PPSU

P P SAVANI UNIVERSITY

SCHOOL OF ENGINEERING

COMPUTER ENGINEERING

SYLLABUS BOOK

AY 2026-27

INSTITUTE VISION
To emerge as an Institute of Excellence by imparting value-based education aided with Research, Innovation and Entrepreneurial skills.

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)
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)

One (1) credit represents 30 hours of learning, comprising an appropriate combination of Theory, Practical, Tutorial, Project, Group Discussion, Case Study, Field Visit, Presentation, Assignment, Term Work, Self-Learning, and other curriculum-approved learning activities.

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

P P Savani University

School of Engineering

Effective From: 2026-27

Authored by: P P Savani University

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PPSU
P P SAVANI UNIVERSITY
NAAC ACCREDITED A+ GRADE

School of Engineering

FIRST YEAR M.TECH (2026-27)

P P SAVANI UNIVERSITY

SCHOOL OF ENGINEERING

TEACHING & EXAMINATION SCHEME FOR FIRST YEAR M.TECH. COMPUTER ENGINEERING PROGRAMME AY: 2026-27

Sem	Course Code	Course Title	Offered By	Teaching Scheme										Examination Scheme								
				Direct Contact Hours			Indirect Contact Hours					Total	Credit	Theory	Practical	Tutorial	Project	GD/CS/FV/PPT	Assignment	Term Work	Self Learning	Total
				Theory	Practical	Tutorial	Project	GD/CS/FV/PPT	Assignment	Term Work	Self Learning			CE/ESE	CE/ESE	CE/ESE	CE/ESE	CE/ESE	CE/ESE	CE/ESE	CE/ESE	CE/ESE
1	SOECH7010	Research Methodology and Ethics	CH	45	0	30	0	0	30	0	15	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
	SOECE7810	Research Project-I	CE	0	0	0	240	60	0	0	60	360	12	0	0	0	100 100	00 100	0	0	100 00	200 200
		ELECTIVE - I																				
	SOECE7510	Artificial Intelligence Search Methods	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
	SOECE7520	Advanced Reinforcement Learning	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
	SOECE7530	Applied NLP and Language Technologies	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
		ELECTIVE - II																				
	SOECE7540	Machine Learning for Engineering Applications	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
	SOECE7550	Deep Learning and Neural Networks	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
	SOECE7560	Cloud Computing Technologies	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
											Total	**720**	**24**									
2	SOECE7010	Computational Research Techniques	CE	45	0	30	0	0	30	0	15	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
	SOECE7820	Research Project-II	CE	0	0	0	240	60	0	0	60	360	12	0	0	0	100 100	00 100	0	0	100 00	200 200
		ELECTIVE - III																				
	SOECE7570	Blockchain Technology	CE	45	0	30	0	0	15	0	30	120	4	30	0	30	0	0	20	0	20	100

P P SAVANI UNIVERSITY

SCHOOL OF ENGINEERING

TEACHING & EXAMINATION SCHEME FOR FIRST YEAR M.TECH. COMPUTER ENGINEERING PROGRAMME AY: 2026-27

Sem	Course Code	Course Title	Offered By	Teaching Scheme										Examination Scheme								
				Direct Contact Hours			Indirect Contact Hours					Total	Credit	Theory	Practical	Tutorial	Project	GD/CS/FV/PPT	Assignment	Term Work	Self Learning	Total
				Theory	Practical	Tutorial	Project	GD/CS/FV/PPT	Assignment	Term Work	Self Learning			CE/ESE	CE/ESE	CE/ESE	CE/ESE	CE/ESE	CE/ESE	CE/ESE	CE/ESE	CE/ESE
		and Applications												50		50			00		00	100
	SOECE7580	Internet Of Things	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
	SOECE7590	Deep Learning for NLP Applications	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
		ELECTIVE - IV																				
	SOECE7600	Computer Vision and Image Analytics	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
	SOECE7610	Industry 4.0 and Industrial IoT Systems	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
	SOECE7620	Advanced Cryptography and Network Security	CE	45	0	30	0	0	15	0	30	120	4	30 50	0	30 50	0	0	20 00	0	20 00	100 100
											Total	720	**24**									

P P Savani University

School of Engineering

Offered by: Department of hemical Engineering

COURSE DETAILS:

Course Code	SOECH7010
Course Name	Research Methodology and Ethics
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	0	30	0	00	30	0	15

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	0	0	0	20	0	200

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE OF THE COURSE:

To help learners to:

- 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 No.	Content	Hours	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 Review, Research Ethics and Methodology:** 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 detection tools (Turnitin, Grammarly, etc.); Research design types – Descriptive, Analytical, Experimental; Sampling techniques and hypothesis formulation; Measurement scales and data collection methods; Case studies and surveys in research.	12	25
3	**Data Analysis and Interpretation:** Statistical analysis of data (mean, median, mode, standard deviation, etc.); Hypothesis testing, confidence intervals, and p-values; Correlation and regression analysis; Data visualization and interpretation using software tools (Excel, SPSS, R, Python).	5	15
4	**Technical Writing and Research Documentation:** Structure and formatting of research papers, theses, and dissertations; Referencing styles (IEEE, APA, MLA); Writing abstracts, technical reports, and conference papers; Use of LaTeX, MS Word, and reference management tools (Mendeley, Zotero).	5	10
5	**Intellectual Property Rights and Patent System:** Overview of Intellectual Property Rights (IPR); Types of IPR – Patents, Copyrights, Trademarks, Industrial Designs, Trade Secrets; Importance of IPR in research and innovation; Indian and international patent systems (WIPO, PCT); Patent drafting, claims, specifications, and filing procedures in India and abroad; Patent search databases (Espacenet, USPTO, InPASS); Technology transfer and commercialization of IPR.	13	25
6	**Case Studies and Contemporary Issues in IPR:** Case studies of patent infringement and IP litigation; IPR in academia-industry collaborations; Startups and IP strategies; Emerging trends in IPR – Artificial Intelligence and IP, Open Innovation, Creative Commons.	5	15
	TOTAL	**45**	**100%**

