# Updated CO and PO’s

* 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
  1. independent and life-long learning
  2. adaptability to new and emerging technologies and
  3. critical thinking in the broadest context of technological change.

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSEG4040P Computational Linguistic & Natural Language Processing 4 0 1 5 Choose Anyone Program Elective For Specialization in Artificial Intelligence & Machine Learning Dr. Prateek Raj

## Course Objectives

1. Introduce the fundamental concepts of **Natural Language Understanding (NLU)** and **Natural Language Generation (NLG)**.
2. Explain the **statistical and probabilistic approaches** for language modelling.
3. Explore the principles and applications of **Large Language Models (LLMs)**.
4. Familiarize students with **corpus creation**, preprocessing techniques, and **tools for machine translation**.
5. Develop **programming skills** required to implement and evaluate NLP techniques.

## Course Outcomes

By the end of this course, students will be able to:

**CO1:** Explain and differentiate the fundamental techniques and models in Natural Language Processing. *(Understand, Analyze)* **CO2:** Analyze and apply the concepts of Large Language Models for solving NLP problems. *(Analyze, Apply)* **CO3:** Design and evaluate methods for Natural Language Generation. *(Create, Evaluate)* **CO4:** Implement and assess machine translation and information retrieval techniques using suitable corpora and tools. *(Apply, Evaluate)*

## CO–PO Mapping with Average (based on the 11 POs)

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | 3 | 3 | 2 | 2 | 2 | – | – | – | 2 | – | 2 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | – | – | – | 2 | – | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | – | – | – | 2 | – | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | – | – | – | 2 | – | 3 |
| **Average** | 3 | 3 | 2.5 | 2.75 | 2.75 | – | – | – | 2 | – | 2.75 |

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSBD4012 Stream Processing 4 0 1 5 Choose Anyone Program Elective For Specialization in Big Data Dr. Prateek Raj

## Course Objectives

1. Explain the core concepts and architecture of **Spark Streaming**.
2. Describe **basic and advanced data sources** used in streaming applications.
3. Explain the working of **stateful operations** in Spark Streaming.
4. Explain the concepts and implementation of **window and join operations** in streaming data.

## Course Outcomes

By the end of this course, students will be able to:

**CO1:** Explain and compare data streaming concepts and different streaming frameworks. *(Understand, Analyze)* **CO2:** Design and implement Spark Streaming applications using Scala or Python. *(Apply, Create)* **CO3:** Analyze and transform access log data streams for meaningful insights. *(Analyze, Evaluate)* **CO4:** Build and manage streaming data pipelines using both stateful and stateless operations. *(Apply, Evaluate)*

## CO–PO Mapping with Average (based on the 11 POs)

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | 3 | 3 | 2 | – | 2 | – | – | – | 2 | – | 2 |
| **CO2** | 3 | 3 | 3 | 2 | 3 | – | – | – | 2 | – | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | – | – | – | 2 | – | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | – | – | – | 2 | – | 3 |
| **Average** | 3 | 3 | 2.8 | 2.67 | 2.8 | – | – | – | 2 | – | 2.75 |

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSDV4014P CICD Pipeline and Security 4 0 1 5 Choose Anyone Program Elective For Specialization in DevOps Dr. Prateek Raj

## Course Objectives

1. Explain the principles and practices of **Continuous Integration and Continuous Deployment (CICD)** and their role in modern software engineering.
2. Describe and configure **CICD pipelines**, including build automation, version control, containerization, and deployment strategies.
3. Integrate **security practices**—such as automated security testing, vulnerability scanning, and code analysis—into CICD pipelines.
4. Apply **DevSecOps principles** to ensure collaboration and embed security throughout the software development and operations lifecycle.
5. Evaluate tools, technologies, monitoring techniques, and industry best practices to build **secure and efficient CICD pipelines** that support continuous delivery of high-quality software.

## Course Outcomes

By the end of this course, students will be able to:

**CO1:** Explore the CICD toolchain—version control, build automation, and containerization—by explaining the core concepts and benefits of CICD pipelines. *(Understand, Analyze)* **CO2:** Integrate security practices such as automated security testing and vulnerability scanning into CICD pipelines. *(Apply, Evaluate)* **CO3:** Design and implement scalable and reliable CICD workflows. *(Apply, Create)* **CO4:** Apply DevSecOps principles to foster collaboration and security throughout the software development process. *(Apply, Evaluate)*

## CO–PO Mapping with Average (based on the 11 POs)

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | 3 | 3 | 2 | 2 | 3 | – | – | – | 2 | – | 2 |
| **CO2** | 3 | 3 | 2 | 2 | 3 | 2 | 2 | – | 2 | – | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | – | 2 | – | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | 2 | 2 | – | 2 | – | 3 |
| **Average** | 3 | 3 | 2.25 | 2.5 | 3 | 1.75 | 1.75 | – | 2 | – | 2.75 |

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSVT4023P Cloud Computing and Security 4 0 1 5 Choose Anyone Program Elective For Specialization in Fullstack Development Dr. Prateek Raj

## Course Objectives

1. Explain the **core principles and concepts** required to secure a cloud ecosystem independent of any specific vendor.
2. Bridge the gap between **traditional and cloud architectures** while addressing enterprise risk management in cloud environments.
3. Develop the ability to **assess and manage security risks** associated with cloud adoption and deployment.
4. Equip students to contribute effectively to **infrastructure and security teams** in organizations utilizing cloud technologies.

