# KUMARAGURU COLLEGE OF TECHNOLOGY,

An autonomous Institution affiliated to Anna University, Chennai

# COIMBATORE – 641 049.

# B.E. COMPUTER SCIENCE AND ENGINEERING

## REGULATION 2024

## I to VIII Semesters (2024 Batch)

# Department of Computer Science and Engineering

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## VISION

To evolve as a center of excellence in Computer Science and Engineering to serve the changing global needs of industry and society.

## MISSION

- **Industry Readiness:** Computer Science and Engineering department is committed to bring out career-oriented graduates who are industry ready through innovative practices of teaching-learning process.
- **Professional Development:** To cultivate professional competence, strong ethical values, team spirit, and leadership qualities among graduates by promoting research culture and continuous learning.
- **Nation Building:** To contribute towards techno-economic and social development of the nation through quality human resource and encouraging entrepreneurship among the young graduates.

## PROGRAM SPECIFIC OUTCOMES (PSOs)

The Program Specific Outcomes of Computer Science and Engineering Undergraduate Program are:

**PSO 1: Proficiency in Software Engineering and System Design**

Graduates will be able to design, develop, and optimize software solutions, applying core principles of computer science to build efficient, scalable, and secure systems

**PSO 2: Competency in Emerging Technologies**

Graduates will develop expertise in emerging technologies and specialized domains enabling them to Innovate and build advanced solutions meeting Industrial and societal needs.

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Program Educational Objectives of the Undergraduate programme in Computer Science and Engineering are to:

**PEO I.** Enable graduates to be successful in their chosen careers, by applying their continual learning of Computer Science and Engineering in their work and life situations.

**PEO II.** Enable graduates of the program to continue to adopt latest technologies and be critical learners displaying creativity and demonstrate to be leaders.

**PEO III.** Prepare graduates of the program to be innovative product engineers catering to the requirements of the enterprises and society.

## PROGRAM OUTCOMES (POs)

Graduates of the Computer Science and Engineering Undergraduate Program should have the

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ability to:

**PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization 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.

**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.

**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.

**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.

**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.

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

**PO8: Individual and Collaborative Teamwork:** 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.

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# KUMARAGURU COLLEGE OF TECHNOLOGY

## COMPUTER SCIENCE AND ENGIEERING

## REGULATION 2024

## B.E. Computer Science and Engineering – Curriculum

## 2024 Batch Structure

**Semester I**

| S.No | Course code | Course Title | Course Mode | Course Type | L | T | P | J | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 24HST103 / 24HST104 | Effective Communication / Professional Communication | Theory | HS | 2 | 0 | 0 | 0 | 2 |
| | 24HSJ102 | Fluency Through Practice | Practical | | 0 | 0 | 0 | 4 | |
| 2 | 24MAI114 | Applied Linear Algebra and Calculus | Embedded | BS | 3 | 0 | 2 | 0 | 4 |
| 3 | 24PHI101 | Applied Physics for Computing | Embedded | BS | 3 | 0 | 2 | 0 | 4 |
| 4 | 24CSI101 | Logical Thinking and Problem Solving | Embedded | ES | 3 | 0 | 2 | 0 | 4 |
| 5 | 24CSI102 | Digital Logic Circuits | Embedded | ES | 2 | 0 | 2 | 0 | 3 |
| 6 | 24HST101 | Heritage of Tamils | Theory | HS | 1 | 0 | 0 | 0 | 1 |
| 7 | 24INP102 | Innovation Practicum - 1 | Practical | ES | 0 | 0 | 2 | 0 | 1 |
| 8 | 24HSP111 | Holistic Wellness - 1 | Practical | HS | 0 | 0 | 2 | 0 | 1 |
| 9 | 24INO101 | FCLF- General Stack-1 | Practical | OE | 0 | 0 | 2 | 0 | 1 |
| 10 | 24CSV001 | Emerging Domains | Embedded | VA | 2 | 0 | 0 | 0 | 0 |
| | | | | | | | | **Total Credits** | 21 |
| | | | | | | | | **Total Contact Hours/week** | 30 |

**Semester II**

| S.No | Course code | Course Title | Course Mode | Course Type | L | T | P | J | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 24HSP005 | Mastering Conversations | Practical | HS | 0 | 0 | 2 | 0 | 1 |
| 2 | 24MAI124 | Multivariate Calculus and Forecasting | Embedded | BS | 3 | 0 | 2 | 0 | 4 |
| 3 | 24CSI103 | Computer Graphics | Embedded | BS | 2 | 0 | 2 | 0 | 3 |
| 4 | 24CSI104 | Data Structures and Algorithms | Embedded | ES | 3 | 0 | 2 | 0 | 4 |
| 5 | 24CSI105 | Embedded Computing Systems | Embedded | ES | 2 | 0 | 2 | 0 | 3 |
| 6 | 24HST102 | Tamils and Technology | Theory | HS | 1 | 0 | 0 | 0 | 1 |
| 7 | 24INP103 | Innovation Practicum- 2 | Practical | ES | 0 | 0 | 2 | 0 | 1 |
| 8 | 24HSP112 | Holistic Wellness-2 | Practical | HS | 0 | 0 | 2 | 0 | 1 |
| 9 | 24INO102 | FCLF- General Stack-2 | Practical | OE | 0 | 0 | 2 | 0 | 1 |
| 10 | 24INP101 | Design Thinking | Practical | HS | 0 | 0 | 2 | 0 | 1 |
| 11 | 24CSV002 | Disruptive Technologies | Embedded | VA | 2 | 0 | 0 | 0 | 0 |
| | | | | | | | | **Total Credits** | **20** |
| | | | | | | | | **Total Contact Hours/week** | **31** |

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| Semester III | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course code** | **Course Title** | **Course Mode** | **Course Type** | **L** | **T** | **P** | **J** | **C** |
| 1 | 24MAI234 | Computational Probability and Statistics | Embedded | BS | 3 | 0 | 2 | 0 | 4 |
| 2 | 24CSI008 | Object Oriented Programming | Embedded | ES | 3 | 0 | 2 | 0 | 4 |
| 3 | 24CSI009 | Database Management Systems | Embedded | PC | 3 | 0 | 2 | 0 | 4 |
| 4 | 24ADI001 | Artificial Intelligence and Automation | Embedded | PC | 3 | 0 | 2 | 0 | 4 |
| 5 | 24INP201 | Innovation Practicum- 3 | Practical | ES | 0 | 0 | 2 | 0 | 1 |
| 6 | 24HSP006 | Mastering Group Discussion and Presentation Skills | Practical | HS | 0 | 0 | 2 | 0 | 1 |
| 7 | 24INOXYY | FCLF- General Stack-3 | Practical | OE | 0 | 0 | 2 | 0 | 1 |
| 8 | 24CSJ210 | Social Internship | Project | PRJ | 0 | 0 | 0 | 0 | 1 |
| 9 | 24ADT015 | Finance, Economics and Marketing | Theory | HS | 3 | 0 | 0 | 0 | 3 |
| 10 | 24ITP012 | Aptitude and Reasoning – I | Practical | HS | 0 | 0 | 2 | 0 | 1 |
| 11 | 24ADV001 | Python Programming | Practical | VA | 0 | 0 | 2 | 0 | 0 |
| | | | | | | | | **Total Credits** | **24** |
| | | | | | | | | **Total Contact Hours/week** | **29** |

| Semester IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course code** | **Course Title** | **Course Mode** | **Course Type** | **L** | **T** | **P** | **J** | **C** |
| 1 | 24MAT243 | Discrete Mathematics and Optimization | Theory | BS | 3 | 0 | 0 | 0 | 3 |
| 2 | 24ITT203 | Computer Organization and Architecture | Theory | PC | 3 | 0 | 0 | 0 | 3 |
| 3 | 24CSI011 | Computer Networks and Security | Embedded | PC | 3 | 0 | 2 | 0 | 4 |
| 4 | 24CSP012 | Java Programming | Practical | PC | 0 | 0 | 4 | 0 | 2 |
| 5 | 24ADI017 | Machine Learning Techniques | Embedded | PC | 3 | 0 | 0 | 2 | 4 |
| 6 | 24INM202 | Environmental Science and Sustainability | Embedded | HS | 1 | 0 | 2 | 0 | 2 |
| 7 | 24HSP007 | Building Professional Readiness | Practical | HS | 0 | 0 | 2 | 0 | 1 |
| 8 | 24INP202 | Innovation Practicum - 4 | Practical | ES | 0 | 0 | 2 | 0 | 1 |
| 9 | 24ITP013 | Aptitude and Reasoning - II | Practical | HS | 0 | 0 | 2 | 0 | 1 |
| | | | | | | | | **Total Credits** | **21** |
| | | | | | | | | **Total Contact Hours/week** | **27** |

| Semester V | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course code** | **Course Title** | **Course Mode** | **Course Type** | **L** | **T** | **P** | **J** | **C** |
| 1 | 24ITI005 | Operating Systems | Embedded | PC | 3 | 0 | 2 | 0 | 4 |
| 2 | 24CSI013 | Full Stack Development | Embedded | PC | 3 | 0 | 2 | 0 | 4 |
| 3 | 24CSI014 | Design and Analysis of Algorithms | Embedded | PC | 3 | 0 | 2 | 0 | 4 |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 24CSI015 | Software Engineering and Agile Practices | Embedded | PC | 3 | 0 | 0 | 2 | 4 |
| 5 | 24------ | Professional Elective I | Embedded/Theory | PE | 2 | 0 | 2 | 0 | 3 |
| 6 | 24HSPXYY | Indian/Foreign Language | Theory | HS | 0 | 0 | 4 | 0 | 2 |
| 7 | 24INM201 | Universal Human Values-II | Theory | HS | 1 | 0 | 0 | 0 | 1 |
| | | | | | | | | **Total Credits** | 22 |
| | | | | | | | | **Total Contact Hours/week** | 29 |

**Semester VI**

| S.No | Course code | Course Title | Course Mode | Course Type | L | T | P | J | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 24CST016 | Formal Languages and Compiler Design | Theory | PC | 3 | 1 | 0 | 0 | 4 |
| 2 | 24CSI017 | Big Data Analytics | Embedded | PC | 3 | 0 | 2 | 0 | 4 |
| 3 | 24CSI018 | Cloud Computing | Embedded | PC | 3 | 0 | 2 | 0 | 4 |
| 4 | 24------ | Professional Elective II | Embedded/Theory | PE | 2 | 0 | 2 | 0 | 3 |
| 5 | 24------ | Professional Elective III | Embedded/Theory | PE | 2 | 0 | 2 | 0 | 3 |
| 6 | 24------ | Professional Elective IV | Embedded/Theory | PE | 2 | 0 | 2 | 0 | 3 |
| 7 | 24------ | OE2 | Theory | OE | 3 | 0 | 0 | 0 | 3 |
| 8 | 24INM302 | Constitution of India | Theory | HS | 1 | 0 | 0 | 0 | 0 |
| | | | | | | | | **Total Credits** | 24 |
| | | | | | | | | **Total Contact Hours/week** | 30 |

**Semester VII**

| S.No | Course code | Course Title | Course Mode | Course Type | L | T | P | J | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 24------ | Professional Elective V | Embedded/Theory | PE | 2 | 0 | 2 | 0 | 3 |
| 2 | 24------ | Professional Elective VI | Embedded/Theory | PE | 2 | 0 | 2 | 0 | 3 |
| 3 | 24------ | Professional Elective VII | Embedded/Theory | PE | 2 | 0 | 2 | 0 | 3 |
| 4 | 24------ | OE3 | Theory | OE | 3 | 0 | 0 | 0 | 3 |
| 5 | 24INM102 | Indian Knowledge System in Science and Engineering | Theory | HS | 1 | 0 | 0 | 0 | 1 |
| 6 | 24CSJ419 | Project Phase-I | Project | PRJ | 0 | 0 | 0 | 6 | 3 |
| 7 | 24CSJ420 | Technical Internship/Certification | Project | PRJ | 0 | 0 | 0 | 0 | 2 |
| | | | | | | | | **Total Credits** | 18 |
| | | | | | | | | **Total Contact Hours/week** | 22 |

**Semester VIII**

| S.No | Course code | Course Title | Course Mode | Course Type | L | T | P | J | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 24CSJ421 | Project Phase-II | Project | PRJ | 0 | 0 | 0 | 24 | 12 |
| | | | | | | | | **Total Credits** | **12** |
| | | | | | | | | **Total Contact Hours/week** | **24** |
| | | | | | | | | **Grand Total Credits** | **162** |

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| List of Professional Electives | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course code** | **Course Title** | **Course Mode** | **Course Type** | **L** | **T** | **P** | **J** | **C** |
| **Web and Software Development** | | | | | | | | | |
| 1 | 24CSC001 | UI and UX Design | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 2 | 24CSC002 | iOS Application Development using Swift | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 3 | 24CSC003 | Mobile Application Development | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 4 | 24CSC004 | Software Testing and Automation | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 5 | 24CSC005 | DevOps Mastery | Embedded | PE | 1 | 0 | 4 | 0 | 3 |
| 6 | 24CSC006 | Software Project Management | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| **Cyber Security** | | | | | | | | | |
| 7 | 24CSC007 | Secure Software Development | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 8 | 24CSC008 | Digital Forensics | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 9 | 24CSC009 | Network Security Administration | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 10 | 24CSC010 | Ethical Hacking and Cyber Laws | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 11 | 24CSE011 | Web Application Security | Theory | PE | 3 | 0 | 0 | 0 | 3 |
| 12 | 24CSE012 | Database Security | Theory | PE | 3 | 0 | 0 | 0 | 3 |
| 13 | 24CSC021 | Digital Evidence and Cyber Investigation | Embedded | PE | 1 | 0 | 4 | 0 | 3 |
| **Blockchain** | | | | | | | | | |
| 14 | 24CSE023 | Blockchain Technology | Theory | PE | 3 | 0 | 0 | 0 | 3 |
| 15 | 24CSE013 | Cryptocurrency and Bitcoins | Theory | PE | 3 | 0 | 0 | 0 | 3 |
| 16 | 24CSE014 | Decentralised Finance | Theory | PE | 3 | 0 | 0 | 0 | 3 |
| 17 | 24CSC015 | Smart Contract Development | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 18 | 24CSC016 | Web3 and DApp Development | Embedded | PE | 2 | 0 | 0 | 2 | 3 |
| **Extended Reality** | | | | | | | | | |
| 19 | 24CSC017 | Game Design and Development | Embedded | PE | 2 | 0 | 0 | 2 | 3 |
| 20 | 24CSC018 | Advanced 3D Modelling | Embedded | PE | 2 | 0 | 0 | 2 | 3 |
| 21 | 24CSC019 | Augmented Reality Application Development | Embedded | PE | 2 | 0 | 0 | 2 | 3 |
| 22 | 24CSC020 | Virtual Reality Application Development | Embedded | PE | 2 | 0 | 0 | 2 | 3 |
| 24 | 24CSC022 | Artificial Intelligence and Machine Learning for Games | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| **Networking and IoT** | | | | | | | | | |
| 25 | 24ITC010 | IOT System Sesign | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 26 | 24ITC011 | AI - Driven intelligent IOT systems | Embedded | PE | 1 | 0 | 0 | 4 | 3 |
| 27 | 24ITC012 | Advanced Network Technologies | Embedded | PE | 2 | 0 | 0 | 2 | 3 |
| 28 | 24ITE013 | Introduction to Industry 4.0 and Industrial Internet of Things | Theory | PE | 3 | 0 | 0 | 0 | 3 |
| 29 | 24ITC014 | IOT Application Development | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| **Cloud Computing** | | | | | | | | | |
| 30 | 24ITC001 | Cloud Application Development | Embedded | PE | 2 | 0 | 0 | 2 | 3 |
| 31 | 24ITC002 | Infrastructure for Private Cloud | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 32 | 24ITC003 | Cloud Storage Management | Embedded | PE | 2 | 0 | 2 | 0 | 3 |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 33 | 24ITC004 | Virtualization and Resource Management | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 34 | 24ITC005 | Cloud Security | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 35 | 24ITC006 | Cloud Automation | Embedded | PE | 2 | 0 | 0 | 2 | 3 |
| 36 | 24ITC007 | Cloud Administration and Solutions Architecture | Embedded | PE | 1 | 0 | 0 | 4 | 3 |
| 37 | 24ITC008 | Secure Computing and soNetworking | Embedded | PE | 1 | 0 | 0 | 4 | 3 |
| 38 | 24ITC009 | Secure Cloud Infrastructure Management | Embedded | PE | 1 | 0 | 0 | 4 | 3 |
| **Artificial Intelligence and Data Science** | | | | | | | | | |
| 39 | 24ADC001 | Business Intelligence | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 40 | 24ADC002 | Deep Learning Applications | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 41 | 24ADE003 | Responsible AI | Theory | PE | 3 | 0 | 0 | 0 | 3 |
| 42 | 24ADC004 | Generative AI | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 43 | 24ADC005 | Social Network Analytics | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 44 | 24ADC006 | Digital Twin Analytics | Embedded | PE | 2 | 0 | 2 | 0 | 3 |
| 45 | 24ADC007 | Agentic AI | Embedded | PE | 1 | 0 | 0 | 4 | 3 |
| 46 | 24ADC008 | AI and ML Infrastructure Engineering | Embedded | PE | 1 | 0 | 0 | 4 | 3 |

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# SEMESTER I

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| 24HST103 | EFFECTIVE COMMUNICATION | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 | 2 |
| HS | | SDG | 4, 8 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to

| | |
|---|---|
| 1 | enhance students' abilities to communicate ideas effectively, both orally and in writing, by developing skills in organizing thoughts clearly and logically and expressing them through well-structured paragraphs and concise summaries. |
| 2 | enable students to critically evaluate and synthesize information from multiple sources and utilize suitable writing techniques and formats to produce professional-quality content tailored to various contexts. |
| 3 | foster active listening, critical reading, and reflective thinking, empowering students to create engaging, relevant, and informative content by applying effective communication strategies across diverse platforms. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | demonstrate proficiency in delivering ideas effectively, both in speaking and writing, with a deeper understanding of the content and the ability to convey complex ideas through well-structured paragraphs and summaries. | Ap |
| CO2 | create and present original content by evaluating information from multiple sources and employing appropriate formats and writing strategies across various professional contexts. | C |
| CO3 | produce engaging and informative content through active listening, reading, reflection, and effective communication skills. | E |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 Engineering Knowledge | 2 Problem Analysis | 3 Design/Development of Solutions | 4 Conduct Investigations of Complex Problems | 5 Engineering Tool Usage | 6 The Engineer and The World | 7 Ethics | 8 Individual and Collaborative Team work | 9 Communication | 10 Project Management and Finance | 11 Life-Long Learning | PSO 1 | PSO 2 |
| 1 | | | | | | | 2 | 2 | 3 | | 3 | | |
| 2 | | | | | | | 2 | 2 | 3 | | 3 | | |
| 3 | | | | | | | 2 | 2 | 3 | | 3 | | |

## *Course Content*

| | |
|---|---|
| **Text Analysis**<br>Composition of Coherent Paragraphs (Expository, Descriptive, Narrative, Evaluative) - Loud Reading (Reading Extracts will be given were students identify the main idea of paragraphs or sections and debrief) | **6 Hours** |

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| | |
|---|---|
| **Visual & Written Analysis**<br>Process writing (Drafting effective introduction, process and conclusion using appropriate transition words and phrases) - Describing Visuals (Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram) - Note Making & Summarizing | **6 Hours** |
| **Professional Correspondence**<br>Crafting Professional Emails - Writing Instruction for Manuals – Reading technical documents (Reading extracts will be given to construct sentences from the new words found in the document) | **6 Hours** |
| **Research and Documentation**<br>Library Reading (Identify at least three sources and extract information, Summarize the main ideas and key findings from each source, compile them findings into a brief report that includes the main points, sources, and relevance to the topic)- Report Writing (Title Page, Abstract, Introduction, Methodology, Results, Discussion, Conclusion and recommendation) | **6 Hours** |
| **Talk Analysis and Podcast Skills**<br>Listening to and analyzing TED talks – Preparing Podcast-PRISM (Professional Rhetoric Improvement and Speech Mastery) to share facts, opinions and experiences - Writing Reviews on products. | **6 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | **0** | **Practical Hours:** | **0** | **Project Hours:** | **0** | **Total Hours:** | **30** |

## Learning Resources

### References:


1. Swamy, V. R. Narayana. Strengthen Your Writing. Orient Longman, 2003.
2. Sasikumar, V., and P. V. Dhamija. Spoken English: A Self-Learning Guide to Conversation Practice. Tata McGraw Hill, New Delhi (1993).
3. Maison, Margaret M. Examine Your English. Orient Longman, 1999.
4. Rizwi, Ashraf. Effective Technical Communication. Tata McGraw Hill, 2005.
5. Pickett, Nell Ann, and Ann A. Laster. Technical English: Writing, Reading, and Speaking.
6. Harpercollins College Div, 1993.


### Online Resources (Weblinks)

1. https://owl.purdue.edu/owl/general_writing/academic_writing/paragraphs_and_paragraphing/index.html
2. https://learnenglish.britishcouncil.org/skills/writing/upper-intermediate b2/describing-trends
3. https://hbr.org/2016/07/how-to-write-email-with-military-precision
4. https://owl.purdue.edu/owl/subject_specific_writing/professional_technical_writing/reports and_memos/index.html

## Assessment (Theory course)

SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

## Course Curated by

| Expert from Industry | Expert(s) from Higher Education Institution | Internal Expert(s) |
|---|---|---|
| Mr.Vijayan Ramanathan ,<br>Project manager,<br>Toppan Merrill. Technologies,<br>Coimbatore | Dr. Aninditha Sahoo, IIT, Madras<br>Dr.P.R.Sujatha Priyadharshini,<br>Anna University, Chennai<br>Dr. E. Justin Ruben,<br>CIT, Coimbatore | Dr. Arokia Lawrence Vijay<br>Dr. Sreejana<br>Dr. Tissaa<br>Department of English |

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|---|---|---|---|
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No:27 | **Date** | 24.08.2024 |

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| 24HST104 | PROFESSIONAL COMMUNICATION (Common to all Departments) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 | 2 |
| HS | | SDG | 4, 8 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to

| | |
|---|---|
| 1 | develop students' abilities to craft clear, concise, and well-structured technical content and professional communications |
| 2 | enhance students' communication skills in team settings |
| 3 | equip students with cross-cultural communication skills and effective listening techniques |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | demonstrate proficiency in crafting clear, concise, and well-structured technical content and professional communications, including emails that meet industry standards. | Ap |
| CO2 | communicate effectively in team settings, showcasing collaboration, conflict resolution, and leadership skills, while employing creative writing techniques to convey complex ideas. | An |
| CO3 | apply principles of cross-cultural communication and effective listening techniques to engage successfully in diverse, globalized professional environments. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | | | | | | 2 | 1 | 3 | 1 | | 3 | | |
| 2 | | | | | | 2 | 3 | 3 | 2 | | 3 | | |
| 3 | | | | | | 1 | 1 | 3 | 1 | | 3 | | |

## Course Content

| | |
|---|---|
| **Mastering Professional Communication**<br>Industry-specific terminology (Business / Technical Register) - Crafting professional emails - Essential elements of an effective email (subject line, salutation, body, closing) - reading and responding to email communication – Networking Emails - Analyzing and interpreting technical texts (Loud Reading). | **6 Hours** |

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| | |
|---|---|
| **Navigating Digital Media**<br>Introduction to Digital media and online communication tools (instant messaging, video conferencing, social media, blogs, forums) - Listening and analyzing advanced audio materials - Creative & Blog Writing (General & Technical). | **6 Hours** |
| **Technical Writing Techniques**<br>Writing Reflective Essays / Experience Sharing, Process writing, Transcoding graphics (interpreting technical texts), Writing Reviews (Research Articles & Books). | **6 Hours** |
| **Building a Professional Digital Presence**<br>Creating Digital Profile - Overview of different digital platforms (LinkedIn, GitHub, personal websites) - Setting Up a LinkedIn Profile – Crafting a Video Resume – Digital Etiquette and Professionalism - Cross-cultural communication and diversity awareness. | **6 Hours** |
| **Social Responsibility in Practice**<br>Environmental and social responsibilities - Case studies and real-world applications - Project Work - Writing Project reports. | **6 Hours** |

| Theory Hours: 30 | Tutorial Hours: 0 | Practical Hours: 0 | Project Hours: 0 | Total Hours: 30 |
|---|---|---|---|---|

## Learning Resources

### Reference books


1. Baker, W., & Ishikawa, T. Transcultural Communication Through Global Englishes: An Advanced Textbook for Students. Routledge, 2021.
2. Bodnar, O., Fedak, S., Hinsirovska, I., Denysiuk, N., Perenchuk, O., Plavutska, I., ... & Shchur, N. English for Study and Work: A Coursebook In-class Activities. 2017.
3. Doff, A., Thaine, C., Puchta, H., Stranks, J., & Lewis-Jones, P. Cambridge English Empower Advanced Student's Book. Cambridge University Press, 2016.
4. Hewings, M., Thaine, C., & McCarthy, M. Cambridge Academic English C1 Advanced Student's Book: An Integrated Skills Course for EAP. Cambridge University Press, 2012.
5. Beer, D. F., & McMurrey, D. A. A Guide to Writing as an Engineer. John Wiley & Sons, 2019.


### Online Resources (Web Links)

1. https://hbr.org/2016/07/how-to-write-email-with-military-precision
2. https://ocw.mit.edu/courses/comparative-media-studies-writing/21w-732-scientific-and-technical-communication-spring-2015/
3. https://www.coursera.org/learn/digital-media
4. https://owl.purdue.edu/owl/subject_specific_writing/professional_technical_writing/reports_and_memos/index.html

## Assessment (Theory course)

SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

## Course Curated by

| Expert from Industry | Expert(s) from Higher Education Institution | Internal Expert(s) |
|---|---|---|
| Mr.Vijayan Ramanathan ,<br>Project manager,<br>Toppan Merrill. Technologies, Coimbatore | Dr. Aninditha Sahoo, IIT, Madras<br>Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai<br>Dr. E. Justin Ruben,CIT, Coimbatore | Dr. Arokia Lawrence Vijay<br>Dr. Hema<br>Department of English |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24HSJ102 | FLUENCY THROUGH PRACTICE | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 4 | 2 |
| HS | | SDG | 4, 9, 12 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Develop professional communication skills, including technical writing, public speaking, and collaborative discourse. |
| 2 | Foster creativity and critical thinking by producing real-world academic and professional outputs such as book chapters, journal articles, and intellectual property. |
| 3 | Instil awareness of global and ethical communication practices, contributing to sustainability and social impact. |
| 4 | Enhance students' language fluency through project-based learning relevant to engineering |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Analyze and apply effective communication techniques in professional contexts. | An |
| CO 2 | Collaborate in teams to design and execute language-based projects with real-world applications. | Ap |
| CO 3 | Develop critical thinking and problem-solving skills through research, analysis, and presentation of technical content. | An |
| CO 4 | Produce publishable-quality written and spoken outputs, such as book chapters, journal articles, and copyrighted content. | C |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | 2 | 2 | 1 | | | 3 | 2 | 2 | 1 | 2 | | |
| 2 | | 3 | 2 | 1 | | | 3 | 2 | 2 | 1 | 2 | | |
| 3 | | 2 | 2 | 2 | | | 3 | 2 | 2 | 1 | 2 | | |
| 4 | | 3 | 1 | 1 | | | 3 | 2 | 2 | 1 | 1 | | |

## Course Content

| | |
|---|---|
| Introduction to Activity Based Learning<br>Research and Initial Project Planning<br>Technical Writing and Documentation<br>Creative Writing<br>Drafting and Editing Techniques<br>Teamwork and Peer Collaboration<br>Public Speaking and Presentation Skills | **60 Hours** |

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| | |
|---|---|
| Challenges to Opportunities<br>Cross-Cultural Communication and Global Ethics<br>Intellectual Property and Copyrighting<br>Publication – English for research Writing<br>Digital Communication & Social Responsibility | |

| Theory Hours: | Tutorial Hours: | Practical Hours: | Project Hours: 60 | Total Hours: 60 |
|---|---|---|---|---|

## Learning Resources

### Reference books


1. Mahesh Kumar, Dr.Soma. Soft Skills: Enhancing Personal and Professional Success, McGraw Hill, 2023.
2. Maxwell, John C. Developing the leader within you, Harper Collins, 2018.
3. Ansarian, Loughman, and Teoh, Mei Lin. Problem-based Language Learning and Teaching: An Innovative Approach to Learn a New Language. Singapore, Springer Nature Singapore, 2018.
4. Savin Baden, M., Major, C. H. (2004). Foundations of Problem Based Learning. United Kingdom: McGraw-Hill Companies, Incorporated.


