

GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA

Department of Computer Science & Engineering

Mappings of Course Outcomes with Program Outcomes for Scheme-2024 B.Tech (CSE)

Se m	Course Code	Course Name	CO #	CO (Course Outcomes)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
3rd	CCS101	Object Oriented Programming	CO1	Demonstrate programming skills in writing, compiling and debugging C++ programs	3		1	2	2								1
			CO2	Use class and object to implement object-oriented approach.	3		1	2	3								2
			CO3	Apply inheritance and polymorphism to implement object-oriented programs.	3		1	2	2								1
			CO4	Analyse the relevance of dynamic memory management for effective memory utilization.		1		2	3							1	
			CO5	Make use of exception handling and file handling in program development.	3		1	2	2								1
			CO6	Develop solution for programming problems using object-oriented principles.	3	3	2	3						2		2	

3rd	CCS102	Data Structures	CO1	Apply Arrays and Linked Lists to solve computational problems.	3		2	2	2							2
			CO2	Implement stack and queue data structures to solve programming problems.	3		2	2	2							2
			CO3	Apply appropriate indexing and searching techniques to optimize data storage and retrieval.	3		3	2	2							2
			CO4	Analyze non-linear data structures to perform efficient storage, retrieval, and traversal operations.		1		2	2						3	
			CO5	Analyze time and space complexity of different sorting algorithms.		1		1	2						1	
			CO6	Identify the appropriate data structure to provide solution with reduced space and time complexity.	3	2	3	2							3	

3rd	ESCS-101	Digital Electronics	CO1	Apply the structure of number systems in digital design.	3		2	3	2								2
			CO2	Minimize the Boolean expressions in SOP and POS form using K-maps.	3		2	2	1								2
			CO3	Apply knowledge of basic characteristics of logic families to design digital circuits.	3		2	3	2								2
			CO4	Demonstrate the basic knowledge of behavioral objects of VHDL in programming.		2		2									2
			CO5	Implement combinational logic circuits using Boolean algebra and logic gates and simulate them using VHDL.				2	2								2
			CO6	Analyze Synchronous and Asynchronous sequential circuits using Flip Flops, registers and Counters and simulate them using VHDL.		2		2	3							2	

3rd	CCS103	Computer Architecture	CO1	Understand the Data representation, Register Transfer and micro-operations in computer system.		2		2									2
			CO2	Illustrate the CPU architecture and I/O interfacing for different modes of transfer.		2		3									2
			CO3	Analyze memory hierarchy in computer system for efficient memory management.		2		2	2							2	
			CO4	Understand the organization of components of a computer system and their interconnectivity.		3		2									1
			CO5	Develop assembly language programs using 8085 instruction set to perform fundamental operations.	3		2	3	2								1
			CO6	Interface peripheral devices with microprocessors using 8255, 8259, and 8237.	3		2	3	2								2

3rd	SMCS101	Seminar and Technical Report Writing For Engineers	CO1	To install BibTeX and PDFLaTeX on Windows and Linux operating systems.	3		1	2	2								1
			CO2	Utilize LaTeX tools for document preparation and compilation.	3		1	2	2								2
			CO3	Compare LaTeX and Markdown formats using Pandoc for documentation purposes.		3		2	2					2			1
			CO4	Present technical content effectively through oral presentations.		2		2	2				3	3	3	1	
			CO5	Use LaTeX effectively for technical document writing.	3		1	2	2								

4th	CCS105	Operating System	CO1	Understand the components of operating systems and design issues associated with it.		1		2									2
			CO2	Apply the knowledge of various process management concepts for process synchronization.	1		2	2	1								2
			CO3	Illustrate the concept of scheduling algorithms to work in multitasking environment.	1		2	1	2								2
			CO4	Analyze the algorithms for deadlock management, file management and memory management.		1		1	2							3	
			CO5	Evaluate file system structures and implement file handling, directory structures, and disk scheduling algorithms.				1	2							3	

4th	CCS106	Computer Networks	CO1	Understand the key concepts of data communication to real-world networking scenarios.		1		2		3					2		2
			CO2	Apply the concepts of analog and digital signals for transmission of data using efficient bandwidth utilization.	2		2	2	3	2					2		1
			CO3	Evaluate network performance metrics and algorithms for selecting efficient communication paths.				2	2						2	2	
			CO4	Analyze the design concepts for process to process delivery in end-to-end communication.		2		3	2						2	3	
			CO5	Assess the functionalities of various network layers and protocols to understand their contribution in computer networks		2		2	2		3		2		2		2

