Technology and its Importance, Basic Crypto Primitives, Cryptographic Hash, Digital Signature	7	15
2.	**Evolution and Elements** Evolution of the Block-chain Technology, Elements of a Block-chain	8	20
3.	**Models** Block-chain Consensus Permission-less Models, Permissioned Models	7	15
4.	**Smart Contract & Models** Smart Contract Hands On, Ethereum Smart Contracts (Permission-less Model), Hyper-ledger Fabric (Permissioned Model)	13	28
5.	**Ecosystem and Applications** Decentralized Identity Management, Block-chain Interoperability, Block-chain Applications	10	22
	TOTAL	45	100

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	Basics of Blockchain Technology	02
2.	Importance of Blockchain in Decentralization	02
3.	Cryptographic Hash Functions & Digital Signatures	02
4.	History and Evolution of Blockchain	02

5.	Key Elements of Blockchain (Blocks, Nodes, Consensus)	02
6.	Blockchain Security and Privacy	02
7.	Permission-less vs. Permissioned Blockchain Models	02
8.	Consensus Mechanisms (Proof of Work, Proof of Stake, Byzantine Fault Tolerance)	02
9.	Scalability and Performance Challenges in Blockchain	02
10.	Introduction to Smart Contracts	02
11.	Ethereum Smart Contracts (Hands-on Solidity Programming)	02
12.	Hyperledger Fabric (Permissioned Blockchain Development)	02
13.	Decentralized Identity Management	02
14.	Blockchain Interoperability & Cross-Chain Communication	02
15.	Real-World Blockchain Applications (Finance, Healthcare, Supply Chain)	02
	TOTAL	30

Text Book(s):

Title	Author/s	Publication
Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more.	Imran Bashir	3rd Edition, Packt Publishing,2020

Reference Book(s):

Title	Author/s	Publication
Blockchain Foundations and Applications	Xun Yi, Xuechao Yang, Andrei Kelarev, Kwok Yan Lam, Zahir Tari	Springer
Blockchain Technology and Applications	Pethuru Raj, Kavita Saini, Chellammal Surianarayanan	Auerbach Publications (CRC Press)
Blockchain Technology and Applications	Dr. Ing. Jan Veuger	Nova Science Publishers

Web Material Link(s):

- https://onlinecourses.nptel.ac.in/noc25_cs08/preview
- https://www.packtpub.com/product/mastering-blockchain-thirdedition/9781839213199
- https://www.hyperledger.org/use/tutorials
- https://ethereum.org/en/developers

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:

- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):

After completion of the course, the student will be able to

SECE7570	Blockchain and its Applications
CO 1	Understand Blockchain Technology
CO 2	Analyze Blockchain Evolution and Elements
CO 3	Implement Blockchain Models & Consensus Mechanisms
CO 4	Develop and Deploy Smart Contracts
CO 5	Apply Blockchain in Real-World Scenarios

Mapping of CO with PO

SECE7570	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	1							1		2
CO 2	2	3		2							2
CO 3	3	2		3	3						2
CO 4	3	2	3		3						2
CO 5	2	2	3		3	2	2			2	2

Mapping of CO with PSO

SECE7570	PSO 1	PSO 2	PSO 3
CO 1	2	1	
CO 2	3	2	1
CO 3	3	3	2
CO 4	3	3	3
CO 5	3	3	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction	1,2,3,4
2	Evolution and Elements	1,4,5,6
3	Models	1,2,3,6
4	Smart Contract & Models	3,4,5,6
5	Ecosystem and Applications	3,4,5,6

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE7580
Course Name: Introduction to Internet of Things
Prerequisite Course(s):

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- Understand the fundamentals of IoT and core technologies.
- Develop practical skills with hardware like Arduino and Raspberry Pi.
- Learn about SDN, Fog/Cloud integration, and analytics.
- Explore real-world IoT domains like smart cities and industrial systems.

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	Introduction to IoT: Concepts, Sensing & Actuation, Networking Basics	4	8
2.	Communication Protocols, Sensor Networks, M2M Communication	8	16
3.	Arduino & Raspberry Pi Programming, Sensor Integration, Python for IoT	8	16
4.	Software Defined Networking (SDN) and IoT Architecture	5	10
5.	Data Handling, Cloud & Fog Computing, IoT Analytics	9	20
6.	Case Studies: Smart Cities, Grid, Industrial IoT, Health, Agriculture	11	30
	TOTAL	45	100

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	Exploring IoT Devices and Communication Models	2
2.	Implementing IoT Protocols & Sensor Data Communication	4
3.	Arduino: Sensor Integration and Code Execution	4
4.	Raspberry Pi Setup and Sensor Interfacing	4
5.	Working with Cloud Platforms & Data Visualization Tools	4
6.	Fog and Edge Computing Applications	4
7.	Mini Project: Case Study on Smart City / Health / Agriculture	8
	TOTAL	30

Text Book(s):

Title	Author/s	Publication

Introduction to IoT	S. Misra, A. Mukherjee, A. Roy	Cambridge University Press, 2020

Reference Book(s):

Title	Author/s	Publication
Research Papers	Various Authors	IEEE, Springer, etc.
Introduction to Industrial IoT and Industry 4.0	CRC Press, 2020	CRC Press, 2020

Web Material Link(s):

- https://onlinecourses.nptel.ac.in/noc25_cs44/preview

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:

- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):

After completion of the course, the student will be able to

SECE7580	Introduction to Internet of Things
CO 1	Explain IoT concepts, architecture, and sensing components.
CO 2	Implement IoT communication protocols and device-level integration.
CO 3	Develop applications using Arduino, Raspberry Pi with sensor-actuator control.
CO 4	Analyze cloud, fog, and edge computing paradigms in IoT ecosystems.
CO 5	Evaluate Case Studies: Smart Cities, Grid, Industrial IoT, Health, Agriculture

Mapping of CO with PO

SECE7580	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	1							1		2
CO 2	3	2		2	3						2
CO 3	3	2	3		3						2
CO 4	2	2			3	2					3
CO 5	2	2				3	2			2	2

Mapping of CO with PSO

SECE7580	PSO 1	PSO 2	PSO 3
CO 1	2	3	1
CO 2	2	3	2
CO 3	3	3	2
CO 4	3	3	2
CO 5	3	3	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply

4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction to IoT: Concepts, Sensing & Actuation, Networking Basics	1, 2
2	Communication Protocols, Sensor Networks, M2M Communication	2, 3
3	Arduino & Raspberry Pi Programming, Sensor Integration, Python for IoT	3, 4, 5,6
4	Software Defined Networking (SDN) and IoT Architecture	2, 4
5	Data Handling, Cloud & Fog Computing, IoT Analytics	3, 4, 5
6	Case Studies: Smart Cities, Grid, Industrial IoT, Health, Agriculture	4, 5, 6

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE7590
Course Name: Deep Learning for Natural Language Processing
Prerequisite Course(s):

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- Understand various deep learning architectures and their applications in Natural Language Processing (NLP).
- Gain proficiency in training and fine-tuning large language models.
- Explore advanced topics such as in-context learning, PEFT, and reinforcement learning through human feedback.
- Develop hands-on experience with NLP tasks using contemporary deep learning techniques.

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	Foundations of NLP & Deep Learning: NLP tasks, n-gram models, neural networks, representations	08	16
2.	Word Embeddings and RNNs: Word2Vec, GloVe, fastText, LSTM, GRU, seq2seq	08	18
3.	Attention and Transformers: Attention, encoder-decoder, Transformer architecture	06	14
4.	Pretraining and Self-supervised Learning: ELMo, BERT, GPT, T5, BART	08	18
5.	LLMs and Efficient Fine-tuning: FLAN-T5, RLHF, prompting, LoRA, QLoRA	08	18
6.	Applications, Long Contexts & Ethics: QA, summarization, RAG, interpretability	07	16
	TOTAL	45	100

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	Implementing n-gram Language Models	02
2.	Word Embedding Techniques: Word2Vec and GloVe	04
3.	Building RNNs and LSTMs for Sequence Modeling	04
4.	Implementing Attention Mechanisms and Transformers	04

5.	Pretraining and Fine-tuning BERT and GPT Models	04
6.	Developing NLP Applications: QA and Text Summarization	04
7.	Exploring PEFT Methods: LoRA and QLoRA	04
	TOTAL	30

Text Book(s):

Title	Author/s	Publication
Speech and Language Processing (3rd Ed.)	Daniel Jurafsky, James H. Martin	Pearson

Reference Book(s):

Title	Author/s	Publication
Deep Learning for NLP	Palash Goyal et al.	Apress
NLP with PyTorch	Delip Rao, Brian McMahan	O'Reilly Media

Web Material Link(s):

- https://onlinecourses.nptel.ac.in/noc25_cs22/preview

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:

- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):

After completion of the course, the student will be able to

SECE7590	Deep Learning for Natural Language Processing
CO 1	Understand foundational NLP tasks and deep learning architectures.
CO 2	Apply embeddings, RNNs, Transformers for NLP tasks.
CO 3	Train and fine-tune pre-trained language models (BERT, GPT).
CO 4	Implement parameter-efficient fine-tuning and in-context learning.
CO 5	Develop ethical and sustainable NLP solutions using interpretability and deployment techniques.