## Course Outcomes

By the end of this course, students will be able to:

**CO1:** Explain core cloud computing concepts and fundamental principles, including standard delivery models and service designs. *(Understand)* **CO2:** Apply identity and access management practices from both cloud providers’ and consumers’ perspectives. *(Apply)* **CO3:** Design foundational security practices to secure modern cloud computing infrastructures. *(Create)* **CO4:** Implement regulatory requirements to secure data in the cloud and analyze the challenges in meeting those requirements. *(Apply, Analyze)*

## CO–PO Mapping with Average (based on the 11 POs)

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | 3 | 3 | 2 | – | 2 | – | – | – | 2 | – | 2 |
| **CO2** | 3 | 3 | 2 | 2 | 3 | – | – | – | 2 | – | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | – | – | – | 2 | – | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | – | – | – | 2 | – | 3 |
| **Average** | 3 | 3 | 2.25 | 2.67 | 2.75 | – | – | – | 2 | – | 2.75 |

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSVT4022P Cloud Application Development 4 0 1 5 Choose Anyone Program Elective For Specialization in Cloud Computing and Virtualization Technology Dr. Prateek Raj

## Course Objectives

1. Provide a solid theoretical background of **high computing paradigms**.
2. Develop a conceptual understanding of **cloud application development platforms and frameworks**.
3. Enable students to explore **cloud applications** and identify those suitable for implementation on the cloud.

## Course Outcomes

By the end of this course, students will be able to:

**CO1:** Correlate underlying technologies for cloud application development with basic programming skills. *(Understand, Apply)*

**CO2:** Apply concepts of high-throughput, data-intensive applications, and task programming. *(Apply)*

**CO3:** Explore and discover various cloud computing platforms for application development. *(Analyze, Evaluate)*

**CO4:** Analyze the use of automation in cloud application development and understand real-time use cases. *(Analyze, Evaluate)*

## CO–PO Mapping with Average (based on the 11 POs)

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | 3 | 3 | 2 | 2 | 2 | – | – | – | 2 | – | 2 |
| **CO2** | 3 | 3 | 2 | 2 | 3 | – | – | – | 2 | – | 2 |
| **CO3** | 3 | 3 | 2 | 2 | 3 | – | – | – | 2 | – | 2 |
| **CO4** | 3 | 3 | 2 | 2 | 3 | – | – | – | 2 | – | 3 |
| **Average** | 3 | 3 | 2 | 2 | 2.75 | – | – | – | 2 | – | 2.25 |

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSSF4021P Digital Forensic 4 0 1 5 Choose Anyone Program Elective For Specialization in Cybersecurity and Digital Forensics Dr. Prateek Raj

## Course Objectives

1. Provide a comprehensive understanding of **principles, methodologies, and techniques** involved in digital forensics investigations.
2. Equip students with the knowledge and skills to **preserve, collect, and analyze digital evidence** in a legally and ethically sound manner.
3. Develop expertise in **analyzing digital artifacts** across file systems, operating systems, network traffic, mobile devices, and memory.
4. Explain essential technical concepts such as **disk imaging, hashing, metadata analysis, volatile memory forensics, network protocols, and encryption**.
5. Familiarize students with the requirements for setting up a **computer forensics lab**, including hardware, software, storage, and lab security.
6. Emphasize **legal and ethical considerations**, anti-forensics techniques, and effective **forensic report writing** skills.

## Course Outcomes

By the end of this course, students will be able to:

**CO1:** Explain the fundamental concepts and principles of digital forensics, including forensic process, evidence preservation, and legal/ethical considerations to conduct professional and responsible digital investigations. *(Understand, Apply)*

**CO2:** Demonstrate proficiency in digital evidence collection, preservation, and analysis techniques across file systems, operating systems, network traffic, mobile devices, and memory. *(Apply, Analyze)*

**CO3:** Utilize forensic tools and software to analyze digital artifacts such as file metadata, email communications, web browser activities, and social media interactions for investigative purposes. *(Apply, Evaluate)*

**CO4:** Apply technical concepts—disk imaging, hashing, volatile memory forensics, network protocols, and encryption—to identify and interpret digital evidence, establish timelines, and reconstruct events. *(Apply, Analyze)*

**CO5:** Produce professional forensic reports adhering to industry standards and effectively communicate findings and conclusions, while detecting and countering anti-forensics techniques. *(Create, Evaluate)*

