Department of Information Science and Engg.

NEP 2021 BATCH

7th and 8th SEM SCHEME and

SYLLABUS

A.Y: 2024-25

Vision of the College:
To develop thoughtful and creative young minds in a learning environment of high academic ambience by synergising spiritual values and technological competence.

Mission of the College:
1. To continuously strive for the total development of students by educating them in state-of-the-art-technologies and managerial competencies providing best in class learning experience with emphasis on skills, values and learning outcomes and helping them imbibe professional ethics and societal commitment.
2. To create research ambience that promotes interdisciplinary research catering to the needs of industry and society.
3. To collaborate with premier academic and research institutions and industries to strengthen multidisciplinary education, applied research, innovation, entrepreneurship and consulting ecosystems.

Vision of the Department:
To be a centre for quality education and research in Information Science and Engineering to create high quality professionals for catering to the need of the society.

Mission of the Department:
1) To enable students to acquire strong fundamental concepts related to the Information Science and Engineering through experiential learning.
2) To educate students towards state-of-the-art-technologies and multidisciplinary practices for a successful career by creating learning-teaching-learning ambience.
3) To inculcate life-long learning through innovation and research attitudes among students related to Information Science and Engineering.

Program Educational Objectives (PEOs):

The objectives of Information Science and Engineering degree program are to prepare students to meet the academic excellence, professionalism, and ability to solve a broad range of problems in rapidly changing technological, economic and social environment.

Graduates of the program will:
1. Pursue career as software engineer, project manager, data scientist, entrepreneur and pursue higher studies and research in Information Science and Engineering domains.
2. Apply mathematical, scientific and Information Science and Engineering knowledge with multidisciplinary approaches to solve real world problems.
3. Possess professionalism, ethical and societal responsibilities and engage in life-long learning through pursuit of skill development and certification courses in Information Science and Engineering.

Programme Outcomes (POs):

To achieve the above objectives, Information Science and Engineering degree programme strives to obtain the following outcomes which should be achieved by all graduates at the time of their graduation.

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Programme Specific Outcomes (PSOs):

1) **Computing System:** Demonstrate the knowledge of evolving hardware and/or software to develop solutions to real life computational problems with a focus on performance optimization.

2) **Communication and Security:** Design and develop solutions for providing efficient transmission, storage, security and privacy of data in diverse computing environment.

3) **Information management:** Apply tools and techniques for management of information system, data analysis and knowledge discovery in the process of decision making.

SCHEME OF TEACHING AND EXAMINATION (NEP 1: 2021 batch)

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
VII Semester													
1.	PCC	N7IS01	Cryptography and Blockchain Technology	ISE	42	0	0	48	3	50	50	100	3
2.	PEC	N7ISPE2x	Professional Elective Course-II	ISE	42	0	0	48	3	50	50	100	3
3.	PEC	N7ISPE3x	Professional Elective Course-III	ISE	42	0	0	48	3	50	50	100	3
4.	OEC	NOE71	Open Elective Course-II	ISE	42	0	0	48	3	50	50	100	3
5.	AEC	NSH09	Research Methodology &Intellectual Property Rights		42	0	0	48	3	50	50	100	2
6.	Project	ISP	Project Work	ISE	Monday to Thursday shall be earmarked for carrying out Project work				3	100	100	200	10
			Total							**350**	**350**	**700**	**24**
		AAP	AICTE Activity Points	40 hours community service to be documented and produced for the examination									
VIII Semester													
1.	Seminar	ISTS	Technical Seminar		One contact hour /week for interaction between the faculty and students.					100	--	100	1
2.	Internship	INT3	Internship – **III** (Research/Industry Internship)		Two contact hours /week for interaction between the faculty and students.					100	100	200	15
3.	NCMC	NMC01	National Service Scheme (NSS)	NSS	Completed during III semester to VIII semester.					50	50	100	0
		NMC02	Physical Education (PE) (Sports and Athletics)	PE									
		NMC03	Yoga and Pranayama	Yoga									
		NCC	NCC	NCC									
			Total							**250**	**150**	**400**	**16**
		AAP	AICTE Activity Points							**100**	---	**100**	**0**

Professional Elective Course -II		**Professional Elective Course - III**	
N7ISPE21	Generative AI and Prompt Engg.	N7ISPE31	Sensors and Internet of Things
N7ISPE22	Ethical Hacking and Digital Forensic	N7ISPE32	Agile Software Technology and Devops
N7ISPE23	Quantum computing	N7ISPE33	Edge Computing
N7ISPE24	Digital Image Processing	N7ISPE34	Distributed Storage Technology

Note: **PCC**: Professional Core Course, **PEC**: Professional Elective Course, **OEC** –Open Elective Course, **AEC** –Ability Enhancement Course

L –Lecture, **T** – Tutorial, **P-** Practical/ Drawing, **S** – Self-Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination

Cryptography and Blockchain Technology

Contact Hours/ Week:	3 (L)	Credits:	3
Total Lecture Hours:	42	CIE Marks:	50
Total Tutorial Hours:	00	SEE Marks:	50
Sub Code:	N7IS01		

Course Objectives:

This course will enable students to:

1. Understand the significance of number theory in cryptographic algorithms
2. Describe the working of different block ciphers
3. Differentiate symmetric and asymmetric cryptographic algorithms and their applications
4. Describe the importance of different cryptographic hash functions.
5. Understand the basics of blockchain technology.