### Online Resources

1. ttps://www.sciencedirect.com/science/article/pii/S2590291123002735
2. https://www.cal.org/adultesl/pdfs/problem-based-learning-and-adult-english-language-learners.pdf
3. https://www.apu.ac.jp/rcaps/uploads/fckeditor/publications/polyglossia/Polyglossia_V16_Ng.pdf

| Assessment | |
|---|---|
| Formative | Summative |
| Assignments, Quiz, Library Record, Draft submission, Oral Presentation | Project Review |

## Course Curated By

| Expert(s) from Industry | Expert(s) from Higher Education Institutions | Internal Expert(s) |
|---|---|---|
| Mr. Vijayan Ramanathan,<br>Project Manager,<br>Toppan Merrill, Technologies,<br>Coimbatore | Dr. Aninditha Sahoo,<br>IIT, Madras<br>Dr.P.R.Sujatha Priyadharshini,<br>Anna University, Chennai<br>Dr. E. Justin Ruben,<br>CIT, Coimbatore | Dr. Arokia Lawrence Vijay<br>Dr. SG Mohanraj |

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| 24MAI114 | APPLIED LINEAR ALGEBRA AND CALCULUS (Common to CS, IT, AD) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| BS | | SDG | 4, 9 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | understand and apply the concepts of eigenvalues, eigenvectors, and matrix transformations to solve real-world linear algebra problems relevant to computing and data sciences. |
| 2 | develop proficiency in vector spaces, subspaces, and matrix decomposition techniques (LU and SVD) for effective analysis and solution of linear systems in engineering and data analytics. |
| 3 | apply differentiation and integration techniques, including optimization and calculation of areas and volumes, to solve practical problems in engineering and computational contexts. |
| 4 | master multivariate calculus concepts such as partial derivatives, Taylor series, and constrained optimization methods for applications in machine learning and data science algorithms. |
| 5 | provide MATLAB techniques for solving first-order and higher-order ordinary differential equations to model and analyse dynamic systems in computing and engineering. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO1 | apply the concepts of eigenvalues and eigenvectors to diagonalize matrices and solve systems of linear equations in real-world applications. | Ap |
| CO2 | apply the concepts of vector spaces, subspaces and matrix decomposition techniques such as LU decomposition and Singular Value Decomposition to solve linear systems and reduce matrix complexity in data science and engineering problems. | Ap |
| CO3 | apply differentiation techniques to solve optimization problems including finding maxima and minima and use integration methods to compute arc lengths, areas between curves and volumes of solids for practical engineering and computational applications. | Ap |
| CO4 | apply multivariate calculus concepts such as partial derivatives and Taylor's series expansion to analyse and approximate multivariable functions for solving engineering and computational problems. | Ap |
| CO5 | analyse and solve constrained and unconstrained optimization problems using the Lagrange multiplier method and determine the maxima and minima of functions with two or more variables relevant to machine learning and data science applications. | An |
| CO6 | analyse methods for solving first-order and higher-order ordinary differential equations to model and analyse dynamic systems in engineering and computing, using appropriate solution techniques to address real-world problems. | An |

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| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | 2 | | | | 2 | | | | | | | | |
| 2 | 1 | 3 | 1 | | 2 | | | | | | | | |
| 3 | 1 | 1 | | 1 | 2 | | | | | | | | |
| 4 | 1 | 1 | | 1 | 2 | | | | | | | | |
| 5 | 1 | | | 1 | 2 | | | | | | | | |
| 6 | 2 | | | | 2 | | | | | | | | |

## Course Content

| | |
|---|---|
| **MATRICES**<br>Eigenvalues and eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors (Statement only) – Cayley Hamilton theorem (excluding proof) - Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.<br><br>**Practical Component**<br>Matrix operations like addition, subtraction, multiplication, inverse, rank and transpose, eigenvalues and eigenvectors of a given matrix and verify the diagonalization of the matrix.<br>Cayley-Hamilton theorem to find the characteristic equation of a matrix and verify that the matrix satisfies its own characteristic equation. | **9 Hours**<br><br>**6 Hours** |
| **VECTOR SPACES**<br>Vector spaces and subspaces over real space – Euclidean spaces - Linear independence and dependence - Basis and Dimension - Null spaces, column spaces and Linear transformations - LU decomposition method - Singular Value Decomposition method. (No proofs of any theorems, only problems based on these topics)<br><br>**Practical Component**<br>Linearly independent and dependent vectors and Singular Value Decomposition.<br>Curve Tracing, 3D and Surface plotting. | **9 Hours**<br><br>**6 Hours** |
| **APPLICATIONS OF CALCULUS**<br>Differentiation: Mean Value Theorem-Maxima and Minima – Integration: Arc Length, Area between two curves, Area of a Surface of Revolution, Volume of solids<br><br>**Practical Component**<br>First and second derivatives of a given function, area between two curves and the volume of a solid of revolution<br>Optimization problems in single variables. | **9 Hours**<br><br>**6 Hours** |

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| | |
|---|---|
| **FUNCTIONS OF SEVERAL VARIABLES**<br>Partial derivatives – Homogeneous functions and Euler's theorem –Total derivative – Taylor's series expansion - Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraints – Jacobians<br><br>**Practical Component**<br>Computing partial derivatives of multivariable functions<br>Optimization problems in multiple variables | **9 Hours**<br><br>**6 Hours** |
| **ORDINARY DIFFERENTIAL EQUATIONS**<br>Solutions of first order linear ODE: Leibnitz equation and Bernoulli's equation – Linear, homogeneous differential equations of second and higher order with constant coefficients.<br><br>**Practical Component**<br>Solution of first order ordinary differential equations.<br>Solution of second and higher order ordinary differential equations | **9 Hours**<br><br>**6 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | **0** | **Practical Hours:** | **30** | **Project Hours:** | **0** | **Total Hours:** | **75** |

## Learning Resources

### Textbooks

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2021
2. Howard Anton and Chris Rorres, "Elementary Linear Algebra", Applications Version, 12th Edition, 2019.

### Reference books

1. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, 2011.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2018
3. David C. Lay, "Linear Algebra and its Applications", Pearson Education Asia, New Delhi, 6th Edition, 2021
4. Weir, MD, Hass J, Giordano FR: "Thomas' Calculus", Pearson Education, 15th Edition, 2023.

### Online Resources (Web Links)

1. Integral Calculus - Khan Academy https://www.khanacademy.org/math/integral-calculus
2. Linear Algebra by MIT Open Courseware (Free) https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/
3. Multivariable Calculus by MIT Open Courseware (Free) https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/
4. Khan Academy: Multivariable Calculus (Free) https://www.khanacademy.org/math/multivariable-calculus
5. Coursera: Introduction to MATLAB Programming by Vanderbilt University https://www.coursera.org/learn/matlab

## Assessment (Embedded course)

SA-I, SA-IIActivity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

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| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | | **Internal Expert(s)** |
| Mr. Ramesh V.S.,<br>STEPS Knowledge Services Private Limited, Coimbatore.<br>Mr.Jayakumar Venkatesan,<br>Valles Marineris International Private Limited- Chennai.<br>Mr. Imran Khan,<br>GE Transportation Company, Bangalore | Dr.T.Govindan,<br>Government College of Engineering, Srirangam, Trichy.<br>Dr.C.Porkodi,<br>PSG College of Technology, Coimbatore.<br>Dr.P.Paramanathan,<br>Amrita Vishwa Vidyapeetham, Coimbatore. | | Dr. D. Arivuoli<br>Dr. J. Dhivya<br>Dr. Vijeta Iyer,<br>Department of Mathematics |
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24PHI101 | APPLIED PHYSICS FOR COMPUTING (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| BS | | SDG | 7, 9, 12 | | | |

| Pre-requisite courses | High School Education | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | understand and apply fundamental principles of wave behaviour, optics, and acoustics, and their practical applications in engineering. |
| 2 | develop a solid understanding of quantum mechanics and quantum computing, and their relevance to modern technology. |
| 3 | integrate physics principles across mechanics, and thermal physics to solve real-world problems. |
| 4 | foster analytical and problem-solving skills by applying key concepts to real-world engineering and technological challenges. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO 1 | apply wave behaviour in optics and demonstrate its applications in real-world technologies. | Ap |
| CO 2 | understand quantum mechanics principles and state their application in quantum information systems. | Ap |
| CO 3 | implement qubits and quantum gates to demonstrate the advantages of quantum computing. | Ap |
| CO 4 | examine the principles of heat transfer mechanisms for effective thermal management in engineering applications. | Ap |
| CO 5 | apply vectors and moments to equilibrium problems in distributed-force systems with free body diagrams | Ap |
| CO 6 | analyse and interpret acoustic principles to assess sound quality and design strategies for effective noise control in real-time applications. | An |

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| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | 3 | | | | | | | | | | | | |
| 2 | 3 | | | | | | | | | | | | |
| 3 | 3 | 2 | | | | | | | | | 2 | | |
| 4 | 3 | | | | | | | | | | 2 | | |
| 5 | 3 | 2 | | | | | | | | | | | |
| 6 | 3 | 2 | | | | | | | | | | | |

## Course Content

**Applied optics** — **9 Hours**

Wave Behaviour in Optics: Reflection, Refraction, Interference, Diffraction and Polarization (qualitative) - Interaction of light and matter - Absorption - Spontaneous emission - Stimulated emission - Population inversion - CO2 laser - Semiconductor lasers - Applications –Laser Imaging and Holography- Laser gyroscopes- LiDAR- Introduction and importance of Fiber Optics Technology- Propagation mechanism of rays in an optical fibre, Meridional rays, Skew rays- Types of optical fibres -Application of Optical Fibers, Optical fibre Communication system with block diagram.

**Practical Component** — **6 Hours**

- Semiconductor laser:
  a) Determination of wavelength of laser
  b) Determination acceptance angle and numerical aperture of an optical fibre.
  c) Determination of particle size
- Spectrometer – Determination of wavelength of mercury source using grating

**Quantum physics** — **9 Hours**

Introduction to Quantum Mechanics- Wave Particle duality- Heisenberg uncertainty principle- Wave function- Postulates of Quantum Mechanics- Schrodinger's Equations - Particle in a box- Eigen values and Eigen function- Quantum confinement – quantum wells, wires and dots – Quantum system for information processing - quantum states – classical bits – quantum bits or qubits –CNOT gate - multiple qubits – quantum gates – advantage of quantum computing over classical computing.

**Practical Component** — **6 Hours**

- Determination of band gap of a semiconductor
- Determination of efficiency of solar cell
- Determination of Planck's constant – Electroluminescence method

**Thermal Physics** — **9 Hours**

Transfer of heat energy – conduction, convection, and radiation – thermal expansion of solids and liquids – expansion joints – bimetallic strips – theory of heat conduction in solids – rectilinear flow of heat – determination of thermal conductivity of a bad conductor - Lee's &

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| | |
|---|---|
| Charlton's disc method - Thermal Insulation – classification and properties – heat exchangers - applications – Thermal Physics in Virtual Reality and Haptics.<br><br>**Practical Component**<br>Lee's Disc method: Determination of thermal conductivity of a bad conductor | **6 Hours** |
| **Mechanics**<br>Introduction to position vector, force vector and moment vector- 3-D representation of force and couple- their moments about a point or line- Distributed-force systems- Free Body diagram- Equilibrium of a body under 2D/3D force systems- Moment of inertia of plane areas; Perpendicular-axis and parallel axis theorems- Rectilinear and curvilinear motion of a particles- Work and energy- Impulse and momentum.<br><br>**Practical Component**<br>• Compound pendulum – Determination of acceleration due to gravity<br>• Non-uniform bending – Determination of Young's modulus | **9 Hours**<br><br>**6 Hours** |
| **Acoustics**<br>Sound basic definitions - Human response to sound and vibration- Range of audible sound pressure levels and frequencies, infra sound, ultrasound-Pitch-Loudness: equal loudness contours and loudness level. Loudness calculations. Principle of superposition of waves, interference, beats, standing waves- Principle of active noise control- Doppler effect. Reverberation - Reverberation time - Absorption coefficient and its determination - Factors affecting the acoustics of the buildings and their remedies.<br><br>**Practical Component**<br>Melde's string – Determination of frequency of a tuning fork | **9 Hours**<br><br>**6 Hours** |

| Theory Hours: | 45 | Tutorial Hours: | 0 | Practical Hours: | 30 | Project Hours: | 0 | Total Hours: | 75 |
|---|---|---|---|---|---|---|---|---|---|

## Learning Resources

### Textbooks


1. Optics, Light, and Lasers: The Practical Approach to Modern Aspects of Photonics and Laser Physics, Dieter Meschede, 3rd Edition, Wiley, 2017.
2. Quantum Mechanics, David H. McIntyre, Cambridge University Press, 2022.
3. Introduction to Quantum Control and Dynamics, Domenico D'Alessandro, 2nd Edition, Chapman and Hall/CRC, 2021.
4. Shames, Irving H. Engineering mechanics statics and dynamics. 2022.
5. Engineering Mechanics: Dynamics, James L. Meriam, L. G. Kraige, J. N. Bolton, John Wiley & Sons, 2020.


### Reference books


1. Engineering Acoustics: Noise and Vibration Control, Malcolm J. Crocker, Jorge P. Arenas, John Wiley & Sons, 2021.
2. Engineering Mechanics, Hibbeler, R. C., Pearson Education India, 2010.
3. Pain, Herbert John. The physics of vibrations and waves. 2022.
4. Introductory Quantum Optics, Christopher C. Gerry and Peter L. Knight, Cambridge university press, 2023.
5. Optics for Engineers, Charles A. DiMarzio, Crc Press, 2024.


### Online Resources (Web Links)

1. https://ocw.mit.edu/courses/2-71-optics-spring-2009/
2. https://ocw.mit.edu/courses/8-04-quantum-physics-i-spring-2016/
3. https://ocw.mit.edu/courses/2-051-introduction-to-heat-transfer-fall-2015/
4. https://ocw.mit.edu/courses/2-001-mechanics-materials-i-fall-2006/
5. https://phet.colorado.edu/en/simulations/waves-intro
6. https://www.nasa.gov/directorates/esdmd/hhp/acoustics-and-noise-control/

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| Assessment (Embedded course) |
|---|
| SA-I, SA-II Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)<br>Lab Workbook, Experimental Cycle tests, viva-voce |

| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert(s)** | |
| | | Capt A.R.Arul<br>Dr. S.Nithya<br>Department of Physics | |
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24CSI101 | LOGICAL THINKING AND PROBLEM SOLVING (Common to all Programmes) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| ES | | SDG | 8, 9 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | gain a comprehensive understanding of computing systems, including their classification, processing units, memory structures, storage hierarchies, and the essential functions and types of operating systems |
| 2 | develop strong logical and analytical thinking skills, enabling the systematic analysis and solution of computational problems using reasoning techniques, algorithms, and flowcharts. |
| 3 | acquire a solid foundation in C programming, mastering the use of data types, operators, control structures, and input/output operations to create efficient and effective programs. |
| 4 | apply advanced programming techniques, including the use of arrays, structures, pointers, and functions, to solve complex real-world problems with a focus on modular and efficient coding practices. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | understand the basic concepts of hardware, software, Operating systems, and the logic behind the functioning of the Computing systems. | U |
| CO2 | apply logical thinking and reasoning to solve computing problems using tools like algorithms and flowcharts. | Ap |
| CO3 | understand the structured programming paradigms, memory organization and how the language can be used as a tool to solve problems. | U |
| CO4 | develop simple programs using data types, operators, control structures, pointers, and functions as appropriate in real world applications. | Ap |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 Engineering Knowledge | 2 Problem Analysis | 3 Design/Development of Solutions | 4 Conduct Investigations of Complex Problems | 5 Engineering Tool Usage | 6 The Engineer and The World | 7 Ethics | 8 Individual and Collaborative Team work | 9 Communication | 10 Project Management and Finance | 11 Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | | | | | | | | | | | |
| 2 | 3 | 2 | 1 | | | | | | | | | 3 | |
| 3 | | 1 | | | | | | | | | | 2 | |
| 4 | 3 | 2 | 1 | | | | | | | | | 3 | |

## Course Content

**FUNDAMENTALS OF COMPUTERS AND COMPUTING** — **6 Hours**

Generations of computers, and classification of computers (supercomputers, mainframes, minicomputers, microcomputers). Processing Units (CPU, GPU, TPU), memory (RAM, ROM), storage devices and hierarchy, input / output and peripheral devices. System software, application software. Operating Systems - Functions (process

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| | |
|---|---|
| management, memory management, file system management, device management, security), types of operating systems (desktop, mobile, networking, distributed, real-time, embedded). **Number Systems**: Introduction to different number systems (binary, octal, decimal, hexadecimal), conversions between number systems, and binary arithmetic (addition, subtraction, multiplication, division).<br><br>**Practical Component**<br>Exploring hardware and software components | <br><br><br><br><br><br>**4 Hours** |
| **LOGICAL THINKING, REASONING AND TOOLS**<br>Problem Analysis – Logical Thinking vs Critical Thinking vs Design Thinking - Inference – Inductive Reasoning – Deductive Reasoning **– Logical Thinking Tools: Algorithms**: Definition and importance, characteristics of algorithms (finite, clear and unambiguous, well-defined inputs and outputs, feasible). Algorithm representation Techniques: Pseudocode, stepwise refinement, and top-down design. **Flowcharts**: Symbols used in flowcharts, creating flowcharts, and examples of flowchart-based problem-solving.<br><br>**Practical Component**<br>Algorithm writing and Flowcharts, | **8 Hours**<br><br><br><br><br><br>**4 Hours** |
| **PROGRAMMING PARADIGMS AND INTRODUCTION TO C PROGRAMMING**<br>**Programming Paradigms**: Structured programming - functional programming - object-oriented programming. **Introduction to C Programming**: History of C - features of C - structure of a C program – input / output statements. **Data Types**: Primitive data types (int, char, float, double) - derived data types, typecast. **Operators**: Arithmetic operators - relational operators - logical operators - bitwise operators - assignment operators - operator precedence. **Conditional Statements**: If - if-else - nested if - switch-case. **Looping Statements**: For loop - while loop - do-while loop. Pre-processor Directives and Command line arguments, Storage Classes.<br><br>**Practical Component**<br>Programs on Operator precedence, Decision Making, Iterations | **11 Hours**<br><br><br><br><br><br><br><br><br>**10 Hours** |
| **ARRAYS AND STRUCTURES**<br>**Collections**: Arrays – 2D Arrays – String Manipulation. **Structures and Unions**: Definition - declaration - accessing members - differences between structures and unions - applications.<br><br>**Practical Component**<br>Programs on Arrays, Structures, Union, | **10 Hours**<br><br><br><br>**6 Hours** |
| **POINTERS AND FUNCTIONS**<br>**Pointers**: Definition - declaration - pointer arithmetic - pointers and arrays.<br>**Functions**: Definition - declaration - types of functions (user-defined, library functions) - parameter passing (by value, by reference) pointers and functions, recursion.<br><br>**Practical Component**<br>Pointers and Functions. Additional programs on Files to be discussed. | **10 Hours**<br><br><br><br><br>**6 Hours** |

| Theory Hours: 45 | Tutorial Hours: 0 | Practical Hours: 30 | Project Hours: 0 | Total Hours: 75 |
|---|---|---|---|---|

**Learning Resources**

**Textbooks:**


1. Kanetkar, Yashavant. Let Us C. BPB Publications, New Delhi (2023).
2. Rajaraman, V. Fundamentals of Computers. PHI Learning, New Delhi (2020).
3. Dromey, R.G. How to Solve it by Computer. Prentice Hall International, New York (2008).


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## Reference


1. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. Introduction to Algorithms. MIT Press, Cambridge (2022).
2. Balagurusamy, E. Programming in ANSI C. McGraw Hill Education, New York (2021).
3. Kernighan, Brian W., and Dennis M. Ritchie. The C Programming Language. Prentice Hall, New York (2017).
4. Patterson, David A., and John L. Hennessy. Computer Organization and Design: The Hardware/Software Interface. Morgan Kaufmann, San Francisco (2017).


## Online Resources (Weblinks)

1. https://nptel.ac.in/courses/106105214
2. https://www.coursera.org/learn/computer-fundamentals
3. https://www.khanacademy.org/computing/computer-science/algorithms
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/
5. https://www.geeksforgeeks.org/c-programming-language/

## Assessment (Embedded course)

SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

## Course Curated by

| Expert(s) from Industry | Expert(s) from Higher Education Institution | Internal Expert |
|---|---|---|
| - | - | Dr. S. Kavitha, Department of Information Technology |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

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| 24CSI102 | DIGITAL LOGIC CIRCUITS (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| ES | | SDG | 9 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | understand digital systems, number systems, and Boolean algebra for logic simplification and circuit design. |
| 2 | learn to analyse and design Combinational and Sequential Logic Circuits |
| 3 | explore digital logic families and implement logic circuits using programmable devices. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | comprehend the fundamental concepts of digital number systems, Boolean algebra, and the basic principles of digital circuit design. | U |
| CO2 | develop and implement logic functions using Boolean algebra, optimizing them through simplification and employing combinational circuit components. | Ap |
| CO3 | construct and validate sequential circuits, such as flip-flops, counters, and shift registers, and integrate these into larger digital systems. | Ap |
| CO4 | develop combinational logic circuits using programmable logic devices. | Ap |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | | | | | | | | |
| 2 | | | 3 | | | | | | | | | 3 | |
| 3 | | | 3 | | | | | | | | | 3 | |
| 4 | 3 | 2 | | | | | | | | | | | |

## Course Content

**OVERVIEW OF DIGITAL SYSTEMS AND BOOLEAN ALGEBRA** — **7 Hours**

Introduction to Digital Systems - Analog vs. Digital Signals – Digital System Design Process- Number base conversions, complements, signed binary numbers – Binary codes- Boolean Algebra and its properties, Boolean functions, Simplification of Boolean functions using Boolean algebra- Canonical and standard forms.

**Practical Component** — **4 Hours**

Study of logic gates

1. Implement Boolean functions using logic gates and validate the outputs with truth tables

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| | |
|---|---|
| **COMBINATIONAL LOGIC CIRCUITS**<br>Overview of Digital Logic Circuits - Simplification of four-variable Boolean functions using Karnaugh maps- Realization of logic gates using NAND and NOR gates –Analysis and design of Combinational Logic Circuits -Half adder, Full adder, Half subtractor, Full subtractor-Code converters - Decoders, Encoders - Multiplexers, Demultiplexers.<br>**Practical Component**<br>1. Design and construct half adders, full adders, half subtractors, and full subtractors.<br>2. Create combinational circuits to solve real-world problems.<br>3. Develop a code converter circuit using logic gates.<br>4. Design and implement decoder and encoder circuits.<br>5. Construct multiplexers and demultiplexers and incorporate them into circuit designs. | **8 Hours**<br><br>**14 Hours** |
| **SEQUENTIAL LOGIC CIRCUITS**<br>SR, JK, D, T flip-flops, Edge-triggering and level-triggering - Asynchronous and synchronous counters - Decade counter, Ring counter - Shift registers (SISO, SIPO, PISO, PIPO).<br>**Practical Component**<br>1. Implement and test various types of shift registers.<br>2. Design and build a synchronous and asynchronous counter. | **8 Hours**<br><br>**8 Hours** |
| **LOGIC FAMILIES AND PROGRAMMABLE DEVICES**<br>Introduction to digital logic families, RTL, ECL, TTL and CMOS - Programmable Logic Devices - Programmable Logic Array (PLA), Programmable Array Logic (PAL) - Implementation of combinational logic circuits using PLA and PAL.<br>**Practical Component**<br>1. Study of VHDL models for combinatorial circuits. | **7 Hours**<br><br>**4 Hours** |

| Theory Hours: 30 | Tutorial Hours: 0 | Practical Hours: 30 | Project Hours: 0 | Total Hours: 60 |
|---|---|---|---|---|

## Learning Resources

### Textbooks:

1. M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson, 2018.

### References:

1. C. H. Roth Jr., Larry L. Kinney "Fundamentals of Logic Design", 7th Edition, Cengage Learning, 2014.
2. John F. Wakerly, "Digital Design: Principles and Practices", 5th Edition, Pearson, 2018.
3. Donald P leach, Albert Paul Malvino, Goutam Saha, "Digital Principles and Application", 8th Edition, McGraw Hill education Private Limited, 2015.
4. Clive Woods, Brian Holdsworth, "Digital Logic Design", 4th Edition, O'Reilly Media, 2002.
5. Donald D.Givone, "Digital Principles and Design", 7th Edition, McGraw Hill, 2010.

### Online Resources (Weblinks)

1. Digital Systems: From Logic Gates to Processors | Coursera
2. Digital Logic Circuits and Design | Udemy
3. Digital Electronic Circuits - Course (nptel.ac.in)

## Assessment (Embedded course)

SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

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| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | | **Internal Expert(s)** |
| | | | Ms. C. Bharathipriya, AP-II<br>Ms. P. Anitha, AP-I<br>Department of Computer Science and Engineering |
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24HST101 | தமிழர் மரபு / HERITAGE OF TAMILS (Common to all Departments) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 0 | 1 |
| HS | | SDG | 4, 11, 16 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | தமிழ் மொழி மற்றும் இலக்கியத்தின் அடிப்படை அம்சங்களை அறிமுகப்படுத்துதல், அதன் தொன்மைக்காலம் முதல் நவீனகாலம் வரையிலான வளர்ச்சியை விளக்கம் செய்யுதல்.<br>Introduce students to the foundational aspects of Tamil language and literature, tracing its evolution from ancient to modern times. |
| 2 | தமிழகத்தின் செழுமையான கலாச்சார பாரம்பரியத்தை அறிமுகப்படுத்துதல், பாறை ஓவியக் கலையிலிருந்து நவீன சிற்ப கலையின்படி அதன் கலை வெளிப்பாடுகளை ஆராய்தல்.<br>Familiarize students with the rich cultural heritage of Tamil Nadu, exploring its artistic expressions from rock art paintings to contemporary sculptures. |
| 3 | தமிழகத்தின் நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகளை அறிதல்- தினணக்கோட்பாடுகளை ஆராய்தல்- இந்திய தேசிய இயக்கத்தில் தமிழர்களின் பங்கினை அறிதல்.<br>To know the folk arts and heroic ames of Tamilnadu-explore the concept of thinai -to know the role of Tamils in Indian National movement. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | தமிழ் மொழி மற்றும் இலக்கியத்தின் அடிப்படை அறிவை மேம்படுத்துதல். மொழி பண்பாட்டில் எவ்வாறு இணைந்துள்ளது என்பதை உணர்தல்.<br>Enhance the fundamental knowledge of Tamil language and literature | U |
| CO2 | பழங்கால பாறை ஓவியங்கள், சிற்பம் என கலைகள் நவீன காலம்வரை எவ்வாறு பயணிக்கிறது என்பதை புரிந்துகொள்ளுதல்.<br>Understand the heritage, rock art paintings to modern art sculpture | U |
| CO3 | நாட்டுப்புறக் கலைகள் தற்காப்புக் கலைகளாகவும், உடல் ஆரோக்கியத்தை மேம்படுத்தும் விதமாகவும் அமைவதை அறிந்து கலைகள் மீதான ஆர்வத்தை அதிகரிக்கச் செய்தல்- தமிழர்களின் அகத்திணை, புறத்திணை கோட்பாட்டினை புரிந்து கொள்ளுதல். இந்திய பண்பாட்டில் தமிழர்களின் பங்களிப்பை அறிதல்.<br>Acquire essential knowledge in the folk and martial arts-understanding the Agam and puram concept- to know the contribution of Tamils in Indian culture. | Ap |

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| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | | | | | | | 3 | 2 | 2 | | 2 | | |
| 2 | | | | | | | 3 | 3 | 2 | | 2 | | |
| 3 | | | | | | | 3 | 2 | 2 | | 2 | | |

## Course Content

| | |
|---|---|
| **மொழி மற்றும் இலக்கியம்**<br>இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தொடக்கம் -பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.<br><br>**LANGUAGE AND LITERATURE**<br>Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan. | **3 Hours** |
| **மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை**<br>நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புற தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.<br>**HERITAGE – ROCK ART PAINTINGS TO MODERN ART SCULPTURES**<br>Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils. | **3 Hours** |
| **நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்**<br>தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள். | **3 Hours** |

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| **FOLK AND MARTIAL ARTS**<br>Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Ciabatta, Valari, Tiger dance - Sports and Games of Tami | |
| **தமிழர்களின் திணைக்கோட்பாடுகள்**<br>தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பொடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் தமிழர்களின் வெற்றி.<br>**THINAI CONCEPTS OF TAMIL**<br>Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas. | **3 Hours** |
| **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு**<br>இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.<br>**CONTRIBUTIONS OF TAMIL TO INDIAN NATIONAL MOMENT AND INDIAN CULTURE**<br>Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books. | **3 Hours** |

| Theory Hours: 15 | Tutorial Hours: 0 | Practical Hours: 0 | Project Hours: 0 | Total Hours: 15 |
|---|---|---|---|---|

**Learning Resources**

**Reference books:**


1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Textbook and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)


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| Online Educational Resources: |
|---|
| 1. https://www.youtube.com/watch?v=IKPwEmsmuZc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e<br>2. https://www.youtube.com/watch?v=j6_ddjn_gLc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e&index=2<br>3. https://docs.google.com/presentation/d/1pf0jbyuDTNdvlcKMnOfoPjbqha7JqdOc/edit#slide=id.p1<br>4. https://www.youtube.com/watch?v=IKPwEmsmuZc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e&index=1 |

| Assessment (Theory course) |
|---|
| SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Assignments, Quiz, Library Record |

| Course Curated by | | | |
|---|---|---|---|
| **Expert from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert** | |
| Mr.Vijayan Ramanathan ,<br>Project manager,<br>Toppan Merrill. Technologies,<br>Coimbatore | Dr. Aninditha Sahoo,<br>IIT, Madras<br>Dr.P.R.Sujatha Priyadharshini,<br>Anna University, Chennai<br>Dr. E. Justin Ruben,<br>CIT, Coimbatore | Suriya Prakash<br>Department of Language | |
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24INP102 | INNOVATION PRACTICUM – 1<br>(Common to all Departments) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 0 | 1 |
| ES | | SDG | 9, 11, 12 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | analyse the effectiveness of systems thinking and problem-solving methodologies in applying data-driven insights for innovative solution design. |
| 2 | evaluate the impact of transdisciplinary collaboration on creating functional hardware prototypes through fabrication techniques. |
| 3 | understand the future trends and implications of technology in developing innovative products. |

## Course Outcomes:

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | recall the fundamental principles of custom hardware design. | R |
| CO2 | understand the appropriate tools and their applications for solving hardware-related problems. | U |
| CO3 | apply systems engineering concepts to real-world hardware design challenges. | Ap |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | 2 | | 1 | | | | | | | | | | |
| 2 | 2 | | | | 1 | | | | | | | | |
| 3 | | 2 | 2 | 1 | | | | | | | | | |

## Course Content

| | |
|---|---|
| **Engineering Fundamentals and Innovation**<br>Why engineering? The concept of street fight engineering - Real-world design process and problem-solving methodology - Data-driven insights and concept generation - Case studies of successful engineering innovations. | **3 Hours** |
| **Transdisciplinary Systems and Manu'Futuring**<br>Transdisciplinary systems to accelerate innovation - Manu'Futuring: Technology in hardware manufacturing and manufacturing of hardware technologies - Future scopes with product case studies. | **6 Hours** |
| **Building Custom Hardware**<br>How to build a basic custom hardware - Electronics fundamentals and components - Software for hardware control - Fabrication techniques. | **6 Hours** |
| **System Thinking and Engineering**<br>Introduction to system thinking - Real world as a system - Concept of system engineering and its application – iLenSys. | **7 Hours** |

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| | |
|---|---|
| **Creativity Time and Tech Teardown**<br>Creativity exercise: Apply system thinking to a real-world problem - Tech teardown: Analyse a product or system to understand its engineering principles - Presentation: Present your creative project and tech teardown with an engaging title | **8 Hours** |

| Theory | Tutorial | Practical | Project | Total |
|---|---|---|---|---|
| Hours: 0 | Hours: 0 | Hours: 30 | Hours: 0 | Hours: 30 |

**Learning Resources**

**Textbooks:**

1. Sanjoy Mahajan - Street Fighting Mathematics
2. Donald Knuth - The Art of Computer Programming
3. Think like a programmer: An introduction to creative problem solving
4. Thinking in Systems: A Primer

**References:**

1. Learning to code: How to think like a programmer
2. How to find innovative ideas: Ramesh Raskar's note
3. Case study: How Tesla changed the auto industry
4. Ultimate Guide: How to develop a new electronic hardware product

**Online Resources (Weblinks)**

1. https://www.ifixit.com/Teardown?srsltid=AfmBOorwzDG9RhJoL3L5tlZ_Dr4sVcey-vPC-pkKTj2E0mWJWtFYlikY
2. https://www.symmetryelectronics.com/technology-teardowns/

**Assessment (Practical course)**

Lab Workbook, Experimental Cycle tests, viva-voce

**Course Curated by**

| Expert from Industry | Expert from Higher Education Institutions | Internal Expert |
|---|---|---|
| Dr. Mahesh Veezhinathan<br>Director - Innovation Practicum<br>Associate VP - Forge. Innovation | - | Dr. Samuel Ratna Kumar P S<br>Assistant Professor – III<br>Department Mechanical Engineering |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 17.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24HSP111 | HOLISTIC WELLNESS-1<br>(Common to all Department) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 0 | 1 |
| HS | | SDG | 2, 3 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | introduce first-year students to the foundational concepts of holistic wellness, emphasizing the integration of physical, mental, emotional, and Internal well-being. |
| 2 | create a balanced lifestyle that promotes overall health and happiness through practical activities. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO 1 | understand the basic principles of holistic wellness. | U |
| CO 2 | apply strategies for maintaining physical health, including nutrition and exercise | Ap |
| CO 3 | practice mindfulness techniques to enhance mental and emotional well-being. | Ap |
| CO 4 | develop a personal wellness plan incorporating various aspects of holistic health. | C |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | | | | | | 2 | | 1 | | | | | |
| 2 | | | | | | 2 | | | | | | | |
| 3 | | | | | | 1 | | | | | 3 | | |
| 4 | | | | | | 2 | | | | | 3 | | |

## Course Content

| | |
|---|---|
| **INTRODUCTION TO HOLISTIC WELLNESS:**<br>• Overview of holistic wellness: physical, mental, emotional, and internal health.<br>• The importance of balance in overall well-being.<br>• Hands-on activity: Self-assessment of current wellness status. | **4 Hour** |
| **PHYSICAL WELLNESS:**<br>• Importance of physical activity and exercise.<br>• Understanding nutrition and its role in health.<br>• Sleep hygiene and its impact on well-being.<br>• Hands-on activity: Designing a personalized fitness and nutrition plan. | **14 Hours** |
| **MENTAL AND EMOTIONAL WELLNESS:**<br>• Stress management techniques.<br>• The role of Yoga, mindfulness and meditation in mental health.<br>• Emotional intelligence and its impact on relationships. | **6 Hours** |

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| | |
|---|---|
| • Hands-on activity: Practicing Yoga, mindfulness and emotional regulation exercises. | |
| **INTERNAL WELLNESS:**<br>• Exploring the concept of Internal wellness.<br>• The role of purpose and meaning in life.<br>• Introduction to meditation and reflective practices.<br>• Hands-on activity: Developing a personal reflection, Yoga and meditation routine. | **4 Hours** |
| **INTEGRATING WELLNESS PRACTICES:**<br>• Combining physical, mental, emotional, and Internal wellness practices into daily life.<br>• Developing a balanced wellness plan.<br>• Hands-on activity: Creating a comprehensive personal wellness plan. | **2 Hours** |

| Theory Hours: 0 | Tutorial Hours: 0 | Practical Hours: 30 | Project Hours: 0 | Total Hours: 30 |
|---|---|---|---|---|

## Learning Resources

### Textbooks:

1. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
2. Rosenberg, Marshall Bertram., Nonviolent Communication: A Language of Life., Puddle Dancer Press, Encinitas, CA (2015).