LIST OF PRACTICAL / TUTORIAL:

Sr. No	Practical / Tutorial	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 02	2
7	Statistical measures (mean, median, mode, standard deviation); hypothesis testing	2
8	Correlation, regression, confidence intervals, p-values; visualization using Excel,	2

	SPSS, R, Python	
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 02	2
15	Patent infringement, IP litigation, academia-industry collaborations, startups, AI and IP, Open Innovation, Creative Commons	2
	TOTAL	**30**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	https://youtu.be/TEqYnV6KWfY?si=UzuKsaX_3VgvnzWf ; https://youtu.be/mAVswCbz_jM?si=CztpFDdGGhyUW2NX ; https://youtu.be/IZLn9_PA_4s?si=Ek9cgAi-S05WPGh6 ; Introduction to Research and Research Process	5
2	https://www.youtube.com/live/91Em1nze7K8?si=kFbWSBChEPkJPoAV ; https://youtu.be/TMQwDQ6eMXc?si=91NKmB5qmtSRoNWn ; https://youtu.be/NxE4xqHk218?si=Ico2bFLGx1hfPjPj ; Literature Review, Research Ethics and Methodology	5
3	https://youtu.be/K9teElePNkk?si=4hh3jbzvn1sdzd2m ; https://youtu.be/XZo4xyJXCak?si=e2gMdqhN29nhcx0w ; https://www.youtube.com/live/cezxxA7YA1g?si=m3d5Whhuz3ZSeSXt ; Data Analysis and Interpretation 5	5

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course. Duration: 2 Hours	50	25
Tutorial	CE	Practical CE Performance of practical which should be evaluated out of 10 marks for each practical and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Practical Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics	20	00

		Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks		
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**40**

TEXT BOOK(S):

Title	Author/s	Publication
Research Methodology: Methods and Techniques	C. R. Kothari, Gaurav Garg	New Age International Publishers (2019)

REFERENCE BOOK(S):

Title	Author/s	Publication
Research Methodology: A Step-by-Step Guide for Beginners	Ranjit Kumar	SAGE Publications (2018)
Intellectual Property Rights: Unleashing the Knowledge Economy	Prabuddha Ganguli	Tata McGraw-Hill (2001)

COURSE OUTCOME(S):

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

SOECH7010	Research Methodology and Ethics
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	Explain the fundamentals of Intellectual Property Rights and apply patent search, drafting, and filing concepts for protecting and commercializing research outcomes.

MAPPING OF CO WITH PO:

SOECH7010	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	2		2							
CO 2	2	3		3	2						
CO 3	2	3	3	3	3						
CO 4	1	2	3	2	2						
CO 5								3	3	3	2

MAPPING OF CO WITH PSO:

SOECH7010	PSO1	PSO2	PSO3

CO 1	2	2	1
CO 2	3	2	2
CO 3	3	3	2
CO 4	2	3	2
CO 5	1	2	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 Research and Research Process	1,2
2	Literature Review, Research Ethics and Methodology 3	3
3	Data Analysis and Interpretation	3
4	Technical Writing and Research Documentation	5
5	Intellectual Property Rights and Patent System	4
6	Case Studies and Contemporary Issues in IPR	6

P P Savani University

School of Engineering

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7810
Course Name	Research Project-I
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	PPT	Assignment	Term Work	Self-Learning
12	360	0	0	0	240	60	0	0	60

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		PPT		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
0	0	0	0	0	0	100	100	0	100	0	0	0	0	100	0	400

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE OF THE COURSE:

To help learners to:

- Identify and formulate a research problem in a chosen domain of engineering and technology.
- Conduct an extensive literature survey using research databases and scholarly resources.
- Develop skills in problem analysis, methodology design, experimentation planning, and result interpretation.
- Enhance technical writing, presentation, and documentation skills.
- Prepare a strong foundation for the successful execution of Research Project.

PROJECT ACTIVITIES:

Module No.	Content	Hours	Weightage in%
1	**Project Activities:** Identification of Research Problem and Domain Selection	20	10
2	**Project Activities:** Literature Review and Research Gap Analysis	40	10
3	**Project Activities:** Problem Formulation and Objective Definition	20	10
4	**Project Activities:** Research Methodology Design	30	10
5	**Project Activities:** Dataset/Experimental Setup Preparation	30	10
6	**Project Activities:** Initial Design and Prototype Development	40	20

7	**Project Activities:** Technical Writing	30	10
8	**Project Activities:** Mid-Term Progress Presentation	15	10
9	**Project Activities:** Final Presentation	15	10
	TOTAL	**240**	**100%**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	NPTEL Research Methodology Courses-	10
2	IEEE Xplore Digital Library	10
3	SpringerLink	10
4	Scopus & Web of Science	10
5	Elsevier Researcher Academy	10
6	Google Scholar	10

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Project Progress	CE	Literature survey, problem formulation, methodology design, mentor evaluation	100	0
Project Final Evaluation	ESE	Technical contribution, implementation progress, report quality, presentation and viva voce	100	50
PPT Presentation	ESE	Content quality, presentation skills, technical understanding, response to questions	100	50
Self Learning	CE	Research paper reviews, online certifications, technical report submissions	100	0
		TOTAL MARKS	**400**	**100**

COURSE OUTCOME(S):

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

SOECE7810	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:

SOECE7810	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:

SOECE7810	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

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7510
Course Name	Artificial Intelligence Search Methods
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	00	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	0	0	0	20	0	200

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE 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	5	10
2	**Classical Search Methods:**	8	20