UNIT I

Introduction to Number Theory

Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality.

Computer Security concepts, The OSI Security Architecture, Security Services, Mechanisms and Attacks, A Model of Network Security.

9 Hours

UNIT II

SYMMETRIC CIPHERS: Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor machine, Steganography.

Block Ciphers and the Data Encryption Standard

Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles,

9 Hours

UNIT III

Block Cipher Operation

Multiple Encryption and Triple DES, Electronic Codebook, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode

Random Bit Generation and Stream Ciphers

Principles of Pseudorandom Number Generation, Pseudorandom Number Generators, Pseudorandom Number Generation Using a Block Cipher, Stream Ciphers, RC4.

8 Hours

UNIT IV

Public-Key Cryptography and RSA

Principles of Public-Key Cryptosystems, The RSA Algorithm

Other Public-Key Cryptosystems: Diffie-Hellman Key Exchange

Cryptographic Hash Functions

Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Secure Hash Algorithm (SHA).

8 Hours

UNIT V

Blockchain: Distributed systems, The history of blockchain, Electronic cash

Introduction to blockchain

Various technical definitions of blockchains, Generic elements of a blockchain, Features of a blockchain, Applications of blockchain technology, Tiers of blockchain technology

Types of blockchain

Public blockchains, Private blockchains, Semi-private blockchains, Permissioned ledger, Distributed ledger, Consensus in blockchain

CAP theorem and blockchain

Benefits and limitations of blockchain

Decentralization, Transparency and trust, Immutability, High availability, Highly secure, Simplification of current paradigms, Faster dealings, Cost saving, Challenges and limitations of blockchain technology.

8 Hours

TEXT BOOKS

1	William Stallings	Cryptography and Network Security -Principles and Practices. 7th Edition, Prentice Hall of India. 2017.
2	Imran Bashir	Mastering Blockchain, Published by Packt Publishing Ltd. Birmingham B3 2PB, UK. ISBN 978-1-78712-544-5

REFERENCE BOOK

1	AtulKahate	Cryptography and Network Security, Tata Mc GrawHill, 2nd Edition, 2008

Course Outcomes:

Upon completion of this course the student will be able to:

CO1. **Apply** the concepts of number theory to build security mechanisms.
CO2. **Analyze** the structure of different block cipher operations.
CO3. **Illustrate** distribution of public keys and analyze security of multilevel encryption schemes.
CO4. **Analyze** different public key algorithms and cryptographic hash functions.
CO5. **Identify** the elements, different types, benefits and limitations of blockchains.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
COs	CO1	2	3										3		
	CO2		3										3		
	CO3		2										3		
	CO4		3										2		
	CO5	3											2		
AVG		3	3										3		

1: Low association 2: Moderate association 3: High association

Generative AI and Prompt Engineering

(Professional Elective Course –II-1)

Contact Hours/ Week:	3 (L)	Credits:	3
Total Lecture Hours:	42	CIE Marks:	50
Total Practical Hours:	00	SEE Marks:	50
Sub Code:	N7ISPE21		

Course objectives:

This course will enable students:

1.	To provide a basic understanding of prompt engineering, large language models for the generation of text and other multimedia content.
2.	To teach the fundamental techniques and standard practices for text generation with LLM like ChatGPT.
3.	To introduce advanced techniques for generation of data using modern techniques like Langchain.
4.	To enable students to have ability to solve complex problems for Image generation using modern tools and techniques like diffusion.
5.	Apply various Techniques using diffusion and fine-tuning methods for image generation.

UNIT I

Five Principles of Prompting: Overview of the principles of prompting

Text Classification: The Dataset, From Text to Tokens, Training a Text Classifier

Text Generation: The Challenge with Generating Coherent Text, Top-k and Nucleus Sampling, Which decoding method is best?

Introduction to Large Language Models for Text Generation: Text Generation Models, History Underpinnings, ChatGPT, GPT-4, Google's Gemini, Opensource, LoRA, Mistral, Claude, Comparison of Different Models.

9 Hours

UNIT II

Standard Practices for Text Generation with ChatGPT: Generating lists, Hierarchical List Generation, Generating JSON, YAML, Diverse Format generation with ChatGPT, Universal translation through LLMs, Identify and Generate new content with textual and extracted features, Summarization, Chunking Text, Strategies, Encodings, Sentimental Analysis, Role Computing: Benefits, Challenges, Usage, GPT Prompting Tactics, Classification with LLMs, Building a classification model, Meta Prompting, etc.

9 Hours

UNIT III

Advanced Techniques for Text Generation with LangChain: Introduction, Chat Models, Langchain Prompt templates, LCEL, Prompt template with Chat Models, Output Parsers, OpenAI & Parallel Function Calling, Function calling and Extracting Data with Langchain, Query planning, creating few-shot prompt templates, limitations with few-shot examples, saving and Loading LLM prompts, Document loaders, Prompt Chaining.