Mapping of CO with PO

SECE7590	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	1							1		2
CO 2	3	2		2	3						2
CO 3	3	2	3	2	3						2
CO 4	2	2		2	3						3
CO 5	2		2			3	3			2	2

Mapping of CO with PSO

SECE7590	PSO 1	PSO 2	PSO 3

CO 1	3	3	1
CO 2	3	3	2
CO 3	3	3	2
CO 4	3	3	3
CO 5	3	3	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	**Content**	**RBT Level**
1	Foundations of NLP & Deep Learning	1, 2, 3
2	Word Embeddings and RNNs	2, 3, 4,5
3	Attention and Transformers	2, 3, 4,6
4	Pretraining and Self-supervised Learning (ELMo, BERT...)	3, 4, 5
5	LLMs and Efficient Fine-tuning (PEFT, In-context, RLHF)	3, 4, 5
6	Applications, Long Contexts & Ethics	4, 5, 6

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE7600
Course Name: Computer Vision and Image Processing - Fundamentals and Applications
Prerequisite Course(s):

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:

- To help learners to Introduce the basic principles and goals of computer vision and image formation models.
- Familiarize students with essential image processing techniques including filtering, transforms, and segmentation.
- Explore feature extraction methods and descriptors for recognizing patterns and detecting salient image information.
- Apply machine learning and deep learning methods to solve real-world computer vision problems such as gesture recognition and tracking.

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	**Introduction to Computer Vision** and Basic Concepts of Image Formation: Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts. Fundamental Concepts of Image Formation: Radiometry, Geometric Transformations, Geometric Camera Models.	08	16
2.	**Fundamental Concepts of Image Formation**: Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections.Image Processing Concepts: Image Transforms.	08	18
3.	**Image Processing Concepts:** Image Transforms, Image Enhancement. Image Processing Concepts: Image Filtering, Colour Image Processing, Image Segmentation	06	14
4.	**Image Descriptors and Features:** Texture Descriptors, Colour Features, Edges/Boundaries. Image Descriptors and Features: Object Boundary and Shape Representations.	08	18
5.	**Fundamentals of Machine Learning**: Image Descriptors and Features: Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded up Robust Features, Saliency. Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Linear Discriminant Analysis.	09	18

6.	**Applications of Computer Vision:** Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, Autoencoders. Week 12: Applications of Computer Vision: Gesture Recognition, Motion Estimation and Object Tracking, Programming Assignments.	06	16
	TOTAL	45	100

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	Solve numerical problems related to image irradiance, brightness, and simple transformations	02
2.	Practice focal length estimation and compute depth using stereo disparity.	04
3.	Derive and apply 2D Fourier Transform on basic images; analyze frequency components.	04
4.	Implement spatial filtering (mean, Gaussian, median); practice thresholding-based segmentation	04
5.	Extract GLCM features and compute color histograms; compare results for various textures.	02
6.	Represent objects using chain codes and Fourier descriptors; analyze boundary-based features.	02
7.	Solve examples on linear regression, K-means clustering, and basic decision theory concepts.	04
8.	Discuss architecture of CNNs and build a simple image classifier using ANN/CNN.	02
9.	Practice basic optical flow and background subtraction for tracking moving objects.	02
	TOTAL	30

Text Book(s):

Title	Author/s	Publication
Computer Vision and Image Processing: Fundamentals and Applications	M.K. Bhuyan	CRC Press

Reference Book(s):

Title	Author/s	Publication
Computer Vision-A Modern Approach	Forsyth & Ponce	Pearson
Computer Vision- Algorithms & Applications	Richard Szeliski	Springer

Web Material Link(s):

- https://onlinecourses.nptel.ac.in/noc25_ee13/preview

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:

- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.

- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):
After completion of the course, the student will be able to

SECE7600	Computer Vision and Image Processing - Fundamentals and Applications
CO 1	Understand the fundamentals of image formation and camera models used in computer vision.
CO 2	Apply image transformation, filtering, enhancement, and segmentation techniques on digital images.
CO 3	Analyze and extract features using various image descriptors like texture, shape, edges, corners, SIFT, HOG, and SURF.
CO 4	Evaluate machine learning algorithms including regression, clustering, and classification models for vision-based applications.
CO 5	Design and implement computer vision applications such as gesture recognition, object tracking, and pattern classification using neural networks and CNNs.

Mapping of CO with PO

SECE7600	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	1							1		2
CO 2	3	2		2	3						2
CO 3	3	3		2	3						2
CO 4	3	3		2	3						2
CO 5	3	2	3		3						2

Mapping of CO with PSO

SECE7600	PSO 1	PSO 2	PSO 3
CO 1	3	3	1
CO 2	3	3	2
CO 3	3	3	2
CO 4	3	3	3
CO 5	3	3	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction to Computer Vision	1,2,3
2	Fundamental Concepts of Image Formation:	2,3
3	Image Processing Concepts	3,4
4	Image Descriptors and Features	3,4,5,6
5	Fundamentals of Machine Learning:	4,5
6	Applications of Computer Vision	4,5,6

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE7610
Course Name: Introduction To Industry 4.0 And Industrial Internet of Things
Prerequisite Course(s):

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:

- Understand the core concepts of Industry 4.0 and its impact on modern industrial systems.
- Describe the architecture and key components of Industrial Internet of Things (IIoT) systems.
- Analyze the role of big data analytics, machine learning, and cybersecurity in IIoT environments.
- Apply Industry 4.0 and IIoT principles to real-world industrial applications and case studies

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	**Introduction:** Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories	08	16
2.	**Industry 4.0:** Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis **Cybersecurity in Industry 4.0**, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.	08	18
3.	**IIoT-Introduction,** Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II. Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.	06	14
4.	**Industrial IoT- Layers:** IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III, Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.	08	18
5.	**Industrial IoT: Big Data Analytics** and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II., Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II,	09	18

	Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.		
6.	**Industrial IoT- Application Domains**: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management., Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies	06	16
	TOTAL	45	100

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	Introduction to Sensing, Actuation, and Industrial Communication Protocols	02
2.	Overview of Industry 4.0 Concepts and Lean Production Systems	04
3.	Cyber-Physical Systems and Next-Gen Sensors in Industry 4.0	04
4.	Fundamentals of Cybersecurity in Industrial IoT	02
5.	Business Models and Reference Architectures for IIoT	02
6.	IIoT Layers: Sensing and Data Processing Techniques	02
7.	Communication and Networking in IIoT Systems	04
8.	Big Data Analytics, Machine Learning, and Programming for IIoT	02
9.	Software Defined Networks and Cloud Computing in IIoT	02
10.	Security and Fog Computing in Industrial IoT	02
11.	Industrial IoT Applications in Healthcare, Power Plants, and Safety	02
12.	Case Studies and Project Work in Industrial IoT Applications	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Introduction to Industrial Internet of Things and Industry 4.0	S. Misra, C. Roy, and A. Mukherjee	CRC Press

Reference Book(s):

Title	Author/s	Publication
Introduction to IoT	S. Misra, A. Mukherjee, and A. Roy	Cambridge University Press

Web Material Link(s):

- https://onlinecourses.nptel.ac.in/noc25_cs43/preview

Course Evaluation:
Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:

- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):

After completion of the course, the student will be able to

SECE7610	Introduction To Industry 4.0 And Industrial Internet Of Things
CO1	Understand the fundamentals of sensing, actuation, industrial communication, and networking in smart systems.
CO2	Interpret the core principles of Industry 4.0 and its enabling technologies such as CPS, AI, AR/VR, and Big Data.
CO3	Analyze the architecture and layered structure of Industrial IoT systems including processing, sensing, and communication.
CO4	Evaluate IIoT applications in various industrial domains with a focus on cybersecurity, cloud, and fog computing.
CO5	Apply knowledge of IIoT to real-world industrial scenarios through case studies and project-based learning.