### References:

1. B.K.S Iyengar., Yoga: The Path to Holistic Health., Dorling Kindersley Limited, City of Publication (2001)
2. Goleman Daniel., Emotional Intelligence., Bloomsbury India, India, (2021).
3. James Allen., As a Man Thinketh., Maple Press, Noida, (2010)
4. Swami Budhanandha., Will power and its development., Advaita Ashrama Mayavati, Pithoragarh, Himalayas from its Publication Department, Calcutta. (2001)
5. Kalderdon Adizes Ichak., What Matters in Life: Lessons I Learned from Opening My Heart ., WS Press, Newtown, PA (2023)

### Online Resources (Weblinks)

1. Learning Suryanamskar
2. Yoga for well-being
3. Nutritional Educational contents
4. Introduction to Psychology
5. Guided Meditation
6. Simplified physical exercises instructions
7. Simplified Physical Exercises
8. Life skills and value education
9. James Allen Library

### Assessment (Practical course)

Participation, Practical activities and assignments, personal wellness plan and reflection.

### Course Curated by

| Expert(s) from Industry | Expert(s) from Higher Education Institution | Internal Expert(s) |
|---|---|---|
| | | Dr. Ezhilarasi, Principal- KCT |
| **Recommended by BoS on** | 16.08.2024 | |
| **Academic Council Approval** | No: 27 | **Date** 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 4CSV001 | EMERGING DOMAINS (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 | 0 |
| VA | | SDG | 3, 9, 12, 15 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

**Course Objectives:**

The purpose of taking this course is to:

| | |
|---|---|
| 1 | provide students with a comprehensive understanding of how emerging technologies like AI, IoT, blockchain, big data, and automation are revolutionizing various industries. Focusing on sectors such as agriculture, education, healthcare, gaming, music, law, and textiles, the course explores the application of these technologies to develop innovative solutions that enhance productivity, sustainability, and user engagement. Students will analyze the impact of digital tools on transforming key sectors and evaluate strategies to improve operational efficiency, creativity, and adaptability. Additionally, the course examines the disruption of traditional business models by these technologies, equipping students with the skills to leverage these changes for innovation and competitiveness in a rapidly evolving landscape. |

**Course Outcomes**

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | understand the role of digital tools in education and healthcare for enhancing user engagement and fostering innovation. | U |
| CO2 | outline the role of technologies in enhancing agricultural practices to demonstrate how these technologies can improve productivity and sustainability in farming. | U |
| CO3 | relate the key technological applications of emerging domains that enhance operational efficiency and creativity. | R |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | | |
| 1 | 1 | | | | | 2 | | 2 | 3 | | 2 | | |
| 2 | 2 | | | | | 3 | | 2 | 3 | | 3 | | |
| 3 | 2 | | | | | 3 | | 2 | 3 | | 3 | | |

## Course Content

| | |
|---|---|
| **EDUCATION**<br>LMS – LCMS – MOOC - Coursera equivalent for Indian languages - LLMs for educational content & answering queries of learners - Multiple Intelligence skills - Information Communication Technologies (ICT) - smart class rooms, Attendance management - Library Systems - use of LLMs to scan through books and respond to learner queries - Educational Software - Assessment software student learning progression - Social media for learning language learning apps - Making learning accessible to all - apps for social teaching - Direction for learning to attain learning outcomes - Connecting learning with opportunities | **3 Hours** |

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| | |
|---|---|
| **AGRICULTURE (CROPS, DAIRY, POULTRY)**<br>Role of Agriculture in Indian Economy - Soil health and fertility management - Investment and Innovation in Agriculture - Government policies and subsidies for agriculture - Role of startups and agritech companies - Innovations in crop production, dairy, and poultry farming - Challenges in traditional farming methods - Integrating technology for sustainable agriculture - Mobile Apps for Agriculture - Digital marketplaces for agricultural products - Precision Farming - IoT in Agriculture - Drones in Agriculture - Aerial spraying of pesticides and fertilizers - Livestock monitoring and management with drone technology - Cloud Computing in Agriculture - Applications of Blockchain in Agriculture - Ensuring transparency and traceability in the supply chain - Blockchain for smart contracts and payments in agriculture. | **6 Hours** |
| **HEALTHCARE - CLINICAL, PHARMACEUTICAL, MENTAL HEALTH AND REHABILITATION**<br>eHealth-Types of records in healthcare: EHR, EMR, PHR - Generative AI in healthcare - Telemedicine - Wearable IoT in Healthcare - Upgrading the legacy software and data security - Future trends and their Examples - Diabetics and pharmaceutical drugs - Digital twins in healthcare - Phases of clinical trial and their frameworks | **6 Hours** |
| **ROLE OF AI**<br>**AI in Music:** Composition and Production - Sound Design and Mixing - Music Recommendation - Personalized Learning - Rights Management and Copyright<br>**AI in Law:** Legal Research - Contract Analysis and Drafting - Predictive Analytics - Document Automation - Compliance Monitoring<br>**AI in Textiles:** Design and Trend Prediction - Quality Control - Supply Chain Optimization - Personalization and Customization - Sustainability | **6 Hours** |
| **GAMING**<br>Introduction to Gaming and Game design - Game Development Tools and Engines - Graphics and Animation in Games - Artificial Intelligence in Games - Game Programming Usecases - Virtual and Augmented Reality - The Future of Gaming and Emerging Technologies - Job Market and gamification. | **3 Hours** |
| **TAMIL COMPUTING**<br>Introduction to types of AI - Data and Domain - Types of Models - Foundation Models (LLM) - Solving Usecases - Natural Language Processing - NLP Applications - NLP Pipeline - NLP Preprocessing - Why Tamil AI? - Building Tamil AI – Necessities - Data Curation Challenges - Data Curation Framework - Core Components - Models for Tamil - Generative AI: Research Directions - Limitations of Generative AI - Role of the community. | **6 Hours** |

| | | | | |
|---|---|---|---|---|
| **Theory Hours: 30** | **Tutorial Hours:** | **Practical Hours:** | **Project Hours:** | **Total Hours: 30** |

| **Learning Resources** |
|---|
| **Online Resources (Weblinks)** |
| 1. Get Interactive: Practical Teaching with Technology \| Coursera<br>2. What future for education? \| Coursera<br>3. Sustainable Agricultural Land Management \| Coursera<br>4. IoT Enabled Farming \| Coursera<br>5. Introduction to Healthcare \| Coursera<br>6. Game Design and Development 4: 3D Platformer \| Coursera |

| **Assessment** |
|---|
| MCQ (10 questions) on every domain in Coursera / Poster Presentation. |

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| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | | **Internal Expert(s)** |
| - | - | | Dr. K. Saranya,<br>Mr. V. Senthilkumar,<br>Dr. N. Jeba,<br>Department of Computer Science and Engineering<br>Ms. G. Shobana,<br>Department of IT,<br>Ms. P. R. Rupashini,<br>Ms. G. Preethi,<br>Department of AI&DS |
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

# Semester – II

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| 24HSP005 | MASTERING CONVERSATIONS (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 0 | 1 |
| HS | | SDG | 4, 8 | | | |

| Pre-requisite courses | - | Data Book / Codes books (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | demonstrate understanding of different perspectives by analyzing complex personal and professional situations. |
| 2 | engage in thoughtful dialogue and discussions about complex, real-world issues, utilizing critical thinking to assess different viewpoints. |
| 3 | apply role-playing as a tool to enhance understanding of workplace dynamics, conflict resolution, and team collaboration. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO 1 | empathize with and understand people in both professional and personal contexts, reflecting on situations from multiple perspectives and participating in activities that mirror career-related scenarios | Ap |
| CO 2 | analyze and converse critically on complex subjects, demonstrating the ability to approach and deal with various social contexts effectively | An |
| CO 3 | exhibit skills in role-playing and enacting given situations to navigate diverse social interactions and career-related contexts. | C |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | | | | | | 3 | | | 3 | 2 | 3 | | |
| 2 | | | | | | | | | 1 | 2 | | | |
| 3 | | | | | | | | | 3 | 2 | | | |

## Course Content

| | |
|---|---|
| **Practical Component / Roleplays Dynamics**<br>Introduction to Role play - Benefits of role plays - Importance of gesture, tone and modulation-Skill development through role play activities - Types of role plays - Conversation Building through communicative functions-Initiating a dialogue- Framing questions- Receiving feedback | **6 Hours** |

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| | |
|---|---|
| | |
| **Practical Component /Roleplays on Social Skill**<br>Social Interactions: - (Ordering food at a restaurant- Making a reservation at a hotel-- Shopping at a store-- Attending a party or social gathering)<br>Travel and Tourism:(Asking for directions- Booking a flight or hotel-- Exploring a new city- Interacting with local people)<br>Community and Volunteering:(Participating in a charity event- Volunteering at a local organization- Discussing community issues- Organizing a community project) | **6 Hours** |
| **Practical Component / Roleplays on Education and Technology**<br>Education and Personal Growth:(Setting goals- (Short term & Long term)- Creating a study plan- Participating in a workshop- Reflecting on personal growth)<br>Technology and Online Interactions:(Participating in an online meeting- Creating a social media post- Writing an email or text message- Making an online purchase)<br>Technology and Science:(Explaining a scientific concept- Discussing emerging technologies- participating in Hackathons- Presenting a research paper) | **6 Hours** |
| **Practical Component / Roleplays on Strategic Insights**<br>Critical Thinking :(Evaluating a news article-solving a moral dilemma-Decision with incomplete information-Assessing a historical event)<br>Problem-Solving:(Resolving a conflict- Negotiating a deal - Making a complaint-Apologizing for a mistake)<br>Business and Entrepreneurship:(Pitching an idea- Negotiating a contract- Conducting a market Research- Presenting a product launch) | **6 Hours** |
| **Practical Component / Roleplays on Cultural Exchange**<br>Cultural Exchange:(Sharing customs and traditions- Discussing cultural differences-Exploring historical events- Participating in a cultural festival)<br>Media and Entertainment:( Event planning- Creating an advertisement-Digital Marketing-Conducting interviews- Creating news broadcast- Writing and Performing a script- Enacting one act plays)<br>Arts and Culture:(Visiting an art gallery - Attending/ organizing a concert or play - Discussing literature- Creating a piece of art) | **6 Hours** |
| **Theory Hours: 0** **Tutorial Hours: 0** **Practical Hours: 30** **Project Hours: 0** **Total Hours: 30** | |

**Learning Resources**

**Reference books**


1. Bonwell, C. C., & Eison, J. A. (1991). Active learning: Creating excitement in the classroom. Washington, DC: The George Washington University.
2. Harbour, E., & Connick, J. (2005). Role playing games and activities rules and tips. Retrieved from https://www.businessballs.com/roleplayinggames.htm
3. Lebaron, J., & Miller, D. (2005). The potential of jigsaw role playing to promote the social construction of knowledge in an online graduate education course. Retrieved from http://paws.wcu.edu/jlebaron/Jigsaw-FnlTCRpdf_050812.pdf
4. Davies, A. (2018). Teaching and learning through role-play: A practical guide. Maidenhead, UK: McGraw-Hill Education.
5. Young, K. C. (2016). The art of role play: Developing realistic scenarios for skill development. Boston, MA: Pearson.
6. Yardley-Matwiejczuk, K. M. (1997). Role play: Theory and practice. London, UK: SAGE Publications Ltd.


**Online Resources (Weblinks)**

1. https://www.niu.edu/citl/resources/guides/instructional-guide
2. https://positivepsychology.com/role-playing-scripts/

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| Assessment (Practical course) |
|---|
| Lab Workbook, Experimental Cycle tests, Quizzes and written assignments, Participation in group activities |

| Assessment | |
|---|---|
| Formative | Summative |
| Assignments / Mini project, Quiz, Lab | Quizzes and written assignments, Participation in group activities |

| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert(s)** | |
| Mr.Vijayan Ramanathan, Project manager, Toppan Merrill. Technologies, Coimbatore | Dr. Aninditha Sahoo, IIT, Madras<br>Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai<br>Dr. E. Justin Ruben, CIT, Coimbatore | Dr. Arokia Lawrence Vijay<br>Dr. Tissaa Tony<br>Department of English | |
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No:27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24MAI124 | MULTIVARIATE CALCULUS AND FORECASTING (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| BS | | SDG | 7, 9 | | | |

| Pre-requisite courses | 24MAI114/ Applied Linear Algebra and Calculus | Data Book / Codes books (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | understand the techniques of evaluating double and triple integrals and applying them to calculate areas and volumes. |
| 2 | familiarize students with vector field concepts such as gradient, divergence, and curl, and apply the theorems of Green, Gauss, and Stokes. |
| 3 | develop an understanding of the least squares method for fitting various types of curves and its application in forecasting. |
| 4 | equip students with knowledge of time series analysis, including construction, trend measurement, and seasonal variation determination. |
| 5 | introduce students to numerical methods such as interpolation, numerical differentiation, and numerical integration. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO 1 | apply double and triple integrals with constant and variable limit concepts to compute areas and volumes in cartesian coordinates. | Ap |
| CO 2 | calculate gradient, divergence, and curl, and verify Green's theorem, Gauss's divergence theorem, and Stokes' theorem in a given vector field. | Ap |
| CO 3 | assess the reliability of predictions using goodness-of-fit measures like $R^2$, RMSE, MAE, and MAPE for the method of least squares to fit linear, parabolic, cubic, and non-linear curves. | An |
| CO 4 | analyze time series data, and measure trends using methods like moving averages and assess seasonal variations through appropriate techniques. | An |
| CO 5 | apply Newton's interpolation techniques for both forward and backward interpolation, perform numerical differentiation. | Ap |
| CO 6 | apply the concepts of Trapezoidal and Simpson's rules for numerical integration. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO1 | PSO 2 |
| 1 | 2 | 2 | | | 2 | | | | | | | | |
| 2 | 2 | | 2 | | 2 | | 2 | | | | | | |
| 3 | 2 | | | 2 | 2 | | | | | | | | |
| 4 | | 2 | | 2 | 2 | | | | | 2 | | | |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 2 | | | 2 | 2 | | | | | | | | |
| 6 | 2 | | | 2 | 2 | | | | | | | | |

| Course Content | |
|---|---|
| **MULTIPLE INTEGRALS**<br>Double integration – Cartesian coordinates – Change of order of integration – Triple integration in Cartesian coordinates –Area as double integral and Volume as triple integral.<br><br>**Practical Component**<br>• Double and triple integration with constant and variable limits.<br>• Area as double integral and volume as triple integral. | **9 Hours**<br><br>**6 Hours** |
| **VECTOR CALCULUS**<br>Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (Only statements excluding proofs)<br><br>**Practical Component**<br>• Evaluation of gradient, divergence, and curl<br>• Verification of Green's theorem in the plane | **9 Hours**<br><br>**6 Hours** |
| **CURVE FITTING AND FORECASTING**<br>Method of least squares – Fitting a linear curve, second-degree parabolic curve, cubic curves and non-linear curves of the form $y= ae^{bx}$ , $y= ab^{x}$, $y = ax^{b}$ by the method of least squares – Forecasting Using Fitted Curves – Assessing the reliability of predictions using goodness-of-fit measures such as $R^2$, Adjusted $R^2$, RMSE (Root Mean Square Error), MAE (Mean Absolute Error), and MAPE (Mean Absolute Percentage Error).<br><br>**Practical Component**<br>• Fitting polynomials curve by Least Square method.<br>• Fitting non-linear curves by Least Square method. | **9 Hours**<br><br>**6 Hours** |
| **TIME SERIES**<br>Time series – Components of Time series – Construction of Time series – Measurement of Trend: Determination of trend by moving averages – Measurement of Seasonal Variations: Method of Simple Average, Ratio to Trend Method and Ratio to moving average method.<br><br>**Practical Component**<br>• Time series construction and Measurement of Trend by Moving Averages.<br>• Simple Average, Ratio to Trend Method and Ratio to Moving Average Method to determine seasonal variations in a time series dataset | **9 Hours**<br><br>**6 Hours** |
| **NUMERICAL DIFFERENTIATION AND INTEGRATION**<br>Interpolation – Newton's forward and backward interpolation – Newton's divided difference interpolation –Numerical differentiation by using Newton's forward, backward and divided differences – Numerical integration by using Trapezoidal and Simpson's 1/3rd and 3/8th rules<br><br>**Practical Component**<br>• Numerical Differentiation - Newton's divided differences.<br>• Numerical Integration using Trapezoidal and Simpson's rule. | **9 Hours**<br><br>**6 Hours** |

| Theory | Tutorial | Practical | Project | Total |
|---|---|---|---|---|
| Hours: 45 | Hours: 0 | Hours: 30 | Hours: 0 | Hours: 75 |

Signature of BOS Chairman-CSE

## Learning Resources

### Textbooks


1. Kreyzig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley and sons, 2023
2. A. Montgomery D.C., Johnson. L.A., Gardiner J.S., "Forecasting and Time series Analysis", McGraw Hill, 1990
3. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 7th Edition, Pearson Education Asia, New Delhi
4. Numerical Methods for Scientific and Engineering Computation by M.K. Jain, S.R.K.Iyengar and R.K. Jain, New Age International Publishers 2007.
5. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", 11th extensively revised edition, Sultan Chand & Sons, 2007.


### Reference books


1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2014.
2. Weir, MD, Hass J, Giordano FR: "Thomas' Calculus", Pearson Education, 15th Edition, 2023
3. Kandasamy P., Thilagavathy K. and Gunavathy K., "Numerical Methods", S. Chand Co. Ltd., New Delhi, 2007.
4. David C. Lay, "Linear Algebra and its Applications", Pearson Education Asia, New Delhi, 6th Edition, 2021
5. Anderson, T. W, "An Introduction to Multivariate Statistical Analysis", John Wiley and Sons, 2003.


### Online Resources (Web Links)

1. **Double and Triple Integrals** (Khan Academy): https://www.khanacademy.org/math/multivariable-calculus/integrating-multivariable-functions
2. **Gradient, Divergence, and Curl** (Paul's Online Math Notes): http://tutorial.math.lamar.edu/Classes/CalcIII/CalcIII.aspx
3. **Method of Least Squares and Curve Fitting** (Wolfram MathWorld): https://mathworld.wolfram.com/LeastSquaresFitting.html
4. **Introduction to Time Series Analysis** (Coursera - University of London): https://www.coursera.org/learn/time-series-analysis
5. **Numerical Integration (Trapezoidal and Simpson's Rule)** (Khan Academy): https://www.khanacademy.org/math/ap-calculus-bc/bc-integration-new/bc-6-14/a/numerical-integration

## Assessment

SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

## Course Curated by

| Expert(s) from Industry | Expert(s) from Higher Education Institution | Internal Expert(s) |
|---|---|---|
| Mr. Ramesh V.S.,<br>STEPS Knowledge Services Private Limited, Coimbatore.<br>Mr. Jayakumar Venkatesan,<br>Valles Marineris International Private Limited- Chennai.<br>Mr. Imran Khan,<br>GE Transportation Company, Bangalore | Dr.T. Govindan,<br>Government College of Engineering, Srirangam, Trichy.<br>Dr.C. Porkodi,<br>PSG College of Technology, Coimbatore.<br>Dr.P. Paramanathan,<br>Amrita Vishwa Vidyapeetham, Coimbatore. | Dr. Vijeta Iyer<br>Dr.K.P. Thilagavathy<br>Ms. Princy Flora<br>Department of Mathematics |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24CSI103 | COMPUTER GRAPHICS (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| BS | | SDG | 9 | | | |

| Pre-requisite course | 24PHI101/Applied Physics for Computing | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | identify and differentiate between various types of 2D graphics, including raster and vector formats. |
| 2 | apply key design principles to create and manipulate vector graphics using industry-standard tools. |
| 3 | explain the stages of the 3D graphics pipeline, from modelling to rendering. |
| 4 | demonstrate proficiency in 3D object manipulation and sculpting by creating fully rendered 3D models. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO 1 | develop a comprehensive understanding of 2D and 3D graphics principles by creating a project that integrates graphics and basic 3D models. | U |
| CO 2 | apply graphics software tools to create and manipulate 2D and 3D graphics and understand the various techniques for 3D modelling. | Ap |
| CO 3 | apply advanced design principles and techniques to develop aesthetically pleasing and functional graphic compositions, in both 2D and 3D environments. | Ap |
| CO 4 | analyse and evaluate the effectiveness of graphic designs by assessing the application using Modelling and sculpting. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | | | | | | | | | | | |
| 2 | 3 | 2 | | | 3 | | | | | | | 2 | |
| 3 | | | 1 | | 3 | | | | | | | 3 | |
| 4 | 3 | 2 | | | 3 | | | | | | | 3 | |

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| Course Content | |
|---|---|
| **Concepts of 2D Graphics and Digital Imaging**<br>Importance of 2D Graphics Types of 2D Graphics: Raster vs. Vector, Introduction to Graphics Software, Understanding Pixels and Resolution, Color Models: RGB, CMYK, Grayscale, Common Raster Formats: JPEG, PNG, BMP. | **4 Hours** |
| **Vector Graphics: Design Principles and Techniques**<br>Vector Graphics Basics & Design Principles and Techniques: Vector vs. Raster: Differences and Use Cases, Paths, Anchors, and Control Points, Primary, Secondary, and Tertiary Colours, Color Harmony, Contrast, and Balance, Basics of Typography Fonts, Choosing and Pairing Fonts, Image Cropping, Resizing, and Scaling, Clipping Masks, Filters, and Effects, Working with Transparency and Alpha Channels. Case study: OpenGL and WebGL for graphics.<br>**Practical Component**<br>1. Creating a Pixel Art Character<br>2. Design a Vector Logo<br>3. Apply Image Manipulation Techniques | **8 Hours**<br><br>**8 Hours** |
| **Exploring 3D Graphics: Key Applications and Workflow**<br>Key Applications of 3D Graphics: Games, Animation, VR/AR, Understanding the 3D Pipeline: Modelling, Texturing, Lighting, Rendering, Introduction to 3D Software Tools ,3D Space and Axes: X, Y, Z -Viewports, Cameras, and Perspective in 3D, Navigation Tools: Panning, Zooming, Rotating Views.<br>**Practical Component**<br>1. Create a Custom Texture for a 3D Object | **6 Hours**<br><br>**4 Hours** |
| **3D Object Manipulation and Transformation Techniques**<br>Working with Objects and Transformations, Types of 3D Objects: Primitives (Cube, Sphere, Cylinder, etc.), Basic Object Manipulation: Move, Rotate, Scale, Understanding Local vs. Global Transformations – Mesh-Faces, Edges, and Vertices - Editing Meshes: Edit Mode vs. Object Mode - Extrusion, Loop Cuts, and Extrusion tools.<br>**Practical Component**<br>1. Model a Simple Object Using Primitives<br>2. Extrude and Shape a Simple 3D Model | **6 Hours**<br><br>**8 Hours** |
| **Advanced 3D Modeling, Sculpting, and Texturing Methods**<br>Modelling & Sculpting, Modifiers: Subdivision Surface, Mirror, Solidify, Using Modifiers for Efficient Modelling, Combining Modifiers to Create Complex Shapes, Basic Sculpting Tools and Brushes, Use Sculpting vs. Traditional Modelling. Materials: Basic Shaders: Diffuse, Glossy, and Transparency, Applying and Editing Basic Materials on Objects Mapping, Creating and Editing UV Maps, Applying 2D Textures to 3D Objects.<br>**Practical Component**<br>1. Apply Materials to a 3D Object<br>2. Sculpt a Simple Organic Shape<br>3. Model a Low-Poly Character.<br>4. Create a UV Map for a 3D Object.<br>5. Design and Apply a Texture to a 3D Object | **6 Hours**<br><br>**10 Hours** |

| Theory Hours: 30 | Tutorial Hours: 0 | Practical Hours: 30 | Project Hours: 0 | Total Hours: 60 |
|---|---|---|---|---|

## Learning Resources

### Reference books


1. David J. Eck, Hobart and William Smith," Introduction to Computer Graphics"2016.
2. John M. Blain," Complete guide to blender graphics computer modelling & animation" 2022.
3. Donald Hearn M. Pauline Baker, "Computer Graphics - C Version", 2nd Edition, Pearson Education, 2011.
4. F.S.Hill, "Computer Graphics using OPENGL", Second edition, Pearson Education,2003.


### Online Resources (Web Links)

1. https://www.coursera.org/specializations/game-design-and-development

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| |
|---|
| 2. https://www.coursera.org/learn/biomedvis/home/week/2 |

| **Assessment (Embedded course)** |
|---|
| SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)<br>Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated by** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert(s)** | |
| Ramesh Kumar K<br>Sr.Technical Consultant -Xr<br>Ark Solutions | - | Dr.K.Saranya<br>Department of Computer Science Engineering | |
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No:27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24CSI104 | DATA STRUCTURES AND ALGORITHMS (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| ES | | SDG | 9 | | | |

| Pre-requisite courses | | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | gain a comprehensive understanding of core data structures (arrays, lists, stacks, queues, trees, graphs) and algorithms, and how they are applied in solving computational problems. |
| 2 | develop the ability to analyze and evaluate the time and space complexity of algorithms using notations such as Big O, Big Theta, and Big Omega, helping in making optimal algorithmic choices for different applications. |
| 3 | acquire hands-on skills to implement and manipulate linear and non-linear data structures (linked lists, binary trees, heaps, hash tables) for real-world software development scenarios, improving program efficiency and memory management. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO 1 | understand various data structures and their application as tools for effective problem-solving. | U |
| CO 2 | identify appropriate linear and non-linear data structures to solve specific computational challenges. | Ap |
| CO 3 | analyze the efficiency and effectiveness of different algorithms by examining time and space complexities and evaluate their performance in solving problems. | An |
| CO 4 | develop programs that employ suitable data structures, individually or in combination, to create efficient solutions for complex challenges. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | | | | | | | | | | | |
| 2 | 3 | | | | | | | | | | | 3 | |
| 3 | | | | 3 | | | | | | | | 3 | |
| 4 | | | 3 | | | | | | | | | 3 | |

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| Course Content | |
|---|---|
| **INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS**<br>Introduction to Data Structures and Algorithms, Importance of data structures in programming and software development, data types vs data structures, Abstract Data Types (ADTs), Algorithm analysis: Big O, Big Theta, Big Omega notations<br>**Practical Component**<br>Implementation of List ADT using arrays | **6 Hours**<br><br>**4 Hours** |
| **LINEAR DATA STRUCTURES**<br>Lists: unordered and ordered lists, insertion, deletion and display operations, Stacks: Implementation, Applications in expression evaluation, Queues: Implementation, Variants (Circular Queue, Priority Queue), Applications, Dynamic Memory Implementation: Linked Lists, stack, queue and queues (Single, Double, and Circular linked implementation).<br>**Practical Component**<br>Implement the applications of Linear Data structures | **12 Hours**<br><br>**8 Hours** |
| **NON-LINEAR DATA STRUCTURES**<br>Trees: Binary Trees, Binary Search Trees, AVL Trees, Tree Traversal Algorithms: Inorder, Preorder, Postorder. Heap - Binary Heap, Complete Binary Tree, Tree Representation of Binary Heap, Max Binary Heap, Min Binary Heap, Insertion and Deletion in Binary Heap. Graphs: Terminologies, Representation (Adjacency Matrix, List), Graph Traversal (BFS, DFS), Spanning Trees, Shortest Path Algorithms (Dijkstra, Floyd-Warshall).<br>**Practical Component**<br>Implement the applications of Non-Linear Data structures | **12 Hours**<br><br>**8 Hours** |
| **SORTING AND SEARCHING ALGORITHMS**<br>Sorting Algorithms: Bubble Sort, Selection sort, insertion sort, Merge Sort, Quick Sort, Heap Sort, Searching Algorithms: Linear Search, Binary Search, Jump search, Exponential search and Interpolation search.<br>**Practical Component**<br>Implement the Sorting and searching Algorithms | **12 Hours**<br><br>**8 Hours** |
| **HASHING TECHNIQUES**<br>Hashing: Hash Functions, Collision Resolution Techniques, Linear probing, Quadratic probing, random probing, Double hashing and rehashing, Hashing Applications. Memory Management: Garbage Collection<br>**Practical Component**<br>Implementation of Hash Table | **3 Hours**<br><br>**2 Hours** |

| Theory Hours: 45 | Tutorial Hours: 0 | Practical Hours: 30 | Project Hours: 0 | Total Hours: 75 |
|---|---|---|---|---|

## Learning Resources

### Textbooks


1. Horowitz, Ellis, Sartaj Sahni, and Susan Anderson-Freed. Fundamentals of Data Structures in C. Universities Press, Hyderabad (2021).
2. Tenenbaum, Aaron M., Yedidyah Langsam, and Moshe J. Augenstein. Data Structures Using C. Pearson, New York (2021).
3. Weiss, Mark Allen. Data Structures Using C. Pearson Education Asia, Singapore (2007).