8 Hours

UNIT IV

Autonomous Agents with Memory and Tools: Chain of Thought, Agents, Using LLMs as an API, Comparing OpenAI functions and react, Agent Toolkits, Customizing Standard agents, Custom Agents in LCEL, Understanding and using Memory, Memory in LangChain, Other Popular Memory Types in LangChain, OpenAI functions Agent with Memory, Advanced Agent frameworks, Callbacks

Introduction to Diffusion Models for Image Generation: OpenAI DALL-E, Stable diffusion, Google Gemini, Text to video, Model Comparison.

Summarization: The CNN/DailyMail Dataset, Text Summarization Pipelines, Comparing different summaries, Measuring the quality of Generated text, Evaluating PEGASUS on

CNN/DailyMail Dataset, Training a Summarization Model.

8 Hours

UNIT V

Standard Practices for Image Generation with Midjourney:
Format Modifiers, Art Style Modifiers, Reverse Engineering Prompts, Quality Boosters, Negative prompts, Weighted Terms, Prompting with an Image, Inpainting, Outpainting, Consistent characters, Prompt rewriting, Meme Unbundling, Meme mapping, prompt analysis
Advanced Techniques for Image Generation with Stable Diffusion:
Running Stable Diffusion, AUTOMATIC1111 Web user Interface, Img3Img, Upscaling images, Interrogate CLIP, SD Inpainting and Outpainting, ControlNet, SAM, DreamBooth Fine-Tuning, Stable Diffusion XL Refiner

8 Hours

TEXT BOOKS

1	James Phoenix, Mike Taylor	Prompt Engineering for Generative AI, May 2024 Publisher(s): O'Reilly Media, Inc. (Chapters 1,2,3,4,6,7,8,9)
2	Lewis Tunstall, Leandro von Werra, Thomas Wolf	Natural Language Processing with Transformers: Building Language Applications with Hugging Face, O'Reilly Publication, 2023.(Chapters 2,5,6)

REFERENCE BOOKS

1	Numa Dhamani, Maggie Engler	Introduction to Generative AI, February 2024 Publisher(s): Manning Publications.
2	Yaswanth Sai Palaghat	Prompt Engineering: The Art Of Asking: Master Generative Ai Tools Like ChatGPT & Midjourney, Publisher: Notion Press

Course Outcomes:
Upon completion of this course the student will be able to:

CO1.	**Analyze** the fundamental and advanced concepts of Generative AI and Large Language Models.
CO2.	**Demonstrate** the implementation of fine-tuning and optimization of LLMs for various tasks using appropriate tools like Hugging face, Langchain etc.
CO3.	**Apply** craft effective prompts for diverse applications and understand the ethical implications of AI model design.
CO4.	**Describe** the potential risks associated with Generative AI and strategies for risk mitigation.
CO5.	**Apply** various Techniques using diffusion and fine-tuning methods for image generation

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
COs	CO1	2												2	
	CO2		2											2	
	CO3			2										2	
	CO4			2										2	
	CO5	2												2	
AVG		2	2	2										2	

1: Low association 2: Moderate association 3: High association

Ethical Hacking and Cyber Forensics

(Professional Elective Course –II-2)

Contact Hours/ Week:	3 (L)	Credits:	3
Total Lecture Hours:	42	CIE Marks:	50
Total Tutorial Hours:	00	SEE Marks:	50
Sub Code:	N7ISPE22		

Course objectives:

This course will enable students to:

1.	Learn and explore aspects of security, importance of data gathering through scanning, banner grabbing, foot printing and enumeration.
2.	Investigate reconnaissance, wireless hacking, web based hacking, VoIP hacking, and database hacking etc.
3.	Explain Intrusion Detection, Policy Creation, Social Engineering, DoS Attacks, Buffer Overflows and Virus Creation.
4.	Gain hands-on experience with banner grabbing, scanning and finger printing, sniffing, phishing and exploitation tactics etc.
5.	Explore and compare different types of hacking and digital forensic tools.

UNIT I

Introduction to Ethical Hacking

Casing the Establishment: Foot Printing: What is foot printing? Why is foot printing necessary? Internet Foot printing- different steps: Determining the scope of your activities, get the proper authorization, publicly available information, WHOIS and DNS Enumeration, DNS Interrogation, Network Reconnaissance.

Scanning: Determining if the System is alive: ARP, ICMP and TCP/UDP Host Discovery, Determining which services are running or listening: Scan types, Identifying TCP and UDP services running, Detecting the Operating System, Processing and Storing scan data. (Text book 1)

9 Hours.

UNIT II

Enumeration: Service Fingerprinting, Vulnerability Scanners, basic banner grabbing, Enumerating Common Network services: FTP, Telnet, SMTP, DNS, TFTP, HTTP and Associated counter measures.

