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 knowledge of engineering fundamentals, science, mathematics & engineering specialization for the solution of complex engineering problems.
PO 2	Problem analysis: Identify, formulate and analyze complex engineering problems leading to substantial conclusions using basic principles of mathematics, science and engineering.
PO 3	Design/development of solutions: Develop solutions for complex engineering problems and design system components or processes meeting specified needs having due consideration for the safety and societal &environmental considerations.
PO 4	Conduct investigations of complex problems: Use research-based knowledge & methods like design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid & viable conclusions.
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and ITtools for prediction and modeling of complex engineering activities with an understanding of the limitations.

PO 6	The engineer and society: Apply cognitive learning by the contextual knowledge to assess societal, health, safety, legaland cultural issues and following responsibilities relevant to the professional engineering practice.
PO 7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge & skill needed for sustainable development.
PO 8	Values & Ethics: Apply basic moral values & ethical principles and pledge to professional ethics/norms andresponsibilities of the engineering practice.
PO 9	Individual and team work: Function effectively as an individual/as a team member or as a leader in diverse teams, andin multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects inmultidisciplinary environments.
PO 12	Life-long learning: Recognize the need, do necessary 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

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 %
	Section I		
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)		
Section II			
1	**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
2	**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
3	**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
4	**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

Mapping of CO with PO

SECH7010	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	3	2								2
CO 2	3	3	2			2		3				
CO 3	3	3	2	3	3							2
CO 4	2	2				2		3	2	3	2	2

Mapping of CO with PSO

SECH7010	PSO1	PSO2	PSO3
CO 1	3	2	3
CO 2	2	3	3
CO 3	3	2	3
CO 4	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	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
CO1	Identify and define a research problem with reference to current trends in Computer Engineering.
CO2	Analyze relevant literature and select appropriate tools and techniques.
CO3	Develop and implement innovative solutions or models for real-world problems.
CO4	Evaluate research findings and present technical documentation and publications.

Mapping of CO with PO

SECE7910	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	2	3	2	1						
CO 2	3	3	2	3	3							
CO 3	3	3	3	3	3	1	1					
CO 4	2	2	2	3	2							

Mapping of CO with PSO

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

Section I			
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
Section II			
Module No.	Content	Hours	Weightage in %

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 Stack Search, DCFS, SMGS, Sequence Alignment, Monotone Heuristic Condition	08	20
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	Judea Pearl	Addison-Wesley

for Computer Problem Solving		
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**	**PO12**
CO 1	3	1				2						2
CO 2	2	3	3	2	2							
CO 3	2	3	2	3								2
CO 4	2	3	3		2				2			
CO 5	2	3	3		3							

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
3	Metaheuristics and Population-Based Search	2, 3, 4
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:

Section I			
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
Section II			
Module No.	Content	Hours	Weightage in %
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	PO12
CO 1	3	2	1									2
CO 2	3	3	2	2	2							
CO 3	2	3	3	3	3				2	2		1
CO 4	3	3	1	3	1							2
CO 5	2	3	3	2	3	1			2		2	3

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
3	Planning and Bootstrapping Methods	1, 2, 3, 4
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:

Section I			
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
Section II			
Module No.	Content	Hours	Weightage in %
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.
CO2	Apply statistical and neural methods to language modeling and word embeddings.
CO3	Design and evaluate translation systems using SMT and NMT techniques.
CO4	Develop simple dialogue systems, chatbots, and neural-based spelling correction systems.

Mapping of CO with PO

SECE7530	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2										
CO 2	3	3	2	1	2							
CO 3	3	3	2	2	3							
CO 4	3	3	3	2	2					2		

Mapping of CO with PSO

SECE7530	PSO1	PSO2	PSO3
CO 1	2	3	1
CO 2	3	3	2
CO 3	3	3	2
CO 4	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 NLP & Word Vectors	1, 2
2	Language Modeling & Neural Networks	2, 3
3	Word Embeddings & RNNs	2, 3, 4
4	SMT and NMT	3, 4, 5
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:**

Section I			
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
Section II			
Module No.	**Content**	**Hours**	**Weightage in %**
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	PO 12
CO 1	2	1			1							2
CO 2	3	2	1	1	2							3

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

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:

Section I			
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
Section II			
Module No.	Content	Hours	Weightage in %
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	PO12
CO 1	3	1				2						2
CO 2	2	3	3	2	2							
CO 3	2	3	2	3								2
CO 4	2	3	3		2				2			
CO 5	2	3	3		3							

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
3	Unsupervised Learning and CNN Foundations	3, 4
4	Advanced Optimization and Regularization Techniques	3, 4
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:

Section I			
Module No.	Content	Hours	Weightage in %
1.	Cloud Introduction: Evolution, Service Models, Deployment Types	4	9
2.	Cloud Architecture, Resource Management, Multi-tenancy, SLA, Metering	4	9
3.	Virtualization: Hypervisors, Containers, VM Provisioning	06	12
Section II			
Module No.	Content	Hours	Weightage in %
4.	**Security & Compliance:** IAM, Trust Models, Authorization	5	11
5.	**Platforms:** AWS, Azure, OpenStack, Fog & Edge Computing	10	24
6.	Serverless Architecture, FaaS, Case Studies & Industry Applications	10	35
	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	PO12
CO 1	3	1				2						2
CO 2	2	3	3		2							2
CO 3	2	3	2	3	3	1			1	1	1	2
CO 4	2	3	3		2				1	2		2

CO 5	3	3	3	3	3				2	2	2	3

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
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 %
	Section I		
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, Applications in reaction kinetics, control theory, and dynamic system modeling	5	10
4	**Partial Differential Equations and Their Numerical Solutions**	5	10

	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		
Section II			
1	**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
2	**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
3	**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
4	**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.

Mapping of CO with PO

SECE7010	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	2	3	2							2
CO 2	3	3	2	2	3							2
CO 3	3	2	3	3	3							2
CO 4	2	3	2	3	3			2	2	3	2	3

Mapping of CO with PSO

SECE7010	PSO1	PSO2	PSO3
CO 1	3	2	3
CO 2	3	2	3
CO 3	2	3	3
CO 4	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
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
CO1	Identify and define a research problem with reference to current trends in Computer Engineering.
CO2	Analyze relevant literature and select appropriate tools and techniques.
CO3	Develop and implement innovative solutions or models for real-world problems.
CO4	Evaluate research findings and present technical documentation and publications.

Mapping of CO with PO

SECE7920	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	2	3	2	1						
CO 2	3	3	2	3	3							
CO 3	3	3	3	3	3	1	1					
CO 4	2	2	2	3	2							

Mapping of CO with PSO

SECE7920	PSO1	PSO2	PSO3
CO 1	3	2	3
CO 2	3	2	3
CO 3	3	2	3
CO 4	2	3	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:**

Section I			
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
Section II			
Module No.	**Content**	**Hours**	**Weightage in %**
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	PO 12
CO 1	2	1			1	1						2
CO 2	3	2	1	1	2							3
CO 3	3	3	2	2	3				1	2	2	3
CO 4	3	3	3	3	2	1	1	2	2	3	3	3
CO 5	3	3	3	3	2		1	2	3	3	3	3

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	1,2,3,4,5,6
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		
Theory	Practical	Tutorial	Credit	CE	ESE	CE	ESE	CE	ESE	Total
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:**

Section I			
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
Section II			
Module No.	**Content**	**Hours**	**Weightage in %**
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	PO 12
CO 1	3	2	1									1
CO 2	3	3	2	2	2							
CO 3	2	3	3	3	3				2	2		1
CO 4	3	3	1	3	1							2
CO 5	2	3	3	2	3	1			2		2	3

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
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:**

Section I			
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
Section II			
Module No.	**Content**	**Hours**	**Weightage in %**
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	PO 12
CO 1	3	3	2	2		2				2		1
CO 2	2	3	3	3	3		1			2		1
CO 3	2	3	2	3	3					2		2
CO 4	3	3	3	3	3		1			2		2
CO 5	3	3	3	3	3	2	2	1		2	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
3	Attention and Transformers	2, 3, 4
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:**

Section I			
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
Section II			
Module No.	Content	**Hours**	**Weightage in %**
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	09	18

	Decision Theory, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Linear Discriminant Analysis.		
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	PO 12
CO 1	3	3	2	2		2				2		1
CO 2	2	3	3	3	3			1		2		1
CO 3	2	3	2	3		3				2		2
CO 4	3	3	3		3		1			2		2
CO 5	3	3	3		3	2	2	1		2	2	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	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:**

Section I			
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
Section II			
Module No.	Content	**Hours**	**Weightage in %**
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	09	18

	Computing in IIoT-Part I, Part II., Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, 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	PO 12
CO1	3	3	2	2					2		1	1
CO2	3	3	2	2	2	2	2	1	2		1	1
CO3	3	3	3	3	2				2		2	2
CO4	3	3	3	2	3	2	1	1	2	1	2	3
CO5	3	3	3	3	3	2	1	1	3	2	3	3

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
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:**

Section I			
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
Section II			
Module No.	Content	**Hours**	**Weightage in %**
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), Introduction to Quantum Cryptography, Blockchain, Bitcoin and Cryptocurrency.	06	16
	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:

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- 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**	**PO 12**
CO1	3	2					3	2				
CO2	3	3	2		2		3	3	2		2	
CO3	3	3					3	3				
CO4	3	3	2	2	2		3	3	2	2	2	
CO5	2	3	2	3			2	3	2	3		

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

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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
5	Cryptographic Hash Function	4,5
6	Cryptanalysis on Stream Cipher	4,5,6