### Reference books


1. Tremblay, Jean Paul, and Paul G. Sorenson. An Introduction to Data Structures with Applications. Tata McGraw-Hill, New Delhi (2014).
2. Mehlhorn, Kurt, and Peter Sanders. Algorithms and Data Structures: The Basic Toolbox. Springer, Berlin (2011).
3. Aho, Alfred V., John E. Hopcroft, and Jeffrey D. Ullman. Data Structures & Algorithms. Pearson Education, New Delhi (2009).


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| Online Resources (Weblinks) |
|---|
| 1. https://open.umn.edu/opentextbooks/textbooks/an-open-guide-to-data-structures-and-algorithms<br>2. https://www.oreilly.com/library/view/data-structures-and/9780133437483/<br>3. https://www.khanacademy.org/computing/computer-science/algorithms<br>4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/<br>5. https://www.geeksforgeeks.org/data-structures/ |

| Assessment (Embedded course) |
|---|
| SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)<br>Lab Workbook, Experimental Cycle tests, viva-voce |

| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert(s)** | |
| | | Dr. S. Kavitha,<br>Department of Information Technology | |
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No:27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24CSI105 | EMBEDDED COMPUTING SYSTEMS (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| ES | | SDG | 9 | | | |

| Pre-requisite course | 24CSI102 - Digital Logic Circuits | Data Book / Code book (If Any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | understand the architecture and design challenges of embedded systems and microprocessors, with a focus on microcontrollers like the 8086 and 8051. |
| 2 | gain expertise in embedded programming techniques, including interrupt handling, firmware development, and sensor integration. |
| 3 | develop practical skills in prototyping embedded systems using real-time operating systems and development boards. |
| 4 | design, implement, and optimize embedded applications by integrating multiple sensors and peripherals for real-world scenarios. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO 1 | understand the fundamental architecture and operation of embedded systems, including the roles and characteristics of microprocessors and microcontrollers. | U |
| CO 2 | apply programming techniques to manage hardware interrupts and control I/O operations. | Ap |
| CO 3 | implement communication protocols and interface microcontrollers with various sensors and peripherals to build functional embedded systems. | Ap |
| CO 4 | experiment with microcontroller architectures and their internal components to design efficient embedded solutions that meet specific requirements. | Ap |
| CO 5 | analyse the effectiveness of embedded system designs through prototype development, sensor fusion techniques, and perform system-level testing for accuracy. | An |

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| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | | | | | | | | | | | |
| 2 | 3 | | | | | | | | | | | | |
| 3 | 3 | | | | | | | | | | | 3 | |
| 4 | | | 3 | | | | | | | | | | |
| 5 | | 3 | | | | | | | | | | 2 | |

## Course Content

| | |
|---|---|
| **FUNDAMENTALS OF EMBEDDED SYSTEMS AND MICROPROCESSOR**<br>Overview of Embedded Systems: Characteristics, system architecture, and design challenges. Introduction to Microprocessors and Microcontrollers- 8086 Microprocessor Architecture-Internal operations - Addressing modes -Instruction formats (Data transfer instructions, Arithmetic instructions, Logical instructions, Branch-and-loop instructions) Interrupts: Software and Hardware interrupts | **9 Hours** |
| **Practical Component**<br>1. Set up a development environment, flash the RTOS onto the microcontroller, and configure basic tasks. Verify the installation by running a simple real-time application.<br>2. Control an I/O connected to a microcontroller | **6 Hours** |
| **MICROCONTROLLER ARCHITECTURE**<br>8051 Microcontroller Architecture- Internal Components- Instruction Set Architecture- I/O Ports and Peripherals- Interrupts and Interrupt Handling - Microcontroller Programming -Interfacing. Automotive-grade microcontrollers, Peripheral Interfaces: Basics of CAN, LIN, SPI, I2C for embedded communication. Introduction to RTOS. Case Study on Embedded Development Boards. | **9 Hours** |
| **Practical Component**<br>1. Interfacing sensor with a microcontroller and display the sensor readings on an LCD.<br>2. Combine data from an accelerometer and gyroscope to estimate the orientation of a device.<br>3. Use interrupts to toggle an LED based on a button press. | **8 Hours** |
| **EMBEDDED PROGRAMMING**<br>Embedded Programming Fundamentals, Bitwise Operations and Port Control, Interrupt Handling, Firmware Development- Writing, testing, and optimizing firmware for embedded systems applications. | **7 Hours** |
| **Practical Component**<br>Develop and optimize firmware for a simple embedded application. | **8 Hours** |
| **SENSOR INTEGRATION**<br>Sensor and Actuators-Overview of temperature sensors, pressure sensors, accelerometers, gyroscopes, and actuators, applications, Sensor Fusion- Techniques for combining data from multiple sensors. System Integration and Case Studies: Developing and testing prototypes using development boards. | **5 Hours** |
| **Practical Component** | **8 Hours** |

**Signature of BOS Chairman-CSE**

| | |
|---|---|
| Design and implement a small embedded system that integrates multiple sensors and communicates with other devices. (Example, a simple weather station that measures temperature, humidity, and pressure, and sends the data to a central system.) | |

| Theory Hours: | 30 | Tutorial Hours: | 0 | Practical Hours: | 30 | Project Hours: | 0 | Total Hours: | 60 |
|---|---|---|---|---|---|---|---|---|---|

## Learning Resources

### Textbooks

1. Raj Kamal, Embedded Systems- Architecture, Programming and Design, 3rd Edition (2017).
2. B. Ram, "Fundamentals of Microprocessors and Microcontrollers," Dhanpat Rai Publications, 7th Edition (2019).

### Reference books

1. K.V. Shibu, Introduction to Embedded Systems, 2nd Edition (2017).
2. Sam Siewert, John Pratt, Real-Time Embedded Components and Systems with Linux and RTOS, 2nd Edition (2016).
3. Sriram Iyer, Pankaj Gupta, Embedded Realtime Systems Programming,1st Edition, (2017).
4. Subrata Ghoshal, Embedded Systems & Robots Projects Using The 8051 Microcontroller, 1stEdition (2009).

## Assessment (Embedded course)

SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

## Course Curated by

| Expert(s) from Industry | Expert(s) from Higher Education Institution | Internal Expert(s) |
|---|---|---|
| | | Mr. Abhijith C Prakash<br>Department of IT |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No:27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24HST102 | தமிழரும் தொழில்நுட்பமும்/ TAMILS AND TECHNOLOGY | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 0 | 1 |
| HS | | SDG | 4, 8 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பத்தை அறிமுகப்படுத்துதல், சங்க கால கட்டிட தொழில்நுட்பத்தை விளக்குதல், கோயில்கள் மற்றும் சிற்பக்கலைகளை ஆராய்தல்.<br>introducing weaving and pottery technology of Tamils -Explaining the building technology of the Sangam Period-Explore temples and sculptures. |
| 2 | கப்பல், இரும்பு, நாணயங்கள், மணி உருவாக்கும் தொழிற்சாலைகள், ஆகியவற்றை விளக்கம் செய்தல், தமிழகத்தின் தொல்லியல் சான்றுகளின் பழமையை உணர்த்துதல்.<br>explain Ship, Iron, Coins, Beads Making Factories. Realizing the Antiquity of Archaeological Evidence of Tamil Nadu |
| 3 | வேளாண்மை மற்றும் அறிவியல் தமிழைப் பற்றி அறிதல், இணையத்தில் தமிழின் தேவையை உணர்த்துதல்,தமிழ் மென்பொருள்களை அறிமுகம் செய்தல்.<br>knowledge of Agricultural and Scientific Tamil, Realizing the need for Tamil on the Internet, Introducing Tamil software. |

## Course Outcomes:

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO 1 | தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பத்தின் முக்கியத்துவத்தினை அறிந்து கொள்ளுதல். சங்ககால தமிழர் வளர்த்த அழகுக் கலைகளைத் தெரிந்து கொள்ளுதல்.<br>know the importance of weaving and pottery technology of Tamils-To know the Aesthetics arts developed by Sangam Tamils | U |
| CO 2 | கப்பல் கட்டும் கலை, இரும்புத் தொழிற்சாலை, நாணயங்கள் அச்சடித்தல்,மணி உருவாக்கும் தொழிற்சாலைகள், சிலப்பதிகாரத்தில் உள்ள மணிகளின் வகையை அறிதல்.<br>knowledge of ship building, ironworks, coinage, minting, and beads making factories,Knowing the types of beads in Silapathikaram. | U |
| CO 3 | வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தை அறிந்து கொள்ளல். அறிவியல் தமிழ் மற்றும் கணினித் தமிழைப் புரிந்து கொள்ளுதல்.<br>know agriculture and irrigation technology. Understanding Scientific Tamil and Computer Tamil. | Ap |

Signature of BOS Chairman-CSE

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | 2 | | 2 | | | | 3 | 2 | 2 | | 2 | | |
| 2 | 2 | | 2 | | | | 3 | 2 | 2 | | 2 | | |
| 3 | 2 | | 2 | | | | 3 | 2 | 2 | | 2 | | |

| Course Content | |
|---|---|
| **நெசவு மற்றும் பானைத் தொழில்நுட்பம்:**<br>சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.<br>Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW)-Graffiti on Potteries. | **3 Hours** |
| **வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:**<br>சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் ரூ சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.<br>Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period. | **3 Hours** |
| **உற்பத்தித் தொழில் நுட்பம்:**<br>கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள்- நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.<br>Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel- Copper and gold- Coins as source of history - Minting of Coins - Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidence - Gem stone types described in Silappathikaram. | **3 Hours** |

**Signature of BOS Chairman-CSE**

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|---|---|
| **வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:**<br>அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம்- கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள்- வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.<br>Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries - Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society. | **3 Hours** |
| **அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:**<br>அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள்- சொற்குவைத் திட்டம்.<br>Development of Scientific Tamil - Tamil computing- Digitalization of Tamil Books- Development of Tamil Software - Tamil Virtual Academy - Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project. | **3 Hours** |

| **Theory Hours: 15** | **Tutorial Hours: 0** | **Practical Hours: 0** | **Project Hours: 0** | **Total Hours: 15** |
|---|---|---|---|---|

**Reference books**


1. தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL- (in print)
6. Social Life of the Tamils the Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tarnils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Textbook and Educational Services Corporation> Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation> Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) - Reference Book.


**Online Resources**

1. https://www.youtube.com/watch?v=Gp1ratX2sOE&list=PLtyn2o7hocf40PtPibRqJTf_dQL3eOtLl
2. https://www.youtube.com/watch?v=jteRvnNiD6w

**Signature of BOS Chairman-CSE**

| Assessment (Theory course) |
|---|
| SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE) |

| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert(s)** | |
| - | - | - | |
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24INP103 | INNOVATION PRACTICUM – II | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 0 | 1 |
| ES | (Common to All branches) | SDG | 9, 11, 12 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | equip students with essential tools and techniques for leveraging open-source technologies to develop proof-of-concepts and prototypes |
| 2 | provide hands-on experience and participants will gain a comprehensive understanding of the entire product development process |
| 3 | final prototyping, empowering them to transform their ideas into tangible outcomes |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO 1 | analyse the effectiveness of various electronic tools and techniques in product development processes | An |
| CO 2 | develop and implement functional software prototypes using open-source tools | Ap |
| CO 3 | design and fabricate 3D models using digital fabrication techniques | Ap |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | 3 | 2 | 2 | 2 | 2 | | | | | | | | |
| 2 | 2 | 2 | 2 | | 2 | | | | | | | | |
| 3 | 2 | 2 | 3 | 2 | 2 | | | | | | | | |

## Course Content

| | |
|---|---|
| **INTRODUCTION TO OPEN-SOURCE TOOLS AND TECHNIQUES**<br>Explore the concept of open-source, its underlying principles and its contrast with proprietary software, Discuss the advantages of using open-source tools, such as lower costs, increased innovation, educational value, and community support, walk through to the commonly used open-source tools for electronics design (KiCad, FreeCAD), software development (Python, Eclipse), and fabrication (Cura, LinuxCNC). | **3 Hours** |
| **ELECTRONICS FUNDAMENTALS AND TOOLS**<br>Introduction to basic electronic components (resistors, capacitors, transistors, etc.), Understanding of electronic circuits and their functions, Hands-on practice with CircuitJS and Falstad, Simulating and analysing electronic circuits, Introduction to Arduino and Raspberry Pi, exploring their capabilities and applications, Designing PCBs using KiCad and EasyEDA, Understanding PCB fabrication processes | **6 Hours** |

Signature of BOS Chairman-CSE

| | |
|---|---|
| **SOFTWARE PROTOTYPING AND TOOLS**<br>Benefits of rapid prototyping in product development, Iterative design and testing, Wireframing tools (Balsamiq, Figma), UI design tools (Sketch, Figma), Programming languages (Python, JavaScript), Testing frameworks (Selenium), No-code platforms (Bubble, Adalo, Wix, AppGyver), Building functional prototypes without extensive coding | **6 Hours** |
| **FABRICATION AND PROTOTYPING**<br>Overview of fabrication techniques (3D printing, laser cutting, CNC machining), Prototyping methods for physical products, using tools like Blender, TinkerCAD, or Fusion 360, Creating 3D models for physical prototypes, Hands-on experience with laser cutting and engraving, Understanding their applications and limitations | **7 Hours** |
| **SIMULATION & DEMONSTRATION**<br>Integrated project demonstration, explaining the design process, technical choices, and outcomes, simulation showcase to demonstrate their understanding of various technical tools and prototyping techniques | **8 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **0** | **Tutorial Hours:** | **0** | **Practical Hours:** | **30** | **Project Hours:** | **0** | **Total Hours:** | **30** |

**Learning Resources**

**Textbooks:**

1. Damir Godec, Joamin Gonzalez-Gutierrez, Axel Nordin, Eujin Pei, Julia Ureña Alcázar, A guide to additive manufacturing, Springer – 2022. https://doi.org/10.1007/978-3-031-05863-9
2. Introducing SolidWorks, Dassault Systems.

**References:**

1. Insight into Electronics
2. Microcontroller Programming with Arduino and Python
3. Fundamentals of 3D modelling

**Online Resources (Weblinks)**

1. Google Play store apps:
   a. https://play.google.com/store/apps/details?id=com.electronicslab
   b. https://play.google.com/store/apps/details?id=it.android.demi.elettronica
2. https://engservices-ece.sites.olt.ubc.ca/files/2020/01/SolidWorks-3D-Printing-Tutorial-R2.pdf

**Assessment (Practical course)**

Lab Workbook, Experimental Cycle tests, viva-voce

**Course Curated by**

| Expert from Industry | Expert(s) from Higher Education Institution | Internal Expert |
|---|---|---|
| Dr. Mahesh Veezhinathan<br>Director - Innovation Practicum<br>Associate VP - Forge. Innovation | - | Dr. Samuel Ratna Kumar P S<br>Assistant Professor – III<br>Department Mechanical Engineering |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 17.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24HSP112 | HOLISTIC WELLNESS-II<br>(Common to all Department) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 0 | 1 |
| HS | | SDG | 3, 4 | | | |

| Pre-requisite courses | 24HSP111 / Holistic Wellness-I | Data Book / Code book (If any) | - |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | build on the foundation laid in Holistic Wellness -I and deepening into the practices and principles of holistic wellness. |
| 2 | explore advanced techniques in mental, emotional, and spiritual well-being, with an emphasis on creating sustainable wellness habits. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO 1 | apply advanced techniques in mindfulness, meditation, and stress management. | Ap |
| CO 2 | understand the role of community and social connections in wellness. | U |
| CO 3 | develop resilience and adaptability in maintaining wellness. | E |
| CO 4 | refine and sustain a personalized holistic wellness plan. | E |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | | | | | | 2 | | 2 | | | | | |
| 2 | | | | | | 2 | | | | | | | |
| 3 | | | | | | 2 | | | | | 3 | | |
| 4 | | | | | | 2 | | | | | 3 | | |

## Course Content

| | |
|---|---|
| **ADVANCED MINDFULLNESS AND MEDITATION:**<br>• Deepening mindfulness practices for enhanced mental clarity.<br>• Exploring different forms of meditation (e.g., guided, transcendental, movement-based).<br>• Hands-on activity: Daily meditation practice and journaling reflections. | **6 Hours** |
| **EMOTIONAL RESILIENCE AND MENTAL HEALTH:**<br>• Building emotional resilience through positive psychology practices.<br>• Cognitive-behavioural strategies for managing stress and anxiety.<br>• Hands-on activity: Developing and practicing a resilience toolkit. | **6 Hours** |
| **SOCIAL AND ENVIRONMENTAL WELLNESS:**<br>• The impact of social connections and community on wellness.<br>• Creating a supportive environment for personal growth.<br>• Hands-on activity: Building a community wellness project or group activity. | **6 Hours** |

**Signature of BOS Chairman-CSE**

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|---|---|
| **INTERNAL GROWTH AND PURPOSE:**<br>• Exploring the deeper aspects of internal wellness and self-actualization.<br>• Reflective practices for discovering life purpose and meaning.<br>• Hands-on activity: Creating a vision board or personal mission statement. | **6 Hours** |
| **SUSTAINING WELLNESS PRACTICES:**<br>• Strategies for maintaining wellness habits over the long term.<br>• Adapting wellness plans to life changes and challenges.<br>• Hands-on activity: Revising and finalizing a long-term personal wellness plan. | **6 Hours** |

| Theory Hours: | 0 | Tutorial Hours: | 0 | Practical Hours: | 30 | Project Hours: | Total Hours: | 30 |
|---|---|---|---|---|---|---|---|---|

**Learning Resources**

**Textbooks:**

1. Hanh, Thich Nhat. The Miracle of Mindfulness: An Introduction to the Practice of Meditation. Beacon Press, Boston (1975).
2. Tolle, Eckhart. The Power of Now: A Guide to Spiritual Enlightenment. New World Library, Novato (1997).
3. Patel, Kamlesh. Heartfulness Way: Heart-Based Meditations for Spiritual Transformation, Kamlesh Patel, 2018.

**References:**


1. Goleman Daniel., Emotional Intelligence., Bloomsbury India, India, (2021).
2. James Allen., As a Man Thinketh., Maple Press, Noida, (2010)
3. Swami Budhanandha., Will power and its development., Advaita Ashrama Mayavati, Pithoragarh, Himalayas from its Publication Department, Calcutta. (2001)
4. Rosenberg, Marshall Bertram., Nonviolent Communication: A Language of Life., Puddle Dancer Press, Encinitas, CA (2015).
5. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
6. Lipton, Bruce., The Biology of Belief 10th Anniversary Edition: Unleashing the Power of Consciousness, Matter & Miracles, Hay House, Carlsbad (2015).
7. Kalderdon Adizes Ichak., What Matters in Life: Lessons I Learned from Opening My Heart
8. ., WS Press, Newtown, PA(2023).
9. Murphy, Joseph., The Power of Your Subconscious Mind [Original Edition (Complete)], Prentice-Hall, Englewood Cliffs (1963).
10. Kamlesh D. Patel., Designing Destiny: The Heartfulness Way, Heartfulness Institute, Chennai (2021)


**Online Resources (Weblinks)**

- Introduction to Psychology
- Guided Meditation
- Life skills and value education
- James Allen Library

**Assessment (Practical course)**

Participation, Practical activities and assignments, personal wellness plan and reflection.

Signature of BOS Chairman-CSE

| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | | **Internal Expert(s)** |
| | | | Dr. Ezhilarasi<br>Principal- KCT |
| **Recommended by BoS on** | | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24INP101 | DESIGN THINKING (Common to all Department) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 0 | 1 |
| ES | | SDG | 9 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

**Course Objectives:**

The purpose of taking this course is to:

| | |
|---|---|
| 1 | introduces first-year engineering students to Design Thinking, focusing on practical, user-centered problem-solving techniques |
| 2 | empathize with users, generate ideas, and create models to test and refine their solutions |
| 3 | understand iteration, empathy, and critical reflection to cultivate a creative mindset |

**Course Outcomes**

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO 1 | apply problem-solving techniques and the Design Thinking process to engineering problems using simple models | Ap |
| CO 2 | understand user needs through various empathy techniques and develop/refine models iteratively based on user insights. | U |
| CO 3 | reflect critically on their learning journeys and the emotional demands of problem-solving. Collaborate effectively in teams to develop innovative solutions | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO 1 | PSO 2 |
| 1 | 1 | | 2 | | | 2 | | 2 | | | 1 | | |
| 2 | 1 | | | | | | | 2 | | | 1 | | |
| 3 | 1 | | 2 | | | 2 | | 1 | | | 1 | | |

## Course Content

| | |
|---|---|
| **Introduction to Problem Solving and Ground Rules**<br>Introduction to problem-solving strategies without mentioning Design Thinking-Emphasize problem-solving attitudes, mindsets, and behaviours necessary for iterative problem solving (e.g., openness to failure, patience, empathy)-Set ground rules for the course, including incentives for creative risk-taking and penalties for non-participation or lack of reflection-Overview of the Design Thinking process and its importance. | **6 Hours** |
| **Empathy and Problem Definition**<br>Techniques for understanding user needs, including observation, interviews, **surveys** and **focus groups-**Importance of secondary research as a complement for the above- | **6 Hours** |

Signature of BOS Chairman-CSE

| | |
|---|---|
| mentioned methods-Introduction to empathy cycles: involve students in two empathy cycles before and after problem definition-Finetuning problem definition based on user insights. | |
| **Ideation and Concept Modelling**<br>Brainstorming ideas and selecting feasible solution-Creating concept modelling to visualize ideas-Include an empathy cycle after students propose solutions, allowing them to revisit and reshape their solutions based on further insights from users. | **6 Hours** |
| **Prototyping and Testing with Models**<br>Building basic prototypes using simple materials (e.g., cardboard, clay)- Introduction to different prototyping methods (e.g., **low-fidelity** vs **high-fidelity models**) for different contexts: product design, space design, policy, and digital/e-commerce solutions-Conduct an empathy cycle after the prototype is developed to gather user feedback and refine the prototype. | **6 Hours** |
| **Iteration and Final Modelling Project**<br>Students refine their prototypes based on feedback from the empathy cycle-Finalize prototypes for presentation based on consistent feedback loops. | **6 Hours** |
| **Presentation, Reflection, and Learning Summaries**<br>Students present their final projects and reflect on their learning journeys, including how their understanding of problem-solving and empathy evolved during the course-**Learning Summary Activity:** Each student presents their individual journey and learning outcomes from the empathy cycles and iterations-Peer review and group discussions. | **6 Hours** |

| Theory Hours: | 0 | Tutorial Hours: | 0 | Practical Hours: | 30 | Project Hours: | 0 | Total Hours: | 30 |
|---|---|---|---|---|---|---|---|---|---|

## Learning Resources

### Textbooks:

1. Handbook of Design Thinking, Christian Muller – Roterberg, Kindly Direct Publishing
2. The Art of Innovation, Tom Kalley
3. **E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company**

### Online Resources (Weblinks)

1. Survey and focus group design guides
2. Guidance on Designing, Administering and Analyzing Focus Groups and Interviews
3. Empathy mapping tools
4. How to Make a Concept Model
5. Brainstorming Techniques: 15 Creative Activities
6. 10 Brainstorming Techniques for Developing New Ideas
7. Brainstorming templates
8. 5 Common Low-Fidelity Prototypes and Their Best Practices
9. UX Prototypes: Low Fidelity vs. High Fidelity
10. Low-fidelity vs. High-fidelity Design Prototypes (and when to use which)

Case study 1: Iterative Design and Prototype Testing of the NN/g Homepage

Case study 2: Using iterative design to optimise the user flow of a product

11. Reflective practice toolkit

## Assessment

Formative: Assignments, Mini project

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| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
| | | Dr. Padhmanand Sudhagar R<br>Department of Bio-Tech<br>Dr. Arul H<br>Department of Physics | |
| **Recommended by BoS on** | 16.08.2024 | | |
| **Academic Council Approval** | No: 27 | **Date** | 24.08.2024 |

**Signature of BOS Chairman-CSE**

| 24CSV002 | DISRUPTIVE TECHNOLOGIES (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 | 0 |
| VA | | SDG | 4, 8, 9 | | | |

| Pre-requisite courses | - | Data Book / Code book (If any) | - |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | introduces various emerging technologies to enable the students to stay relevant and to thrive towards domain. Students will gain insights into innovation and technopreneurship, learning how to identify opportunities and bring technological solutions to market. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO 1 | understand the emergence of cutting-edge technologies and their impact on the businesses. | U |
| CO 2 | understand the evolution of techno entrepreneurial ecosystems | U |
| CO 3 | relate the ways in which the disruptive technologies play a pivotal role in solving contemporary and futuristic real-world operations. | R |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning |
| 1 | 2 | | | | | | | 2 | 3 | | 2 |
| 2 | 2 | | | | | | | 2 | 3 | | 2 |
| 3 | 1 | | | | | | | 2 | 3 | | 2 |

## Course Content

| | |
|---|---|
| **DATA SCIENCE, ANALYTICS AND VISUALIZATION**<br>Data as the new oil - Data-Driven Innovation- Big Data Technologies – Data Analysis vs Data Analytics – Data Visualization – Decision making through Data - Ethical and Privacy Challenges - Trends – opportunities – skills. | **3 Hours** |
| **AUTOMATION AND ARTIFICIAL INTELLIGENCE**<br>Information Systems – ERP – CRM – Robotic Process Automation - AI basics - Machine Learning - Neural networks - Deep Learning - Natural Language Processing - Computer Vision - Generative Adversarial Networks (GANs) – Robotics – Ethical AI and Regulatory Considerations - Global Investments – Sustainability - Trends – opportunities – skills. | **3 Hours** |
| **INTERNET OF THINGS AND UNMANNED ARIAL VEHICLES**<br>Characteristics of IoT – Physical Design of IoT - Logical Design of IoT – Enabling Technologies – IoT Components – IoT Prototyping – IoT Devices – Applications: Home Automation – Industry 4.0 - Smart Cities - Unmanned Aerial Vehicles & types - UAV Technologies: Urban Air Mobility (UAM), Vertically Integrated Drones, Drone Swarms | **3 Hours** |

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| | |
|---|---|
| - Counter-Drone Technology- Energy Efficiency and Sustainability - Trends – Opportunities – Skills. | |
| **CLOUD AND EDGE COMPUTING**<br>Cloud models – Cloud applications - storage, Collaborative documents, presentations, spreadsheets – SAAS – PAAS – IAAS -Benefits of cloud – Challenges in cloud computing – Edge Computing – Forms of Edge Computing – EDGE VS Cloud - Trends – opportunities – skills. | **3 Hours** |
| **EXTENDED REALITY**<br>Basics of XR - XR Landscape - Intro to AR-VR-MR Concepts – Metaverse - MR Strategy & Remote Collaboration – Spatial computing - Challenges and Ethical Considerations – Skills - Trends – opportunities. | **4 Hours** |
| **NETWORKING & DISTRIBUTED COMPUTING**<br>Layered Architecture – Networking tools – 5G and Beyond – Software Defined Networks – Network Monitoring and analysis – Distributed Computing – Distributed Sensor Networks – Blockchain fundamentals – DAO - Trends – opportunities – skills. | **3 Hours** |
| **WEB AND SOFTWARE DEVELOPMENT**<br>Web Technologies - Web 3.0 – Need for Software Engineering – Full stack development – Mobile application development – front end - backend - Meta Developer Circles & forums - Cross-platform application development – UI & UX - Open-Source development – Responsive Web Design - Trends – opportunities – skills. | **3 Hours** |
| **CYBERSECURITY**<br>Fundamentals - Security goals, mechanisms and Services – Cyber Defence – Offensive Cyber Security - Cyber forensics – Malware Analysis – Threat Intelligence - Threat Hunting - Security technologies - Cyber warfare – Cyber Physical System – Trends – opportunities – skills. User behaviour analysis. | **4 Hours** |
| **INNOVATION AND TECHNOPRENEURSHIP**<br>Innovation and Creativity - Entrepreneurial Mindset - Identifying Opportunities - Business Planning - Product Development and Innovation - Technology Commercialization - Marketing and Branding - Entrepreneurial Leadership - Entrepreneurial Ecosystems - Trends – opportunities – skills. | **4 Hours** |

| **Theory Hours: 30** | **Tutorial Hours:** | **Practical Hours:** | **Project Hours:** | **Total Hours: 30** |
|---|---|---|---|---|

**Learning Resources**

**Textbooks**


1. Davy Cielen, Arno D B Meysman, Mohamed Ali, "Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools", 2016.
2. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Fourth edition, 2020.
3. Höller, J., Tsiatsis, V., Mulligan, C., Karnouskos, S., Avesand, S., & Boyle, D., " From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Springer, 2019.
4. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", 2021 John Wiley & Sons, Inc
5. A. B. Lawal, "Cloud Computing Fundamentals: Learn the Latest Cloud Technology and Architecture with Real-World Examples and Applications", A. B. Lawal publication, 2020.
6. Ralf Doerner, Wolfgang Broll, Paul Grimm, Bernhard Jung," Virtual and Augmented Reality (VR/AR),Foundations and Methods of Extended Realities (XR)"Springer Cham
7. Andrew S Tanenaum, David Wetherall, "Computer Networks", Pearson Prentice Hall, Fifth edition, 2011.
8. Joseph J. Bambara, Paul R. Allen, Kedar Iyer, Rene Madsen, Solomon Lederer, Michael Wuehler, "Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions", McGraw-Hill, 2018.
9. Nico Loubser , "Software Engineering for Absolute Beginners: Your Guide to Creating Software Products", First edition, 2021.
10. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson Education; Seventh edition, 2017.