Mapping of CO with PO

SECE7610	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	1			3				1		2
CO 2	3	2			3						2
CO 3	3	2		2	3						2
CO 4	2	3		2	3	2	2				2
CO 5	2	2	3			3	2	2		2	2

Mapping of CO with PSO

SECE7610	PSO 1	PSO 2	PSO 3
CO 1	3	3	2
CO 2	3	3	3
CO 3	3	3	3
CO 4	3	3	3
CO 5	3	3	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction:	1,2,3
2	Industry 4.0:	2,3,4,5,6
3	IIoT-Introduction	2,3,4
4	Industrial IoT- Layers	3,4,5
5	Industrial IoT: Big Data Analytics	3,4,5
6	Industrial IoT- Application Domains:	4,5,6

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE7620
Course Name: Cryptography and Network Security
Prerequisite Course(s):

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:

- Understand core concepts of classical and modern cryptography including symmetric and asymmetric techniques.
- Develop mathematical foundations essential for cryptographic algorithms such as number theory and modular arithmetic.
- Analyze and apply encryption, authentication, and key management methods for secure communication.
- Explore advanced cryptographic applications including digital signatures, cryptanalysis, blockchain, and quantum cryptography.

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	**Introduction** to cryptography, Classical Cryptosystem, Block Cipher. Data Encryption Standard (DES), Triple DES, Modes of Operation, Stream Cipher.	08	16
2.	**LFSR based Stream Cipher,** Mathematical background, Abstract algebra, Number Theory. Modular Inverse, Extended Euclid Algorithm, Fermat's Little Theorem, Euler Phi-Function, Euler's theorem.	08	18
3.	**Advanced Encryption Standard (AES),** Introduction to Public Key Cryptosystem, Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem. **Week 6:** Primarily Testing, ElGamal Cryptosystem, Elliptic Curve over the Reals, Elliptic curve Modulo a Prime.	06	14
4.	**ElGamal Public Key Cryptosystem**, Rabin Cryptosystem. Message Authentication, Digital Signature, Key Management, Key Exchange, Hash Function.	08	18
5.	**Cryptographic Hash Function**, Secure Hash Algorithm (SHA), Digital Signature Standard (DSS). Cryptanalysis, Time-Memory Trade-off Attack, Differential and Linear Cryptanalysis.	09	18
6.	**Cryptanalysis on Stream Cipher**, Modern Stream Ciphers, Shamir's secret sharing and BE, Identity-based Encryption (IBE), Attribute-based Encryption (ABE). Side-channel attack, The Secure Sockets Layer (SSL), Pretty Good Privacy (PGP),	06	16

	Introduction to Quantum Cryptography, Blockchain, Bitcoin and Cryptocurrency.		
	TOTAL	45	100

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	IImplement Caesar Cipher and Vigenère Cipher using a programming language of your choice.	02
2.	Simulate DES and Triple DES encryption and decryption with different modes of operation (ECB, CBC, etc.).	04
3.	Design and implement a simple LFSR-based stream cipher.	04
4.	Solve problems on modular arithmetic, modular inverse, and apply the Extended Euclidean Algorithm.	02
5.	Implement RSA key generation, encryption, and decryption using large prime numbers.	02
6.	Perform Diffie-Hellman key exchange and demonstrate secure key generation.	02
7.	Simulate AES encryption with various key sizes (128/192/256 bits).	04
8.	Implement and verify cryptographic hash functions (SHA-1, SHA-256) using tools or code.	02
9.	Create a digital signature and verify message integrity using DSS or RSA.	02
10.	Conduct basic cryptanalysis on substitution and transposition ciphers.	02
11.	Demonstrate Shamir's Secret Sharing scheme and simulate identity-based encryption	02
12.	Explore SSL/TLS handshake using Wireshark and simulate basic blockchain transaction using Python.	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Cryptography and Network Security: Principles and Practice	William Stallings	Pearson Education

Reference Book(s):

Title	Author/s	Publication
Cryptography and Network Security	Behrouz A. Forouzan and Debdeep Mukhopadhyay	McGraw-Hill Education
Introduction to Modern Cryptography	Jonathan Katz and Yehuda Lindell	CRC Press

Web Material Link(s):

- Cryptography and Network Security - Course

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:
- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):
After completion of the course, the student will be able to

SECE7620	Cryptography and Network Security
CO1	Understand the principles of classical and modern cryptographic systems.
CO2	Apply symmetric and asymmetric encryption algorithms to secure data communication.
CO3	Solve problems using mathematical concepts such as modular arithmetic, number theory, and algebra relevant to cryptography.
CO4	Analyze and implement various cryptographic protocols for authentication, key exchange, and data integrity.
CO5	Evaluate cryptographic algorithms and techniques for vulnerabilities using cryptanalysis methods.

Mapping of CO with PO

SECE7620	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**
CO 1	3	1							1		2
CO 2	3	2		2	3						2
CO 3	3	3		2							2
CO 4	2	3		3	3						2
CO 5	2	3	2	2	3						2

Mapping of CO with PSO

SECE7620	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	2	2	3
CO 2	3	2	3
CO 3	3		2
CO 4	3	2	3
CO 5	2	3	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	**Content**	**RBT Level**
1	Introduction	1,2,3
2	LFSR based Stream Cipher	2,3,4
3	Advanced Encryption Standard (AES),	3,4
4	ElGamal Public Key Cryptosystem	3,4,5,6
5	Cryptographic Hash Function	4,5
6	Cryptanalysis on Stream Cipher	4,5,6

SECOND YEAR M.TECH.

P P Savani University
School of Engineering
Department of Chemical Engineering

Course Code: SECH8010
Course Name: Scientific Communication
Prerequisite Course(s): -

Teaching & Examination Scheme

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:

- To develop a strong foundation in mathematical modeling techniques that enable students to represent, analyze, and solve complex engineering and research problems using analytical and computational approaches.
- To equip students with advanced numerical methods for solving algebraic, differential, and partial differential equations that arise in real-world engineering systems and simulations.
- To enable the application of optimization techniques and data-driven modeling for research-based decision-making and process/system performance improvement in diverse engineering domains.
- To familiarize students with modern computational tools and software such as MATLAB, Python, Aspen Plus, and scientific libraries for effective simulation, analysis, and visualization of mathematical models.
- To enhance students' ability to apply statistical, probabilistic, and data analysis techniques for experimental data interpretation, hypothesis testing, and uncertainty quantification in engineering research.

Course Content:

Module	Content	Hour	Weightage In %
1.	**Fundamentals of Scientific Communication** Importance of scientific communication in research and academia, Types: Written, oral, visual, and digital communication, Principles of clarity, accuracy, brevity, and objectivity, Audience analysis and purpose-driven writing	5	10
2.	**Technical Writing and Documentation** Structure and components of technical reports, project reports, and research papers, Style guides: IEEE, APA, Chicago, ACS formats, Writing abstracts, summaries, introductions, and conclusions, Common grammar and language issues in technical writing	7	20
3.	**Scientific Publishing and Peer Review** Types of scientific publications: Journals, conferences, books, patents, Selecting appropriate journals (impact factor, indexing, scope), Manuscript submission process and peer review system, Predatory journals and publication ethics	5	10
4.	**Research Proposal and Grant Writing**	5	10

	Structure of research proposals, Writing research objectives, methodology, expected outcomes, Budget preparation, timelines, deliverables, Overview of funding agencies: DST, CSIR, DBT, UGC, SERB, and international agencies		
5.	**Oral and Visual Scientific Communication** Planning and delivering effective research presentations, Slide preparation and visual design principles, Scientific posters: design and layout, Handling questions and feedback during conferences	5	10
6.	**Communication for Patents, Standards, and Technical Manuals** Writing invention disclosure forms and patent summaries, Writing for SOPs, user manuals, and technical documentation, Terminology management and readability improvement, Collaborative writing and version control	8	20
7.	**Digital and Online Scientific Communication** Science blogs, podcasts, and social media in research dissemination, Creating and managing professional research profiles (ORCID, ResearchGate, Google Scholar), Open Access vs. Subscription publishing, Science communication for public outreach	5	10
8.	**Ethics and Professionalism in Scientific Communication** Plagiarism, self-plagiarism, and citation ethics, Authorship criteria and conflicts, Data sharing and reproducibility, Gender-neutral and inclusive language in research writing	5	10
	Total	**45**	**100**