	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		
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	6	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 Stack Search, DCFS, SMGS, Sequence Alignment, Monotone Heuristic Condition	8	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	8	20
	TOTAL	**45**	**100%**

LIST OF PRACTICAL / TUTORIAL:

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

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours

1	NPTEL – IIT/IISc Courses https://youtu.be/iF1tOCEXLXY?si=rVcklzoK5UUECuSF	29
2	SWAYAM https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_cs67	01

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course. Duration: 2 Hours	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks	20	00
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**50**

TEXT BOOK(S):

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

REFERENCE BOOK(S):

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 OUTCOME(S):

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

SOECE7510	Artificial Intelligence Search Methods
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:

SOECE7510	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:

SOECE7510	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 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

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7520
Course Name	Advanced Reinforcement Learning
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	00	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	0	0	0	20	0	200

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE 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	4	6
5	**Deep RL:** Deep Q-Networks (DQN), Policy Gradients for Full RL	5	9
6	**Advanced and Hierarchical RL :** Hierarchical RL, POMDPs (Partially Observable MDPs)	10	20

7			
	TOTAL	**45**	**100%**

LIST OF PRACTICAL / TUTORIAL:

Sr. No	Practical / 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**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	NPTEL – IIT/IISc Courses https://www.youtube.com/watch?v=9vMpHk44XXo	29
2	SWAYAM https://onlinecourses.nptel.ac.in/e-learning/preview/noc19_cs55	01

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course. Duration: 2 Hours	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks	20	00

Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**50**

TEXT BOOK(S):

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

REFERENCE BOOK(S):

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 OUTCOME(S):

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

SOECE7520	Advanced 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:

SOECE7520	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	2									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	5		3						2

MAPPING OF CO WITH PSO:

SOECE7520	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 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

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7530
Course Name	Applied NLP and Language Technologies
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	00	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	0	0	0	20	0	200

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE OF THE COURSE:

To help learners to:

- 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 No.	Content	Hours	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, Applications in reaction kinetics, control theory, and dynamic system modeling	5	10
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 PRACTICAL / TUTORIAL:

Sr. No	Practical / Tutorial	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	2

	process control	
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	2
	TOTAL	**30**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	NPTEL – IIT/IISc Courses https://www.youtube.com/watch?v=02QWRAhGc7g&list=PLJJzI13YAXCHxbVgiFaSI88hj-mRSoMtI	15
2	SWAYAM https://nptel.ac.in/courses/106105158	15

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course. Duration: 2 Hours	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks	20	00

Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**50**

TEXT BOOK(S):

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

REFERENCE BOOK(S):

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 OUTCOME(S):

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

SOECE7530	Applied NLP and Language Technologies
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:

SOECE7530	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:

SOECE7530	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 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 Mathematical Modeling in Research	3,5
2	Advanced Linear Algebra and Its Applications	1,4
3	Advanced Calculus and Differential Equations	1,3
4	Partial Differential Equations and Their Numerical Solutions	2,6
5	Numerical Techniques and Scientific Computing	1,5
6	Optimization Techniques in Research	3,4
7	Probability, Statistics, and Data-Driven Modeling	2,4
8	Computational Tools and Research Applications	3,5

P P Savani University

School of Engineering

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7540
Course Name	Machine Learning for Engineering Applications
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	0	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	0	0	0	20	0	200

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE 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.

COURSE 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
	TOTAL	**45**	**100%**

LIST OF PRACTICAL / TUTORIAL:

Sr. No	Practical / 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
	TOTAL	**30**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	https://www.digimat.in /nptel/courses/video/106106198/L01.html	29
2	SWAYAM https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs76	01

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course.	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks	20	0
Self	CE	40 MCQ questions based on self-study resources and	20	0

Learning		online learning | 0.5 marks per question | Total = 20 marks		
		TOTAL MARKS	**200**	**50**

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.

COURSE OUTCOME(S):

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

SOECE7540	Machine Learning for Engineering 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:

SOECE7540	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	2							1		2
CO 2	3	3		2							2
CO 3	3	2	3	2							2
CO 4	3	3		2							2
CO 5	3	2	3								2

MAPPING OF CO WITH PSO:

SOECE7540	PSO1	PSO2	PSO3
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 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

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7550
Course Name	Deep Learning and Neural Networks
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
04	120	45	0	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	0	0	0	20	0	200

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE 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	5	10
2	**Optimization and Neural Network Basics:** Optimization Techniques, Gradient Descent, Batch Optimization, Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning	8	20
3	**Unsupervised Learning and CNN Foundations:** Unsupervised Learning with Deep Networks, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning	6	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	8	20

	Normalization		
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	8	20
	TOTAL	**45**	**100%**

LIST OF PRACTICAL / TUTORIAL:

Sr. No	Practical / 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**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	https://www.youtube.com/watch?v=x0-1qC54F-k	02
2	https://www.youtube.com/watch?v=QlhHqMnd9Wo	02
3	https://www.youtube.com/watch?v=W3_yaf3HvHU&list=PLbRMhDVUMngc7NM-gDwcBzIYZNFSK2N1a	25
4	https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ee16	01

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course.	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Tutorial Performance – 25Marks	50	25

		External Viva Voce – 25 Marks		
Assignment	CE	Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks	20	00
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**50**

TEXT BOOK(S):

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

REFERENCE BOOK(S):

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 OUTCOME(S):

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

SOECE7550	Deep Learning and Neural Networks
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:

SOECE7550	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:

SOECE7550	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 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

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7560
Course Name	Cloud Computing Technologies
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
04	120	45	0	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	0	0	0	20	0	200