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11. Pankaj Goyal, “Before You Start Up : How to Prepare to Make Your Startup Dream a Reality”, Fingerprint Publishing, 2017.

| **Assessment** | |
|---|---|
| Formative | Summative |
| MCQS (10 questions) on every cohort in Coursera / Poster Presentation. | Nil |

| **Course Curated by** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert(s)** | |
| | | Dr. N. Jeba, Department of Computer Science Engineering | |
| **Recommended by BoS on** | 16.8.2024 | | |
| **Academic Council Approval** | No:27 | **Date** | 24.08.2024 |

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# SEMESTER III

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| 24CSI008 | OBJECT ORIENTED PROGRAMMING (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| ES | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the basic principles and features of object-oriented programming using C++. |
| 2 | Explore the use of classes, objects, constructors, destructors, and various forms of inheritance |
| 3 | Apply the concepts of function overloading, operator overloading, and polymorphism |
| 4 | Use pointers and virtual functions to implement dynamic behaviour in programs. |
| 5 | Implement exception handling and generic programming using C++. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Explain the basic principles of OOP and structure of C++ programs. | U |
| CO 2 | Illustrate the use of classes, objects, and access control in program design. | U |
| CO 3 | Apply constructors, destructors, and various inheritance types in solving real-world problems. | Ap |
| CO 4 | Demonstrate function overloading, operator overloading, and polymorphism using pointers. | Ap |
| CO 5 | Implement exception handling and generic programming using C++ templates and Standard Template Library. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | | | | | | | | | 3 | |
| 2 | 2 | | | 3 | | | | | | | | 3 | |
| 3 | | 2 | | 3 | | | | | | | | 3 | |
| 4 | 2 | | | 3 | | | | | | | | 3 | |
| 5 | | | 3 | 3 | | | | | | | | 3 | |

**Course Content**

| | |
|---|---|
| **PRINCIPLES OF OOP AND INTRODUCTION TO C++**<br>Basic concepts of Object-Oriented Programming-Benefits and Applications of OOP-Structure of a C++ program-Tokens, Keywords, Identifiers, Basic Data Types-Input and Output in C++ -Type Conversion- Operators -Control Structures | **9 Hours**<br><br>**6 Hours** |

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| | |
|---|---|
| **Practical Component**<br>Simple C++ programs to demonstrate control flow, arithmetic operations, and console I/O | |
| **CLASSES AND OBJECTS**<br>Defining a Class, Creating Objects -Member Functions, Access Specifiers -Scope Resolution Operator, Nesting of Member Functions-Memory Allocation for Objects-Static Members, Array of Objects-Passing Objects as Arguments, Returning Objects<br>**Practical Component**<br>Programs on class and object creation, object arrays, and member access | **9 Hours**<br><br><br><br><br>**6 Hours** |
| **CONSTRUCTORS AND INHERITANCE**<br>Constructors- Default, Parameterized, Copy Constructor , Destructors -Inline Functions, Default Arguments- Inheritance: Types -Single, Multilevel, Multiple, Hierarchical-Friend Functions- Abstract Classes<br>**Practical Component**<br>Demonstrate all types of inheritance along with constructors using C++ | **9 Hours**<br><br><br><br>**6 Hours** |
| **POLYMORPHISM AND POINTERS**<br>Function Overloading-Operator Overloading- Unary, Binary-Rules for Overloading-constructor overloading- Pointers to Objects, this Pointer-Virtual Functions, Runtime Polymorphism<br>**Practical Component**<br>Programs to demonstrate compile time and runtime polymorphism along with pointers | **9 Hours**<br><br><br><br>**6 Hours** |
| **EXCEPTION HANDLING ,FILES AND GENERIC PROGRAMMING**<br>Introduction to exceptions and error types-Syntax and semantics of try, catch, throw-Multiple catch blocks and generic catch-Nested try blocks and rethrowing exceptions Handling uncaught exceptions - File Streams and Their Types - Reading and Writing Data to Files-Function Templates- Class Templates-Standard Template Library.<br>**Practical Component**<br>Programs on handling exceptions using try-catch, throw, rethrow; implementing function and class templates using STL containers and algorithms like sort and find- File handling using ifstream, ofstream, fstream – Reading/writing text data, | **9 Hours**<br><br><br><br><br>**6 Hours** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | | **Practical Hours:** | **30** | **Project Hours:** | **Total Hours:** **75** |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. E. Balagurusamy, Object Oriented Programming with C++, 8th Edition, McGraw Hill Education, 2021.<br>2. Robert Lafore, Object-Oriented Programming in C++, 4th Edition, Sams Publishing, 2002 |
| **Reference books/ Web Links** |
| 1. Bjarne Stroustrup, *The C++ Programming Language*, 4th Edition, Addison-Wesley, 2014.<br>2. Herbert Schildt, *C++: The Complete Reference*, 4th Edition, McGraw-Hill Education, 2008.<br>3. Joyce Farrell, *Object-Oriented Programming Using C++*, 4th Edition, Cengage Learning, 2008. |
| **Online Resources** |
| 1. https://www.programiz.com/cpp-programming<br>2. https://www.geeksforgeeks.org/c-plus-plus/<br>3. https://cplusplus.com/doc/tutorial/<br>4. https://www.tutorialspoint.com/cplusplus/ |

| **Assessment (Embedded course)** |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)<br>Lab Workbook, Experimental Cycle tests, viva-voce |

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| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert** | |
| - | - | Ms. R. Nivetha<br>Department of Computer Science and Engineering | |
| **Recommended by BoS on** | 09.05.2025 | | |
| **Academic Council Approval** | No: 28 | **Date** | 26.06.2025 |

**Signature of BOS Chairman-CSE**

| 24CSI009 | DATABASE MANAGEMENT SYSTEMS (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| PC | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | Nil |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | Acquire knowledge of fundamental database concepts, data models, and database system architecture. |
| 2 | Develop practical skills in designing relational databases using Entity-Relationship modelling and normalization techniques. |
| 3 | Gain competency in using Structured Query Language for data definition, data manipulation, and complex data retrieval. |
| 4 | Understand the principles of query processing, optimization, transaction management, and concurrency control in database systems. |
| 5 | Develop the ability to analyze database design choices and query strategies for performance, integrity, and compare relational databases with NoSQL alternatives. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply relational database concepts to define structures and manage data effectively. | Ap |
| CO 2 | Design and normalize relational database schemas using Entity-Relationship modelling and normalization techniques to ensure data integrity. | Ap |
| CO 3 | Implement relational operations and join strategies using relational algebra and SQL to retrieve and combine data efficiently. | Ap |
| CO 4 | Analyze transaction processing concepts, concurrency issues, and recovery techniques to ensure the consistency and correctness of database systems. | An |
| CO 5 | Apply CRUD operations in NoSQL databases to manage semi-structured and unstructured data effectively. | Ap |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | | | 3 | | | | | | | | 2 |
| 2 | | 2 | | | 3 | | | | | | | 3 | |
| 3 | 2 | | 3 | | | | | | | | | | 2 |
| 4 | | 3 | | 2 | | | | | | | | 2 | 3 |
| 5 | | 3 | 2 | | | | | | | | | 2 | |

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| Course Content | |
|---|---|
| **INTRODUCTION TO DATABASES AND DATA MODELLING**<br>**Evolution from File Systems to DBMS – Advantages of Using DBMS approach - Types of Data - Data Models - DB Architecture and users - Relational** Model Concepts - Attributes, Tuples, Relations and Constraints -Differences between OLAP and OLTP- Introduction to SQL: DDL, DML, Data Types, Constraints and Aggregate Functions.<br><br>**Practical Component**<br>Creation of a database and writing SQL queries to retrieve information from the database - Exploring the use of WHERE, ORDER BY, and limit clauses in SQL - Implement Aggregate Functions. | **9 Hours**<br><br>**6 Hours** |
| **RELATIONAL MODELLING AND DATABASE DESIGN**<br>Logical Database Design: Different approaches in Logical design, ER Modeling, ER notations - Steps in ER modeling. Physical database design: Converting ER Model to Relational Database Design, Normalization -Functional Dependency, 1NF, 2NF, 3NF, Boyce-Codd Normal Form (BCNF) - Decomposition properties.<br><br>**Practical Component:**<br>Implementation of ER Diagram and identifying its entities, relations, attributes and constraints – Converting the ER diagram into relational schema – Convert a relation to 1NF, 2NF, 3NF and BCNF. | **9 Hours**<br><br>**6 Hours** |
| **PHYSICAL DATABASE DESIGN AND QUERY PROCESSING**<br>Overview of File Organization – RAID concepts - Indexing: Single, Multilevel – Dynamic - B+-tree indexing – Hashing Techniques – Static and Dynamic Hashing – Relational Algebra – Translating SQL Queries into Relational Algebra – Joins – Query Optimization: Join Query Optimization – Query Optimization Rules – Tuple Relational Calculus.<br><br>**Practical Component:**<br>Simulation of relational Algebra operations – Performing joins using Relational Algebra – Implementation of various SQL joins. | **9 Hours**<br><br>**6 Hours** |
| **TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL**<br>Transaction Concepts - ACID Properties - Transaction States – Transaction control Commands - Serializability Concepts - Recovery Mechanisms: Undo/Redo, Shadow Paging, Log Based Recovery - Concurrency Control: Locking Protocols, Timestamp Protocols, Deadlock Handling.<br><br>**Practical Component:**<br>Implement multiple transactions using SQL involving BEGIN, COMMIT & ROLLBACK – Write SQL Queries for Nested Transactions. | **9 Hours**<br><br>**6 Hours** |
| **NOSQL DATABASE MANAGEMENT**<br>Introduction to NoSQL Databases – Key Features and Principles of NoSQL – CAP Theorem – Classification of NoSQL Databases- Querying in NoSQL Systems: CRUD operations – NoSQL Query Language Overview<br><br>**Practical Component:**<br>Creation of Database and Performing CRUD operations in NoSQL – Querying with NoSQL databases. | **9 Hours**<br><br>**6 Hours** |

| Theory | Tutorial | Practical | Project | Total |
|---|---|---|---|---|
| **Hours: 45** | **Hours: 0** | **Hours: 30** | **Hours: 0** | **Hours: 75** |

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## Learning Resources

### Textbooks

1. Silberschatz, Abraham, Henry F. Korth, and S. Sudarshan. Database System Concepts. 7th Edition, McGraw Hill, 2019.
2. Elmasri, Ramez, and Shamkant B. Navathe. Fundamentals of Database Systems. 7th Edition, Pearson, 2017.

### Reference books/ Web Links

1. Ramakrishnan, Raghu, and Johannes Gehrke. Database Management Systems. 4th Edition, McGraw Hill, 2015.
2. Sadalage, Pramod J., and Martin Fowler. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. Addison-Wesley Professional, 2012.

### Online Resources

1. https://onlinecourses.nptel.ac.in/noc24_cs12/preview
2. https://online.stanford.edu/courses/soe-ydatabases0005-databases-relational-databases-and-sql
3. https://www.w3schools.com/sql/
4. https://mode.com/sql-tutorial/
5. https://www.scaler.com/topics/course/dbms/

## Assessment (Embedded course)

SA-I, SA-II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

## Course Curated by

| Expert(s) from Industry | Expert(s) from Higher Education Institution | Internal Expert |
|---|---|---|
| - | - | Mr. K. Manoj, Department of Computer Science and Engineering |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 09.05.2025 | | |
| **Academic Council Approval** | No: 28 | **Date** | 26.06.2025 |

**Signature of BOS Chairman-CSE**

| 24ADI001 | ARTIFICIAL INTELLIGENCE AND AUTOMATION | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| PC | (Common to AD, CS, IT) | SDG | 8,9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | Nil |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | Understand the fundamentals of AI and its potential for decision making. |
| 2 | Introduce the concept of artificial intelligence, methods, techniques and applications |
| 3 | Gain practical experience through case studies and hands-on projects. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | Apply the foundational concepts of AI, including intelligent agents, predicate logic, and knowledge representation techniques, to perform logical reasoning. | Ap |
| CO2 | Analyze and implement classical and heuristic search algorithms to solve complex AI problems. | An |
| CO3 | Apply probabilistic reasoning techniques to represent and infer knowledge under uncertainty in AI systems. | Ap |
| CO4 | Analyze decision-making models to optimize AI-driven strategic and sequential decision-making under uncertainty. | An |
| CO5 | Design and implement AI-driven automation systems and workflows using appropriate tools to streamline tasks and enhance operational efficiency across diverse domains. | Ap |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | | | | | | 2 | 3 | |
| 2 | | 3 | | | | | | | | | 2 | 3 | |
| 3 | 3 | | | | 2 | | | | | | 2 | 3 | |
| 4 | | 3 | | | 2 | | | | | | | 3 | |
| 5 | | | 2 | | 3 | | | | | | | 2 | |

## Course Content

**INTRODUCTION TO AI** — **9 Hours**

Fundamentals of AI - Definitions, Key concepts, Intelligent agents, Agents and Environment. Propositional Logic – Agents based on Propositional Logic – First order logic – Syntax and semantics – Knowledge Engineering in First Order Logic– Inference – Unification - Forward and backward chaining - Resolution.

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| | |
|---|---|
| **Practical Component**<br>Intelligent Agent Simulation - Propositional Logic and Knowledge-Based Agent - First Order Logic and Inference (Chaining and Resolution) | **6 Hours** |
| **PROBLEM SOLVING**<br>State space search; production systems, search space control; depth first search, breadth-first search. Heuristic Based Search: Hill climbing, best-first search, A*Algorithm and AO* algorithm, Min-max algorithms, game playing – Alpha beta pruning branch and bound, Problem Reduction, Constraint Satisfaction.<br><br>**Practical Component**<br>Implement AI search algorithms such as BFS, DFS, A* and AO* - Develop an AI for Tic-Tac-Toe or Chess using heuristic-based decision-making - Implement a Sudoku solver or a N-Queens problem solver using backtracking and constraint satisfaction techniques. | **9 Hours**<br><br>**6 Hours** |
| **REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE**<br>Handling uncertainty in AI, Probability theory and its connection to logic, Concepts of independence and conditional probability, Structure of Bayesian Networks, Bayesian rule and its applications, Markov Models and Hidden Markov Models (HMMs), Probabilistic graphical models and Inference algorithms.<br><br>**Practical Component**<br>Build and evaluate a Bayesian Network for a real-world problem - Implement Hidden Markov Models (HMM) for sequence prediction tasks | **9 Hours**<br><br>**6 Hours** |
| **DECISION-MAKING**<br>Importance of decision making in AI, Utility, preferences and Expected utility in decision-making under uncertainty, Decision Theory Basics, Markov Decision Processes (MDPs), Game theory and strategic decision-making in AI.<br><br>**Practical Component**<br>Implement a simple MDP for decision-making in a dynamic environment - Develop a game-theoretic model for AI-based strategic decision-making | **9 Hours**<br><br>**6 Hours** |
| **ARTIFICIAL INTELLIGENCE FOR AUTOMATION**<br>Understanding Automation, Applications of AI-driven Automation, Opportunities and challenges in AI automation. Automation in production systems-Automation principles and strategies-Basic elements of an automated system.<br>Introduction to Robotic Process Automation- Benefits of RPA, Components of RPA- RPA Platforms-About Ui Path.<br><br>**Practical Component**<br>Downloading and installing UiPath Studio - Explore Robotic Process Automation (RPA) tools like UiPath or Automation anywhere - Create a basic automation to extract information from a document and store it in a spreadsheet. | **9 Hours**<br><br>**6 Hours** |

| Theory | Tutorial | Practical | Project | Total |
|---|---|---|---|---|
| Hours:45 | Hours:0 | Hours: 30 | Hours:0 | Hours:75 |

**Learning Resources**

**Textbooks**


1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 4th Edition, Pearson Education / Prentice Hall of India (2022).
2. Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress Publications (2020).


**Reference**


1. Rich E., Knight K. and Nair B. S., Artificial Intelligence, Tata McGraw Hills, Fourth Edition (2024).


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| |
|---|
| 2. Alok Mani Tripathi, “Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – UiPath”, Packt Publishing (2018). |
| **Online Resources (Weblinks)** |
| 1. https://onlinecourses.nptel.ac.in/noc22_cs56<br>2. https://www.coursera.org/specializations/roboticprocessautomation |

| **Assessment (Embedded course)** |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)<br>Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| - | - | Dr Chandrakala D<br>Professor/Department of Artificial Intelligence and Data Science |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 09.05.2025 | | |
| **Academic Council Approval** | No: 28 | **Date** | 26.06.2025 |

**Signature of BOS Chairman-CSE**

| 24ADT015 | FINANCE, ECONOMICS AND MARKETING (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |
| HS | | SDG | 8 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | Nil |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | Understand core concepts of managerial economics and apply demand estimation techniques in business decision-making. |
| 2 | Gain foundational knowledge of cost and financial accounting for analyzing and preparing basic financial statements. |
| 3 | Develop skills in financial statement analysis and cash-flow management for strategic financial planning. |
| 4 | Apply marketing principles and research analytics to formulate integrated, data-driven growth strategies. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | Apply core economic concepts (demand, supply, elasticity, utility) to managerial decision-making. | Ap |
| CO2 | Record, summarise and interpret fundamental financial transactions in accordance with generally accepted accounting principles (GAAP/Ind-AS). | Ap |
| CO3 | Analyse and evaluate corporate performance using the three key financial statements and cash-flow-based metrics (EBITDA, FCF, EVA). | An |
| CO4 | Design customer-centred marketing strategies that integrate traditional and digital channels to create, communicate and capture value. | Ap |
| CO5 | Employ data-driven market research and analytics to segment, target and position offerings and to forecast demand under uncertainty. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | 2 | 2 | | | | | | | | | |
| 2 | | 2 | | | | | | | | | | | |
| 3 | | 2 | | | | | | | | | 2 | | |
| 4 | | 2 | | | | | | | | | 2 | | |
| 5 | | 2 | | | | | | | | | | 3 | 3 |

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| Course Content | |
|---|---|
| **MANAGERIAL ECONOMICS & DEMAND ESTIMATION**<br>Managerial goals vs. shareholder value; Law of demand & supply; elasticity (price, income, cross); marginal utility & consumer surplus; exceptions to the law of demand; quantitative & qualitative demand-forecasting techniques (time-series, causal models, Delphi, big-data tools); introduction to behavioural economics for managers. | **9 Hours** |
| **COST & FINANCIAL ACCOUNTING FUNDAMENTALS**<br>Cost concepts—fixed, variable, stepped, sunk, opportunity, relevant; economies & diseconomies of scale; cost-volume-profit analysis; accounting principles & conventions, double-entry system, journal-ledger-trial balance; the accounting equation; preparation of basic Income Statement and Balance Sheet. | **9 Hours** |
| **FINANCIAL STATEMENT ANALYSIS & CASH-FLOW MANAGEMENT**<br>Operating vs. financing & investing cash flows; preparation of the Statement of Cash Flows (IND-AS 7); working-capital management; ratio analysis—liquidity, leverage, profitability, efficiency; advanced cash-flow metrics (EBITDA, FCF, EVA); brief introduction to valuation multiples. | **9 Hours** |
| **MARKETING PRINCIPLES IN THE DIGITAL ERA**<br>Evolution of marketing & the holistic marketing concept; Marketing vs. Selling; customer value & satisfaction; 7 Ps and extended service mix; product-life-cycle strategies; overview of digital marketing (SEO, SEM, social, content, influencer); omnichannel customer journeys. | **9 Hours** |
| **MARKET RESEARCH, ANALYTICS & STRATEGIC INTEGRATION**<br>Marketing-information systems (MIS); environmental & competitor scanning (PESTLE & Porter 5-forces); STP—segmentation techniques, targeting criteria, positioning maps; basics of marketing analytics (A/B testing, RFM, CLV); integrating finance & marketing for growth strategy—profit-impact of marketing decisions, budgeting, ROI dashboards; capstone case discussion. | **9 Hours** |

| Theory Hours:45 | Tutorial Hours: 0 | Practical Hours: 0 | Project Hours: 0 | Total Hours:45 |
|---|---|---|---|---|

## Learning Resources

### Textbooks

1. P. Geetika, P. Roy Chowdhury & P. Ghosh. Managerial Economics (3e), McGraw-Hill (2017).
2. V. G. Narayanan. An Easy Introduction to Financial Accounting: A Self-Study Guide (2020).
3. Philip Kotler, Kevin Lane Keller. Marketing Management (16e), Pearson (2022).

### Reference

1. D. N. Gujarati & D. C. Porter. Essentials of Econometrics (4e), McGraw-Hill (2009).
2. C. Dougherty. Introduction to Econometrics (4e), OUP (2020).
3. Tapan K. Panda. Marketing Management: Text & Cases (3e), Excel Books (2023).
4. Mike Grigsby. Marketing Analytics: Strategic Models & Metrics, Kogan Page (2022).
5. Peter Atrill & Eddie McLaney. Financial Accounting for Decision Makers (9e), Pearson (2021).

### Online Resources (Weblinks)

1. https://fulfillment.shiprocket.in/blog/demand-estimation/
2. https://www.coursera.org/learn/uva-darden-financial-accounting
3. https://www.investopedia.com/articles/stocks/07/easycashflow.asp
4. https://handbook.flinders.edu.au/topics/2025/busn1022
5. https://insight7.io/marketing-research-and-insights-8-integration-techniques/

| Assessment (Theory course) |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) |

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| Course Curated By | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| - | - | Aman Kumar Dubey<br>Assistant Professor & Program Head/MBA IEV |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 09.05.2025 | | |
| **Academic Council Approval** | No: 28 | **Date** | 26.06.2025 |

**Signature of BOS Chairman-CSE**

| 24ITP012 | APTITUDE AND REASONING -I<br>(Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 0 | 1 |
| HS | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | Equip with essential aptitude and reasoning skills commonly assessed in recruitment processes across various industries. |
| 2 | Develop proficiency in solving numerical problems related to arithmetic, percentages, ratios, time and work, and other job-relevant topics |
| 3 | Improve analytical thinking through practice with syllogisms, coding-decoding, blood relations, and logical sequences. |
| 4 | Train to answer questions accurately and efficiently under time constraints, as required in most job aptitude tests. |

## Course Outcomes:

| After successful completion of this course, the students shall be able to | | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply fundamental arithmetic concepts to solve real-life and exam-based problems. | Ap |
| CO 2 | Solve time-based problems with logical approaches. | Ap |
| CO 3 | Demonstrate the ability to simplify and solve number system-related problems. | Ap |
| CO 4 | Use deductive reasoning in topics like direction sense, blood relations, and coding-decoding problems. | An |
| CO 5 | Interpret and analyze data sets presented in tables, bar charts, pie charts, and line graphs. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | | | | | | 3 | 1 | |
| 2 | 3 | | | | | | | | | | 3 | 1 | |
| 3 | 3 | | | | | | | | | | 3 | | |
| 4 | 3 | | 2 | | | | | | | | 3 | 2 | |
| 5 | 3 | | | | | 2 | | | | | 3 | 2 | |

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| Course Content | |
|---|---|
| **RATIO AND PROPORTION, NUMBER SYSTEM**<br>Simple Equations, BODMAS rule, Basic proportional, Ratio and Proportions – Common factor multiplication types, Problems with Coins and Rupees, Problems with Income, Expenditure and Savings, Number System – Even and Odd Number Series, Numbers and its Digits, Arithmetic Operations on Number system | **6 Hours** |
| **AVERAGES AND PERCENTAGES, PROFIT AND LOSS**<br>Basic percentage calculations, Percentage increase/decrease, Successive percentage changes, Averages - Weighted average, Moving averages, Application-based problems, Profit and Loss- Cost price, selling price, and marked price, Profit and loss percentage, Successive discounts | **6 Hours** |
| **TIME AND WORK, PIPES AND CISTERNS**<br>Work Efficiency, Combined Work, Alternative Work, Efficiency and Time unknown Problems, Same Group of Members Working Together, Different Group of Members Working Together, Pipes and Cisterns – Filling Time Calculations, Tank Capacity Calculations | **6 Hours** |
| **BLOOD RELATIONS, CODING AND DECODING**<br>Family tree problems, Coded and complex relationships, Puzzle-based questions, Coding and Decoding – Single Word Coding, Two Word Coding, Number Coding, Letter and Number Coding, Symbol Coding | **6 Hours** |
| **SEATING ARRANGEMENTS, DIRECTION SENSE**<br>Linear Arrangements, Circular, Square and Rectangular (Facing centre and Facing Outward) Arrangements, Complex Arrangements, Cardinal directions, Angle and distance calculation, Shadow-based reasoning | **6 Hours** |

| Theory Hours: | Tutorial Hours: | Practical Hours: | Project Hours: | Total Hours: |
|---|---|---|---|---|
| 0 | 0 | 30 | 0 | 30 |

| Learning Resources |
|---|
| **Textbooks** |
| 1. R.S. Agarwal, A Modern Approach to Logical Reasoning – comprehensive for verbal and non-verbal reasoning, S. Chand Publisher, (2022). |
| **Reference books/ Web Links** |
| 1. Arun Sharma, How to Prepare for Quantitative Aptitude for the SA-I, SA-II, McGraw Hill, (2021). |
| **Online Resources** |
| 1. https://crm.mastersacademy.in/ |

| Assessment |
|---|
| MCQ |

| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert** | |
| Mr. Vivekanand,<br>CEO and Founder – Masters Academy | - | Dr. D. Sudharson,<br>Department of Artificial Intelligence and Data Science | |
| **Recommended by BoS on** | 09.05.2025 | | |
| **Academic Council Approval** | No: 28 | **Date** | 26.06.2025 |

**Signature of BOS Chairman-CSE**

| 24ADV001 | PYTHON PROGRAMMING (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 0 | 0 |
| VA | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Learn the basic syntax, programming structures, and core data types of Python. |
| 2 | Work with functions, file operations, and error handling to build functional programs. |
| 3 | Explore object-oriented programming and use libraries like NumPy and Pandas for data handling. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO1 | Construct basic Python programs using variables, data types, operators, and control flow statements. | Ap |
| CO2 | Develop modular programs by defining functions and utilizing data structures like lists, tuples, and dictionaries for effective data management. | Ap |
| CO3 | Apply object-oriented principles to create classes, objects, and implement inheritance to model real-world problems. | Ap |
| CO4 | Implement file handling operations to read and write data from text and CSV files and incorporate exception handling for robust code. | Ap |
| CO5 | Utilize NumPy and Pandas libraries to perform fundamental data manipulation, filtering, and cleaning tasks on datasets. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledg | Problem Analysis | Design/Development of | Conduct Investigations of | Engineering Tool Usage | The Engineer and The | Ethics | Individual and Collaborati | Communication | Project Management and | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | | 3 | | | | | | | 3 | |
| 2 | 3 | 2 | 2 | | 3 | 3 | | | | | | 3 | |
| 3 | 3 | 2 | 3 | | 3 | | | | | | | 3 | |
| 4 | 3 | 2 | 2 | | 3 | | | | | | | 3 | |
| 5 | 3 | 2 | 2 | | 3 | | | | | | | 3 | |

## Course Content

| | |
|---|---|
| **PYTHON BASICS**<br>Python syntax, Variables, Data Types (int, float, string), Type Casting, I/O, Arithmetic & Logical Operators.Conditional Statements: if, if-else, if-elif-else. Iterative Statements: for loop, while loop, break, continue. | **6 Hours** |
| **FUNCTIONS,STRINGS, LISTS AND DICTIONARIES**<br>Defining functions, arguments (positional, keyword), return values, Lambda functions. String handling: slicing, strip(), split().Lists: creation, indexing, methods (append, | **6 Hours** |

Signature of BOS Chairman-CSE

| | |
|---|---|
| remove, sort). Tuples: characteristics, indexing, methods.Dictionaries: Key-value pairs, methods (get, keys, items, update). | |
| **OOPS CONCEPTS**<br>OOP concepts. Creating Classes and Objects, self parameter, __init__ method.Inheritance (Single, Multilevel), Method Overriding. | **6 Hours** |
| **FILE HANDLING AND EXCEPTION HANDLING**<br>Reading and writing files, file modes (r, w, a), with statement. Working with text and CSV files. Understanding exceptions. try-except-finally, Raising custom exceptions. | **6 Hours** |
| **PYTHON LIBRARIES**<br>Introduction to NumPy, Arrays, creation, and operations. Pandas Library: Series, DataFrames. Data Manipulation (filtering, sorting). Handling Missing Data. | **6 Hours** |

| Theory Hours: | Tutorial Hours: | Practical Hours: 30 | Project Hours: | Total Hours:30 |
|---|---|---|---|---|

## Learning Resources

### Textbooks

1. Eric Matthes, *Python Crash Course*, 3rd Edition, No Starch Press, 2023.
2. Paul J. Deitel and Harvey M. Deitel, *Python for Programmers*, 1st Edition, Pearson, 2019.

### Reference

1. Al Sweigart, Automate the Boring Stuff with Python, 2nd Edition, No Starch Press, 2020.
2. Wes McKinney, Python for Data Analysis, 3rd Edition, O'Reilly Media, 2022.
3. The Python Standard Library Documentation: https://docs.python.org/3/library/

### Online Resources (Weblinks)

1. https://onlinecourses.nptel.ac.in/noc24_cs83/preview
2. https://www.coursera.org/specializations/python

## Assessment

MCQs, Continuous Lab Work & Evaluation, Auto-Graded Online Assignments (HackerRank, etc.)