List of Tutorials

Tutorial	Content	Duration (Hours)
1	Fundamentals of Scientific Communication	2
2	Technical Writing and Documentation	2
3	Polishing Abstracts and Summaries	2
4	Scientific Publishing and Peer Review	2
5	Understanding Peer Review Processes	2
6	Research Proposal and Grant Writing	2
7	Preparing a Grant Budget and Timeline	2
8	Oral and Visual Scientific Communication	2
9	Creating a Scientific Poster	2
10	Practicing Presentation Q&A	2
11	Communication for Patents, Standards, and Technical Manuals	2
12	Digital and Online Scientific Communication	2
13	Building a Research Profile	2
14	Ethics and Professional plinary Communication	2
15	Ethics and Professionalism in Scientific Communication	2
	Total	**30**

Text Book:

Title	Author(s)	Publication
Scientific Writing and Communication: Papers, Proposals, and Presentations	Angelika H. Hofmann	Oxford University Press

Reference Books:

Title	Author(s)	Publication
The Craft of Scientific Writing	Michael Alley	Springer
Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded	Joshua Schimel	Oxford University Press

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks with a duration of 1 hour.
- Faculty Evaluation consists of 10 marks, as per the guidelines provided by the Course Coordinator.
- End Semester Examination will consist of a comprehensive 60 marks theory exam.

Tutorials:

- Continuous Evaluation consists of the performance in tutorials, which should be evaluated out of 10 marks for each tutorial in the next session. The average of these will be converted to 10 marks.
- Internal Viva component of 10 marks based on tutorial understanding and application.
- Tutorial-based assignment/quiz/problem-solving test of 20 marks during the End Semester Evaluation.
- Viva/Oral performance during the End Semester Evaluation carrying 10 marks.

Course Outcome(s):

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

SECH8010	Scientific Communication
CO 1	Demonstrate understanding of different forms of scientific communication
CO 2	Develop structured technical documents such as reports, research papers, and grant proposals using standard writing styles.
CO 3	Navigate the publication process and evaluate journals for scientific dissemination while avoiding unethical practices.
CO 4	Plan and deliver effective scientific presentations, posters, and digital content for academic and public engagement.
CO 5	Apply ethical standards, responsible authorship practices, and digital tools for transparent, inclusive, and professional scientific communication.

Mapping of CO with PO

SECH8010	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	1	1							2		2
CO 2	1	2		1	1				3		2
CO 3	1	2		2	1		3		2		2
CO 4	1	1			1				3		2
CO 5						2	3		2		2

Mapping of CO with PSO

SECH8010	PSO1	PSO2	PSO3

CO 1	1	3	1
CO 2	2	3	2
CO 3	1	2	3
CO 4	1	3	2
C0 5	1	2	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	**Content**	**RBT Level**
01	Fundamentals of Scientific Communication	3,5
02	Technical Writing and Documentation	1,4
03	Scientific Publishing and Peer Review	1,3
04	Research Proposal and Grant Writing	2,6
05	Oral and Visual Scientific Communication	1,5
06	Communication for Patents, Standards, and Technical Manuals	3,4
07	Digital and Online Scientific Communication	2,4
08	Ethics and Professionalism in Scientific Communication	3,4

P P Savani University
School of Engineering
Department of Computer Engineering

Course Code: SECE8910
Course Name: Research Project-III
Prerequisite Course/s: -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
-	10	-	10	-	-	80	120	-	-	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:
To help learners to

- To engage students in identifying, formulating, and solving real-world research problems.
- To encourage independent and original thinking in designing, implementing, and evaluating computational systems.
- To promote the use of research methodology, scientific writing, and effective communication of results.

List of Practical's:

Sr. No.	Name of Practical	Hours
1.	Orientation, topic finalization, and problem statement definition.	10
2.	Literature review using IEEE/ACM/ScienceDirect databases.	20
3	Identification of research gap and formulation of research objectives.	10
4	Selection of methodology, tools, and technologies.	10
5	Initial prototype design or dataset collection/preprocessing.	10
6	Core development: algorithm/model/system design begins.	10
7	Implementation continues with performance testing.	30
8	Experimentation, result collection, tuning.	20
9	Result validation (graphs, statistical methods, comparisons).	20
10	Drafting research report/paper, presentation preparation	10
	TOTAL	150

Practical:

- Each student should be assigned a faculty guide.
- Regular weekly review meetings are mandatory.
- Mid-term internal evaluation and final external viva should be scheduled.
- Research should ideally be aligned with current thrust areas: AI, ML, IoT, Cybersecurity, Data Science, Cloud Computing, Blockchain, etc.

Course Outcome(s):
After the completion of the course, the student will be able to

SECE8910	Research Project-I
CO 1	Identify and define a research problem with reference to current trends in Computer Engineering.
CO 2	Analyze relevant literature and select appropriate tools and techniques.
CO 3	Develop and implement innovative solutions or models for real-world problems.
CO 4	Evaluate research findings and present technical documentation and publications.
CO 5	Demonstrate professional ethics, teamwork, and project management skills throughout the research process

Mapping of CO with PO

SECE8910	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	2	3		2							2
CO 2	2	3		2	3						2
CO 3	3	2	3		3						2
CO 4		2		3	1				3		2
CO 5						2	3	3	1	3	2

Mapping of CO with PSO

SECE8910	PSO1	PSO2	PSO3
CO 1	3	2	1
CO 2	2	3	1
CO 3	3	3	2
CO 4	2	2	2
CO 5	2	2	3

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE8510
Course Name: Matlab Programming for Numerical Computation
Prerequisite Course(s):

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:

- Learn basics of MATLAB programming
- Get introduced to numerical methods for engineering problems
- Will be able to use MATLAB to solve computational problems

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	**Introduction to MATLAB Programming:** MATLAB Basics, Vectors and Matrices, MATLAB Functions, Scripts and Programming Constructs, Plotting and Visualization, Input and Output, MATLAB Toolboxes and Applications	08	15
2.	**Building Code with MATLAB:** loops, execution control, best-practices for MATLAB functions and Basic Debugging and Error Handling	06	20
3.	**Approximations and Errors:** Taylor's / Maclaurin series expansion of some functions will be used to introduce approximations and errors in computational methods	06	10
4.	**Linear Equations**: The focus of this module is to do a quick introduction of most popular numerical methods in linear algebra, and use of MATLAB to solve practical problems. **Nonlinear Equations**: After introduction to bisection rule, this module primarily covers Newton-Raphson method and MATLAB routines fzero and fsolve.	08	15
5.	**Numerical Differentiation and Integration:** Methods of numerical differentiation and integration, trade-off between truncation and round-off errors, error propagation and MATLAB functions for integration. **Ordinary Differential Equations (ODE):** Explicit ODE solving techniques in single variable	06	10
6.	**ODE-IVP in Multiple Variables:** ODE solving in multiple variables, stiff systems, and practical problems.	03	10
7.	**Regression and Interpolation**: linear and nonlinear regression and interpolation functions in MATLAB. ODE-BVP and DAE: ODE-Boundary Value Problems; Differential Algebraic Equations	04	10

8.	**Partial Differential Equations (PDEs):** Practical ways of solving Hyperbolic and Parabolic PDEs **Bringing it all together:** Optimization and Solving interesting computational problems by bringing together multiple concepts	04	10
	TOTAL	**45**	**100**

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	Explore MATLAB Basics and Perform Arithmetic Operations.	02
2.	Create and Manipulate Vectors and Matrices in MATLAB.	02
3.	Develop and Execute User-defined MATLAB Functions.	02
4.	Write MATLAB Scripts Using Loops and Conditional Statements.	02
5.	Visualize Data Using 2D and 3D Plotting in MATLAB.	02
6.	Perform Input/Output Operations and File Handling in MATLAB.	02
7.	Implement Debugging Techniques and Error Handling in MATLAB.	02
8.	Approximate Functions Using Taylor and Maclaurin Series.	02
9.	Solve Systems of Linear Equations Using MATLAB.	02
10.	Solve Nonlinear Equations Using Bisection and Newton-Raphson Methods.	02
11.	Perform Numerical Differentiation and Integration in MATLAB.	02
12.	Solve Single-Variable Ordinary Differential Equations (ODEs).	02
13.	Solve Multi-Variable ODEs and Handle Stiff Systems in MATLAB.	02
14.	Apply Regression and Interpolation Techniques Using MATLAB.	02
15.	Solve Boundary Value Problems, DAEs, PDEs, and Optimization Problems by Integrating Multiple MATLAB Concepts.	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Applied Numerical Analysis Using MATLAB	Fausett L.V.	Pearson Education

Reference Book(s):

Title	Author/s	Publication
Numerical Methods for Engineers, 5th Ed	Chapra S.C. and Canale R.P.	McGraw Hill

Web Material Link(s)

https://onlinecourses.nptel.ac.in/noc25_ch29/preview

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.