4th	CCS107	Discrete Mathematics	CO1	Apply the principles of sets, relations, and functions to solve mathematical problems.	2		1	1	2								1
			CO2	Construct formal proofs to validate logical arguments using mathematical reasoning.	3	2	1	2								1	
			CO3	Evaluate combinatorial problems using appropriate mathematical methods and techniques.				2	2							1	
			CO4	Apply number theory concepts to solve computational problems in computer science.	3		1	2	2								1
			CO5	Prove elementary properties of algebraic structures and apply them in the analysis and interpretation of data to draw valid conclusions.		2		2	3							1	
			CO6	Make use of appropriate mathematical models to assess real-world problems.	3		1	2	2								2

4th	LCCS109	Data Analytics Tools	CO1	Apply data preparation techniques in Excel and Python to clean, filter, and merge structured datasets for analysis.	3		1	2	3								2
			CO2	Create charts and dashboards using Matplotlib and Power BI/Tableau to display the changes and relationships within datasets.	3			2	2							2	
			CO3	Perform statistical inference methods to validate hypotheses using real-world data samples.		2		2	2							2	
			CO4	Design interactive dashboards in Power BI/Tableau to present key performance indicators and filtering options for data exploration.	3			2	2							2	
			CO5	Integrate Excel, Python, and data visualization tools in a project to analyze a given dataset by preparing data, calculating performance metrics, and presenting insights for decision-making.	3	2	1	1	2					2	2	3	

			CO5	Apply the principles of Turing machines to design computational models for solving complex engineering and decision problems.	3		1	3	2							1	
			CO6	Analyze and compare the computational capabilities of linear bounded automata with Turing machines in the context of context-sensitive languages.		2		1	2							2	

5th	CCS111	Cyber Security	CO1	Apply cyber security principles within legal, regulatory, and ethical frameworks of cyberspace.	3		1	2	2							2
			CO2	Analyze cyber security threats and attacks impacting systems, networks, and applications.		3		2	2						2	
			CO3	Explore cyber security strategies, risk management practices, and emerging approaches to strengthen organizational security.		2		2	3						2	
			CO4	Examine security protocols and defence mechanisms for secure communication and protection.		2		3	3						2	
			CO5	Evaluate ethical, social, and human factors influencing cyber security practices and incidents.				2	3						2	
			CO6	Design preventive and response measures based on real-world cyber security incidents.	3	3	2	3							3	

5th	CCS112	Software Engg.	CO1	Apply various software process models and agile methods to software development problems.	3		1	2	2								1
			CO2	Analyze requirements and represent decision logic using techniques like decision trees and decision tables.		3		2	2							2	
			CO3	Create design diagrams such as DFDs, ER diagrams and structure charts based on software design principles.	3	2	3	2								3	
			CO4	Evaluate project management tools including metrics, estimation methods, scheduling and risk plans.				3	3							2	
			CO5	Apply testing techniques including unit, integration and system testing to various software problems.	3		2	3	3								1
			CO6	Analyze version control systems and software maintenance approaches for managing software evolution.		3		2	2							2	

5th	ESCS106	Enterprenurship and Startup	CO1	Comprehend concept and theories of entrepreneurship and its role in economic development.		2		1									1
			CO2	Develop business plan and identify the reasons of failure of business plan	3		1	1								2	
			CO3	Illustrate the steps in starting MSME		1		1									1
			CO4	Comprehend government policies and regulatory framework available in India to facilitate the process of entrepreneurial development		2		1									1
			CO5	Understand the contemporary issues of sustainable development; Identify difference sources of finance for new enterprises and assess the role of financial institutions and various government schemes in entrepreneurial development				2	2							2	
			CO6	Assess the role of financial institutions and various government schemes in entrepreneurial development				1	3							2	