Remote Connectivity and VoIP Hacking: Preparing to Dial Up, War-dialing, Brute-Force Scripting, PBX Hacking, Voicemail Hacking, Virtual Private Network hacking, Voice over IP attacks. (Text book 1)

9 Hours.

UNIT III

Network Devices: Discovery, Autonomous System Lookup.

Wireless Hacking : Wireless Footprinting, Wireless Scanning and Enumeration

Web Server Hacking: Sample Files, Source Code Disclosure, Canonicalization Attacks, Server Extensions, Buffer Overflows, Web Server Vulnerability Scanners.

8Hours.

UNIT IV

Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and information security, Who are Cybercriminals? Classifications of Cybercrimes. Cyber offenses: How Criminals Plan Them: How Criminals Plan the Attacks. Social Engineering, Cyberstalking, Cybercafé and Cybercrimes. Botnets: The Fuel for Cybercrime, Attack Vector, cloud Computing. (Text book 2)

8 Hours.

UNIT V
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, virus and Worms. Trojan Horses and Backdoors, Steganography, Buffer Overflow, Attacks on Wireless Networks. (Text book 2)
8 Hours.

TEXT BOOKS		
1	Stuart McClure, Joel Scambray and Goerge Kurtz	Hacking Exposed 6: Network Security Secrets & Solutions, Tata McGraw Hill Publishers, 2010.
2	Sunit Belapure and Nina Godbole.	Cyber Security: Understanding Cyber Crime, Computer Forensic And Legal Perspectives, Wiley India Pvt Ltd, ISBN: 978-81-265-2179, 2013.

REFERENCE BOOKS		
1	Stuart McClure, Joel Scambray and Goerge Kurtz	Hacking Exposed Network Security Secrets & Solutions, 5th Edition, Tata McGraw Hill Publishers, 2010.
2	Rafay Baloch	A Beginners Guide to Ethical Hacking, 2010. www.hacking.book.com
3	Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle	Gray Hat Hacking The *Ethical Hackers* Handbook, 3rd Edition, McGraw-Hill Osborne Media paperback, January 27, 2011.

Course Outcomes: Upon completion of this course the student will be able to:	
CO1:	**Identify** and **Analyze** the stages of ethical hacker requirements using latest techniques of foot printing and scanning on targeted system.
CO2:	**Identify** the tools and techniques to carry out a penetration testing using enumeration, remote connectivity, discovering monitoring system and firewalls, etc.
CO3:	**Apply** the knowledge to secure the network and test the security by a good understanding of networking, social engineering and Hardware hacking.
CO4:	**Describe** fundamental concepts of cybercrime and Forensics.
CO5:	**Evaluate** various security and digital forensic tools used to protect the system/user data for cyber Forensic.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
COs	CO1	2	3				2							3	
	CO2		3											3	
	CO3		2											2	
	CO4		3											3	
	CO5	3					3							2	
AVG			3											3	

1: Low association 2: Moderate association 3: High association

QUANTUM COMPUTING

Contact Hours/ Week:	3L	Credits:	3
Total Lecture Hours:	42	CIE Marks:	50
Sub. Code:	N7ISPE23	SEE Marks:	50

Course objectives: This course will enable students to:	
1.	Learn the fundamentals of quantum computing
2.	Recognize the problem-solving approach using finite dimensional mathematics
3.	Describe Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.
4.	Be familiar with the architecture and hardware of quantum computing
5.	Mastering knowledge of basic quantum logical operations and algorithms for processing quantum information and Cryptography.

UNIT I

Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and VectorSpaces, Set Theory. **Complex Numbers:** Definition of Complex Numbers, Algebra of ComplexNumbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrices, Transcendental Numbers

9 Hours

UNIT II

Basic Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials,Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement.

Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation,QKE.

9 Hours

UNIT III

Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, TheD-Wave Quantum Architecture.

Quantum Hardware: Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

8 Hours

UNIT IV

Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

8 Hours

UNIT V

Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve.

The Impact of QuantumComputing on Cryptography: Asymmetric Cryptography, Specific Algorithms, Specific Applications.

8 Hours

TEXT BOOKS

1	Dr. Chuck Easttom,	Quantum Computing Fundamentals, 1ST EDITION Paperback – 1 March 2022
2	Nielsen M. A.	Quantum Computation and Quantum Information, Cambridge University Press 10th Anniversary Edition Hardcover – 9 December 2010.

REFERENCE BOOKS		
1	Noson S. Yanofsky and Mirco A. Mannucci	Quantum Computing for Computer Scientists Cambridge University Press, 2008
2	Benenti G., Casati G. and Strini G.	Principles of Quantum Computation and Information, Vol.Basic Concepts. Vol. Basic Tools and Special Topics, World Scientific. 2 Paperback – Illustrated, 21 March 2007
3	Pittenger A. O.	An Introduction to Quantum Computing Algorithms. : v. 19 (Progress in Theoretical Computer Science) Hardcover – 1 December 1999