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE 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	**Introduction:** Cloud Introduction: Evolution, Service Models, Deployment Types	5	10
2	**Cloud Architecture:** Cloud Architecture, Resource Management, Multi-tenancy, SLA, Metering	5	10
3	**Virtualization:** Virtualization: Hypervisors, Containers, VM Provisioning	6	15
4	**Security & Compliance:** IAM, Trust Models, Authorization	9	15
5	**Platforms:** AWS, Azure, OpenStack, Fog & Edge Computing	10	25
6	**Serverless Architecture:** FaaS, Case Studies & Industry Applications	10	25
	TOTAL	**45**	**100%**

LIST OF PRACTICAL / TUTORIAL:

Sr. No	Practical / Tutorial	Hours
1	Cloud Basics and Service Models	02
2	Virtualization & Hypervisor Setup	08
3	Implementing IAM & Security Policies in Cloud	04
4	Hands-on with AWS/OpenStack/CloudSim	04
5	case Study: Residual Network and Transfer Learning	04
6	Edge/Fog Computing Simulation and Analysis	04
7	Mini Project: Deployment of a Cloud-based Solution	04
	TOTAL	**30**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	https://www.youtube.com/watch?v=NzZXz3fJf6o&list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J	29
2	https://nptel.ac.in/courses/106105167	01

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	0
	ESE	Comprehensive written examination covering all modules of the course.	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	0
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks	20	0
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	0
		TOTAL MARKS	**200**	**50**

TEXT BOOK(S):

Title	Author/s	Publication
Cloud Computing: Principles and Paradigms	Rajkumar Buyya, James	Wiley

	Broberg, Andrzej M. GoscinskI	

REFERENCE BOOK(S):

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 OUTCOME(S):

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

SOECE7560	Cloud Computing Technologies
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:

SOECE7560	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:

SOECE7560	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 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

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7010
Course Name	Computational Research Techniques
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	0	30	0	0	30	0	15

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	00	0	0	20	0	200

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE OF THE COURSE:

To help learners 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.
- Equip students with advanced numerical methods for solving algebraic, differential, and partial differential equations that arise in real-world engineering systems and simulations.
- Enable the application of optimization techniques and data-driven modeling for research-based decision-making and process/system performance improvement in diverse engineering domains.
- 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.
- 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 No.	Content	Hours	Weightage in%
1	**Foundations of Mathematical Modeling and Linear Algebra for Research:** Fundamentals of model formulation and validation; Classification of models: deterministic vs. stochastic, static vs. dynamic; Dimensional analysis and similarity; Vector spaces,	8	20

	inner product spaces, Gram-Schmidt orthogonalization; Eigenvalue problems and diagonalization; Applications in chemical process design, Principal Component Analysis (PCA), process control, machine learning, and computational algorithms.		
2	**Differential Equations and Dynamic System Modeling:** Higher-order ordinary differential equations (ODEs) and systems of ODEs; Stability analysis and phase portraits; Laplace transforms and their applications; Introduction to partial differential equations (PDEs): Heat, wave, and Laplace equations; Applications in reaction kinetics, control theory, dynamic system modeling, and transport phenomena.	8	20
3	**Numerical Methods and Scientific Computing:** Numerical differentiation and integration (Trapezoidal and Simpson's rules); Root-finding methods: Newton-Raphson, Secant, and Broyden's methods; Interpolation and curve fitting; Numerical solutions of large systems using Jacobi and Gauss-Seidel methods; Software implementation using MATLAB, Python, and Octave.	7	15
4	**Numerical Solutions of PDEs and Computational Techniques:** Separation of variables; Fourier methods; Finite Difference Method (FDM); Introduction and comparison of Finite Volume Method (FVM) and Finite Element Method (FEM); Applications in Computational Fluid Dynamics (CFD), mass transfer, heat transfer, and neural PDE solvers.	7	15
5	**Optimization Techniques and Data-Driven Modeling:** Classical and non-classical optimization techniques; Linear, nonlinear, constrained, and unconstrained optimization; Metaheuristic algorithms: Genetic Algorithms (GA), Particle Swarm Optimization (PSO), and Simulated Annealing; Probability distributions and random variables; Regression modeling and data-driven model development; Applications in process design and machine learning.	8	20
6	**Statistical Analysis, Computational Tools, and Research Applications:** Estimation, hypothesis testing, confidence intervals, ANOVA, and Bayesian inference; Research-centric use of MATLAB, Python (NumPy, SciPy, SymPy, Pandas, Scikit-learn), Aspen Plus, ANSYS Fluent, TensorFlow, and PyTorch; Error analysis, reproducibility, and scientific documentation; Capstone Project: Solving a real-life or simulated research problem.	7	10
	TOTAL	**45**	**100%**

LIST OF PRACTICAL / TUTORIAL:

Sr. No	Practical / Tutorial	Hours
1	Fundamentals of model formulation and validation; classification of models (deterministic vs. stochastic, static vs. dynamic)	02
2	Dimensional analysis, similarity; applications in chemical process design and computational algorithms	02
3	Vector spaces, inner product spaces, Gram-Schmidt orthogonalization	02