5th	MC103	Disaster Management and Preparedness	CO1	Explain the basic concepts of disaster management, including hazards, vulnerabilities, risks, capacities, impacts, prevention, and mitigation strategies.		3		2									1
			CO2	Classify the various natural and human induced disasters for preparing the hazard and vulnerabilities profile of india		2		4	2							1	
			CO3	Assess the environment , social, economic health and demographic impacts of disasters to perform basic vulnerabilities and risk assessment for disaster -prone areas.				1	2							1	
			CO4	Apply the principles of disaster management cycle for effective disaster risk reduction.	1		1	1	1								
			CO5	Describe the role of modern technology in disaster predication , monitoring and management				1	1							1	
			CO6	Demonstrate awareness of disaster mgmt practices for various stakeholders in building resilient and sustainable communities	1	2	1	1	1								

6th	CCS114	Cloud Computing	CO1	Discuss cloud computing concepts, service models and cloud deployment models.		2		2								1
			CO2	Apply virtualization technology in cloud implementation.	3		2	3	2							1
			CO3	Manage storage and databases on cloud platforms.	3		2	3	2							1
			CO4	Implement cloud networking , content delivery network and load balancing in cloud.	3		3	3	3							1
			CO5	Analyze security threats and implement security in cloud systems.		2		3	3						2	
			CO6	Compare open source and commercial cloud platforms.				3								

			CO5	Apply target-machine-oriented code generation strategies with effective register allocation and local optimizations.	3		2	3	2							1
			CO6	Analyze intermediate and target code using machine-independent optimization techniques based on data-flow and control-flow analysis.		2		2	2						2	

6th	FSCS101	Corporate Readiness and Employability Enhancement Program	CO1	Develop a professional digital identity by creating resumes, portfolios, and professional profiles on networking platforms	1	1	3	1								1	
			CO2	Apply AI-powered tools and digital productivity platforms to support learning, problem solving, and professional tasks	2		1	1	3								3
			CO3	Analyze real-world problems using computational and analytical thinking approaches to identify logical and structured solutions		3		2	2							3	
			CO4	Interpret and analyze data using basic quantitative and logical reasoning techniques for informed decision making		1		3	2							1	
			CO5	Construct clear and professional written communication, including emails and structured content, using appropriate grammar and comprehension techniques	1	1	3	1								1	
			CO6	Execute effective communication and collaboration strategies during group discussions, presentations, and interview situations	1		1	1	2								2

6th	HSMC10 4	Universal Human Values: Understanding Harmony	CO1	Conduct self-exploration and distinguish between values and skills, happiness and accumulation of physical facilities, the self, and the body, Intension and Competence of an individual		1		1									1
			CO2	Analyze the value of harmonious relationship based on trust and respect in personal and professional life		1		1	2							2	
			CO3	Examine the role of a human being in ensuring harmony in society and nature		1		1	2							2	
			CO4	Understanding (or developing clarity) of the harmony in the nature and their coexistence		1		1									1
			CO5	Apply the understanding of ethics in life and profession	3		1	1	2								2

Professional Electives																	
5th	ECS101	Generative AI	CO1	Discuss the principles of Generative AI and differentiate generative and discriminative models with suitable examples.		2		3									
			CO2	Apply probability distributions, sampling methods, and basic language models to represent and generate data.	2		1	2	2								2
			CO3	Design and analyze generative models such as Autoencoders, Variational Autoencoders, and Restricted Boltzmann Machines for synthetic data generation.		1	2	2	3							2	
			CO4	Analyze the architecture, training process, and applications of generative adversarial networks.		1		2	3							2	
			CO5	Analyze and evaluate transformer-based generative models and large language models for text and multimodal generation tasks.		1		2	2			3				2	
			CO6	Evaluate generative model outputs using standard metrics and assess ethical and responsible AI considerations.				2	2			2		3		1	

5th	ECS103	Cryptography & Network Security	CO1	Apply appropriate security mechanisms to mitigate common network and wireless security threats, including port-based authentication frameworks.	3		3	2	3								2
			CO2	Implement symmetric and asymmetric cryptographic algorithms and analyze their effectiveness for secure communication.		3		2								2	
			CO3	Analyze data integrity and authentication mechanisms using cryptographic hash functions, message authentication codes, and digital signatures.		3		2								2	
			CO4	Evaluate public key infrastructure, IEEE 802.1X authentication framework, and secure communication protocols for networked and cloud-based systems.				3	3							2	
			CO5	Apply cryptographic techniques and security protocols to address challenges in modern network, wireless, and cloud environments.	3		3	2	3								2