- End Semester Examination consists of 60 marks.

Practical/Tutorial:
- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):
After completion of the course, the student will be able to

SECE8510	Matlab Programming for Numerical Computation
CO 1	Understand MATLAB basics, matrices, functions, loops, and plotting.
CO 2	Solve linear and nonlinear equations and handle approximation errors using MATLAB.
CO 3	Apply numerical differentiation, integration, and solve ODEs in MATLAB.
CO 4	Perform regression, interpolation, BVP, and DAE problem-solving in MATLAB.
CO 5	Integrate MATLAB and numerical methods to solve complex computational problems.

Mapping of CO with PO

SECE8510	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**
CO 1	3	1			2				1		2
CO 2	3	3		2	3						2
CO 3	3	3		2	3						2
CO 4	3	3		2	3						2
CO 5	3	3	3	2	3						2

Mapping of CO with PSO

SECE8510	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	2	**3**	1
CO 2	2	**3**	2
CO 3	2	**3**	2
CO 4	2	**3**	2
CO 5	**3**	**3**	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	**Content**	**RBT Level**
1.	Introduction to MATLAB Programming	1,2,3
2.	Building Code with MATLAB	2,3,4
3.	Approximations and Errors	2,3,4
4.	Linear Equations	3,4,5
5.	Numerical Differentiation and Integration	3,4,5
6.	ODE-IVP in Multiple Variables	3, 4, 5, 6
7.	Regression and Interpolation	3, 4, 5, 6
8.	Partial Differential Equations (PDEs)	3, 4, 5, 6

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE8520
Course Name: Quantum Algorithms and Cryptography
Prerequisite Course(s):

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:

- To understand the fundamental principles of quantum computation and quantum information theory.
- To analyze and implement key quantum algorithms and their computational advantages.
- To explore classical, quantum, and post-quantum cryptographic techniques and their security foundations.

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	**Fundamentals of Quantum Information :**Postulates of Quantum Mechanics relevant to computation, Quantum bits (qubits), superposition, and measurement, Quantum gates and circuits: single- and multi-qubit gates, Quantum states and density matrices, Entanglement and its mathematical representation, No-Cloning Theorem and its cryptographic significance, Quantum parallelism and its role in computational advantage	06	13
2.	**Foundational Quantum Algorithms:** Concept of oracle-based quantum computation, Deutsch–Jozsa Algorithm — problem statement, circuit, and analysis, Simon's Algorithm — hidden subgroup identification and exponential speedup, Bernstein–Vazirani Algorithm — inner product problem and query complexity reduction	04	9
3.	**Classical Cryptography Foundations:** Principles of secure cryptographic design, RSA cryptosystem — mathematical background and security assumptions, Discrete Logarithm problem and its hardness assumptions, Symmetric vs. Public Key encryption, Key exchange mechanisms (Diffie–Hellman), Random Oracle Model, RSA and ElGamal encryption schemes	06	13
4.	**Quantum Fourier and Search Algorithms:** Boolean Fourier Analysis, Quantum Fourier Transform (QFT): theory, implementation, and properties, Grover's Algorithm — amplitude amplification and quantum search	05	10
5.	**Advanced Quantum Algorithms:** Shor's Algorithm for integer factoring and discrete logarithm, Connection between	05	10

	factoring and periodicity problems, Hidden Subgroup Problem (HSP): definition and examples		
6.	**Post-Quantum Cryptography and Lattices:** Introduction to Post-Quantum Cryptography (PQC) Lattices: definitions, basis, Gram–Schmidt orthogonalization, Hard lattice problems: SVP, CVP, SIS, and LWE, Learning with Errors (LWE) and Short Integer Solution (SIS) problems, Connections to the Dihedral Hidden Subgroup Problem	06	15
7.	**Modern Cryptographic Constructions:** Public Key Encryption and security models, Fully Homomorphic Encryption (FHE): basic construction and applications, Quantum Key Distribution (QKD): BB84, E91 protocols, Quantum One-Time Pad and its unconditional security	06	12
8.	**Quantum Cryptographic Systems:** Quantum Public Key Encryption schemes, Quantum Fully Homomorphic Encryption (QFHE): concepts and constructions, Quantum authentication and signature schemes, Future directions: hybrid classical-quantum cryptography and quantum-safe standards	07	18
	TOTAL	**45**	**100**

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	Study of Qubit Representation, Superposition, and Measurement Principles.	02
2.	Design and Analysis of Basic Quantum Gates and Circuit Operations.	02
3.	Verification of Quantum Entanglement and Demonstration of the No-Cloning Theorem.	02
4.	Implementation and Analysis of the Deutsch–Jozsa Algorithm.	02
5.	Simulation and Comparative Study of Simon's and Bernstein–Vazirani Algorithms.	02
6.	Construction and Security Evaluation of the RSA Cryptosystem.	02
7.	Implementation of the Discrete Logarithm Problem and ElGamal Encryption Scheme.	02
8.	Design and Evaluation of Key Exchange Protocols in the Random Oracle Model.	02
9.	Implementation and Performance Analysis of Grover's Quantum Search Algorithm.	02
10.	Study and Simulation of the Quantum Fourier Transform (QFT).	02
11.	Demonstration of Shor's Algorithm and the Hidden Subgroup Problem.	02
12.	Introduction to Lattice-Based Cryptography and Hard Computational Problems.	02
13.	Design and Implementation of LWE-Based Post-Quantum Encryption Schemes.	02
14.	Simulation of Quantum Key Distribution Using the BB84 Protocol.	02

15.	Analysis of the Quantum One-Time Pad and Fully Homomorphic Encryption Concepts.	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Quantum Computation and Quantum Information	Michael A. Nielsen & Isaac L. Chuang	Cambridge University Press

Reference Book(s):

Title	Author/s	Publication
Introduction to Modern Cryptography, 3rd Edition	Jonathan Katz and Yehuda Lindell	CRC Press
Post-Quantum Cryptography	Daniel J. Bernstein, Johannes Buchmann, and Erik Dahmen (Eds.)	Springer

Web Material Link(s)

https://onlinecourses.nptel.ac.in/noc25_cs61/preview

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:

- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):

After completion of the course, the student will be able to

SECE8520	Quantum Algorithms and Cryptography
CO 1	Understand the fundamental concepts of quantum computation and quantum information.
CO 2	Apply basic quantum algorithms to solve computational problems efficiently.
CO 3	Analyze the impact of quantum computing on classical cryptographic systems.
CO 4	Design and evaluate post-quantum cryptographic schemes such as lattice-based encryption.
CO 5	Demonstrate understanding of quantum cryptographic protocols like QKD and quantum homomorphic encryption.