Course Outcomes: Upon completion of this course the student will be able to:	
CO1.	**Grasps** the basics of quantum computing
CO2.	**Familiarity** with 1-qubit / 2-qubit gate operators and ability to design simple quantum circuits
CO3.	**Describe** Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.
CO4.	**Analyze** Quantum algorithms and their implementation
CO5.	**Recognize and apply** the Impact of Quantum Computing on Cryptography for various applications.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
COs	CO1	1	2											2	
	CO2	1	2											2	
	CO3	1	2	3										2	
	CO4	2	3											3	
	CO5	2	3											2	
AVG		2	3											3	

1: Low association 2: Moderate association 3: High association

Digital Image Processing

(Professional Elective Course –II-4)

Contact Hours/ Week:	3 (L)	Credits:	3
Total Lecture Hours:	42	CIE Marks:	50
Total Tutorial Hours:	00	SEE Marks:	50
Sub Code:	N7ISPE24		

Course objectives:

This course will enable students to:

1. Understand basics of Digital Image Processing concepts.
2. Analyze the intensity transformation of an image.
3. Analyze and apply spatial filtering and frequency domain filtering.
4. Understand the role of alternative colour spaces and their usage in Image Processing.
5. Explore basic image segmentation techniques.

UNIT I

Introduction:

What is Digital Image Processing? The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

Digital Image Fundamentals

Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition.

9 Hours

UNIT II

Digital Image Fundamentals (Continued……)

Image Sampling and Quantization, Some Basic Relationships Between Pixels, Introduction to the Basic Mathematical Tools Used in Digital Image Processing

Intensity Transformations And Spatial Filtering:

Background, Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering.

9 Hours.

UNIT III

Intensity Transformations And Spatial Filtering (Contd.)

Smoothing Spatial filtering, Sharpening Spatial Filters.

Filtering In The Frequency Domain:

Preliminary Concepts, Image Smoothing Using Lowpass Frequency Domain Filters, Image Sharpening Using Highpass Filters.

8 Hours

UNIT IV

Color Image Processing:

Color Fundamentals, Color Models, Pseudo-Color Image processing, Basics of Full-color Image Processing.

Morphological Image Processing:

Preliminaries, Erosion and Dilation, Opening and Closing, The HIT-or-Miss transformation, Some basic Morphological Algorithms.

8 Hours

UNIT V

Image Segmentation:
Fundamentals. Point, Line and Edge Detection. Thresholding: Foundation, Basic Global Thresholding, Segmentation by Region Growing and by Region Splitting and Merging, Region Segmentation Using Clustering and Superpixels.

8 Hours

TEXT BOOKS

1	Rafael. C. Gonzalez and Richard E. Woods.	Digital Image Processing, 4th Edition, Pearson Education 2018.

REFERENCE BOOKS

1	Rafael. C. Gonzalez and Richard E. Woods, Steven L. Eddins	Digital Image Processing Using Matlab, 3rd Edition, Pearson Education 2020.

Course Outcomes:
Upon completion of this course the student will be able to:

CO1. **Apply** the basic concepts of image processing on images.
CO2. **Formulate** and **analyze** different image enhancement techniques on images to understand them.
CO3. **Analyze** the image transformation with respect to frequency and spatial domain filtering.
CO4. **Analyze** the Color image processing concepts of different color models.
CO5. **Apply** segmentation techniques on images to find the boundaries.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
COs	CO1	3												3	
	CO2		1											1	
	CO3	2												2	
	CO4		2											2	
	CO5		2											2	
AVG		3	2											2	

1: Low association 2: Moderate association 3: High association

Sensors and Internet of Things

(Professional Elective Course –III-1)

Contact Hours/ Week:	3 (L)	Credits:	3
Total Lecture Hours:	42	CIE Marks:	50
Total Tutorial Hours:	00	SEE Marks:	50
Sub Code:	N7ISPE31		

Course objectives:

This course will enable students to:

1. Learn the basic concepts and principles of different sensors.
2. Explore the fundamental concepts of IoT
3. Familiarize with the design methodology and research directions.
4. Apply Python to IoT domain.
5. Differentiate different IoT Physical Devices and End points.

UNIT I

Introduction: Definition of a transducer, Block Diagram, Active and Passive Transducers, Advantages of Electrical transducers. Resistive Transducers: Potentiometers: Characteristics, Loading effect, and problems. Strain gauge: Theory, Types, applications and problems. Thermistor,RTD: Theoru Theory,ApplicationsandProblems.

9 Hours

UNIT II

Fundamentals of IOT: Introduction, Physical design of IoT, Logical design of IoT, IoT Enabling technologies, IoT Levels and Deployment Templates, IoT vs M2M.

9 Hours.

UNIT III

IOT Design Methodology: Need for IoT systems management, IoT Design Methodology, Internet of Things Strategic Research and Innovation Agenda:

Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Smart-X Applications, Internet of Things and Related Future Internet Technologies.

8 Hours

UNIT IV

IOT Systems: Logical Design using Python: Introduces Python, installing Python, Python data types & data structures, control flow, functions, modules, packages, file input/output, data/time operations and classes.

8 Hours

UNIT V

IOT Physical Devices & Endpoints: What is an IoT device, Raspberry Pi device, About the board, Linux on Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python.