4	Eigenvalue problems, diagonalization, Jordan forms; applications in PCA and process control	02
5	Higher-order ODEs, systems of ODEs; stability analysis and phase portraits	02
6	Laplace transforms; applications in reaction kinetics and control theory	02
7	Heat, wave, and Laplace equations; method of separation of variables	02
8	Fourier, finite difference, FVM, FEM methods; applications in mass transfer and CFD	02
9	Numerical differentiation, integration (Trapezoidal, Simpson's rule); root-finding (Newton-Raphson, Secant)	02
10	Interpolation, curve fitting; implementation in MATLAB, Python, Octave	02
11	Classical and non-classical optimization; linear and non-linear optimization	02
12	Metaheuristic algorithms (Genetic Algorithms, PSO, Simulated Annealing), multivariable optimization	02
13	Probability distributions, random variables; estimation, hypothesis testing	02
14	Regression modeling, ANOVA, Bayesian inference; applications in process monitoring	02
15	MATLAB, Python (NumPy, SciPy, Pandas, Scikit-learn), Aspen Plus, ANSYS Fluent; capstone project	02
	TOTAL	**30**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	https://youtu.be/sKVFkVoYfbs?si=tX5NIrhCmhwY0lKb ; https://youtu.be/FME9avU3u2Y?si=Rrws3iLURl0vyyNj ; https://youtu.be/Pcp7gxAKLTk?si=djZ-nX4h-LSaDyj8 ; Foundations of Mathematical Modeling and Linear Algebra for Research	3
2	https://youtu.be/04pdHAgV38E?si=d-NJZxIig8B2jpsY ; https://youtu.be/u14ZObiV7GU?si=CUwLn290rjBKKkmH ; https://youtu.be/3E8QcXEBvYU?si=xhi0BqaR2VosI1_X ; Differential Equations and Dynamic System Modeling	3
3	https://youtu.be/vg8BtY1lUFE?si=VQiU-zWk_Ykpo9z3 ; https://youtu.be/z2QpdRGYXQk?si=rAU4M2C1ig8liOik ; https://youtu.be/dHvUk7af2H4?si=jDaQq68ac309aYId ; Numerical Methods and Scientific Computing	3
4	https://youtu.be/ZSNl5crAvsw?si=ztaFCWjfF3lxFl1g ; https://youtu.be/svtuoyi3DNw?si=DKuXEZrpy0-fiqsx ; https://youtu.be/QndgX29Ui-M?si=lJYHBfL3mj4pFIAd ; Numerical Solutions of PDEs and Computational Techniques	2
5	https://youtu.be/p_O6SXFGDrA?si=o9BTsSaTPXqXS3q_ ; https://youtu.be/CzgU4BYPYQQ?si=JGBOXBC3TZxZjiDx ; https://youtu.be/COJYh1qBCdo?si=f-Y2GF81W4dIljQ6 ; Optimization Techniques and Data-Driven Modeling	2
6	https://www.youtube.com/live/E0_TPwnWJy0?si=YKK3JJiu5yTw0kSd ; https://youtu.be/zaT4gZa-46U?si=S-1HY9Tbht0YHVFU ;	2

	https://youtu.be/ONR_Qxwbyd4?si=kX1Ix-OQWEeOYgOQ ; Statistical Analysis, Computational Tools, and Research Applications	

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	0
	ESE	Comprehensive written examination covering all modules of the course. Duration: 2 Hours	50	25
Tutorial	CE	Performance of practical which should be evaluated out of 10 marks for each practical and average of the same will be converted to 30 marks.	30	0
	ESE	Quiz / Practical Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics • Technical Depth & Literature Integration – 5 Marks • Methodological Rigor, Analysis & Innovation– 5 Marks • Synthesis, Discussion & Conclusion – 5 Marks • Professional Presentation, LaTeX/Formatting & Citations – 5 Marks	20	0
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	0
		TOTAL MARKS	**200**	**40**

TEXT BOOK(S):

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

REFERENCE BOOK(S):

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

COURSE OUTCOME(S):

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

SOECE7010	Computational Research Techniques

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 and communicate findings effectively.
CO 5	Integrate interdisciplinary approaches, ethical practices, and sustainability principles in developing innovative mathematical and computational research solutions.

MAPPING OF CO WITH PO:

SOECE7010	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	2		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:

SOECE7010	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 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 Mathematical Modeling and Linear Algebra for Research	1,2
2	Differential Equations and Dynamic System Modeling	3
3	Numerical Methods and Scientific Computing	3
4	Numerical Solutions of PDEs and Computational Techniques	5
5	Optimization Techniques and Data-Driven Modeling	4
6	Statistical Analysis, Computational Tools, and Research Applications	6

P P Savani University

School of Engineering

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7820
Course Name	Research Project-II
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	PPT	Assignment	Term Work	Self-Learning
12	360	0	0	0	240	60	0	0	60

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		PPT		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
0	0	0	0	0	0	100	100	0	100	0	0	0	0	100	0	400

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE OF THE COURSE:

To help learners to:

- Identify and formulate a research problem in a chosen domain of engineering and technology.
- Conduct an extensive literature survey using research databases and scholarly resources.
- Develop skills in problem analysis, methodology design, experimentation planning, and result interpretation.
- Enhance technical writing, presentation, and documentation skills.
- Prepare a strong foundation for the successful execution of Research Project.

PROJECT ACTIVITIES::

Module No.	Content	Hours	Weightage in%
1	**Project Activities:** Identification of Research Problem and Domain Selection	20	10
2	**Project Activities:** Literature Review and Research Gap Analysis	40	10
3	**Project Activities:** Problem Formulation and Objective Definition	20	10
4	**Project Activities:** Research Methodology Design	30	10
5	**Project Activities:** Dataset/Experimental Setup Preparation	30	10
6	**Project Activities:** Initial Design and Prototype Development	40	20

7	**Project Activities:** Technical Writing	30	10
8	**Project Activities:** Mid-Term Progress Presentation	15	10
9	**Project Activities:** Final Presentation	15	10
	TOTAL	**240**	**100%**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	NPTEL Research Methodology Courses-	10
2	IEEE Xplore Digital Library	10
3	SpringerLink	10
4	Scopus & Web of Science	10
5	Elsevier Researcher Academy	10
6	Google Scholar	10

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Project Progress	CE	Literature survey, problem formulation, methodology design, mentor evaluation	100	0
Project Final Evaluation	ESE	Technical contribution, implementation progress, report quality, presentation and viva voce	100	50
PPT Presentation	ESE	Content quality, presentation skills, technical understanding, response to questions	100	50
Self Learning	CE	Research paper reviews, online certifications, technical report submissions	100	0
		TOTAL MARKS	**400**	**100**