5th	ECS104	Advanced Computer Networks	CO1	Analyze network architectures to ensure the optimal network performance.		1		1	2							1	
			CO2	Implement IOS configurations and TCP/IP protocol concepts to configure and troubleshoot computer networks.	3		2	3	2		1						1
			CO3	Configure various switching mechanisms, STP, and VLANs to build efficient and loop-free switched network topologies.	3		2	2	3								1
			CO4	Design optimized internetworking solutions using routing algorithms and protocols.	3	2	2	3								2	
			CO5	Configure Wireless LANs, IEEE 802.11 operations, and Mobile Ad hoc Networks using network simulation tools to understand wireless communication behaviors.	3		2	2	2	1							1
			CO6	Apply IoT, SDN, and blockchain concepts to utilize modern network architectures effectively.	3		2	2	2	2					1		1

5th	ECS105	Object Oriented Analysis and Design Using UML	CO1	Apply object-oriented modeling principles and UML notations to represent real-world systems.	3		1	3	2								1
			CO2	Develop requirement models using use case diagrams, activity diagrams, and structured use case descriptions.	3	3	2	3	3					2		2	
			CO3	Analyze problem statements to identify classes, attributes, operations, relationships, and construct class/object/package diagrams.		2		3	2							3	
			CO4	Analyze dynamic system behavior using sequence, collaboration, activity, and state machine diagrams with events and concurrency.		2		2	2							3	
			CO5	Evaluate alternative architectural models and justify system design decisions using UML.				2	3					2		2	
			CO6	Design complete UML based solutions using advanced UML concepts, extensibility, and CASE tools for scalable systems.	3	2	3	2	3				2		2	3	

5th	ECS106	Computer Graphics	CO1	Apply mathematical and programming concepts to solve computer graphics problems.	3	2	1	2	2							2	2
			CO2	Analyze and evaluate computer graphics algorithms for real-world applications.		3	1	2	2							3	
			CO3	Apply clipping, area-filling techniques and color models in graphics applications.	3		1	2	2								3
			CO4	Use advanced techniques for transformation and modification of 2D and 3D objects.	3		2	2	2							2	
			CO5	Implement algorithms for visualization, rendering and representation of graphical objects.	3		2	3	3							2	2
			CO6	Evaluate computer graphics concepts in the development of real-world graphical applications.	3	3	2	3	2					2		3	3

6th	ECS107	Natural Language Processing	CO1	Apply the knowledge of mathematics and engineering to understand the computational properties of natural languages and the commonly used algorithms for processing linguistic information.	3		1	2	2								2
			CO2	Implement and evaluate part-of-speech tagging and parsing techniques using probabilistic models and context free grammars.				3	2							2	
			CO3	Demonstrate the concepts of morphology, syntactic analysis, semantic interpretation and pragmatics of the language, with use of different approaches.		2		3									1
			CO4	Examine lexical semantics and word representation techniques, including embeddings, to measure semantic similarity and meaning in text.		2		2	2							1	

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6th	ECS108	Big Data	CO1	Apply Big Data technologies to handle large-scale and different types of data.	3		1	2	2							2
			CO2	Implement distributed data storage and processing using Hadoop HDFS and MapReduce.	3		2	2	3							3
			CO3	Analyze data processing needs to choose appropriate Hadoop ecosystem tools such as Hive, Pig, and Spark.		2		3	2						2	
			CO4	Analyze NoSQL database models to identify suitable solutions for Big Data storage and retrieval.		2		2	3						3	
			CO5	Evaluate Big Data analytics frameworks for effective large-scale data analysis and decision-making.				2	2						2	
			CO6	Design and develop an end-to-end Big Data application using Hadoop, Spark, and NoSQL tools.	3	3	2	3				3	2		3	

6th	ECS110	Network Security and Cryptography	CO1	Identify and analyze network security threats and design appropriate security models and mechanisms.		3		1	3							1	
			CO2	Apply number theory and algebraic concepts to understand cryptographic algorithms.	3		1	2	3								2
			CO3	Implement and evaluate classical and modern symmetric-key cryptographic algorithms and hash functions.				2	2							1	
			CO4	Understand and analyze public-key cryptographic techniques including RSA and key exchange mechanisms.		3		2	3	3						1	
			CO5	Apply authentication, key management, and Internet security protocols to provide secure communication.	3		1	2	2								1