8 Hours

TEXT BOOKS:

1	Vijay Madisetti & Arshdeep Bahga	Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
2	A.K. Sawhney	Electrical and Electronic Measurements and Instrumentation, 18th Edition, 2008, Dhanpat Rai and Sons

REFERENCE BOOKS:

1	Ovidiu Vermesan, Peter Friess	Internet of Things – From Research and Innovation to Market Deployment, River Publishers Series in Communication, River Publishers, 2014.
2	ClarenceW.de Silva	Sensor systems: Fundamentals and applications, 2016, 2nd Edition, CRC Press.

Course Outcomes: Upon completion of this course the student will be able to:	
CO1.	**Describe** the concepts, principles and applications of different sensors.
CO2.	**Apply** the fundamental concepts of IoT in different applications.
CO3.	**Survey** different enabling technologies and use the design methodology in future research directions.
CO4.	**Apply** Python to develop problems in IoT domain
CO5.	**Distinguish** different IoT Physical Devices and End Points.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
COs	CO1		3	3										3	
	CO2	3	2											3	
	CO3	3												2	
	CO4		2											2	
	CO5	3	2											2	
AVG		3	2	3										2	

1: Low association 2: Moderate association 3: High association

Agile Software Technology and DevOps

(Professional Elective Course –III-2)

Contact Hours/ Week:	3 (L)	Credits:	3
Total Lecture Hours:	42	CIE Marks:	50
Total Tutorial Hours:	00	SEE Marks:	50
Sub Code:	N7ISPE32		

Course Objectives

The objectives of this course are:

1.	Learn traditional testing activities versus agile methodologies.
2.	Describe agile development practices, design achieve agility.
3.	Explain roles and responsibilities of scrum master and product owner.
4.	Explore how individuals work collaboratively.
5.	Understand the four pillars of devops.

UNIT I

Chapter 1-Introduction

What Is Agile Testing, anyway? Agile Values What Do We Mean by Agile Testing? A Little Context for Roles and Activities on an Agile Team, How Is Agile Testing Different, Whole-Team Approach?

Chapter 2 -Ten principles for Agile Testers

What's an Agile Tester? The Agile Testing Mind-Set x CONTENTS, Applying Agile Principles and Values, Adding value.

9 Hours

UNIT II

Chapter3-Organiational challenges

Cultural Challenges, Organizational Culture, Barriers to Successful Agile Adoption by Test/QA Teams, Introducing Change, Management Expectations, Change Doesn't Come Easy.

Chapter 4-Transitioning Typical processes

Seeking Lightweight Processes, Metrics, Defect Tracking, Test Planning, Existing Processes and Models.

9 Hours

UNIT III

Chapter 5- The Agile Testing Quadrants

The Agile Testing Quadrants

Chapter 6-Technology- facing Tests that support the team

An Agile Testing Foundation, Why Write and Execute These Tests? Where Do Technology-Facing Tests Stop? What If the Team Doesn't Do These Tests?

Chapter 7- Business- Facing tests that support the team

Driving Development with Business-Facing Tests, The Requirements Quandary, Thin Slices, Small Chunks, How Do We Know We're Done?

8 Hours

UNIT IV

Introduction to Devops: The Big Picture of devops, Introduction to devops, The Four Pillars of Effective Devops.

Collaboration - Individuals Working Together: Sparkle Corp Weekly Planning Meeting, Defining Collaboration, Opportunities for Competitive Advantage, Mentorship, Introducing Mindsets.

8 Hours

UNIT V

Affinity - From Individuals to Teams. Sparkle Corp Development Demo Day, People networks, What Makes a Team? **Tools - Ecosystem Overview:** Software Development, Automation, Monitoring, Evolution of the Ecosystem. **Scaling - Inflection Points:** Understanding Scaling, Organizational Structure, Team Flexibility, Organizational Lifecycle.
8 Hours

TEXTBOOKS		
1	Lisa Crispin, Janet Gregory	Agile Testing: Practical guide for Testers and Agile team, Pearson Education, Inc. 2009.
2	Jennifer Davis and Ryn Daniels	Effective DevOps, Kindle Edition, First Edition, June 2016.

REFERENCE BOOKS	
1	Robert C. Martin, Agile Software Development, Principles, Patterns, and Practices, Prentice Hall; 1st edition, 2002.
2	The DevOPS Handbook: How to Create World, Gene Kim & Jez Humble, It Revolution Press, 2016.

Course Outcomes: Upon completion of this course the student will be able to:	
CO1.	**Analyse** the various principles of agile Testers and purpose of agile testing
CO2.	**Describe** various Organizational Challenges and Agile Testing Quadrants.
CO3.	**Analyse** the business values of adopting agile development.
CO4.	**Analyze** how individuals work collaboratively.
CO5.	**Describe** software development, evolution of ecosystem, organizational structure and life cycle.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
COs	CO1	2											2		
	CO2	2											2		
	CO3	2											2		
	CO4	2		2									2		
	CO5	2											2		
AVG		2		2									2		

1: Low association 2: Moderate association 3: High association

Edge Computing

(Professional Elective Course –III-3)

Contact Hours/ Week:	3L	Credits:	3
Total Lecture Hours:	42	CIE Mark:	50
Sub. Code:	N7ISPE33	SEE Marks:	50

Course objectives:

This course will enable students to:

1.	Understand the fundamental concept of computing paradigms.
2.	Describe the various architectures of edge computing.
3.	Explore data types and different data analytics.
4.	Gain knowledge about data storage security and authentication at the edge.
5.	Explore various use cases of Edge Computing.