COURSE OUTCOME(S):

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

SOECE7820	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:

SOECE7820	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:

SOECE7820	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

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7570
Course Name	Blockchain Technology and Applications
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
04	120	45	0	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	0	0	0	20	0	200

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE 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

COURSE 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	**Permissionless Models:** Architectural Foundations of Open Networks, Consensus Paradigms & Network Incentives, Programmable Blockchains & Smart Contracts, Vulnerabilities, Game Theory, and Attacks	4	8
4	**Permissioned Models:** closed enterprise networks, role-based access control, and Membership Service Providers	3	7
5	**Smart Contract & Models:** Smart Contract Hands On, Ethereum Smart Contracts	13	28

	(Permission-less Model), Hyper-ledger Fabric (Permissioned Model)		
6	**Ecosystem and Applications:** Decentralized Identity Management, Block-chain Interoperability, Block-chain Applications	10	22
	TOTAL	**45**	**100%**

LIST OF PRACTICAL / TUTORIAL:

Sr. No	Practical / 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**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	https://www.youtube.com/watch?v=Yhwj1iVfMLc&t=6s	26
2	https://www.hyperledger.org/use/tutorials	04

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course.	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics	20	00

		Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks		
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**50**

TEXT BOOK(S):

Title	Author/s	Publication
Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks	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 Foundations and Applications	Pethuru Raj, Kavita Saini, Chellammal Surianarayanan	Auerbach Publications (CRC Press)
Blockchain Foundations and Applications	Dr. Ing. Jan Veuger	Nova Science Publishers

COURSE OUTCOME(S):

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

SOECE7570	Blockchain Technology and Applications
CO 1	Analyze blockchain architecture, cryptographic primitives, and distributed ledger technologies
CO 2	Evaluate consensus mechanisms, security vulnerabilities, and permissionless blockchain networks.
CO 3	Analyze permissioned blockchain frameworks, access control, and enterprise blockchain architectures.
CO 4	Design and develop smart contracts using Ethereum and Hyperledger Fabric.
CO 5	Evaluate blockchain interoperability, decentralized applications, and emerging blockchain solutions.

MAPPING OF CO WITH PO:

SOECE7570	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	3	2			1						1
CO 2	2	3		2	2			1			1
CO 3	2	3	2	1	2	1					1
CO 4	2	2	3	2	3				1	1	2

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

MAPPING OF CO WITH PSO:

SOECE7570	PSO1	PSO2	PSO3
CO 1	3	2	1
CO 2	3	2	2
CO 3	2	3	2
CO 4	2	3	3
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	1,2,3,4
2	Evolution and Elements	1,4,5,6
3	Permissionless Models	1,2,3,6
4	Permissioned Models	1,2,3,6
5	Smart Contract & Models	3,4,5,6
6	Ecosystem and Applications	3,4,5,6

P P Savani University

School of Engineering

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7580
Course Name	Internet Of Things
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	0	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	0	0	0	20	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE 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.

COURSE CONTENT:

Module No.	Content	Hours	Weightage in%
1	**Foundations of Internet of Things:** Introduction to IoT: Concepts, Sensing & Actuation, Networking Basics	04	08
2	**Communication Technologies for IoT:** Communication Protocols, Sensor Networks, M2M Communication	08	16
3	**IoT Hardware Platforms and Programming:** Arduino & Raspberry Pi Programming, Sensor Integration, Python for IoT	08	16
4	**IoT System Architecture and Software-Defined Networking:** Software Defined Networking (SDN) and IoT Architecture	05	10
5	**Cloud, Fog Computing, and Data Analytics for IoT:** Data Handling, Cloud & Fog Computing, IoT Analytics	09	20
6	**Smart IoT Solutions and Industrial Applications:**	11	30

	Case Studies: Smart Cities, Grid, Industrial IoT, Health, Agriculture		
	TOTAL	**45**	**100%**

LIST OF PRACTICAL / TUTORIAL:

Sr. No	Practical / Tutorial	Hours
1	Exploring IoT Devices and Communication Models	02
2	Implementing IoT Protocols & Sensor Data Communication	04
3	Arduino: Sensor Integration and Code Execution	04
4	Raspberry Pi Setup and Sensor Interfacing	04
5	Working with Cloud Platforms & Data Visualization Tools	04
6	Fog and Edge Computing Applications	04
7	Mini Project: Case Study on Smart City / Health / Agriculture	08
	TOTAL	**30**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	https://www.youtube.com/watch?v=CpDhjRX_WfA	29
2	https://onlinecourses.nptel.ac.in/noc25_cs44/preview	01

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course. Duration: 2 Hours	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks.	20	00
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**50**

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
Introduction to Industrial IoT and Industry 4.0	CRC Press, 2020	CRC Press, 2020

COURSE OUTCOME(S):

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

SOECE7580	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:

SOECE7580	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		3						2
CO 4	2	2			3	2					3
CO 5	2	2				3	2			2	2

MAPPING OF CO WITH PSO:

SOECE7580	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 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 Internet of Things	1,2
2	Communication Technologies for IoT	2,3
3	IoT Hardware Platforms and Programming	3,4,5,6
4	IoT System Architecture and Software-Defined Networking	2,4
5	Cloud, Fog Computing, and Data Analytics for IoT	3,4,5
6	Smart IoT Solutions and Industrial Applications	4,5,6

P P Savani University

School of Engineering

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7590
Course Name	Deep Learning for NLP Applications
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	0	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	20	0	20	0	0	0	20	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE 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.