## CO–PO Mapping with Average (based on the 11 POs)

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | 3 | 3 | 2 | 2 | 2 | – | – | – | 2 | – | 2 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | – | – | – | 2 | – | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | – | – | – | 2 | – | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | – | – | – | 2 | – | 3 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | – | – | – | 3 | – | 3 |
| **Average** | 3 | 3 | 2.4 | 2.6 | 2.6 | – | – | – | 2.2 | – | 2.8 |

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSGG4015P Augmented Reality and Virtual Reality Development 4 0 1 5 Choose Anyone Program Elective For Specialization in Graphics and Gaming Dr. Prateek Raj

## Course Objectives

1. Understand the fundamental concepts and principles of **Augmented Reality (AR)** and **Virtual Reality (VR)**, including their differences, applications, and potential impact on various industries.
2. Gain proficiency in using **AR/VR hardware and software tools**, including devices, headsets, controllers, and development platforms.
3. Develop practical skills in creating AR/VR experiences using techniques such as **marker-based and markerless AR tracking**, VR environment design, and user interaction implementation.
4. Acquire hands-on experience in AR/VR development with the **Unity game engine**, including asset importing, scene creation, scripting, and performance optimization.
5. Apply **user experience (UX) and interaction design principles** to create immersive and user-friendly AR/VR interfaces and understand the challenges in designing and testing AR/VR applications.

## Course Outcomes

By the end of this course, students will be able to:

**CO1:** Demonstrate knowledge and understanding of AR/VR concepts, technologies, and applications. *(Understand)*

**CO2:** Apply knowledge to create AR/VR experiences using industry-standard tools. *(Apply, Create)*

**CO3:** Analyze the effectiveness of different AR/VR design choices and techniques and assess their impact on user experience, performance, and overall application quality. *(Analyze, Evaluate)*

**CO4:** Critically evaluate AR/VR applications in terms of usability, user experience, and effectiveness. *(Evaluate)*

**CO5:** Synthesize knowledge and skills to design and develop original AR/VR applications. *(Create, Evaluate)*

## CO–PO Mapping with Average (based on the 11 POs)

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | 3 | 3 | 2 | – | 2 | – | – | – | 2 | – | 2 |
| **CO2** | 3 | 3 | 3 | 2 | 3 | – | – | – | 2 | – | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | – | – | – | 2 | – | 3 |
| **CO4** | 3 | 3 | 2 | 2 | 3 | – | – | – | 2 | – | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | – | – | – | 3 | – | 3 |
| **Average** | 3 | 3 | 2.6 | 2.5 | 2.8 | – | – | – | 2.2 | – | 2.8 |

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSIS4015P Single Board Computers and IoT Applications Development 4 0 1 5 Choose Anyone Program Elective For Specialization in Internet of Things (IoT) Dr. Prateek Raj

## Course Objectives

1. Understand the fundamental concepts of **Single Board Computers (SBCs)** and **Embedded Systems**.
2. Gain proficiency in working with **Raspberry Pi** and **Linux-based systems**.
3. Develop programming and interfacing skills for **Raspberry Pi applications**.
4. Master the use of **cloud technologies** for IoT applications.

## Course Outcomes

By the end of this course, students will be able to:

**CO1:** Demonstrate proficiency in Single Board Computers and Embedded Systems. *(Understand, Apply)*

**CO2:** Apply the principles of Real-Time Operating Systems (RTOS). *(Apply)*

**CO3:** Utilize Raspberry Pi and Linux-based systems for embedded applications. *(Apply)*

**CO4:** Develop programming and interfacing solutions using Raspberry Pi. *(Apply, Create)*

**CO5:** Apply IoT principles and integrate cloud technologies for IoT applications. *(Apply, Evaluate)*

## CO–PO Mapping with Average (based on the 11 POs)

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO1** | 3 | 3 | 2 | 2 | 2 | – | – | – | 2 | – | 2 |
| **CO2** | 3 | 3 | 2 | 2 | 3 | – | – | – | 2 | – | 2 |
| **CO3** | 3 | 3 | 2 | 2 | 3 | – | – | – | 2 | – | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | – | – | – | 2 | – | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | – | – | – | 3 | – | 3 |
| **Average** | 3 | 3 | 2.4 | 2.4 | 2.8 | – | – | – | 2.2 | – | 2.6 |

*Average is calculated using only the non-blank entries in each column.*

# Following codes not found in updated academic handbook shared

1. CSBD3022
2. CSIS3026
3. CSEG3073
4. CSEG3071

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSBD3022 Big Data Overview 4 0 1 5

Code Not found in HandBook

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSIS3026 Wireless Sensor Network 4 0 1 5

Code Not found in HandBook

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSEG3073 Operation Research & Game Theory 4 0 1 5

Code Not found in HandBook

SOCS 2025 B.Tech Computer Science and Engineering  
6 CSEG3071 Parallel Computing 4 0 1 5

Code Not found in HandBook