## Course Curated by

| Expert(s) from Industry | Expert(s) from Higher Education Institution | Internal Expert(s) |
|---|---|---|
| - | - | Rupashini P R,<br>Assistant Professor,<br>Department of Artificial Intelligence and Data Science |
| **Recommended by BoS on** | 09.05.2025 | |
| **Academic Council Approval** | No: 28 | **Date** 26.06.2025 |

**Signature of BOS Chairman-CSE**

# SEMESTER IV

Signature of BOS Chairman-CSE

| 24ITT203 | COMPUTER ORGANIZATION AND ARCHITECTURE (Common to CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |
| PC | | SDG | 4,9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | Introduce the basic structure and functional components of a computer system, including its evolution, Von Neumann architecture, and performance parameters. |
| 2 | Explain the internal organization of a basic computer, focusing on instruction formats, addressing modes, and the distinction between CISC and RISC architectures. |
| 3 | Explore arithmetic and logic unit (ALU) operations including integer and floating-point computations. |
| 4 | Examine memory hierarchy, cache, and I/O system designs and their impact on performance. |
| 5 | Explore modern advancements in computer architecture, including multicore processors, parallel architectures, and multiprocessor systems with interconnection structures and synchronization techniques. |

## Course Outcomes:

| After successful completion of this course, the students shall be able to | | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Identify and explain the structure, functional units, performance characteristics of computer systems | U |
| CO 2 | Apply arithmetic algorithms to perform for addition, subtraction, multiplication, and division with correctness and efficiency in problem-solving tasks. | Ap |
| CO 3 | Apply the concepts of instruction execution, multiple bus organization, and control unit design to implement control logic using hardwired and microprogrammed approaches. | Ap |
| CO 4 | Explain the operations of I/O subsystems and memory architectures, and describe the roles of programmed I/O, interrupts, DMA, RAM, cache, and memory hierarchy in data transfer and system performance. | U |
| CO 5 | Utilize the principles of pipelining, hazard management, and parallel processing architectures such as superscalar, multicore, and GPU acceleration to improve performance in real-time computing systems. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | 2 | | | | | | | | | | | |
| 2 | 2 | 2 | | | | | | | | | | | |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 3 | | 2 | | | | | | | | | 2 | |
| 4 | 3 | 2 | | | | | | | | | | 2 | |
| 5 | 2 | 2 | | | | | | | | | | 1 | |

## Course Content

| | |
|---|---|
| **FUNDAMENTALS OF COMPUTER ORGANIZATION**<br>Organization and Architecture- Structure and Function- Functional Units-Basic Operations and Concepts-Bus Structure-Performance. Memory Locations and Addresses - Memory Operations - Instruction and Instruction Sequencing - Addressing Modes - Basic I/O Operations. Case Study: Evolution of Intel, ARM Architectures/Processor Families | **7 Hours** |
| **COMPUTER ARITHMETIC**<br>Addition and Subtraction of Signed Numbers-Design of Fast Adders-Multiplication of Positive Numbers-Signed Operand Multiplication-Fast Multiplication-Integer Division-Floating Point Numbers and Operation. | **11 Hours** |
| **BASIC PROCESSING UNIT**<br>Fundamental Concepts - Execution of a Complete Instruction - Multiple Bus Organization - Hardwired Control – Microprogrammed Control – Microinstructions-Microprogram Sequencing-Wide Branch Addressing | **9 Hours** |
| **I/O AND MEMORY**<br>The I/O Subsystem, -Programmed I/O- I/O Interrupts -Direct Memory Access (DMA) - The Components of Memory System – RAM Structure: The Logic Designer's Perspective – Memory Boards and Modules-Memory Hierarchy – The Cache- The Memory Subsystem. | **9 Hours** |
| **PIPELING AND PARALLEL PROCESSING**<br>Basic Concepts - Data Hazards - Instruction Hazards – Influence on instruction sets - Data path and control considerations - Superscalar operation. Multiple Processor Organization-Types, Parallel Organization. Multicore Computers Introduction – Organization- Software and Hardware performance issues. Case Study: GPU Acceleration in Real-Time System. | **9 Hours** |

| Theory | Tutorial | Practical | Project | Total |
|---|---|---|---|---|
| **Hours: 45** | **Hours: 0** | **Hours: 0** | **Hours: 0** | **Hours: 45** |

## Learning Resources

### Textbooks


1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, 5th Edition, McGraw-Hill, (2014).
2. Vincent P Heuring, Harry F Jordan, TG Venkatesh., Computer Systems Design and Architecture, 2nd Edition, Pearson, (2014).
3. William Stallings, Computer Organization and Architecture - Designing for Performance, 9th Edition, Prentice Hall, (2012).


### Reference books/ Web Links


1. M. Moris Mano, Computer System Architecture, Revised 3rd Edition, Pearson, (2017).
2. John P.Hayes, Computer Architecture and Organization, 3rd Edition, McGraw Hill, (2002).
3. David A.Patterson and John L.Hennessy, Computer Organization and Design: The hardware / software interface, 5th Edition, Morgan Kaufmann, (2014).
4. Andrew S. Tanenbaum, Structured Computer Organization, 6th EditionPearson Education, (2016)


### Online Resources (Weblinks)

Signature of BOS Chairman-CSE

1. https://profile.iiita.ac.in/bibhas.ghoshal/teaching_coa_2021.html
2. https://www.cse.iitd.ac.in/~srsarangi/archbooksoft.html
3. https://onlinecourses.nptel.ac.in/noc22_cs88/preview
4. https://www.coursera.org/learn/comparch
5. https://www.udemy.com/course/computer-organization-and-architecture-j/?srsltid=AfmBOoo3L-F9CWPP3HioEoAzx57cX2iGGEU3Bi0UOLTD0aLRh_BAREfE&couponCode=ST21MT30625G1

| **Assessment (Theory course)** |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) |

| **Course Curated by** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert** | |
| - | - | Mr. M. Sathish, Department of Computer Science and Engineering | |
| **Recommended by BoS on** | 09.05.2025 | | |
| **Academic Council Approval** | No: 28 | **Date** | 26.06.2025 |

**Signature of BOS Chairman-CSE**

| 24CSI011 | COMPUTER NETWORKS AND SECURITY (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| PC | | SDG | 4,9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1. | Illustrate the basic concepts, architecture, and protocols of computer networks, including the OSI and TCP/IP models. |
| 2. | Familiarize students with networking hardware (routers, switches, firewalls) and basic configuration principles. |
| 3. | Explore the functionalities, differences, and use-cases of major transport protocols such as TCP (Transmission Control Protocol) and UDP (User Datagram Protocol). |
| 4. | Explain the basic security principles such as confidentiality, integrity, availability and explore common threats, vulnerabilities and encryption techniques. |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Understand the principles of data communication and functionalities of standard network reference models. | U |
| CO 2 | Apply error detection methods and flow control techniques to ensure reliable data transmission in network communications. | Ap |
| CO 3 | Implement routing algorithms to recommend optimal paths for efficient packet switching and internetworking. | Ap |
| CO 4 | Apply congestion control mechanisms to assess their effectiveness and identify the functionalities of application layer protocols | Ap |
| CO 5 | Construct a secure data communication model using standard cryptographic algorithms for cyber defense. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative work Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 3 | | | | | | | | | 2 | 2 | |
| 2 | 3 | 3 | | 3 | | | | | | | | | 2 |
| 3 | 3 | | 3 | 3 | | | | | | | | | 2 |
| 4 | 3 | | 3 | | | 3 | | | | | | | 2 |
| 5 | 3 | 2 | 3 | | | | | | | | | 2 | |

Signature of BOS Chairman-CSE

| Course Content | |
|---|---|
| **DATA COMMUNICATIONS**<br>Basics of Data Communication, Network Models: The OSI Model, TCP/IP Protocol Suite, Addressing, Transmission Media, Networking Devices, Network Topologies.<br><br>**Practical Component**<br>Demonstrate the use of network Diagnostic tools such as PING, TRACEROUTE, IPCONFIG , NSLOOKUP AND NETSTAT | **8 Hours**<br><br>**6 Hours** |
| **DATA LINK LAYER**<br>Encoding, Error Detection, Reliable Transmission, MAC Protocols, Multiple Access Protocols: Random Access, Controlled Access and Channelization.<br><br>**Practical Component**<br>Design a network topology in Cisco Packet Tracer with multiple devices, configure IP addresses and network protocols, and verify connectivity and proper communication between all devices. | **9 Hours**<br><br>**6 Hours** |
| **Network Layer**<br>Circuit Switching, Packet Switching, Bridges and LAN Switches, Spanning Tree Algorithm, Internetworking, IPv4, Subnetting, IPv6, Routing Techniques (RIP, OSPF, BGP). | **9 Hours** |
| **TRANSPORT LAYER AND APPLICATION LAYER**<br>UDP, TCP, Congestion Control, Resource Allocation, TCP Congestion Control, Congestion Avoidance Mechanisms, Quality of Service (Integrated Services, Differentiated Services), Network Traffic Analysis. Application Layer -DNS, Email, WWW, HTTP.<br><br>**Practical Component**<br>Capture and analyze network traffic using Wireshark to identify and examine packets, perform traffic analysis to assess network performance, and conduct vulnerability analysis to detect any security issues or anomalies -Implement TCP and UDP client-server applications using UNIX socket programming functions. | **10 Hours**<br><br>**10 Hours** |
| **NETWORKS SECURITY CONCEPTS**<br>Introduction to network security concepts, Network Security Model, Classical Encryption Techniques-Symmetric cipher model, Substitution techniques, Transposition techniques, Block cipher concepts and Data Encryption Standard.<br><br>**Practical Component**<br>Implementation of substitution and transposition technique. | **9 Hours**<br><br>**8 Hours** |

| Theory Hours: 45 | Tutorial Hours: 0 | Practical Hours: 30 | Project Hours: 0 | Total Hours: 75 |
|---|---|---|---|---|

## Learning Resources

### Textbooks


1. Behrouz A. Forouzan, "Data Communications and Networking with TCPIP Protocol Suite", 6th Edition, Tata McGraw-Hill, New Delhi, (2022).
2. Andrew S. Tanenbaum and David J. Wetherall," Computer Networks",Fifth Edition, Prentice Hall Publisher, (2010).


### Reference books/ Web Links


1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach," Fifth Edition, Morgan Kaufmann Publishers Inc., (2011).
2. William Stallings, "Data and Computer Communications," Tenth Edition, Pearson Education, (2013).


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3. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet," Sixth Edition, Pearson Education, (2012).
4. William Stallings, "Network Security Essentials: Applications and Standards," Fifth Edition, Pearson Education, (2013).

**Online Resources**

1. https://www.classcentral.com/course/udacity-computer-networking-2336.
2. https://www.classcentral.com/course/fundamentals-network-communications-9267.
3. https://www.classcentral.com/course/computer-communications-18777.
4. https://www.mygreatlearning.com/academy/learn-for-free/courses/network-security.

| **Assessment (Embedded Course)** |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)<br>Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated by** | | | |
|---|---|---|---|
| **Expert from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert(s)** | |
| | | Dr.A. Roshini,<br>Department of Computer Science and Engineering | |
| **Recommended by BoS on** | 09.05.2025 | | |
| **Academic Council Approval** | No:28 | **Date** | 26.06.2025 |

**Signature of BOS Chairman-CSE**

| 24CSP012 | JAVA PROGRAMMING<br>(Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 0 | 2 |
| PC | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the basics of Java programming, including loops, arrays, and string manipulations. |
| 2 | Apply the principles of Object-Oriented Programming (OOP) such as inheritance, polymorphism, and abstraction. |
| 3 | Learn and implement Java Collections, Strings, and lambda expressions. |
| 4 | Enable students to perform file operations and utilize the Java Collection Framework. |
| 5 | Equip students with skills to develop GUI-based applications and connect them to databases. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply the core principles of Java programming and Object-Oriented Programming (OOP) concepts to write modular, efficient Java applications | Ap |
| CO 2 | Utilize Java packages, interfaces, and exception handling mechanisms to build reusable and error-resilient code | Ap |
| CO 3 | Develop multi-threaded applications and perform string and wrapper class manipulations in Java. | Ap |
| CO 4 | Analyse input/output operations and use Java's collection framework for real-time data storage and retrieval | An |
| CO 5 | Develop GUI-based Java applications using event controls and connect them to databases using JDBC | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | 2 | 3 | | 2 | | | | | | | 2 | |
| 2 | 2 | 2 | 3 | | | | | | | | | | |
| 3 | 2 | 2 | 3 | | | | | | 2 | 2 | | | |
| 4 | 3 | 3 | 2 | | | | | | 1 | 2 | | 2 | |
| 5 | 2 | 2 | 3 | | | | | | | | | | |

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| Course Content | |
|---|---|
| **JAVA PROGRAMMING BASICS**<br>OOP Basics – Java Features -Java Programming Concepts, Control statement, Arrays, Method Overloading, Abstract Classes, Inheritance, Method Overriding | **12 Hours** |
| **PACKAGES, INTERFACES AND EXCEPTION HANDLING**<br>Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces, Exception Handling-Try, Catch, and Finally, Throw and Throws Clause-User-defined Exception | **12 Hours** |
| **MULTITHREADING AND STRINGS**<br>Multithreaded Programming: Life cycle of a thread -Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication–Multithreading- Wrappers – Auto boxing - String handling – String operations -String methods - Wrapper classes | **12 Hours** |
| **FILES AND COLLECTION FRAMEWORK**<br>I/O Basics – Reading and Writing Console I/O – Reading and Writing Files -Streams - Byte streams and Character streams - Java Collection Framework-Array List, LinkedList, Stack, Queue, Map, Generic Collections, Introduction to Lambda Expressions | **12 Hours** |
| **EVENT HANDLING AND DATABASE CONNECTIVITY**<br>GUI programming using Swing and JavaFX – Limitations of applets – Event-driven programming model – JFrame, Stage and Scene – Event handling: action, mouse and key events – Basic Swing controls and layout managers – JavaFX controls and Menus<br>Database connectivity using JDBC – JDBC architecture and drivers – Connecting Java applications with databases - Integration of Swing/JavaFX applications with databases. | **12 Hours** |

| Theory Hours: | Tutorial Hours: | Practical Hours: 60 | Project Hours: | Total Hours: 60 |
|---|---|---|---|---|

| Learning Resources |
|---|
| **Textbooks** |
| 1. Herbert Schildt, Java: The Complete Reference, 12th Edition, McGraw-Hill Education, 2022.<br>2. Kathy Sierra and Bert Bates, Head First Java, 2nd Edition, O'Reilly Media, 2005.<br>3. Rod Johnson, Expert One-on-One J2EE Development without EJB, Wiley Publishing, 2004. |
| **Reference books/ Web Links** |
| 1. Bruce Eckel, Thinking in Java, 4th Edition, Prentice Hall, 2006.<br>2. Josh Long, Cloud Native Java: Designing Resilient Systems with Spring Boot, Spring Cloud, and Cloud Foundry, O'Reilly Media, 2017.<br>3. Craig Walls, Spring in Action, 5th Edition, Manning Publications, 2018.<br>4. Paul Deitel and Harvey Deitel, Java How to Program, 11th Edition, Pearson, 2017. |
| **Online Resources** |
| 1. https://www.coursera.org/specializations/java-programming<br>2. https://www.edx.org/learn/java<br>3. https://www.codecademy.com/learn/learn-java<br>4. https://docs.oracle.com/en/java/javase/ |

| Assessment (Practical course) |
|---|
| Lab Workbook, Mini project, Experimental Cycle tests, viva-voce and End Semester Examination |

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| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert(s)** | |
| - | - | Dr.S.Sathyavathi, Ms.G.Shobana<br>Assistant Professor<br>Department of IT<br>Ms. M. Jhansisridevi<br>Assistant Professor<br>Department of CSE | |
| **Recommended by BoS on** | 29.11.2025 | | |
| **Academic Council Approval** | No: 29 | **Date** | 24.12.2025 |

**Signature of BOS Chairman-CSE**

| 24ADI017 | MACHINE LEARNING TECHNIQUES | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 2 | 4 |
| PC | | SDG | 9 | | | |

| Pre-requisite courses | 24MAI234 Computational Probability and Statistics | Data Book / Code book (If any) | Nil |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | Understand the fundamental concepts of machine learning, its types, workflows, and evaluation metrics. |
| 2 | Learn key supervised learning methods for regression and classification and apply them to real-world problems. |
| 3 | Explore unsupervised learning techniques such as clustering, dimensionality reduction, and association rule mining. |
| 4 | Apply ensemble learning methods and basic deep learning concepts to build more accurate and robust models |
| 5 | Develop practical machine learning applications, including recommender systems, by implementing a complete end-to-end ML pipeline |

## Course Outcomes

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | Apply suitable data preprocessing and feature selection techniques to prepare datasets for building effective machine learning models. | Ap |
| CO2 | Implement various regression and classification algorithms to solve supervised learning problems. | Ap |
| CO3 | Analyze unsupervised learning techniques to discover hidden patterns and relationships in data. | An |
| CO4 | Apply ensemble and deep learning models using gradient-based optimization and backpropagation techniques. | Ap |
| CO5 | Develop recommender systems using collaborative, content-based, and hybrid filtering approaches to provide personalized recommendations. | Ap |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | | | | 2 | 2 | | | | | 2 | |
| 2 | 3 | 2 | | | 2 | | | | | | 2 | 3 | 2 |
| 3 | 3 | 2 | | | 2 | | | | | | 2 | 3 | 2 |
| 4 | 3 | 2 | | | 2 | | | | | | 2 | 3 | 2 |
| 5 | 3 | 2 | | | 2 | | | | | | 2 | 3 | 2 |

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## Course Content

| | |
|---|---|
| **INTRODUCTION TO MACHINE LEARNING**<br>Definition and scope of Machine Learning-Types of Machine Learning: Supervised, Unsupervised, Semi-supervised, Reinforcement-Steps in a Machine Learning project-Data Preprocessing-Feature selection and normalization-Performance evaluation metrics- Accuracy, Precision, Recall, F1-Score, ROC-AUC-Overfitting and Underfitting -Applications of Machine Learning | **7 Hours** |
| **SUPERVISED LEARNING**<br>Regression Techniques- Linear Regression, Polynomial Regression, Ridge and Lasso Regression- Classification Algorithms- K-Nearest Neighbors, Decision Trees, Random Forests, Naïve Bayes, Support Vector Machines- Evaluation of Supervised Models – Confusion Matrix, Cross-validation, Bias-Variance tradeoff- Case Studies and Practical Implementation | **8 Hours** |
| **UNSUPERVISED LEARNING**<br>Clustering Techniques- K-Means- Hierarchical- DBSCAN - Dimensionality Reduction-PCA- LDA- t-SNE-Association Rule Mining – Apriori and FP-Growth Algorithms-Anomaly and Outlier Detection-Applications of Unsupervised Learning in Real-World Domains | **10 Hours** |
| **ENSEMBLE LEARNING AND INTRODUCTION TO DEEP LEARNING**<br>Ensemble Methods- Bagging, Boosting, Stacking- Random Forest and Gradient Boosting Models - Introduction to Deep Learning- Neural Networks- Perceptron- Activation Functions-Architecture of Deep Neural Networks-Optimization Techniques- Gradient Descent- Backpropagation-Introduction to CNN and RNN – Concepts and Applications | **12 Hours** |
| **RECOMMENDER SYSTEMS AND APPLICATIONS**<br>Introduction to Recommender Systems - Collaborative Filtering – User-based and Item-based-Content-based and Hybrid Recommendation Techniques-Matrix Factorization and Latent Factor Models-Deep Learning-based Recommendation- Autoencoders- Neural Collaborative Filtering-Evaluation Metrics for Recommender Systems-Applications in E-commerce, Media, and Healthcare | **8 hours** |
| **PROJECT**<br><br>To design and develop a comprehensive machine learning pipeline that processes real-world datasets through data preprocessing, supervised and unsupervised learning, ensemble techniques, and deep learning fundamentals. The project must include classical regression and classification models, clustering and dimensionality reduction methods, ensemble algorithms, and a recommender system component, culminating with explainable ML insights and model evaluation using industry-standard metrics.<br><br>**Final Deliverables (Presentation & Report)**<br><br>• GitHub repo with code, data samples, and README<br>• 10-minute project presentation with visuals<br><br>Final report summarizing problem, methods, datasets, results, and future work | |

| Theory Hours:45 | Tutorial Hours:0 | Practical Hours: 0 | Project Hours:30 | Total Hours:75 |
|---|---|---|---|---|

## Learning Resources

### Textbooks


1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Fourth Edition, (2020).
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, Foundations of Machine Learning, Second Edition, MIT Press, (2018).
3. Falk, Kim, Practical Recommender Systems, United States, Manning, (2019).


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| Reference |
|---|
| 1. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rd Edition (1997).<br>2. Sebastain Raschka, Vahid Mirjalili , Python Machine Learning, Packt publishing 3rd Edition, (2019).<br>3. M.Gopal, Applied Machine Learning, McGraw Hill Education, New York, (2018). |
| **Online Resources (Weblinks)** |
| 1. https://www.coursera.org/specializations/machine-learning-introduction<br>2. https://onlinecourses.nptel.ac.in/noc19_cs53/preview<br>3. https://pll.harvard.edu/course/data-science-machine-learning |

| Assessment (Embedded course) |
|---|
| SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)<br>Review I, Review II, Project Report, viva-voce |

| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | | **Internal Expert(s)** |
| - | - | | Ms. Tharsanee R M,<br>AP/Artificial Intelligence & Data Science |
| **Recommended by BoS on** | 29.11.2025 | | |
| **Academic Council Approval** | No: 29 | **Date** | 24.12.2025 |

**Signature of BOS Chairman-CSE**

| 24ITP013 | APTITUDE AND REASONING – II (Common to AD, CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 0 | 1 |
| HS | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | Familiarize the aptitude test patterns used by multinational companies and government organizations. |
| 2 | Use reasoning and aptitude skills to solve real-world problems typically faced in business and technical environments. |
| 3 | Enable to solve calendar-based problems. |

## Course Outcomes:

| After successful completion of this course, the students shall be able to | | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Solve puzzles problems using structured and step-by-step logic. | Ap |
| CO 2 | Solve time and distance-based problems effectively | Ap |
| CO 3 | Assess mental calculation speed using Vedic math techniques and shortcuts for quicker problem solving. | E |
| CO 4 | Develop test-taking strategies to handle quantitative and reasoning questions under time and calendar constraints. | Cr |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | | | | | | 3 | | |
| 2 | 3 | | 2 | | | | | | | | 3 | 2 | |
| 3 | 3 | | | | | 2 | | | | | 3 | 2 | |
| 4 | 3 | | | | | | | | | | | | |

## Course Content

| | |
|---|---|
| **SIMPLE AND COMPOUND INTEREST, PROBABILITY**<br>Basic formulae and shortcuts, Difference between simple and compound interest, Annual and half-yearly compounding, Incremental and Depreciation Problems, Equal Instalments, Probability – Concepts, Probability Laws, Successive and One by one draw methods. | **6 Hours** |
| **SPEED, TIME AND DISTANCE, PROBLEMS ON TRAINS**<br>Total Distance, Average Speed Calculations, Relative Speed, Train Crossing a Pole, Train Crossing a Platform, Bridge, Tunnel, Two Trains Crossing Each other. | **6 Hours** |

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| | |
|---|---|
| **BOATS AND STREAMS, SYLLOGISM**<br>Stream and Boat Moving in Same Direction, Stream and Boat Moving in Opposite Directions, Downstream and Upstream Time Calculations, Syllogism - Venn Diagram Method, Analytical Method, Possibility-based Syllogisms | **6 Hours** |
| **NUMBER SERIES, MIXTURES AND ALLIGATIONS**<br>Missing Numbers Series, Wrong Number Series, Next Number Sequence, Alpha Numeric pattern, Number and Letter Series, Rule Alligations, Replacement Problems, Mixture Concentration. | **6 Hours** |
| **CALENDAR, CLOCKS, PUZZLES**<br>Day, Date, and Year Identification Problems, Clocks – Mirror image, Angle Calculations, Odd one out, Pattern recognition, Box-based puzzles Floor-based puzzles | **6 Hours** |

| Theory Hours: | Tutorial Hours: | Practical Hours: | Project Hours: | Total Hours: |
|---|---|---|---|---|
| 0 | 0 | 30 | 0 | 30 |

| **Learning Resources** |
|---|
| **Textbooks** |
| 1. R.S. Agarwal, A Modern Approach to Logical Reasoning – comprehensive for verbal and non-verbal reasoning, S. Chand Publisher, (2022). |
| **Reference books/ Web Links** |
| 1. Arun Sharma, How to Prepare for Quantitative Aptitude for the SA-I, SA-II, McGraw Hill, (2021). |
| **Online Resources** |
| 1. https://crm.mastersacademy.in/ |

| **Assessment** |
|---|
| MCQ |

| **Course Curated by** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | | **Internal Expert** |
| Mr. Vivekanand,<br>CEO and Founder – Masters Academy | - | | Dr. D. Sudharson,<br>Department of Artificial Intelligence and Data Science |
| **Recommended by BoS on** | 09.05.2025 | | |
| **Academic Council Approval** | No: 28 | **Date** | 26.06.2025 |

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# SEMESTER V

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| 24ITI005 | OPERATING SYSTEMS | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| PC | | SDG | 8,9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the basic concepts, structure, and key functions of operating systems. |
| 2 | Learn how operating systems manage hardware, processes, memory, and files. |
| 3 | Analyze different process scheduling, synchronization, and memory allocation techniques. |
| 4 | Gain hands-on experience in simulating and implementing OS functionalities. |
| 5 | Explore real-world applications of operating systems, including virtualization. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Interpret the evolution, architecture and functionalities of Operating Systems. | Ap |
| CO 2 | Design and analyze process scheduling strategies and synchronization techniques. | An |
| CO 3 | Apply inter-process communication and concurrency control in modern systems. | Ap |
| CO 4 | Implement memory management schemes and virtualization strategies. | Ap |
| CO 5 | Analyze the design and functionality of file systems and real-time operating systems. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | | | | | | | | |
| 2 | | 3 | | | | | | | | | | 3 | |
| 3 | | | | | 3 | | | | | | | | |
| 4 | | | 3 | | | | | | | | | | |
| 5 | | | | 3 | | | | | | | | | 3 |

## Course Content

**Operating System Fundamentals and Process Management** — **9 Hours**

Introduction: OS Services - OS Structures: Monolithic, Layered, Modular, Micro-kernel - Process Concept, Lifecycle, Process Control Block, Process Scheduling Queues -

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| | |
|---|---|
| System Calls, User Mode and Kernel Mode, Interrupts - Threads: User-level, Kernel-level, Thread Models<br><br>**Practical Component**<br>1. Linux File System & Shell Scripting.<br>2. Process Management in Linux (Creating process using fork(), observing orphan & Zombie states) | <br><br>**6 Hours** |
| **CPU Scheduling and Deadlocks**<br>Scheduling Basics: Preemptive & Non-Preemptive - CPU Scheduling Algorithms: FCFS, SJF, Priority, Round Robin - Multiprocessor Scheduling - Deadlock: Conditions, Resource Allocation Graph - Deadlock Handling: Prevention, Avoidance, Detection & Recovery<br><br>**Practical Component**<br>1. Simulation of CPU scheduling algorithms (FCFS, SJF, Priority, RR)<br>2. Banker's Algorithm to detect safe/unsafe states | **9 Hours**<br><br>**6 Hours** |
| **Concurrency and Synchronization**<br>Inter-process Communication - Synchronization: Peterson's Solution, Bakery Algorithm, Hardware Support - Semaphores, Monitors, Classical Problems (Dining Philosophers, Readers-Writers) - IPC in Unix Systems - Locking in Multiprocessors: Scalable Locks, Lock-free Coordination<br><br>**Practical Component**<br>1. Implement process synchronization using semaphores/monitors<br>2. Solve Dining Philosophers problem using threads and semaphores | **9 Hours**<br><br>**6 Hours** |
| **Memory Management and Virtualization**<br>Main Memory Management – Main Memory Allocation Strategies – Paging and Segmentation – Hardware Support: Address Translation, Translation Lookaside Buffer (TLB), Caching – Virtual Memory and Demand Paging – Page Replacement Algorithms: FIFO, LRU, Optimal – Thrashing and Working Set Model – Virtualization Concepts: Hardware and Software Virtualization, Server and Network Virtualization – Hypervisors: Type-1 and Type-2 – Containers – Cost of Virtualization.<br><br>**Practical Component**<br>1. Implement dynamic memory allocation algorithms (First-fit, Best-fit, Worst-fit)<br>2. Simulation of Page Replacement Algorithms (FIFO, LRU, Optimal) Virtualization setup: Type-1 & Type-2 Hypervisor | **9 Hours**<br><br>**6 Hours** |
| **File Systems, Storage, and RTOS**<br>File System Interface: Access Methods, Directory Structures - Implementation: File Allocation, Directory Management - File Recovery: Journaling, Soft Updates, Log-structured FS - Distributed File Systems - Disk Structure, Disk Scheduling (Seek Time, Rotational Latency) – RTOS Introduction – RTOS Scheduling – RTOS Examples and Use cases - OS Performance, Scalability, Trends in Mobile OS<br><br>**Practical Component**<br>1. Implement file locking mechanisms in Linux<br>2. Real-Time Task Scheduling and Synchronization using FreeRTOS (or any RTOS simulator) | **9 Hours**<br><br>**6 Hours** |

| | | | | |
|---|---|---|---|---|
| **Theory Hours: 45** | **Tutorial Hours: 0** | **Practical Hours: 30** | **Project Hours: 0** | **Total Hours: 75** |

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| Learning Resources |
|---|
| **Textbooks** |
| 1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", 10th Edition, Wiley, United States 2018.<br>2. Fox, Richard, "Linux with Operating System Concepts", 2nd Edition, Chapman and Hall/CRC, UK 2022. |
| **Reference books/ Web Links** |
| 1. William Stallings, "Operating Systems: Internals and Design Principles", 9th Edition, Pearson, United Kingdom 2018.<br>2. Andrew S. Tanenbaum, "Modern Operating Systems', 4th Edition, Pearson, United Kingdom 2016.<br>3. Love, Robert, "Linux System Programming: talking directly to the kernel and C library", 2nd Edition, O'Reilly Media, Inc, United States 2013. |
| **Online Resources** |
| 1. https://www.scaler.com/topics/course/free-operating-system-course/<br>2. https://www.coursera.org/specializations/codio-introduction-operating-systems |

| Assessment (Embedded Course) |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert** | |
| - | - | Mr. K. Manoj<br>Department of Computer Science and Engineering | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSI013 | FULL STACK DEVELOPMENT | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| PC | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | To equip students with foundational knowledge of web development technologies, including HTML, CSS, JavaScript, and Bootstrap. |
| 2 | To enable students to build dynamic and responsive web applications using ReactJS and integrate backend services with NodeJS and ExpressJS. |
| 3 | To provide hands-on experience in database management using MongoDB and deploying applications using Git and cloud platforms. |
| 4 | To foster problem-solving skills and teamwork through practical implementation of full-stack development concepts. |
| 5 | To familiarize students with modern development workflows, version control, and deployment practices used in industry. |

| Course Outcomes | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Create well-structured and styled web pages following modern web development standards. | Ap |
| CO 2 | Apply knowledge to develop interactive and dynamic web applications with effective front-end and back-end communication. | Ap |
| CO 3 | Utilize server-side concepts to build efficient APIs and implement middleware for enhancing application functionalities. | Ap |
| CO 4 | Perform database operations, including data modelling and management, to support dynamic applications. | Ap |
| CO 5 | Deploy web applications effectively to hosting platforms and implement version control to manage collaborative development. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 | |
| 1 | 2 | | | | | | | | | | | 3 | | |
| 2 | | 3 | | | | | | | | | | 3 | | |
| 3 | 2 | | | | | | | | | | | 3 | | |
| 4 | | | 2 | | | | | | | | | 3 | | |
| 5 | | | | | 3 | | | | | | | 3 | | |