COURSE CONTENT:

Module No.	Content	Hours	Weightage in%
1	**Foundations of Natural Language Processing and Deep Learning:** Foundations of NLP & Deep Learning: NLP tasks, n-gram models, neural networks, representations	08	16
2	**Word Embeddings and Recurrent Neural Networks:** Word Embeddings and RNNs: Word2Vec, GloVe, fastText, LSTM, GRU, seq2seq	08	18
3	**Attention Mechanisms and Transformer Architectures:** Attention and Transformers: Attention, encoder-decoder, Transformer architecture	08	14
4	**Pre-trained Language Models and Self-Supervised**	08	18

	Learning: Pretraining and Self-supervised Learning: ELMo, BERT, GPT, T5, BART		
5	**Large Language Models and Parameter-Efficient Fine-Tuning:** LLMs and Efficient Fine-tuning: FLAN-T5, RLHF, prompting, LoRA, QLoRA	09	18
6	**Applications, Retrieval-Augmented Generation, and Ethical AI:** Applications, Long Contexts & Ethics: QA, summarization, RAG, interpretability	08	16
	TOTAL	**49**	**100%**

LIST OF PRACTICAL / TUTORIAL:

Sr. No	Practical / 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	**26**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	https://www.youtube.com/watch?v=02QWRAhGc7g&list=PLJJzI13YAXCHxbVgiFaSI88hj-mRSoMtI	29
2	https://onlinecourses.nptel.ac.in/noc25_cs22/preview	01

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course. Duration: 2 Hours	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics	20	00

		Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks.		
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**50**

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

COURSE OUTCOME(S):

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

SOECE7590	Deep Learning for NLP Applications
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:

SOECE7590	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		2	3						3
CO 5	2		2			3	3			2	2

MAPPING OF CO WITH PSO:

SOECE7590	PSO1	PSO2	PSO3
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 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 Natural Language Processing and Deep Learning	1,2,3
2	Word Embeddings and Recurrent Neural Networks	2,3,4,5
3	Attention Mechanisms and Transformer Architectures	2,3,4,6
4	Pre-trained Language Models and Self-Supervised Learning	3,4,5
5	Large Language Models and Parameter-Efficient Fine-Tuning	3,4,5
6	Applications, Retrieval-Augmented Generation, and Ethical AI	4,5,6

P P Savani University

School of Engineering

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7600
Course Name	Computer Vision and Image Analytics
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	0	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	20	0	20	0	0	0	20	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE OF THE COURSE:

To help learners to:

- 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.

COURSE CONTENT:

Module No.	Content	Hours	Weightage in%
1	**Introduction to Computer Vision and Image Formation:** 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	**Camera Models, Calibration, and Image Processing Fundamentals:** Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections.Image	08	18

	Processing Concepts: Image Transforms.		
3	**Image Processing Techniques and Segmentation:** Image Transforms, Image Enhancement. Image Processing Concepts: Image Filtering, Colour Image Processing, Image Segmentation	08	14
4	**Image Features, Descriptors, and Shape Representation:** Texture Descriptors, Colour Features, Edges/Boundaries. Image Descriptors and Features: Object Boundary and Shape Representations.	08	18
5	**Machine Learning for Computer Vision:** : 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	**Deep Learning and 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.	08	16
	TOTAL	**49**	**100%**

LIST OF PRACTICAL / TUTORIAL:

Sr. No	Practical / 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	**26**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	https://onlinecourses.nptel.ac.in/noc25_ee13/preview	30

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course. Duration: 2 Hours	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks	30	00
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks.	20	00
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**50**

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

COURSE OUTCOME(S):

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

SOECE7600	Computer Vision and Image Analytics
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:

SOECE7600	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	3		2	3						2
CO 4	3	3		2	3						2
CO 5	3	2	3		3						2

MAPPING OF CO WITH PSO:

SOECE7600	PSO1	PSO2	PSO3
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 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 and Image Formation	
2	Camera Models, Calibration, and Image Processing Fundamentals	
3	Image Processing Techniques and Segmentation	
4	Image Features, Descriptors, and Shape Representation	
5	Machine Learning for Computer Vision	
6	Deep Learning and Applications of Computer Vision	

P P Savani University

School of Engineering

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7610
Course Name	Industry 4.0 and Industrial IoT Systems
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	00	30	0	0	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	0	0	20	0	0	0	20	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE OF THE COURSE:

To help learners to:

- 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

COURSE CONTENT:

Module No.	Content	Hours	Weightage in%
1	**Introduction to Industry 4.0 and Industrial Communication Systems:** 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 Technologies and Cyber-Physical Systems:** 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 &	08	18

	Actuation, Industrial Internet Systems.		
3	**Industrial Internet of Things (IIoT): Architecture and Sensing Technologies:** 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	**IIoT Communication, Networking, and Big Data Analytics:** 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	**IIoT Security, Cloud & Fog Computing, and Industrial Applications:** 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, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.	09	18
6	**Advanced IIoT Applications and Industry Case Studies:** 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 PRACTICAL / TUTORIAL:

Sr. No	Practical / 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**

SELF-LEARNING ONLINE RESOURCES:

Sr	Link / Description	Self-

. No		Learning Hours
1	https://www.youtube.com/watch?v=BRTxpGUmn_Q&list=PLeIwGZPgtiz5sr1JRO_777omVQZJEqk_W	29
2	https://onlinecourses.nptel.ac.in/noc25_cs43/preview	01

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course. Duration: 2 Hours	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks.	20	00
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**50**

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

COURSE OUTCOME(S):

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

SOECE7610	Industry 4.0 and Industrial IoT Systems
CO 1	Understand the fundamentals of sensing, actuation, industrial communication, and networking in smart systems.
CO 2	Interpret the core principles of Industry 4.0 and its enabling technologies such as CPS, AI, AR/VR, and Big Data.
CO 3	Analyze the architecture and layered structure of Industrial IoT systems including

	processing, sensing, and communication.
CO 4	Evaluate IIoT applications in various industrial domains with a focus on cybersecurity, cloud, and fog computing.
CO 5	Apply knowledge of IIoT to real-world industrial scenarios through case studies and project-based learning.