Mapping of CO with PO

SECE8520	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	1			2				1		2
CO 2	3	3		2	3						2

CO 3	3	3		2	3						2
CO 4	3	3		2	3						2
CO 5	3	3	3	2	3						2

Mapping of CO with PSO

SECE8520	PSO 1	PSO 2	PSO 3
CO 1	2	3	1
CO 2	3	3	1
CO 3	2	3	2
CO 4	3	3	2
CO 5	2	3	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1.	Fundamentals of Quantum Information	1, 2
2.	Foundational Quantum Algorithms	2, 3
3.	Classical Cryptography Foundations	1, 2, 3
4.	Quantum Fourier and Search Algorithms	2, 3, 4,6
5.	Advanced Quantum Algorithms (Shor's, HSP)	2, 3, 4,5
6.	Post-Quantum Cryptography and Lattices	2, 3, 4, 5,6
7.	Modern Cryptographic Constructions	2, 3, 4, 5
8.	Quantum Cryptographic Systems	2, 3, 4, 5, 6

P P Savani University
School of Engineering
Department of Computer Engineering

Course Code: SECE8530
Course Name: Introduction to Embedded System Design
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
03	02	00	05	40	60	40	60	00	00	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- To understand the fundamentals and applications of embedded systems in real-world domains.
- To design embedded systems using a structured, building-block approach for efficiency.
- To develop skills in programming and interfacing using the MSP430 low-power microcontroller.
- To learn power supply design, sensor interfacing, and communication protocols for embedded devices.
- To gain practical experience and code management skills using embedded C and GIT tools.

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Introduction to Embedded Systems**: Overview of Embedded Systems and Computer Systems Terminology. Modular approach to Embedded System Design using the Six-Box Model: Input Devices, Output Devices, Embedded Computer, Communication Block, Host & Storage Elements, and Power Supply.	05	10%
2.	**Microcontroller-Based Embedded System Design:** Microcontroller-based Embedded System Design concepts. Salient Features of Modern Microcontrollers. Elements of the Microcontroller Ecosystem and their significance.	04	8%
3.	**Power Supply Design for Embedded Systems:** Power Supply Design for Embedded Applications. Linear Regulator and Switching Power Supply Topologies. Power Supply Design Considerations for Embedded Systems.	04	8%
4.	**Introduction to MSP430 Microcontroller:** Overview of MSP430 Microcontroller and its CPU Architecture. Programming Methods for MSP430. Introduction to the LaunchPad Platform.	05	10%
5.	**Interfacing Fundamentals:** Fundamentals of Physical Interfacing. Interfacing Input Devices (Switches, Keyboards) and Output Devices (LEDs, Seven-Segment Displays). Advanced Interfacing: Driving loads (High-side, Low-side, H-bridge), Multiplexing & Charlieplexing, Shaft Encoders.	06	14%
6.	**Embedded Programming and Development Tools:** Programming the MSP430 using Embedded C. Basics of Version Control Systems (Git). Installing and Using Code Composer Studio (CCS). Digital I/O Interfacing: LEDs and Switches.	06	14%

7.	**Timers, Interrupts, and Communication Interfaces:** MSP430 Clock and Reset System. Interrupts and Efficient ISR Design. Timer Modules: Operation, PWM Generation, and Capture Modes. Serial Communication Protocols: UART, SPI, I2C, and USCI Module Interfacing.	07	16%
8.	**Advanced Applications:** Interfacing LCDs and ADC/DAC Modules with MSP430. Random Number and Custom Waveform Generation. Low Power Modes in MSP430. Circuit Prototyping Techniques. FSMD-based Single-Purpose Computer Design.	08	20%
	TOTAL	45	100%

List of Practical:

Sr. No	Name of Practical	Hours
1	Study of Embedded System Components and Six-Box Model	02
2	Study of MSP430 LaunchPad and Its Development Environment	02
3	Design and Testing of Regulated Power Supply for Embedded Circuit	02
4	Interfacing LEDs and Switches with MSP430: Implement basic digital input/output and observe LED control and switch input	02
5	Interfacing Seven Segment Display (SSD) with MSP430: Display numeric output using MSP430 GPIO pins; understand multiplexing basics	04
6	Configure Timer to generate PWM for brightness/speed control applications	02
7	Interface a sensor or potentiometer with MSP430 ADC and observe digital readings	04
8	Implement serial data transfer between MSP430 and PC via UART	04
9	Write and test programs using GPIO and Timer interrupts for event handling	04
10	Mini Project: Embedded Application Design using MSP430	04
	TOTAL	30

Text Book (s):

Title	Author/s	Publication
Embedded System Design: A Unified Hardware / Software Introduction	Tony Givargis and Frank Vahid	Wiley India

Reference Book (s):

Title	Author/s	Publication
Learning Embedded Systems with MSP430 FRAM Microcontrollers	Byul Hur	CRC Press / Taylor & Francis
Introduction to Embedded Systems: Using Microcontrollers and the MSP430	Manuel Jiménez, Rogelio Palomera, Isidoro Couvertier	Springer
Embedded Systems Design Using the MSP430FR2355 LaunchPad	Brock J. LaMeres	Springer

Web Material Link(s):

- https://onlinecourses.nptel.ac.in/noc25_cs41/preview
- https://www.geeksforgeeks.org
- https://www.totalphase.com

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration, which will be converted to 30 marks.

- Faculty evaluation consists of 10 marks as per the guidelines provided by the course coordinator.
- End Semester Examination consists of 60 marks.

Practical:

- Continuous Evaluation consists of the performance of practical which will be evaluated out of 10 marks for each practical and average of the same will be converted to 20 marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/test consists of 30 marks during End Semester Exam.
- Viva/oral performance consists of 30 marks during End Semester Exam.

Course Outcome(s):

After the completion of the course, the following course outcomes will be able to:

SECE8530	INTRODUCTION TO EMBEDDED SYTEM DESIGN
CO 1	Explain the fundamental concepts of embedded systems, their architecture, and design approaches using modular and microcontroller-based methodologies.
CO 2	Design efficient power supply circuits and apply hardware interfacing techniques for input/output devices using microcontrollers.
CO 3	Develop and implement embedded programs for the MSP430 microcontroller using Embedded C and appropriate development tools.
CO 4	Analyze and utilize timers, interrupts, and serial communication protocols (UART, SPI, I2C) for effective embedded system operations.
CO 5	Integrate hardware and software components to design, prototype, and implement an MSP430-based embedded project.

Mapping of CO with PO

SECE8530	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	2			2				1		2
CO 2	3	2	3	2	3						2
CO 3	3	3	3	2	3						2
CO 4	3	3	2	2	3						2
CO 5	3	2	3	2	3			3		2	2

Mapping of CO with PSO

SECE8530	PSO1	PSO2	PSO3
CO 1	3	2	1
CO 2	3	3	2
CO 3	2	3	3
CO 4	2	3	3
CO 5	3	3	3

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1	Introduction to Embedded Systems	1,2
2	Microcontroller-Based Embedded System Design	2,3
3	Power Supply Design for Embedded Systems	3,4,5,6
4	Introduction to MSP430 Microcontroller	2,3
5	Interfacing Fundamentals	3,4

6	Embedded Programming and Development Tools	3,5
7	Timers, Interrupts & Communication Interfaces	4,5
8	Advanced Applications	5,6

P P Savani University
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Department of Computer Engineering

Course Code: SECE8540
Course Name: High Performance Scientific Computing
Prerequisite Course(s): --

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:
To help learners to

- understand computer architectures and parallel programming paradigms.
- analyze numerical algorithms in high-performance environments.
- apply parallel programming using MPI, OpenMP, and GPU computing.
- evaluate and optimize performance for large-scale scientific computations.

Course Content:

Section I			
Module No.	Content	Hours	Weightage in %
1.	**Introduction to High Performance Scientific Computing:** Overview of scientific computing, types of parallelism, performance metrics, Amdahl's Law, scalability, and motivation for HPC.	06	13
2.	**Computer Architecture for HPC:** Processor organization, memory hierarchy, cache coherence, NUMA, interconnection networks, and parallel hardware trends.	06	13
3.	**Parallel Programming Models:** Shared vs distributed memory models, threads, message passing, data vs task parallelism, and hybrid systems.	06	13
4.	**Message Passing Interface (MPI):** MPI environment, communicators, point-to-point communication, collective communication, synchronization, and example programs.	06	13
5.	**OpenMP Programming:** Threads, parallel regions, work sharing constructs, synchronization, data scoping, reduction clauses, and performance considerations.	05	11
6.	**Parallel Algorithms:** Matrix operations, sorting, FFT, numerical integration, solving linear systems, and domain decomposition methods.	05	11
7.	**Performance Optimization:**	05	11

	Profiling, load balancing, vectorization, communication overhead, memory optimization, and case studies.		
8.	**Applications and Emerging Trends:** HPC applications in physics, machine learning, weather simulation, bioinformatics, and trends in exascale computing.	06	13
	TOTAL	45	100

List of Tutorials:

Sr. No.	Name of Tutorial	Hours
1.	Case studies on HPC architectures and scalability problems.	02
2.	Exercises on speedup, efficiency, and Amdahl's Law calculations.	04
3.	Introduction and hands-on with MPI programming.	04
4.	Implementing collective and point-to-point MPI communications.	04
5.	OpenMP parallel programming exercises and performance tuning.	04
6.	Implementation of parallel matrix multiplication and FFT.	04
7.	Profiling and performance analysis using benchmark tools.	04
8.	Mini-project: Parallel implementation of a scientific problem using MPI/OpenMP.	04
	TOTAL	30

Text Book(s):

Title	Author/s	Publication
An Introduction to Parallel Programming	Pacheco, P. S.	Morgan Kaufmann Publishers

Reference Book(s):

Title	Author(s)	Publication
Parallel Programming in C with MPI and OpenMP	Quinn, M. J.	McGraw-Hill
Sourcebook of Parallel Computing	Dongarra, J., Foster, I., et al.	Morgan Kaufmann
Parallel Programming: Techniques and Applications	Wilkinson, B., Allen, M.	Pearson

Web Material Link(s):

- High Performance Scientific Computing - Course

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests, each of 30 marks and 1 hour of duration and average of the same will be converted to 30 marks.
- Faculty evaluation consists of 10 marks as per the guidelines provided by the Course Coordinator.
- End Semester Examination consists of 60 marks.

Tutorial:

- Continuous Evaluation consists of tutorial performance which should be evaluated out of 10 for each tutorial and average of the same will be converted to 20 marks.
- Internal viva consists of 20 marks.

- Tutorial performance/quiz/test consists of 30 marks during End Semester Exam.
- Viva-voce consists of 30 marks during End Semester Exam.

Course Outcome(s):

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

SECE8540	HIGH PERFORMANCE SCIENTIFIC COMPUTING
CO 1	Explain the architecture and need for high-performance computing systems.
CO 2	Implement parallel programming techniques using MPI and OpenMP.
CO 3	Evaluate numerical algorithms in terms of computational performance and scalability.
CO 4	Optimize and benchmark parallel programs using profiling tools.
CO 5	Develop and demonstrate high-performance solutions for real-world applications.

Mapping of CO with PO

SECE8540	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	P010	PO11
CO 1	3	1			2				1		2
CO 2	3	2	3	2	3						2
CO 3	3	3		3	3						2
CO 4	3	2	3	2	3						2
CO 5	3	2	3	2	3			3		2	2

Mapping of CO with PSO

SECE8540	PSO1	PSO2	PSO3
CO 1	2	3	1
CO 2	3	2	1
CO 3	2	3	2
CO 4	3	2	2
CO 5	2	3	3

Level of Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1.	Introduction to High Performance Scientific Computing	1, 2
2.	Computer Architecture for HPC	2, 3
3.	Parallel Programming Models	2, 3,5,6
4.	Message Passing Interface (MPI)	3, 4
5.	OpenMP Programming	3, 4
6.	Parallel Algorithms	3, 4, 5
7.	Performance Optimization	4, 5
8.	Applications and Emerging Trends	5, 6

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE8550
Course Name: GPU Architectures and Programming
Prerequisite Course(s):

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course to:

- Understand the fundamentals of GPU architecture, memory hierarchy, and parallel execution models.
- Develop proficiency in CUDA and OpenCL programming for solving computationally intensive problems.
- Analyze and optimize GPU-based applications for performance improvement in engineering and AI domains.

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	**Traditional Computer Architecture** RISC pipeline overview (IF, ID, EX, MEM, WB) Hazards and pipeline forwarding Cache and register file basics Register file and SIMD instruction basics	06	15
2.	**GPU Architectural Foundations** Evolution from graphics to general-purpose GPUs Streaming Multiprocessors (SMs) and thread hierarchy GPU memory hierarchy (shared, global, constant) Comparison: GPU vs. CPU architecture	06	15
3.	**Fundamentals of CUDA Programming** CUDA programming model: threads, blocks, grids Writing and launching kernel functions GPU memory spaces: global, shared, constant, texture Thread synchronization	05	10
4.	**Warp Scheduling and Control Flow** SIMT model of execution Warp formation and warp scheduling policies Divergence in control flow and its performance implications Quantitative analysis of warp efficiency	05	10
5.	**GPU Memory Optimization** Memory access coalescing and alignment Shared memory and bank conflicts Use of caches and constant memory for performance	06	15

	Quantitative analysis of memory throughput and latency hiding		
6.	**Reduction kernel optimization** Avoiding divergence in reductions Kernel fusion techniques Thread/block tuning and occupancy optimization	05	10
7.	**OpenCL Programming and Heterogeneous Computing** OpenCL platform and execution model Writing kernels and managing command queues Memory management and buffer handling CPU–GPU interoperability and performance tuning	07	15
8.	**GPU Applications and Neural Network Acceleration** GPU acceleration for AI and machine learning Neural network computation: matrix multiplication, convolution, Efficient training and inference using CUDA/cuDNN	05	10
	TOTAL	**45**	**100**

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	Simulate the five-stage RISC pipeline (IF, ID, EX, MEM, WB) and identify hazards (structural, data, control).	02
2.	Implement cache memory simulation and register file operations; measure hit/miss rates and verify SIMD instruction behavior.	02
3.	Visualize GPU thread, block, and grid hierarchy; map 1D/2D/3D data to threads.	02
4.	Analyze GPU memory hierarchy (shared, global, constant) and understand the graphics pipeline	02
5.	Write and execute basic CUDA kernels (vector addition, matrix multiplication).	02
6.	Implement thread synchronization using __syncthreads() and handle race conditions in shared memory.	02
7.	Map multi-dimensional data (2D/3D matrices) to CUDA thread blocks and grids.	02
8.	Implement synchronized parallel operations (e.g., array reduction) and observe correct results with proper synchronization.	02
9.	Simulate warp execution and measure performance impact of branch divergence.	02
10.	Experiment with warp scheduling and occupancy; analyze active vs idle threads for different block sizes.	02
11.	Implement coalesced vs uncoalesced memory access in matrix operations and compare execution time.	02
12.	Optimize shared memory usage (tiling) and resolve bank conflicts; measure throughput improvement.	02

13.	Optimize reduction kernels (sum, min/max) and compare naive vs optimized performance.	02
14.	Apply kernel fusion and tune thread/block dimensions for maximum occupancy; benchmark fused vs separate kernels.	02
15.	Write OpenCL kernels for vector addition; implement a CPU-GPU hybrid workload and measure performance.	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
"Computer Architecture -- A Quantitative Approach" -	John L.Hennessy and David A. Patterson	Morgan Kaufmann
Programming Massively Parallel Processors	David Kirk and Wen-mei Hwu	

Reference Book(s):

Title	Author/s	Publication
Heterogeneous Computing with OpenCL	Benedict Gaster,Lee Howes, David R. Kaeli	Morgan Kaufmann

Web Material Link(s)

https://onlinecourses.nptel.ac.in/noc25_cs37/preview

Course Evaluation:
Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:

- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):
After completion of the course, the student will be able to

SECE8550	GPU Architectures and Programming
CO 1	Understand the fundamentals of traditional and GPU architectures, including pipelines, SIMD, and memory hierarchies.
CO 2	Develop parallel programs using CUDA and OpenCL programming models for heterogeneous computing.
CO 3	Analyze warp scheduling, SIMT execution, and control flow divergence for performance evaluation.
CO 4	Optimize GPU memory usage and kernel performance through coalescing, shared memory, and thread management techniques.
CO 5	Apply GPU computing concepts to accelerate AI and machine learning applications.