UNIT I

Introduction to Computing:

The Major Impacts of Computing, Parallel Computing, Shared Memory Systems, Distributed Memory Systems, Hybrid Model and Distributed Computing. Cluster Computing: High-Performance Clusters, Load Balancing Clusters and High-Availability Clusters.

Utility Computing, Grid Computing and Cloud Computing. Characteristics of Cloud Environments, Cloud Models, Cloud Service Models, Cloud Deployment Models. Other Computing Paradigms: Ubiquitous Computing, Jungle Computing, Fog Computing and Osmotic Computing.

9 Hours

UNIT II

Edge Computing and Its Essentials:

Introduction, Edge Computing Architecture, Edge Devices, Edge Server Cluster, Cloud Server, Background Essentials: IoT Devices, Mobile Phone-Based Sensors, Medical Sensors, Neural Sensors, Environmental and Chemical Sensors, Radio Frequency Identification and Actuators.

Networking Architecture, Network Management and Control, Orchestration. Edge Computing State-of-the-Art Interfaces and Devices: Middleware, Hydra, Aura, TinyDB, FiWare, Application Interfaces, Edge Computing Simulators: PureEdgeSim, IoTSim-Edge, iFogSim and Edge CloudSim.

9 Hours

UNIT III

Edge Analytics: Types of Data, Data Analytics, Goals of Data Analytics, Domains Benefiting from Big Data Analytics, Real-Time Applications of Data Analytics, Phases of Data Analytics. Data Collection and Pre-Processing, Machine Learning-Model Building and Performance Evaluation.

Types of Data Analytics: Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Edge Data Analytics and Potential of Edge Analytics. Architecture of Edge Analytics.

8 Hours

UNIT IV

Edge Data Storage Security:

Data Security, Data Confidentiality, Identity-Based Encryption, Attribute-Based Encryption, Proxy Re-encryption, Functional Encryption, Honey Encryption and Searchable Encryption. Homomorphic Encryption: Types of Homomorphic Encryption, Basic Functions of Homomorphic Encryption.

Authentication: Single-Domain Authentication, Cross-Domain Authentication, Handover Authentication. Privacy-Preserving Schemes: Data Privacy, Location Privacy and Identity Privacy. Edge-Based Attack Detection and Prevention.

8 Hours

UNIT V
Edge Computing Use Cases and Case Studies: Use Cases, Edge Computing High-Potential Use Cases: Autonomous Vehicles, Smart Cities, Industrial Automation, Network Functions, Gaming, Content Delivery, Financial Sector, Augmented Reality, and Healthcare Sector.
Realization of Edge Computing in Healthcare: Ensuring Storage Security: Devices and Setup. Case Study I: Pulse Oximeter to Detect ARDS in Edge Server:Pulse Oximetry, Oxygen Delivery (DO2), Oxygen Consumption (VO2), Acute Respiratory Distress Syndrome and Analysis in Edge Server.
8 Hours

TEXT BOOKS		
1	K. Anitha Kumari, G Sudha Sadasivam, D. Dharani and M Niranjana Murthy,	Edge Computing – Fundamentals, Advances and Applications, CRC Press, 2022.

REFERENCE BOOKS		
1	Jie Cao, Quan Zhang, Weisong Shi.	Edge Computing: A Primer, Springer Cham, 2018, ISBN 978-3-030-02083-5.
2	Javid Taheri, Schahram Dustdar, Albert Zomaya and Shuiguang Deng.	Edge Intelligence: From Theory to Practice-Springer International Publication AG-2023.
3	Xiao Ma, Mengwei Xu, Qing Li, Yuanzhe Li, Ao Zhou, Shangguang Wang.	5G Edge Computing: Technologies, Applications and Future Visions, Springer Nature, 1st -2024.

Course Outcomes:
Upon completion of this course the student will be able to:

CO1.	**Describe** various computing paradigms like Parallel computing, Distributed computing, Cluster computing, Grid computing and Cloud computing.
CO2.	**Describe** various edge sensors, edge computing architecture, edge devices and simulators.
CO3.	**Explore** different types data and data analytics.
CO4.	**Summarize** various data storage security and authentication mechanisms at the edge.
CO5.	**Analyze** different use cases for Edge computing and **apply** edge computing paradigms to healthcare.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
COs	CO1		3										3		
	CO2		3										3		
	CO3		3	1									3		
	CO4		3	1									3		
	CO5		3										3		
AVG			3	1									3		

1: Low association 2: Moderate association 3: High association.