MAPPING OF CO WITH PO:

SOECE7610	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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:

SOECE7610	PSO1	PSO2	PSO3
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 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 Industry 4.0 and Industrial Communication Systems	
2	Industry 4.0 Technologies and Cyber-Physical Systems	
3	Industrial Internet of Things (IIoT): Architecture and Sensing Technologies	
4	IIoT Communication, Networking, and Big Data Analytics	
5	IIoT Security, Cloud & Fog Computing, and Industrial Applications	
6	Advanced IIoT Applications and Industry Case Studies	

P P Savani University

School of Engineering

Offered by: Department of Computer Engineering

COURSE DETAILS:

Course Code	SOECE7620
Course Name	Advanced Cryptography and Network Security
Prerequisite Course/s	None

TEACHING SCHEME:

Credit	Total Learning Hours	Direct Contact Hours			Indirect Contact Hours				
		Theory	Practical	Tutorial	Project	CS	Assignment	Term Work	Self-Learning
4	120	45	00	30	0	00	15	0	30

GD = Group Discussion | CS = Case Study | FV = Field Visit | PPT = Presentation

EXAMINATION SCHEME:

Theory		Practical		Tutorial		Project		CS		Assignment		Term Work		Self-Learning		Total
CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	CE	ESE	
30	50	0	0	30	50	0	0	20	0	20	0	0	0	20	0	100

CE: Continuous Evaluation, ESE: End Semester Exam

OBJECTIVE OF THE COURSE:

To help learners to:

- 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.

COURSE CONTENT:

Module No.	Content	Hours	Weightage in%
1	**Fundamentals of Cryptography and Symmetric Key Cryptosystems:** Introduction to cryptography, Classical Cryptosystem, Block Cipher. Data Encryption Standard (DES), Triple DES, Modes of Operation, Stream Cipher.	08	16
2	**Mathematical Foundations of Modern Cryptography:** 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 Symmetric Encryption and Public Key Cryptography:** Advanced Encryption Standard (AES), Introduction to Public Key Cryptosystem, Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem. Primarily Testing, ElGamal Cryptosystem, Elliptic Curve over the Reals, Elliptic curve Modulo a Prime.	06	14
4	**Public Key Encryption, Authentication, and Key Management:** ElGamal Public Key Cryptosystem, Rabin Cryptosystem. Message Authentication, Digital Signature, Key Management, Key Exchange, Hash Function.	08	18
5	**Cryptographic Hash Functions, Digital Signatures, and Cryptanalysis:** Cryptographic Hash Function, Secure Hash Algorithm (SHA), Digital Signature Standard (DSS). Cryptanalysis, Time-Memory Trade-off Attack, Differential and Linear Cryptanalysis.	09	18
6	**Advanced Cryptographic Techniques and Emerging Security Technologies:** 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 PRACTICAL / TUTORIAL:

Sr. No	Practical / Tutorial	Hours
1	Implement 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	02

	transaction using Python.	
	TOTAL	**30**

SELF-LEARNING ONLINE RESOURCES:

Sr. No	Link / Description	Self-Learning Hours
1	https://www.youtube.com/watch?v=PRuwvCkuT-4&list=PLeIwGZPgtiz557G6DEryTL-M5b9KtKGwX&index=5	29
2	https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs16	01

COURSE EVALUATION & ASSESSMENT RUBRICS:

Component	CE/ESE	Evaluation Methodology / Rubrics	Marks	Passing Marks
Theory	CE	Two Internal Tests of 30 marks each shall be conducted during the semester. The average of both tests will be converted to 30 marks.	30	00
	ESE	Comprehensive written examination covering all modules of the course. Duration: 2 Hours	50	25
Tutorial	CE	Performance of tutorial which should be evaluated out of 10 marks for each tutorial and average of the same will be converted to 30 marks.	30	00
	ESE	Quiz / Tutorial Performance – 25Marks External Viva Voce – 25 Marks	50	25
Assignment	CE	Assignment Evaluation Rubrics Understanding & Coverage of Content– 5 Marks Analysis, Critical Thinking & Evidence– 5 Marks Structure, Flow & Organization– 5 Marks Grammar, Style & Formatting/Referencing– 5 Marks	20	00
Self Learning	CE	40 MCQ questions based on self-study resources and online learning | 0.5 marks per question | Total = 20 marks	20	00
		TOTAL MARKS	**200**	**50**

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

COURSE OUTCOME(S):

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

SOECE7620	Advanced Cryptography and Network Security
CO 1	Understand the principles of classical and modern cryptographic systems.
CO 2	Apply symmetric and asymmetric encryption algorithms to secure data communication.
CO 3	Solve problems using mathematical concepts such as modular arithmetic, number theory, and algebra relevant to cryptography.
CO 4	Analyze and implement various cryptographic protocols for authentication, key exchange, and data integrity
CO 5	Evaluate cryptographic algorithms and techniques for vulnerabilities using cryptanalysis methods.

MAPPING OF CO WITH PO:

SOECE7620	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	3		2							2
CO 4	2	3		3	3						2
CO 5	2	3	2	2	3						2

MAPPING OF CO WITH PSO:

SOECE7620	PSO1	PSO2	PSO3
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 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 Cryptography and Symmetric Key Cryptosystems	1,2,3
2	Mathematical Foundations of Modern Cryptography	2,3,4
3	Advanced Symmetric Encryption and Public Key Cryptography	3,4
4	Public Key Encryption, Authentication, and Key Management	3,4,5,6
5	Cryptographic Hash Functions, Digital Signatures, and Cryptanalysis	4,5
6	Advanced Cryptographic Techniques and Emerging Security Technologies	4,5,6