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| Course Content | |
|---|---|
| **HTML, CSS AND JAVASCRIPT**<br>HTML – Basics - Bootstrap – Introduction - grid system – components – utilities - JavaScript – Fundamentals - DOM manipulation – events - basic ES6 features - Web Development Stack - Full Stack – Introduction – Types: MERN, MEAN, MEVN, LAMP, Ruby on Rails, Django, NET, JAMSTACK<br>**Practical Component**<br>Web page creation using HTML and CSS – Client-side Scripts creation and Validation of Web Form Controls using JavaScript – Responsive landing page design using Bootstrap- AI Tools. | **9 Hours**<br><br>**6 Hours** |
| **REACTJS**<br>Introduction to React – Components – JSX – props – lifecycle - state - Advanced React – Hooks - context API - basic routing<br>**Practical Component**<br>Application building using React and API integration – Implementation of Hooks and context API in the platform– AI tools. | **9 Hours**<br><br>**6 Hours** |
| **NODEJS AND EXPRESSJS**<br>NodeJS – Basics – modules - npm – ExpressJS - Setting up a server – routing - middleware<br>**Practical Component**<br>Setting up a RESTful API - middleware implementation for user authentication– AI tools. | **9 Hours**<br><br>**6 Hours** |
| **INTEGRATION WITH MONGODB**<br>MongoDB – Basics – Connecting MongoDB with Node.js – MongoDB Native Driver – Mongoose for Schema and Model Management – Async/Await Database Operations – Authentication and Security – REST API Development using MongoDB and Node.js<br>**Practical Component**<br>Record management system using MongoDB – schema creation using Mongoose– AI tools. | **9 Hours**<br><br>**6 Hours** |
| **DEPLOYMENT WITH GIT**<br>Git - Version control - Branching and merging - Deployment concepts - Environment variables - Deploying applications using platforms like Heroku and Vercel - AI-assisted development using Anthropic Claude and OpenAI ChatGPT.<br>**Practical Component**<br>Deploy a full stack application to Heroku or Vercel - Manage version control for a collaborative project using Git branching and merging. – AI tools. | **9 Hours**<br><br>**6 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | **0** | **Practical Hours:** | **30** | **Project Hours:** | **0** | **Total Hours:** | 75 |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. “Mastering HTML, CSS & JavaScript Web Publishing” by Laura Lemay, Rafe Colburn, Jennifer Kyrnin, BPB Publications,2016.<br>2. "Node.js Web Development: Server-side web development " by David Herron, 5th Edition, 2020.<br>**3. "**React Up & Running" by Stoyan Stefanov, O'Reilly Media, Inc, 2021.<br>4. Web Development with MongoDB and Node JS” by Mithun Satheesh, Bruno Joseph D'mello, Jason Krol, Packt Publishing Limited; 2nd edition, 2015. |
| **Reference books/ Web Links** |
| 1. "Node.js in Action" by Alex Young, Bradley Meck, Mike Cantelon, Tim Oxley, Marc Harter, T.J. Holowaychuk, and Nathan Rajlich, Manning, 2nd Edition, 2017<br>2. "Node.js Design Patterns" by Luciano Mammino and Mario Casciaro, 3rd Edition, 2025. |

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| |
|---|
| 3. "Web Development with Node and Express" by Ethan Brown, O'Reilly Media, Inc. 2nd Edition, 2019. |
| **Online Resources** |
| 1. Introduction to Web Development with HTML, CSS, JavaScript \| Coursera<br>2. Getting Started with Git and GitHub \| Coursera<br>3. Developing Back-End Apps with Node.js and Express \| Coursera<br>4. Introduction to MongoDB \| Coursera<br>5. [Project] Build a CRUD Node.js and MongoDB employee management web-app \| Coursera |

| **Assessment (Embedded Course)** |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated By** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | | **Internal Expert(s)** |
| Mr. Sai Shankar<br>Project Manager<br>Ernst & Young | | | Nivetha R, AP/CSE<br>Sathyaseelan N, AP/CSE |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSI014 | DESIGN AND ANALYSIS OF ALGORITHMS | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| PC | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI104 Data Structures and Algorithms | Data Book / Codes / Standards (If any) | NIL |
|---|---|---|---|

## Course Objectives:

The purpose of taking this course is to:

| | |
|---|---|
| 1 | Understand fundamental algorithmic problem-solving techniques and the importance of algorithmic analysis in various problem types, data structures, and efficiency classes. |
| 2 | Explore advanced algorithmic paradigms like Divide and Conquer, Greedy Strategy, Dynamic Programming, Backtracking, Branch and Bound for solving complex problems. |
| 3 | Analyze the efficiency of algorithms using theoretical and empirical methods considering their time complexity and space complexity. |
| 4 | Investigate computational complexity theory, including P, NP, NP-complete, and NP-hard problems, and the use of approximation algorithms in optimization. |

## Course Outcomes:

| After successful completion of this course, the students shall be able to | | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO1 | Apply algorithmic problem-solving strategies and analyze the performance of recursive and non-recursive algorithms using asymptotic notations. | Ap |
| CO2 | Apply divide and conquer techniques to solve computational problems and use recurrence solving methods to determine the efficiency of recursive algorithms. | Ap |
| CO3 | Apply greedy and dynamic programming approaches to solve optimization problems and evaluate their efficiency. | Ap |
| CO4 | Analyze combinatorial problems using backtracking and branch-and-bound strategies to derive optimal solutions. | An |
| CO5 | Analyze problem complexity to classify problems as P, NP, NP-complete, or NP-hard and examine approximation techniques for solving hard problems. | An |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Teamwork | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | 2 | | | | | | | | 3 | |
| 2 | 3 | 3 | 2 | 2 | | | | | | | | 3 | |
| 3 | 3 | 3 | 2 | 2 | | | | | | | | 3 | |
| 4 | 2 | 3 | | 2 | | | | | | | | 2 | |
| 5 | 2 | 2 | | 2 | | | | | | | | 2 | |

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| Course Content | |
|---|---|
| **FOUNDATIONS OF ALGORITHM ANALYSIS**<br>Fundamentals of algorithmic problem solving – Important problem types – Analysis framework – Asymptotic notations and basic efficiency classes – Mathematical Analysis: Recursive algorithms, non-recursive algorithms - Brute Force String matching.<br><br>**Practical Component**<br>Implement and compare recursive vs. iterative algorithms - Analyze different algorithmic performance – Brute Force String matching. | **7 Hours**<br><br>**4 Hours** |
| **DIVIDE AND CONQUER**<br>Divide and conquer: Solving recurrences: Substitution method, recursion-tree method, master method. The maximum-subarray problem - Multiplication of large integers – Strassen's matrix multiplication.<br><br>**Practical Component**<br>Implement and analyze the maximum subarray problem using divide and conquer – Implement Strassen's matrix multiplication algorithm. | **10 Hours**<br><br>**6 Hours** |
| **GREEDY STRATEGY AND DYNAMIC PROGRAMMING**<br>Greedy algorithms: Fractional Knapsack Problem - Activity selection problem – Huffman codes. Elements of dynamic programming - Matrix chain multiplication - Longest Common Subsequence (LCS) - 0/1 Knapsack problem and memory functions – Optimal binary search trees - All Pairs Shortest Paths: Floyd-Warshall Algorithm.<br><br>**Practical Component**<br>Construct Huffman coding tree for data compression - Implement Matrix chain multiplication - Solve Longest Common Subsequence (LCS) Problem - Implement 0/1 knapsack problem using memory functions. | **12 Hours**<br><br>**8 Hours** |
| **BACKTRACKING, BRANCH AND BOUND**<br>Backtracking strategy: N-Queens Problem – Hamiltonian circuit problem – Subset Sum problem – Graph Coloring. Branch and bound strategy: Assignment problem - Traveling Salesperson Problem - 0/1 knapsack problem.<br><br>**Practical Component**<br>Apply backtracking to solve the N-Queens problem - Implement backtracking approach to perform Graph Coloring using minimum number of colors - Apply Branch and Bound technique to solve the Travelling Salesman Problem for optimal tour cost. | **9 Hours**<br><br>**8 Hours** |
| **COMPUTATIONAL COMPLEXITY AND APPROXIMATION ALGORITHMS**<br>Polynomial time, Polynomial-time verification, P and NP problems, NP-Complete problems – NP-Hard problems – NP-completeness and reducibility - Introduction to Approximation Algorithms: vertex-cover problem – Randomization and linear programming: Subset-sum problem.<br><br>**Practical Component**<br>Implement the Vertex-Cover Problem using a Greedy Approximation Algorithm. | **7 Hours**<br><br>**4 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | **0** | **Practical Hours:** | **30** | **Project Hours:** | **0** | **Total Hours:** | **75** |

## Learning Resources

### Textbooks


1. Cormen, Thomas H., Leiserson, Charles E., Rivest, Ronald L., Stein, Clifford., Introduction to Algorithms, MIT Press, Cambridge (2022).
2. Levitin, Anany., Introduction to the Design and Analysis of Algorithms, Pearson Education, New York (2021).


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3. Horowitz, Ellis., Sahni, Sartaj., Fundamentals of Computer Algorithms, Galgotia Publications, New Delhi (2008).

**Reference books/ Web Links**

1. Sen, Sandeep., Kumar, Amit. Design and Analysis of Algorithms: A Contemporary Perspective. United States: Cambridge University Press, 2019.
2. Baase, Sara. Computer Algorithms: Introduction to design and analysis. India: Pearson Education, 2009.
3. Aho, Alfred V.., Hopcroft, John E., The Design and Analysis of Computer Algorithms. India: Pearson Education, 1974.
4. Kozen, Dexter C. The design and analysis of algorithms. Springer Science & Business Media, 2012.
5. Kleinberg, Jon., Tardos, Éva., Algorithm Design, Pearson Education, New York (2022).
6. Dasgupta, Sanjoy., Papadimitriou, Christos H., Vazirani, Umesh., Algorithms, McGraw-Hill Education, New York (2006).
7. Horowitz, Ellis., Sahni, Sartaj., Rajasekaran, Sanguthevar., Computer Algorithms, Silicon Press, New Jersey (2007).

**Online Resources**

1. https://onlinecourses.nptel.ac.in/noc19_cs47/preview
2. https://onlinecourses.swayam2.ac.in/nou25_ma09/preview
3. https://onlinecourses.swayam2.ac.in/cec20_cs03/preview

**Assessment (Embedded Course)**

SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

**Course Curated by**

| Expert(s) from Industry | Expert(s) from Higher Education Institution | Internal Expert |
|---|---|---|
| - | - | Ms. E. Shriaarthy, Department of Artificial Intelligence and Data Science |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 09.05.2025 | | |
| **Academic Council Approval** | No: 28 | **Date** | 26.06.2025 |

**Signature of BOS Chairman-CSE**

| 24CSI015 | SOFTWARE ENGINEERING AND AGILE PRACTICES | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 2 | 4 |
| PC | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand fundamental software engineering principles, processes, and SDLC models for building quality software systems. |
| 2 | Comprehend Agile values, principles, and frameworks such as Scrum, Kanban, and Extreme Programming (XP). |
| 3 | Implement software testing strategies including unit, integration, system, and acceptance testing in both traditional and Agile contexts. |
| 4 | Apply software project management techniques including planning, scheduling, estimation, risk management, and team organization. |
| 5 | Apply software quality standards, metrics, and process improvement models (CMMI, ISO) to real-world software projects. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Explain SDLC phases and process models; analyse their applicability to real-world software projects using appropriate tools. | An |
| CO 2 | Implement Agile practices including Scrum ceremonies, Kanban boards, sprint planning, backlog grooming, and retrospectives. | Ap |
| CO 3 | Design and execute comprehensive software testing strategies including TDD, black-box, white-box, and automated testing using JUnit/Selenium. | Ap |
| CO 4 | Apply software project management techniques: effort estimation (COCOMO II), scheduling, risk analysis, and SCM using Git and JIRA. | Ap |
| CO 5 | Apply ISO/IEC 25010 quality metrics and CMMI practices to assess software quality and implement CI/CD pipelines to support DevOps practices in Agile software development. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 3 | | | 2 | | | | | | | 3 | |
| 2 | | 3 | | 3 | | | | 2 | | 3 | 3 | 3 | |
| 3 | 3 | 3 | 3 | | 3 | | | | | | | 3 | 2 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | 3 | | | 3 | | | | | | 3 | 3 | |
| 5 | | 3 | | | 3 | | | | | | 3 | 3 | 3 |

| **Course Content** | |
|---|---|
| **SOFTWARE ENGINEERING FUNDAMENTALS**<br>Introduction to Software Engineering – Software characteristics, types and myths – Software crisis – SDLC overview – Process models: Waterfall, Incremental, Spiral, RAD, and Prototype model – Unified Process – Requirements Engineering: elicitation, specification, functional and non-functional requirements, use case modelling – Software design concepts: cohesion, coupling, modularity, layered architecture – UML basics: class, sequence, and activity diagrams – Coding standards and best practices.<br>**Project Component: Requirements and Design Phase**<br>Students form project teams and identify a real-world problem. Activities include: (a) eliciting and documenting functional and non-functional requirements using a requirements specification template, (b) drawing use case diagrams and activity diagrams using draw.io or StarUML, (c) creating a class diagram for the proposed system, and (d) preparing a project charter document. Deliverable: Software Requirements Specification (SRS) document. | **9 Hours**<br><br>**6 Hours** |
| **AGILE METHODOLOGIES**<br>Agile Manifesto: 12 principles and 4 values – Agile vs Traditional approaches – Scrum framework: Product Owner, Scrum Master, Development Team – Scrum artefacts: Product Backlog, Sprint Backlog, Increment – Scrum ceremonies: Sprint Planning, Daily Stand-up, Sprint Review, Sprint Retrospective – Kanban: WIP limits, boards, flow metrics, cumulative flow diagrams – Extreme Programming (XP): pair programming, TDD, CI, refactoring – Lean Software Development principles – SAFe overview – Agile estimation: Story Points, Planning Poker – Agile metrics: velocity, burndown charts, cycle time.<br>**Project Component: Agile Sprint Simulation**<br>Students execute a two-sprint Agile simulation on their project: (a) groom the product backlog with at least 15 user stories with acceptance criteria, (b) conduct a Sprint Planning meeting and commit to a sprint backlog, (c) maintain a physical or digital Kanban board (Trello/JIRA) updating task status daily, (d) produce a sprint burndown chart, (e) conduct a Sprint Review and Retrospective and document outcomes, and (f) calculate team velocity and forecast the next sprint capacity. Deliverable: Sprint 1 report with burndown chart and retrospective notes | **9 Hours**<br><br>**6 Hours** |
| **SOFTWARE TESTING**<br>Software testing fundamentals: verification vs validation – Testing levels: unit, integration, system, acceptance testing – Testing types: black-box (equivalence partitioning, boundary value analysis, decision table), white-box (statement, branch, path coverage, cyclomatic complexity) – Test-Driven Development (TDD) and Behaviour-Driven Development (BDD) – Test planning, test case design, and test execution – Testing in Agile: continuous testing, regression, exploratory testing – Defect management lifecycle – Automation tools: JUnit 5, Selenium WebDriver – Performance and load testing concepts – UAT – Testing metrics: defect density, test coverage.<br>**Project Component: Testing Phase**<br>Students perform comprehensive testing on their project: (a) write unit tests using JUnit 5 for at least three core modules with minimum 80% code coverage, (b) apply TDD by writing failing tests first and then writing code to pass them for one new feature, (c) design black-box test cases using equivalence partitioning and boundary value analysis for login and data entry modules, (d) perform a code walkthrough for cyclomatic complexity calculation, (e) record and replay a UI test flow using Selenium IDE, and (f) prepare a defect log and test summary report. Deliverable: Test Plan document, JUnit test files, and defect log. | **9 Hours**<br><br>**6 Hours** |

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|---|---|
| **SOFTWARE PROJECT MANAGEMENT**<br>Software project management concepts – Project planning and WBS – Software size and effort estimation: Function Point Analysis, COCOMO I and COCOMO II – Project scheduling: Gantt charts, PERT/CPM – Resource allocation and levelling – Risk management: identification, probability-impact matrix, mitigation, monitoring – Software configuration management: version control, baselines, change management – Tools overview: Git, JIRA – Team organization and leadership styles – Project closure.<br>**Project Component: Planning Phase**<br>Continuing from Unit I project, students: (a) develop a detailed WBS and estimate effort using COCOMO II with a provided estimation sheet, (b) create a project schedule using Gantt chart (MS Project or GanttProject tool), (c) build a risk register identifying at least five risks with mitigation strategies, (d) set up a Git repository for the team project with branching strategy, and (e) create a JIRA board with epics and user stories mapped to sprints. Deliverable: Project Plan document and Git repository link. | **9 Hours**<br><br>**6 Hours** |
| **SOFTWARE QUALITY, PROCESS IMPROVEMENT AND DEVOPS**<br>Software quality concepts: product quality vs process quality – ISO/IEC 25010:2023 quality model – Software metrics: Halstead metrics, McCabe's cyclomatic complexity, function point – Quality models: McCall's and Boehm's models – CMMI levels and process areas – ISO 9001 and ISO/IEC 12207 – Software maintenance: corrective, adaptive, perfective, preventive – DevOps principles: CI/CD pipelines, infrastructure as code, containerization (Docker basics) – GitHub Actions for CI/CD – Cloud-native overview – Agile + DevOps integration – Retrospective-driven improvement.<br>**Project Component: Quality, DevOps and Final Delivery**<br>Students complete and demonstrate their projects: (a) compute software metrics (cyclomatic complexity, Halstead volume) for their codebase using a static analysis tool (SonarQube Lite or similar), (b) configure a basic CI pipeline using GitHub Actions to auto-run JUnit tests on every push, (c) containerize the application using Docker (write a Dockerfile and docker-compose.yml), (d) prepare a software quality report benchmarking against ISO/IEC 25010 attributes: functionality, reliability, usability, maintainability, (e) present the complete project to the class with a live demo. Deliverable: Final project report, GitHub Actions CI log, Docker files, and quality report. | **9 Hours**<br><br>**6 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | | **Practical Hours:** | | **Project Hours:** | **30** | **Total Hours:** | **75** |

**Learning Resources**

**Textbooks**


1. Pressman, Roger S., and Maxim, Bruce R., Software Engineering: A Practitioner's Approach, 9th Edition, 2019
2. Sommerville, Ian., Engineering Software Products: An Introduction to Modern Software Engineering, 1st Edition, 2020, Pearson Education.
3. Wohlin, Claes., Runeson, Per., and Olsson, Thomas., Experimentation in Software Engineering, 2nd Edition, 2024, Springer.
4. Dingsoeyr, Torgeir., Dybaa, Tore., Moe, Nils Brede., Agile Software Engineering Skills, 1st Edition, 2023, Springer


**Reference books/ Web Links**


1. Kim, Gene., Humble, Jez., Debois, Patrick., Willis, John., and Forsgren, Nicole., The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, 2nd Edition, 2021, IT Revolution Press..
2. Jorgensen, Paul C., and DeVries, Byron., Software Testing: A Craftsman's Approach, 5th Edition, 2022, CRC Press / Taylor & Francis.


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3. Martin, Robert C., Clean Agile: Back to Basics, 1st Edition, 2019 (Widely adopted post-2020), Prentice Hall.
4. Forsgren, Nicole., Humble, Jez., and Kim, Gene., Accelerate: The Science of Lean Software and DevOps, 1st Edition, 2018 (Widely adopted post-2020), IT Revolution Press.
Note: Evidence-based research on high-performing software teams; pairs directly with DevOps Handbook for Unit V.
5. Schwaber, Ken., and Sutherland, Jeff., The Scrum Guide – The Definitive Guide to Scrum, 2020 Edition (Latest), Scrum.org. [Free Download: https://scrumguides.org]

**Online Resources**

1. https://scrumguides.org – Official Scrum Guide 2020 (Free PDF)
2. https://agilemanifesto.org – The Agile Manifesto and 12 Principles
3. https://nptel.ac.in/courses/106105085 – NPTEL: Software Engineering (IIT Bombay)
4. https://www.atlassian.com/agile – Atlassian Agile Coach: Scrum, Kanban, XP Guides
5. https://docs.github.com/en/actions – GitHub Actions CI/CD Documentation
6. https://www.coursera.org/learn/software-processes-and-agile-practices – Coursera: Software Processes & Agile Practices (University of Alberta)

**Assessment (Embedded Course)**

SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

**Course Curated by**

| Expert(s) from Industry | Expert(s) from Higher Education Institution | Internal Expert |
|---|---|---|
| - | - | Dr. Sathyavathi, AP/IT |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

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# SEMESTER VI

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| 24CST016 | FORMAL LANGUAGES AND COMPILER DESIGN | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 0 | 4 |
| PC | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the fundamental concepts of automata theory and formal languages |
| 2 | Analyze and design various parsing techniques used in compilers |
| 3 | Implement lexical and syntax analyzers using tools like Lex and YACC. |
| 4 | Develop skills for intermediate code generation and optimization. |
| 5 | Utilize AI-assisted compiler design tools and modern development environments to enhance automata simulation, parser generation, debugging, and code optimization. |

| Course Outcomes | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Identify various languages and automata within the Chomsky hierarchy, demonstrating their properties and applications. | U |
| CO 2 | Build finite automata, push down automata and Turing machine. | Ap |
| CO 3 | Design lexical analyzers and parsers using formal grammar rules, ensuring syntactic correctness of programming languages. | Ap |
| CO 4 | Apply compiler construction tools to build front-end modules. | Ap |
| CO 5 | Analyze intermediate code and symbol table structures to ensure accurate translation and optimization of source code. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | 3 | | | 2 | | | | | | | 2 | |
| 2 | | | 3 | 2 | 2 | | | | | | | 2 | |
| 3 | | | 3 | | 2 | | | | | | | 2 | |
| 4 | 2 | 2 | | | 2 | | | 3 | | | | | 3 |
| 5 | | | | 2 | 1 | | | | | 3 | | | |

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| Course Content | |
|---|---|
| **Introduction To Formal Languages And Finite Automata**<br>Automata and Language: Chomsky hierarchy of languages, Introduction to Finite Automata –Non-Deterministic Finite Automata- equivalence of NFAs and DFAs-minimization of DFA-Regular Expressions. Context-free Grammar – Parse tree derivations - Context-free languages<br>**Tools:** ChatGPT and GitHub Copilot | **12 Hours** |
| **Pushdown Automata and Turing Machines**<br>Definition of the Pushdown automata - Languages of a Pushdown Automata - Equivalence of Pushdown automata, Deterministic Pushdown - The basic model for Turing machines (TM), Techniques for Turing machine construction, TM as acceptors, TM as a computer of integer functions, Types of TMs. | **12 Hours** |
| **Compiler Phases and Lexical Analysis**<br>Introduction to Compiler Design – Phases of a Compiler- Lexical Analysis: Role of Lexical Analyser-Tokens, Lexemes, Patterns- Regular Expressions for Lexical Specification- Lex Tools: Lexical Analyzer Generator (Lex) | **12 Hours** |
| **Syntax Analysis and Semantic Analysis**<br>Syntax Analysis: Introduction to Parsers: Expressing syntax – Top-down parsing: Recursive descentparsing, Non-recursive predictive parsing.Bottom-upparsing: LR(0), LR(1), and LALR(1).Implementation of Parser – YACC. | **12 Hours** |
| **Context-Sensitive Analysis**<br>Type Systems – Attribute Grammar – Syntax Directed Translation. Intermediate Representations: Graphical and Linear Intermediate Representations – Symbol tables.Procedure Abstraction: Procedure calls – Name Spaces – Communicating Values between Procedures<br>**Tools:** ChatGPT and GitHub Copilot | **12 Hours** |

| | | | | |
|---|---|---|---|---|
| **Theory Hours: 45** | **Tutorial Hours:15** | **Practical Hours:00** | **Project Hours:0** | **Total Hours: 60** |

**Learning Resources***

**Textbooks**


1. Peter Linz, “An Introduction to Formal Languages and Automata”, Seventh Edition, 2022.
2. Alfred V.Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Prentice Hall, Second Edition, 2023.


**Reference books**


1. J.E.Hopcroft, R.Motwani and J.D Ullman, “Introduction to Automata Theory, Languages and Computations”, Fourth Edition, Pearson Education, 2023
2. John C.Martin, “Introduction to Languages and the Theory of Computation”, Fourth Edition, Tata McGraw Hill, 2010.
3. Ken Kennedy and Randy Allen, Optimizing Compilers for Modern Architectures: A DependenceBased Approach, Morgan Kaufmann Publishers, 2001.
4. Allen I. Holub, “Compiler Design in C”, Prentice Hall of India, 2003. 2. C.N. Fischer and R.J. LeBlanc,
5. “Introduction to Compiler Techniques”, Second edition, Tata McGraw-Hill, 2003.


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6. Andrew W. Appel and Jens Palsberg, “Modern Compiler Implementation in Java”, Cambridge University Press, Second Edition, 2002

| Web Resources |
|---|
| 1. University of Cambridge – Regular Languages and Finite Automata Materials<br>2. IIT Bombay – Theory of Computation Course Materials<br>3. https://nptel.ac.in/courses/106105190 -Compiler Design |

| Assessment (Theory course) |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) |

| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert** | |
| - | - | Mr. V. Senthilkumar, AP/CSE | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSI017 | BIG DATA ANALYTICS | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| PC | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI009 Database Management Systems | Data Book / Code book (If any) | Nil |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Acquire knowledge of the challenges and opportunities presented by Big Data and the analytics lifecycle in this context. |
| 2 | Develop practical skills in using distributed computing frameworks for large-scale data processing tailored for analytics. |
| 3 | Gain competency in applying and adapting machine learning algorithms to work effectively on massive datasets using scalable libraries like Spark MLlib. |
| 4 | Understand techniques for analyzing streaming data and graph data at scale, and the challenges of visualizing big data. |
| 5 | Develop the ability to critically evaluate the suitability, limitations, and ethical implications of different Big Data analytical techniques and interpret results. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO1 | Apply distributed data processing techniques using frameworks like Apache Spark DataFrames/SQL to prepare large-scale datasets for analysis. | Ap |
| CO2 | Apply scalable machine learning algorithms using Spark MLlib for tasks like classification, regression, and clustering on big data. | Ap |
| CO3 | Analyze massive datasets to uncover patterns and assess the performance characteristics and scalability limitations of Big Data analytical algorithms. | An |
| CO4 | Analyze the appropriateness of various Big Data machine learning models and analytical approaches for specific business problems and data characteristics. | An |
| CO5 | Apply methods to assess the quality, significance, and potential biases of insights derived from Big Data analytics by testing data veracity and validating modeling assumptions in practical scenarios. | Ap |

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| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Fi | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | 2 | | | 3 | | | | | | | 2 | 3 |
| 2 | | 2 | 2 | | 3 | | | | | | | 3 | 3 |
| 3 | | 3 | | 2 | 2 | | | | | | | 2 | 2 |
| 4 | | 3 | 2 | | | | | | | | | 3 | 2 |
| 5 | | 3 | | | | | | 2 | | | | 3 | 2 |

**Course Content**

| | |
|---|---|
| **Introduction to Big Data and Analytics Landscape**<br><br>Big Data Characteristics, Data Sources, Challenges, Analytics Lifecycle Review in Big Data Context, Big Data Ecosystem Overview: Hadoop-HDFS, YARN, MapReduce - Spark, NoSQL databases role, Spark Environment Setup-Local, Cluster, Cloud – Databricks-EMR-Synapse, Introduction to Spark Architecture -Driver, Executors<br><br>**Practical Component:**<br><br>Install/Set up Spark environment in cloud- Basic interaction with Spark shell/notebooks using PySpar-Read and write data from local filesystem or cloud storage using Spark. AI-assisted data preprocessing (GPT-based text cleaning, anomaly detection). | **9 Hours**<br><br>**6 Hours** |
| **Distributed Data Processing with Spark**<br><br>Spark Core Concepts Recap: Resilient Distributed Datasets (RDDs), Data Frames, Datasets, Spark DataFrame API: Selecting, Filtering, Aggregating, joining large datasets, Handling Missing Data at Scale -using DataFrames, Spark SQL: Querying DataFrames, Integrating SQL and DataFrame operations, Optimization Basics: Partitioning, Caching/Persistence, Broadcast Joins<br><br>**Practical Component:**<br><br>Perform extensive data manipulation tasks -cleaning, transformation, feature engineering large datasets using PySpark DataFrame API and Spark SQL- Explore Spark UI for basic job monitoring. AI-powered query optimization (AI suggesting efficient Spark SQL/DataFrame operations). | **9 Hours**<br><br>**6 Hours** |
| **Advanced Big Data Processing**<br><br>Stream Processing Analytics Introduction - Real-time data vs. batch - Event-driven architecture - Stream processing use cases - monitoring, alerting - Spark Structured Streaming Core Concepts - Spark Structured Streaming Architecture - Reading from | **9 Hours** |

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|---|---|
| sources - Basic Kafka integration overview - Basic stateless and stateful transformations - Outputting streams.<br><br>**Practical Component:**<br><br>Run a basic Spark Structured Streaming application - Construct a graph using GraphFrames from sample data and perform basic queries. AI-based real-time anomaly detection in streaming data (fraud detection, IoT monitoring). | **6 Hours** |
| **Advanced Big Data Analytics Techniques**<br><br>Graph Analytics Introduction with Spark - Graph Concepts - Common graph problems - GraphFrames/GraphX Overview - Basic graph construction - Motif finding - Simple graph algorithms - Analyzing Performance & Scalability in Distributed Systems - Common bottlenecks - Factors affecting Spark scalability - Data Ingestion at Scale Overview - Tools and techniques.<br><br>**Practical Component:**<br><br>Analyze the Spark UI for a given batch job to identify stages, tasks, and discuss potential data skew or shuffling issue. - Design a data ingestion strategy for a given big data scenario, discussing tool choices. AI graph embeddings (Node2Vec, Graph Neural Networks). | **9 Hours**<br><br>**6 Hours** |
| **Big Data Visual Analytics**<br><br>Challenges in Visualizing Big Data: Overplotting, Performance, Visualization Techniques for Big Data: Aggregation, Sampling, Density plots, Tooling Databricks viz, BI tools, Interpreting Models built on Big Data: Feature importance, Model limitations, Bias considerations, Data Veracity and Quality Impact, Case Studies: Real-world Big Data Analytics Applications - Evaluating Quality, Significance, and Bias of Insights<br><br>**Practical Component:**<br><br>Visualize aggregated Spark results using Matplotlib/Seaborn- Sample large data for effective visualization- Explore feature importances from trained Spark models- Mini-project: Apply techniques from Modules II-IV to a large dataset, interpret results, create relevant visualizations, and evaluate the findings and approach. AI visualization assistants (Power BI Copilot, Tableau AI, Databricks AI dashboards). | **9 Hours**<br><br>**6 Hours** |

| Theory Hours:45 | Tutorial Hours:0 | Practical Hours:30 | Project Hours:0 | Total Hours:75 |
|---|---|---|---|---|

**Learning Resources**

**Textbooks:**


1. Chambers, Bill, and Matei Zaharia. Spark: The Definitive Guide: Big Data Processing Made Simple. O'Reilly Media 2018
2. Damji, Jules S., et al. Learning Spark. 2nd Edition, O'Reilly Media 2020.
3. Ryza, Sandy, et al. Advanced Analytics with Spark. 2nd Edition, O'Reilly Media 2017.