6th	ECS111	Agile Software Development and DevOps	CO1	Apply agile principles to build software iteratively and adapt to changing requirements.	3		2	2	2			2					2
			CO2	Analyze the core practices behind specific agile methodologies.		3		2	2	3						1	
			CO3	Use version control concepts and tools to manage source code in software development.	3		2	2	2			3	2				1
			CO4	Apply the concepts of continuous integration and continuous delivery for automation.	3		2	2	2					2	2		2
			CO5	Elaborate security vulnerabilities and policies for secure development practices.		2		2									1
			CO6	Make use of tools to collaborate in cross functional teams and enhance communication.	3		2	2	2		3	1	2	2			2

6th	ECS113	Soft Computing	CO1	Understand the fundamental concepts, principles, and significance of soft computing in intelligent systems.		3		2									2
			CO2	Analyze uncertainty, imprecision, and learning mechanisms in computational problem-solving.		3		3	3							3	
			CO3	Apply appropriate soft computing approaches to model and solve real-world engineering problems.	3		3	3	3								3
			CO4	Evaluate the performance and suitability of different soft computing techniques for given applications.				2	3							3	
			CO5	Design computational solutions by integrating multiple soft computing paradigms.	3	3	3	3								3	
			CO6	Demonstrate the ability to implement and interpret results of soft computing-based systems.	2		3	3	3							3	

6th	ECS114	Data Science	CO1	Identify real-world problems and relevant data using the data science process.	3		1	2	2								2
			CO2	Perform statistical computations to summarize data and draw meaningful conclusions.	3		2	1	3								2
			CO3	Implement basic R programming techniques to organize and transform datasets from multiple sources.	2		1	2	2								1
			CO4	Analyze data quality, structure, and representation issues, including ethical considerations in data handling.		2		1	2		2					2	
			CO5	Evaluate datasets using exploratory data analysis to identify patterns, relationships, and trends.				1	2							3	
			CO6	Create effective and ethical visualizations to communicate data-driven insights clearly.	3	2	2	3					2			3	

6th	ECS115	Digital Forensics	CO1	Apply digital forensic concepts to classify and investigate cyber-crimes.	3		1	2	2								2
			CO2	Analyze digital crime scenes and implement proper evidence handling procedures.		3		2	3							2	
			CO3	Evaluate forensic artifacts from computers, networks, and mobile devices.				3	3			3				3	
			CO4	Investigate real-world cyber incidents using forensic tools and methodologies.				3	3				2			3	
			CO5	Design legally compliant and ethical digital investigation strategies.	3	2	2	3		3		3		2		3	

6th	ECS116	IoT Architecture and Protocols	CO1	Illustrate the fundamental ecosystem of IoT and identify domain-specific challenges in scalability and energy efficiency.		2		2									2
			CO2	Describe and compare IoT architectural models and evaluate their suitability for different IoT applications		3		2	2							3	
			CO3	Analyze communication models and technologies for IoT connectivity.		3		2	2							3	
			CO4	Apply various network and application layer protocols to ensure communication solution and interoperability within an IoT middleware.	2		2	2	3								2
			CO5	Assess security, privacy, and interoperability challenges in IoT environments through the analysis of real-world IoT application case studies.				2	2	1	2	3				3	
			CO6	Design and implement an IoT application using standard platforms, tools, and design methodology.	3	2	3	2					2		2	2	

6th	ECS117	Software Testing And Quality Assurance	CO1	Analyze fundamental software engineering and software testing concepts.	3		1	2	2							2	
			CO2	Design effective test cases using black-box and white-box testing techniques.	3	2	3	2								3	
			CO3	Implement unit testing using automated testing tools.	3		1	1	3								2
			CO4	Analyze integration, system, acceptance, performance and security testing using appropriate methods.		3	3	2								2	
			CO5	Examine software quality and quality assurance practices using standard quality models, metrics, and process maturity frameworks.				3	3							2	

6th	ECS118	Computer Vision	CO1	Understand the fundamental concepts of computer vision.	2	2											
			CO2	Apply multi-view geometry and depth estimation techniques for 3D scene analysis.	2		2	3	2								2
			CO3	Extract visual features and descriptors for effective representation of images and scenes.		2	2	2	2					2	2		
			CO4	Implement object detection and pattern recognition techniques using clustering and classification methods for real-world vision problems.	2		2	2	3								2
			CO5	Design motion analysis algorithms for dynamic scene interpretation.	3	3	3	3	3					2		3	