Mapping of CO with PO

SECE8550	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	1			2				1		2
CO 2	3	2	3	2	3						2
CO 3	3	3		3	3						2
CO 4	3	2	3	2	3						2
CO 5	3	2	3	2	3			3		2	2

Mapping of CO with PSO

SECE8550	PSO 1	PSO 2	PSO 3
CO 1	3	2	1
CO 2	3	3	1
CO 3	2	3	1
CO 4	3	3	1
CO 5	3	3	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1.	Traditional Computer Architecture	1,2,3
2.	GPU Architectural Foundations	2,3,4,6
3.	Fundamentals of CUDA Programming	2,3,4
4.	Warp Scheduling and Control Flow	3,4,5
5.	GPU Memory Optimization	3,4,5
6.	Reduction kernel optimization	3, 4, 5, 6
7.	OpenCL Programming and Heterogeneous Computing	3, 4, 5, 6
8.	GPU Applications and Neural Network Acceleration	3, 4, 5, 6

P P Savani University
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Department of Computer Engineering

Course Code: SECE8560
Course Name: Data Analytics with Python
Prerequisite Course(s):

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
3	0	2	5	40	60	0	0	40	60	200

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the Course:

- Introduce students to the fundamentals of Python programming for data analytics.
- Develop the ability to preprocess, clean, and visualize datasets using Python libraries.
- Provide a strong foundation in probability, statistics, and hypothesis testing for data-driven decision-making.
- Equip students with skills to implement regression, classification, and clustering techniques for predictive modeling.
- Enable students to analyse real-world problems through case studies and projects using data analytics tools.

Co**urse Content:**

Module No.	Content	Hours	Weightage in %
1.	**Introduction to Data Analytics and Python Fundamentals**: Data analytics process & applications, Python basics (syntax, variables, control flow, functions, file handling).	05	10
2.	**Python Data Structures and Preprocessing:** Lists, tuples, dictionaries, sets, string operations, data cleaning, handling missing values, feature scaling, encoding.	05	10
3.	**Exploratory Data Analysis (EDA) & Visualization:** Descriptive statistics, data exploration, data visualization with NumPy, Pandas, Matplotlib, Seaborn.	06	15
4.	**Probability, Sampling & Hypothesis Testing**: Probability distributions, sampling, sampling distributions, one-sample & two-sample tests, Chi-square test.	06	15
5.	**Analysis of Variance (ANOVA) & Regression**: One-way and two-way ANOVA, linear regression, multiple regression, assumptions, model evaluation.	06	15
6.	**Logistic Regression & Classification Models**: Concepts of MLE, logistic regression, ROC analysis, classification performance measures.	05	10

7.	**Clustering Techniques**: Introduction to cluster analysis, K-means, hierarchical clustering, evaluation of clusters.	06	15
8.	**Decision Trees & Case Studies**: CART models, decision tree learning, advanced applications and real-world case studies using Python.	06	10
	TOTAL	**45**	**100**

List of Tutorial:

Sr. No	Name of Tutorial	Hours
1.	Explore Python Basics: Variables, Data Types, and Arithmetic Operations.	02
2.	Create and Manipulate Lists, Tuples, Dictionaries, and Sets in Python.	02
3.	Develop and Execute User-defined Functions and Modules in Python.	02
4.	Perform File Handling and String Manipulations in Python.	02
5.	Conduct Data Cleaning and Preprocessing Using Pandas.	02
6.	Perform Exploratory Data Analysis and Visualization Using Matplotlib/Seaborn.	02
7.	Apply Descriptive Statistics and Probability Distributions on Datasets.	02
8.	Perform Sampling and Hypothesis Testing Using Python Libraries.	02
9.	Implement One-way and Two-way ANOVA on Real-world Datasets.	02
10.	Apply Simple and Multiple Linear Regression Using scikit-learn.	02
11.	Implement Logistic Regression and ROC Curve Analysis.	02
12.	Perform Clustering Techniques: K-means and Hierarchical Clustering.	02
13.	Build Decision Tree and CART Models for Classification Problems.	02
14.	Conduct Case Study: Healthcare/Finance Dataset Analysis Using Python.	02
15.	Mini-Project: Integrating Data Preprocessing, EDA, Regression/Classification, and Model Evaluation.	02
	TOTAL	**30**

Text Book(s):

Title	Author/s	Publication
Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython	Wes McKinney	O'Reilly Media

Reference Book(s):

Title	Author/s	Publication
Python Programming using Problem Solving Approach	Reema Thareja	Oxford University Press
Python Machine Learning	Sebastian Raschka, Vahid Mirjalili	Packt Publishing
Data Mining: Concepts and Techniques	Jiawei Han, Micheline Kamber	Morgan Kaufmann

Applied Statistics and Probability for Engineering	Douglas C. Montgomery, George C. Runger	Wiley

Web Material Link(s)
https://onlinecourses.nptel.ac.in/noc25_cs17/preview

Course Evaluation:

Theory:

- Continuous Evaluation consists of two tests each of 30 marks and 1 Hour of duration and average of the same will be converted to 30 marks.
- Faculty Evaluation consists of 10 marks as per the guidelines provided by Course Coordinator.
- End Semester Examination consists of 60 marks.

Practical/Tutorial:

- Continuous Evaluation consists of performance of Practical/Tutorial which should be evaluated out of 10 for each practical and average of the same will be converted to 20 Marks.
- Internal viva consists of 20 marks.
- Practical performance/quiz/drawing/test of 30 marks during End Semester Exam.
- Viva/Oral performance of 30 marks during End Semester Exam.

Course Outcome(s):

After completion of the course, the student will be able to

SECE8560	Data Analytics with Python
CO 1	Demonstrate understanding of Python fundamentals for data analytics.
CO 2	Apply preprocessing, cleaning, and visualization techniques to real-world datasets.
CO 3	Perform statistical analysis, hypothesis testing, and regression modeling.
CO 4	Implement classification and clustering algorithms using Python libraries.
CO 5	Analyze real-world case studies through Python-based data analytics projects.

Mapping of CO with PO

SECE8560	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	3	1			2				1		2
CO 2	3	2		2	3						2
CO 3	3	3		2	3						2
CO 4	3	3		2	3						2
CO 5	3	2	3	2	3			3		2	2

Mapping of CO with PSO

SECE8560	PSO 1	PSO 2	PSO 3
CO 1	2	**3**	1
CO 2	2	**3**	2
CO 3	2	**3**	2
CO 4	2	**3**	2
CO 5	**3**	**3**	2

Level of Bloom's Revised Bloom's Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create

Module No	Content	RBT Level
1.	Introduction to Data Analytics and Python Fundamentals	1,2,3
2.	Python Data Structures and Preprocessing	2,3,4,6

3.	Exploratory Data Analysis (EDA) & Visualization	2,3,4
4.	Probability, Sampling & Hypothesis Testing	2,3,4,5
5.	Analysis of Variance (ANOVA) & Regression	3,4,5
6.	Logistic Regression & Classification Models	3, 4, 5, 6
7.	Clustering Techniques	3, 4, 5, 6
8.	Decision Trees & Case Studies	3, 4, 5, 6

P P Savani University

School of Engineering

Department of Computer Engineering

Course Code: SECE8920
Course Name: Major Research Project
Prerequisite Course/s: -

Teaching & Examination Scheme:

Teaching Scheme (Hours/Week)				Examination Scheme (Marks)						
Theory	Practical	Tutorial	Credit	Theory		Practical		Tutorial		Total
				CE	ESE	CE	ESE	CE	ESE	
-	25	-	25	-	-	200	300	-	-	500

CE: Continuous Evaluation, ESE: End Semester Exam

Objective(s) of the course:
To help learners to

- To engage students in identifying, formulating, and solving real-world research problems.
- To encourage independent and original thinking in designing, implementing, and evaluating computational systems.
- To promote the use of research methodology, scientific writing, and effective communication of results.

Outline of the Course:

- The project will be aligned with the aims of the engineering Programme and its areas of specialization and shall be based on the recent trends in technology.
- The student shall carry out a comprehensive project at relevant academic / R&D / industrial organization.
- The student is required to submit a project report based on the work carried out

Course Outcome(s):
After the completion of the course, the student will be able to

SECE8920	Major Research Project
CO 1	Identify a research problem in the field of computer engineering and define clear research objectives.
CO 2	Apply suitable tools, techniques, and methods to design and develop a research solution.
CO 3	Analyze and interpret data or results obtained from experiments or simulations
CO 4	Prepare and present the research work effectively through reports, presentations, or publications.
CO 5	Work independently or in a team to manage time, resources, and project activities responsibly.

Mapping of CO with PO

SECE8920	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO 1	3	3		2							2

CO 2	3	3	3	2	3						2
CO 3	3	3		3	3						2
CO 4	2	2		2	2				3		2
CO 5	2	2				2	3	3		3	2

Mapping of CO with PSO

SECE8920	PSO1	PSO2	PSO3
CO 1	2	1	2
CO 2	3	2	2
CO 3	3	2	
CO 4	2	3	3
CO 5	1	1	3

P P Savani School of Engineering

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