Distributed Storage Technology

(Professional Elective Course –III-4)

Contact Hours/ Week:	3 (L)	Credits:	3
Total Lecture Hours:	42	CIE Marks:	50
Total Tutorial Hours:	00	SEE Marks:	50
Sub Code:	N7ISPE34		

Course objectives:

This course will enable students to:

1. Understand different storage centric and server centric IT infrastructures.
2. Compare different network storage options in multiple platforms.
3. Define information security and identify different storage virtualization technologies.
4. Identify security considerations to be applied across different storage network devices.
5. Understand the Sensor management, power management, and sensor network middleware.

UNIT I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages; Case study: Replacing a server with Storage Networks.

Intelligent Disk Subsystems- 1: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels, JBOD, Storage virtualization using RAID and different RAID levels. Caching: Acceleration of Hard Disk Access.

9 Hours

UNIT II

Intelligent Disk Subsystems, I/O Techniques: 1: Intelligent disk subsystems; Availability of disk subsystems. The Physical I/O path from the CPU to the Storage System; SCSI.

I/O Techniques -2 Network Attached Storage: Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage.

9 Hours

UNIT III

File System and NAS: Local File Systems; Network file Systems and file servers; Shared disk file systems; Comparison of fibre Channel and NAS.

Storage Virtualization-1: Once again virtualization in the I/O path, Limitations and requirements

8 Hours.

UNIT IV

Storage Virtualization-2 Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

8 Hours

UNIT V

Security Considerations: Overview of Information Security, Security Methods, Storage Security Technology, Storage Security Challenges, Fiber Channel SAN Security, NAS Security.

8 Hours

TEXT BOOKS

1	Ulf Troppens, Rainer Erkens and Wolfgang Muller	Storage Networks Explained – John Wiley & Sons, 2nd Edition, 2011.
2	Robert Spalding	Storage Networks: The Complete Reference- Tata McGraw Hill Publications, Indian Edition, 2017.

REFERENCE BOOKS

1	Richard Barker, Paul Massiglia, and John	Storage Area Network Essentials: A Complete Guide to understanding and Implementing SANs – Wiley India, 2002.
2	Marc Farley	Storage Networking Fundamentals, Cisco Press, 2005

Course Outcomes:
Upon completion of this course the student will be able to:

CO1.	**Describe** the fundamental requirements of the file systems.
CO2.	**Describe** storage area network architectures.
CO3.	**Describe** different RAID levels, SAN and NAS technologies for real world.
CO4.	**Compare** different storage virtualization techniques.
CO5.	**Recognize** different security elements to address solutions across different storage network.

Mapping of Course Outcomes (COs) to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
COs	CO1	3													3
	CO2	3	2												3
	CO3	3	2												3
	CO4	3	2												3
	CO5	3	2												3
AVG		3	2												3

1: Low association 2: Moderate association 3: High association

RESEARCH METHODOLOGY AND IPR

Contact Hours/ Week	:	2(L)+0(T)+0(P)	Credits:	2
Total Lecture Hours	:	0	CIE Marks:	0
Total Practical Hours	:	30	SEE Marks:	0

Course Objective:

The objectives of the course is to make students to:

1. Understand the knowledge on basics of research and its types.
2. Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
3. Acquire the knowledge of Ethics in Engineering Research.
4. Know the concepts of Intellectual Property Rights in engineering.
5. Acquire the knowledge to apply for the granting patents and its procedure.

Unit-I
Introduction: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations
6-Hours.
Unit-II
Research Problem: Effective literature studies approaches, analysis Plagiarism, and Research ethics.
6-Hours.
Unit-III
Technical Writing: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee
6-Hours.
Unit-IV
Intellectual Property Rights: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.
6-Hours.
Unit-V
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.
6-Hours.

Course Outcomes: Upon completion of this course the student will be able to:		
CO1	:	Identify based on the knowledge the basics of research and its types.
CO2	:	Apply knowledge to write Literature Review, Technical Reading, Attributions and Citations.
CO3	:	Follows the knowledge of Ethics in Engineering Research
CO4	:	Apply the concepts of Intellectual Property Rights in engineering
CO5	:	Apply IPR knowledge for the granting patents and its procedure for new innovative product for grants.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3		2								3	3		
CO2	3	3	3		2								3	3		
CO3	3	3	3		2								3	3		
CO4	3	3	3		2								3	3		
CO5	3	3	3		2								3	3		

Text Books:

Sl. No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Wayne Goddard and Stuart Melville	Research methodology: an introduction, 2nd Edition, 2014, Juta Academic Lt.D. ISBN 9780702156601.
2.	Stuart Melville and Wayne Goddard	Research methodology: an introduction for science & engineering students, 2nd Edition, Juta Academic,
2.	Ranjit Kumar	Research Methodology: A Step by Step Guide for beginners, 4th Edition, SAGE Publications India Pvt Ltd, 2023, ISBN: 9789351501336

Reference Book:

Sl. No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	T. Ramapp	Intellectual Property Rights Under WTO", S. Chand, 2008
2.	Robert P. Merges, Peter S. Menell, Mark A. Lemley	Intellectual Property in New Technological Age", 2016.