**References:**


1. McKinney, Wes. Python for Data Analysis. 3rd Edition, O'Reilly Media 2022.
2. Géron, Aurélien. Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow. 3rd Edition, O'Reilly Media 2022.


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| **Online Educational Resources:** |
|---|
| 1. Apache Spark Documentation: https://spark.apache.org/docs/latest/<br>2. Databricks Academy: https://www.databricks.com/learn/training/home<br>3. UC San Diego Big Data Specialization, IBM's "Scalable Machine Learning on Big Data using Apache Spark". https://www.coursera.org/learn/big-data-machine-learning?msockid=33660228836e634337a017cd82c3628e<br>4. https://onlinecourses-archive.nptel.ac.in/noc17_mg24/preview |

| **Assessment (Embedded course)** |
|---|
| SA I , SA II , Activity and Learning Task(s), MCQ, End Semester Examination (ESE)<br>Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated by** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | | **Internal Expert(s)** |
| Mr.Nagaraj Ramamorthy<br>Lean Engineer<br>Mahindra & Mahindra | Dr.M.Sangeetha<br>Professor<br>IT/CIT | | Dr.S.Rajasekaran,<br>AP-II/Department of AI&DS |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

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| 24CSI018 | CLOUD COMPUTING | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 0 | 4 |
| PC | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the basics and benefits of cloud computing. |
| 2 | Explore different types of cloud models and services. |
| 3 | Examine cloud migration strategies and approaches. |
| 4 | Analyze risk measurement, assessment, and mitigation strategies in application migration. |
| 5 | Understand the economic cost models for cloud planning and leverage cloud technologies to optimize resource allocation. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply the fundamental concepts and deployment models of cloud computing to demonstrate virtualization. | Ap |
| CO 2 | Apply cloud service models to categorize their benefits, risks, and use cases. | Ap |
| CO 3 | Analyze vendor roles and capabilities for successful cloud adoption. | An |
| CO 4 | Design a migration plan for application transition to the cloud securely. | Ap |
| CO 5 | Apply cloud infrastructure strategies to manage cloud resource allocation through economic models. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | | | | | | | | 2 | 3 | |
| 2 | 3 | 3 | | | | | | 2 | | | | 3 | |
| 3 | 3 | | 3 | | | | | | | 2 | | 3 | |
| 4 | 3 | 2 | | | | | | | | | 3 | 3 | |
| 5 | 3 | | 3 | | | | | | | 3 | | 3 | |

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| **Course Content** | |
|---|---|
| **FUNDAMENTALS OF CLOUD COMPUTING**<br>Cloud Computing Basics – History – Peer to peer computing - Distributed computing – Characteristics of cloud - Pros and Cons of cloud computing – Cloud Deployment Models – Public, Private, Hybrid, Community - Evolving Data Center into Private Cloud - Data center Components – Virtualization - KVM, VMware ESXi,, Xen - Data center security - Security layers - Host, network, VM, user access - Extracting Business value in Cloud Computing - Cloud Scalability - Distribution over the Internet<br>**Practical Component**<br><br>Set up the KVM hypervisor and verify virtualization support. - Deploy a Linux VM using virt-install in KVM – execute linux commands in Linux VM - create a VM Snapshot and Restore it in KVM - Create a Windows VM in VirtualBox and configure the network to check the Internet connection – Create and run a simple Linux VM in VirtualBox – Install VMWare work station and Create a VMs - Configure Virtual Networking to provide communication between VMs. | **10 Hours**<br><br>**8 Hours** |
| **CLOUD DELIVERY MODELS**<br>Introduction to Cloud Services - Infrastructure as a Service (IaaS) – Networking options - Virtual Private Cloud - Storage Management in IaaS - Persistent vs. ephemeral storage - File and Object storage - Data Protection – Container - VM vs Containers - Overview of OpenNebula as an IaaS platform - IaaS security - Benefits and challenges in using IaaS - Platform as a Service (PaaS) – Overview - PaaS Examples – Aneka Overview – Aneka Architecture – Aneka Programming Models - Benefits and challenges - Software as a Service (SaaS) – Introducing SaaS, SaaS Examples - Evaluating SaaS – user and vendor perspective - Impact of SaaS - Benefits and risks of SaaS - IaaS vs PaaS vs SaaS.<br><br>**Practical Component**<br>Create windows and Linux VMs in different IaaS platforms, Create a VPC in public cloud – Host a website in any IaaS platform - Run OpenNebula Sandbox via VirtualBox/VMware and deploy a VM - Create a Custom VM Template in OpenNebula - Deploy a sample app on a PaaS platform - Use a SaaS product Google Docs or Canva and list its features - Compare IaaS, PaaS, SaaS with real-world examples and prepare a report | **15 Hours**<br><br>**10 Hours** |
| **Cloud Computing - Challenges, Risk and Mitigation**<br>Cloud Storage, Application performance, Data Integration, Security. Ensuring Successful Cloud Adoption-Designing a Cloud Proof of Concept, Vendor roles and capabilities, moving to the Cloud. Impact of Cloud on IT Service Management. Risks: Measuring and assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies Risks and Consequences of Cloud Computing- Legal Issues, Compliance Issues, Privacy and Security.<br><br>**Practical Component**<br>Create and apply security groups in any cloud, Set user roles and permissions using Identity and Access Management. | **12 Hours**<br><br>**06 Hours** |
| **Managing the Cloud**<br>Managing and Securing Cloud Services, Managing Desktops and devices on the cloud, SOA and Cloud computing, Managing the Cloud environment, Planning for the Cloud – Economic Cost Model and Leveraging the Cloud, Cloud computing resources | **08 Hours** |

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|---|---|
| **Practical Component**<br>Measure the resource utilization in a public cloud platform and list the usage of CPU, RAM, storage in a VM – create snapshot and generate backup of cloud instances, configure and activate cloud pricing calculators in any public cloud platform to estimate cost for running a basic app. | **06 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | **0** | **Practical Hours:** | **30** | **Project Hours:** | **0** | **Total Hours:** | **75** |

**Learning Resources**

**Textbooks**

1. Thomas Erl, Eric Barceló Monroy, Cloud Computing: Concepts, Technology, Security & Architecture, 2nd Edition - Pearson Paperback – 29 February 2024.
2. Kirk Hausman, Susan L. Cook, Telmo Sampaio, " CLOUD ESSENTIALS CompTIA® Authorized Courseware for Exam CLO-001", John Wiley & Sons Inc., 2013
3. Judith Hurwitz , Robin Bloor , Marcia Kaufman , Fern Halper, "Cloud Computing for Dummies", Wiley Publishing Inc., 2010

**Reference books/ Web Links**

1. Lauri Swede, Cloud Computing Essential Guide: A Foundational Understanding of Cloud Computing, Kindle Edition , 2022.
2. Erl," Cloud Computing: Concepts, Technology & Architecture", Pearson Education, 2014
3. Srinivasan, "Cloud Computing: A Practical Approach for Learning and Implementation "Pearson Education, 2014

**Online Resources**

1. https://www.coursera.org/learn/cloud-computing
2. https://www.youtube.com/watch?v=2LaAJq1lB1Q
3. https://explore.skillbuilder.aws/learn/courses/134/aws-cloud-practitioner-essentials
4. https://www.cloudskillsboost.google/paths/11
5. https://cloud.google.com/security?hl=en
6. https://www.ibm.com/topics
7. https://developer.hashicorp.com/terraform/tutorials/aws-get-started

**Assessment (Embedded Course)**

SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

**Course Curated by**

| Expert(s) from Industry | Expert(s) from Higher Education Institution | Internal Expert(s) |
|---|---|---|
| | | Mr. C. Jeganathan, AP/IT |

| | | | |
|---|---|---|---|
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

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# ELECTIVES

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# WEB AND SOFTWARE DEVELOPMENT

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| 24CSC001 | UI AND UX DESIGN<br>(Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Apply UI/UX design concepts and empathy techniques to identify user needs and develop user-centered solutions. |
| 2 | Understand design thinking methods for solving user experience problems. |
| 3 | Gain skills in visual design and UI component creation. |
| 4 | Practice wireframing, prototyping, and usability testing. |
| 5 | Use tools like Figma to build interactive user interfaces. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply UI and UX design concepts along with empathy techniques to identify user needs and propose suitable user-centered design solutions | Ap |
| CO 2 | Apply UI design principles to implement visual design standards and UI components to enhance user interaction. | Ap |
| CO 3 | Conduct UX research using at least two industry-relevant techniques to align user goals with business objectives | Ap |
| CO 4 | Create and evaluate responsive wireframes and prototypes using iterative testing methods for a given user scenario | An |
| CO 5 | Design an interactive, user-centered interface using essential Figma tools and techniques | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | | | | | | | | | | 3 | |
| 2 | | | 3 | | | | | | | | | 3 | |
| 3 | | | 3 | | | | | | | | | 3 | |
| 4 | | | | | 2 | | | | | | | 3 | |
| 5 | | | | | 2 | | | | | | | 3 | |

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| Course Content | |
|---|---|
| **INDUSTRY-RELEVANT DESIGN THINKING**<br>Understanding UI vs. UX Design, Design Thinking Framework, Innovative Thinking Methods, Empathy Techniques for User Insights.<br>**Practical Component**<br>1. Create User Personas and Empathy Maps for a selected product idea.<br>2. Apply Design Thinking methodology to identify and solve a user problem.<br>3. Design a project board and visual theme using Canva. | **6 Hours**<br><br>**6 Hours** |
| **UI DESIGN PRINCIPLES FOR INDUSTRY**<br>Visual Design Standards, UI Components and Design Patterns, User Interaction and Engagement, Branding Integration and Style Guides.<br>**Practical Component**<br>1. Explore and analyze common UI components and interaction patterns.<br>2. Design a responsive user interface layout using Figma.<br>3. Create a UI Style Guide with colors, typography, and components. | **6 Hours**<br><br>**6 Hours** |
| **UX RESEARCH AND STRATEGY IN THE INDUSTRY**<br>UX Fundamentals for Business Impact Design Process, Industry Research Techniques, Aligning User and Business Goals<br>**Practical Component**<br>1. Perform competitor analysis and user research for a digital product.<br>2. Develop user journey maps aligning user and business goals.<br>3. Create a pattern library including fonts, colors, and reusable assets. | **6 Hours**<br><br>**6 Hours** |
| **WIREFRAMING, PROTOTYPING AND TESTING**<br>Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings -Prototype Iteration.<br>**Practical Component**<br>1. Design low-fidelity wireframes and wireflow diagrams for an application.<br>2. Develop an interactive prototype using Figma<br>3. Conduct usability testing and refine the prototype based on feedback. | **6 Hours**<br><br>**6 Hours** |
| **LOW CODE -NO CODE TOOLS**<br>Low code- No code Design Tools -Essential Concepts of Figma - Setup and Configure Figma - Images, Shapes, and Tools - Working with Figma - Figma Components - Styles and Libraries in Figma - Cards and Layout Grids in Figma.<br>**Practical Component**<br>1. Configure a Figma workspace and create basic UI screens.<br>2. Create and manage layout grids and Auto Layout features in Figma.<br>3. Design reusable components and build a shared design library. | **6 Hours**<br><br>**6 Hours** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | **Practical Hours:** | **30** | **Project Hours:** | **Total Hours:** | 60 |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. Jon Yablonski, Laws of UX: Using Psychology to Design Better Products & Services, O'Reilly, 2021. |
| **Reference books/ Web Links** |
| 1. Joel Marsh, UX for Beginners, O'Reilly, 2022.<br>2. Don Norman, The Design of Everyday Things: Revised and Expanded Edition, Basic Books, 2013. |

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3. Steve Krug, Don't Make Me Think: A Commonsense Approach to Web Usability, New Riders, 2014.
4. Jeffrey Zeldman and Ethan Marcotte, Responsive Web Design, A Book Apart, 2011.
5. Jenifer Tidwell, Charles Brewer and Aynne Valencia, Designing Interfaces: Patterns for Effective Interaction Design, 3rd Edition, O'Reilly Media, 2020.

**Online Resources**

1. https://www.coursera.org/learn/designing-user-interfaces-and-experiences-uiux

| **Assessment (Embedded Course)** |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE)<br>Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Nivetha R<br>Assistant Professor<br>Department of Computer Science and Engineering |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No:30 | **Date:** 19.06.2026 |

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| 24CSC002 | iOS APPLICATION DEVELOPMENT USING SWIFT (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI008 Object Oriented Programming | Data Book / Codes / Standards ( If any) | NA |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the fundamentals of Swift programming language and develop basic programming logic using Swift Playground. |
| 2 | Familiarize students with the Xcode development environment and debugging techniques for building iOS applications |
| 3 | Apply Swift programming concepts such as operators, control structures, functions, and collections in problem-solving. |
| 4 | Implement advanced Swift concepts including optionals, enumerations, segues, and navigation controllers in mobile application development. |
| 5 | Design and develop interactive multi-screen iOS applications using UIKit components and view controller lifecycle management. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply Swift programming constructs to develop and execute basic code snippets using playgrounds within a defined timeline. | Ap |
| CO 2 | Analyze and debug Swift programs in Xcode to ensure error-free execution through systematic testing and validation. | Ap |
| CO 3 | Construct Swift programs using operators, conditionals, and loops to solve well-defined programming problems with measurable logic and correctness. | An |
| CO 4 | Analyze and implement advanced Swift programming concepts such as optionals, enumerations, segues, and navigation controllers in mobile applications. | An |
| CO5 | Design and develop multi-screen iOS applications using controllers, and view controller lifecycle methods for efficient application flow management. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | | 3 | 2 | 2 | | | | | | | | 2 |
| 2 | | | 3 | 2 | 2 | | | | | | | | 2 |
| 3 | | | 3 | 3 | 3 | | | | | | | | 3 |
| 4 | | | 3 | 3 | 3 | | | | | | | | 3 |

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| Course Content | |
|---|---|
| **INTRODUCTION TO SWIFT PROGRAMMING AND CONTROL STRUCTURES**<br>Introduction to Swift and Playgrounds - Constants, Variables - Naming Constants and Variables, Data Types - Type Safety - Type Inference - Operators - Basic Arithmetic - Numeric Type Conversion - Logical and Comparison Operators - Control Flow - If Statements - If Else Statements- Switch Statements.<br>**Practical Component**<br>1. Implement basic arithmetic and logical operations using Swift Playground<br>2. Develop programs using conditional statements (if–else and switch).<br>3. Design and develop a simple Calculator application using Swift. | **6 Hours**<br><br>**6 Hours** |
| **XCODE ENVIRONMENT AND INTERFACE BUILDER ESSENTIALS**<br>Xcode - Xcode Files Types - Xcode Preference - Building, Running, and Debugging an App - Interface Builder Basics - Storyboards - Interface Builder Layout - Outlets And Actions.<br>**Practical Component**<br>4. Explore Xcode environment, project structure, and debugging tools<br>5. Create user interfaces using Storyboards, Outlets, and Actions<br>6. Design and develop a Light App using Interface Builder. | **6 Hours**<br><br>**6 Hours** |
| **UIKIT FUNDAMENTALS AND USER INTERFACE**<br>Introduction to UIKit Strings - Concatenation and Interpolation - String Equality and Comparison - Functions - Parameters - Return Values - Structures - Instances - Instance Methods - Classes and Inheritance Collections - Arrays - Dictionaries - Loops - For Loops - While Loops .Common System Views - View Controllers - Displaying Data Controls In Action - Buttons - Switches - Sliders - Text Fields - Actions and Outlets - Auto Layout and Stack Views.<br>**Practical Component**<br>1. Develop applications using strings, functions, collections, and loops.<br>2. Create interactive user interfaces using UIKit controls and Auto Layout.<br>3. Design and develop a Color Picker or Xylophone application. | **6 Hours**<br><br>**6 Hours** |
| **ADVANCED SWIFT CONCEPTS AND NAVIGATION TOOLS**<br>Optionals - Functions and Optionals - Type Casting and Inspection - Guard - Guard with Optionals - Constant and Variable Scope - Enumerations - Segues and Navigation Controllers.<br>.**Practical Component**<br>1. Implement programs using optionals, type casting, and enumerations.<br>2. Create multi-screen applications using Segues and Navigation Controllers.<br>3. Design and develop a Traffic Light application with screen navigation. | **6 Hours**<br><br>**6 Hours** |
| **APP NAVIGATION AND VIEW CONTROLLER LIFECYCLE**<br>Navigation Controllers - Tab Bar Controllers - View Controller Life Cycle- View Did Load - View Event Management<br>**Practical Component**<br>1. Develop applications using Navigation Controllers and Tab Bar Controllers.<br>2. Demonstrate View Controller Life Cycle events and event management.<br>3. Design and develop a Simple Alarm application using Tab Bar Controller. | **6 Hours**<br><br>**6 Hours** |

| Theory Hours: 30 | Tutorial Hours: 0 | Practical Hours: 30 | Project Hours: 0 | Total Hours: 60 |
|---|---|---|---|---|

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| Learning Resources* |
|---|
| **Textbooks** |
| 1. Develop in Swift, Fundamentals, Apple Education, https://books.apple.com/in/book/develop-in-swi,-fundamentals/id1581182804.<br>2. Sadun, Erica., The Swift Programming Language., Addison-Wesley Professional Boston (2015). |
| **Reference books/ Web Links** |
| 1. Neumann, Matt., Beginning Xcode: Swift Edition., Apress New York (2015). |

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|---|
| 2. Hoffman, Craig Clayton., iOS Programming for Beginners: Kickstart your iOS app development journey with a hands-on guide to Swift 5.7 and Xcode 14., Packt Publishing Birmingham (2022).<br>3. Mark, Ray., iOS Apprentice: Beginning iOS Development with Swift., Razeware LLC (2022).<br>4. Sadun, Erica., Swift Pocket Reference., O'Reilly Media Sebastopol (2015). |
| **Online Resources** |
| 1. https://coursera.org/learn/programming-fundamentals-swift<br>2. https://coursera.org/professional-certificates/meta-ios-developer |

| Assessment (Embedded Course) |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| Course Curated By | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| Mr. Sai Shankar<br>Project Manager<br>Ernst & Young | | Nivetha R,<br>AP/CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSC003 | MOBILE APPLICATION DEVELOPMENT (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | |
|---|---|---|---|

| Course Objectives**: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the concepts of native, hybrid, web, and cross-platform mobile application development using modern development frameworks. |
| 2 | Develop responsive and interactive mobile applications. |
| 3 | Apply mobile application development techniques for implementing device-specific features such as location services, user interaction, and activity management. |
| 4 | Build mobile applications integrated with databases, responsive interfaces, and cross-platform deployment strategies using modern development tools. |
| 5 | Utilize AI-assisted mobile application development tools for UI design, code generation, debugging, testing, and deployment of mobile applications. |

| Course Outcomes***: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Understand the fundamental concepts, classifications, and characteristics of mobile and web applications including development approaches. | U |
| CO 2 | Design and develop responsive user interfaces that adapt to different device screens and user contexts. | Ap |
| CO 3 | Build cross-platform applications incorporating graphical user interface components and basic user input validation techniques. | Ap |
| CO 4 | Implement mobile application features that utilize device-specific functionalities for location awareness and activity management. | Ap |
| CO 5 | Design and implement cross-platform applications with features for user interaction, task management, and data visualization using modern development frameworks | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | | | 2 | | | | | | | | 3 |
| 2 | | | 3 | | 2 | | | | | | | | 3 |
| 3 | | | 3 | | 2 | | | | | | | | 3 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | | 3 | | 2 | | | | | | | | 3 |
| 5 | | | 3 | | 2 | | | | | | | | 3 |

| **Course Content** | |
|---|---|
| **FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT**<br>Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, Overview of Flutter architecture, Installing flutter SDK<br><br>**Practical Component**<br>Design a basic responsive web page that displays a user's profile (name, photo, and bio) properly on both mobile and desktop views using HTML5 and CSS3. | **6 Hours**<br><br>**6 Hours** |
| **DART PROGRAMMING FUNDAMENTALS**<br>Variables, data types, operators, expressions, functions, object oriented programming, classes, collections, null safety, async programming.<br><br>**Practical Component**<br>Develop a hello world using Dart<br>Implement OOP examples.<br>Implement few mini projects, for example student grade calculator | **6 Hours**<br><br>**6 Hours** |
| **CROSS-PLATFORM APP DEVELOPMENT USING FLUTTER**<br>Implementing widgets in flutter, stateless vs stateful widgets, layout widgets, rows, columns, containers, stack, navigation and routing, forms and user input, event handling, grids, styling, responsive UI design<br><br>**Practical Component**<br>Flutter environment setup<br>create hello world app using flutter environment.<br>Implement basic user interface with forms, display collections of data, integrate multiple screens with navigation | **6 Hours**<br><br>**6 Hours** |
| **DATA HANDLING AND API INTEGRATION**<br>JSON parsing, REST API Integration, HTTP package, future builder, stream builder, local storage and firebase basics, flutter packages, camera integration, gps, notifications, file handling.<br><br>**Practical Component**<br>Fetch API data<br>Parse JSON data<br>Create a simple mobile application using flutter to fetch and display the current geographic location of the user using the device's GPS sensor. | **6 Hours**<br><br>**6 Hours** |
| **DEPLOYMENT AND PUBLISHING**<br>Build APK and app bundle, release configuration, publishing to google play store, app store, CI/CD overview<br><br>**Practical Component**<br>Develop a small mobile app, release and simulate deployment.<br>**AI Tools:** ChatGPT, GitHub Copilot | **6 Hours**<br><br>**6 Hours** |

| **Theory Hours: 30** | **Tutorial Hours:0** | **Practical Hours:30** | **Project Hours:0** | **Total Hours:60** |
|---|---|---|---|---|

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| Learning Resources* |
|---|
| **Textbooks** |
| 1. Anubhav Pradhan, Anil V. Deshpande, "Composing Mobile Apps: Learn. Explore. Apply. Using Android", Wiley publication, 2014 |

| |
|---|
| 2. Dawn Griffiths & David Griffiths, Head First Android Development, 3rd Edition, O'Reilly Media, 2021. |
| 3. Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, Fullstack React Native: Create beautiful mobile apps with JavaScript and React Native, 1st Edition, Independently Published, 2019. |
| **Reference books/ Web Links** |
| 1. John Horton, Android Programming for Beginners, 3rd Edition, Packt Publishing, 2021. |
| 2. Shaun Lewis & Mike Dunn, Native Mobile Development: A Cross-Reference for iOS and Android, 1st Edition, O'Reilly Media, 2019. |
| 3. Pawan Lingras, Matt Triff, Rucha Lingras, Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, 1st Edition, Cengage Learning, 2016. |
| 4. John M. Wargo, Apache Cordova 4 Programming, 1st Edition, Addison-Wesley Professional, 2015 |
| 5. Dan Ward, React Native Cookbook: Recipes for Solving Common React Native Development Problems, 2nd Edition, Packt Publishing, 2019. |
| **Online Resources** |
| 1. https://www.coursera.org/learn/introduction-to-mobile-app-development |

| Assessment (Embedded Course) |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| Course Curated By | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Mr. V. Senthil Kumar V<br>Mr. N. SathyaSeelan N<br>Assistant Professor II<br>Department of Computer Science and Engineering |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSC004 | SOFTWARE TESTING AND AUTOMATION (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI015 Software Engineering and Agile Practices | Data Book / Codes / Standards ( If any) | |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | To apply software testing concepts and techniques to ensure software quality and reliability. |
| 2 | To learn how to do the testing and planning effectively |
| 3 | To build test cases and execute them |
| 4 | To focus on wide aspects of testing and understanding multiple facets of testing |
| 5 | To get an insight about test automation and the tools used for test automation |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply fundamental software testing concepts and techniques to evaluate and ensure quality in software systems | Ap |
| CO 2 | Apply test planning techniques to effectively organize, prioritize, and schedule testing tasks in a structured test strategy. | Ap |
| CO 3 | Design and execute test cases using manual and automated methods to validate functional requirements in software systems. | Ap |
| CO 4 | Analyze various testing types and levels to determine their appropriateness in given scenarios. | An |
| CO 5 | Evaluate and utilize software test automation tools to improve testing efficiency and coverage. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | | | | | | | | 3 |
| 2 | 3 | | | | | | | | | | | | 3 |
| 3 | | 2 | | | | | | | | | | | 3 |
| 4 | | | 2 | | | | | | | | | | 3 |
| 5 | | | | | 2 | | | | | | | | 3 |

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| **Course Content** | |
|---|---|
| **FOUNDATIONS OF SOFTWARE TESTING**<br>Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing<br>**Practical Component**<br>1. Analyze a simple software application and identify its functional and non-functional requirements for testing.<br>**2.** Classify test scenarios using Black-Box and White-Box testing techniques.<br>3. Prepare a Software Testing Life Cycle (STLC) and V-Model mapping for a selected application.<br>4. Perform Unit Testing on selected program modules and document the results. | **6 Hours**<br><br>**6 Hours** |
| **TEST PLANNING**<br>The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.<br><br>**Practical Component**<br>1. Identify test objectives, scope, assumptions, and risks for a selected application.<br>2. Develop a comprehensive Test Plan document.<br>3. Create a Test Schedule and Resource Allocation Plan.<br>4. Design a Bug Reporting Template and define testing metrics for project monitoring. | **6 Hours**<br><br>**6 Hours** |
| **TEST DESIGN AND EXECUTION**<br><br>Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle<br>**Practical Component**<br>1. Identify testable requirements and derive test scenarios.<br>2. Design test cases using Equivalence Class.<br>3. Design test cases using Boundary Value Analysis.<br>4. Design and execute test cases using Path Testing and Data Flow Testing techniques. | **6 Hours**<br><br>**6 Hours** |
| **ADVANCED TESTING CONCEPTS**<br>Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.<br><br>**Practical Component**<br>1. Perform Compatibility and Usability Testing on a web or mobile application.<br>2. Conduct Security Testing and document identified vulnerabilities.<br>3. Perform Load, Stress, and Volume Testing using suitable testing tools.<br>4. Execute test cases, record defects, and prepare a Bug Life Cycle report. | **6 Hours**<br><br>**6 Hours** |

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| **TEST AUTOMATION AND TOOLS**<br>Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.<br><br>**Practical Component**<br>1. Configure Selenium WebDriver and automate basic browser operations.<br>2. Automate form validation and navigation test cases using Selenium.<br>3. Develop and execute TestNG test suites and generate automated test reports.<br>4. Automate end-to-end testing of a web application and generate execution reports. | **6 Hours**<br><br>**6 Hours** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | **Practical Hours:** | **30** | **Project Hours:** | **Total Hours:** | 60 |

**Learning Resources***

**Textbooks**

1. Yogesh Singh, Software Testing, Cambridge University Press, 2013.
2. Unmesh Gundecha, Satya Avasarala, Selenium WebDriver 3 Practical Guide, Second Edition, Packt Publishing, 2018.

**Reference books/ Web Links**

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, John Wiley & Sons, Inc., 2015.
2. Ron Patton, Software Testing, 2nd Edition, Sams Publishing, 2006.
3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, 5th Edition, Taylor & Francis Group, 2021.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, Packt Publishing, 2018.
5. Elfriede Dustin, Thom Garrett, Bernie Gauf, Implementing Automated Software Testing, Addison-Wesley Professional, 2009.
6. Satya Avasarala, Selenium WebDriver Practical Guide, Packt Publishing, 2014.
7. Varun Menon, TestNG Beginner's Guide, Packt Publishing, 2013.

**Online Resources**

1. https://www.coursera.org/specializations/software-testing-automation
2. https://onlinecourses.nptel.ac.in/noc22_cs61/preview

**Assessment (Embedded Course)**

SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

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| Course Curated By | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Nivetha R & Arthi J<br>Assistant Professor<br>Department of Computer Science and Engineering |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSC005 | DEVOPS MASTERY<br>(Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 4 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | NA |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | To apply DevOps concepts, Linux, and networking fundamentals to create and manage system environments effectively. |
| 2 | Apply version control and continuous integration techniques to streamline development workflows |
| 3 | Implement containerization and orchestration using Docker and Kubernetes |
| 4 | Automate configuration management and infrastructure deployment using Ansible and Terraform. |
| 5 | Integrate end-to-end DevOps toolchains for efficient deployment and monitoring in real-world projects. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply foundational DevOps concepts, Linux, and networking essentials to create and manage system environments effectively. | Ap |
| CO 2 | Implement version control using Git and develop CI/CD pipelines with Jenkins to automate build and deployment processes | Ap |
| CO 3 | Design and deploy containerized applications using Docker and manage orchestration through Kubernetes clusters. | An |
| CO 4 | Automate configuration and infrastructure provisioning using Ansible and Terraform to ensure scalability and reproducibility. | Ap |
| CO5 | Integrate multiple DevOps tools into a cohesive workflow to deliver reliable, continuous, and monitored software solutions. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | | 3 | 2 | 2 | | | | | | | | 2 |
| 2 | | | 3 | 2 | 2 | | | | | | | | 2 |
| 3 | | | 3 | 3 | 3 | | | | | | | | 3 |
| 4 | | | 3 | 3 | 3 | | | | | | | | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | 3 | 3 | 3 | | | | | | | | 3 |

| **Course Content** | |
|---|---|
| **FOUNDATIONS OF DEVOPS AND LINUX FUNDAMENTALS LAB**<br>• Linux file system navigation<br>• User, group, and permission management<br>• Shell scripting for automation<br>• Networking essentials: IP, ports, protocols<br>**Practical Component**<br>1. Perform Linux file system navigation and file management using basic Linux commands.<br>2. Create and manage users, groups, and file permissions in Linux.<br>3. Develop shell scripts for task automation such as file backup, log analysis, and user management.<br>4. Configure and verify basic networking settings including IP addresses, ports, and network connectivity. | **3 Hours**<br><br>**12 hours** |
| **VERSION CONTROL AND CONTINUOUS INTEGRATION LAB**<br>• Git fundamentals, branching, merging, conflict resolution<br>• GitHub workflows<br>• Jenkins setup, job configuration, CI pipeline scripting<br>**Practical Component**<br>1. Create and manage a Git repository using commit, push, pull, and clone operations.<br>2. Implement Git branching, merging, and conflict resolution workflows.<br>3. Configure a GitHub repository and implement collaborative development workflows using pull requests.<br>4. Install and configure Jenkins to automate code build and integration processes. | **3 Hours**<br><br>**12 hours** |
| **CONTAINERIZATION AND ORCHESTRATION**<br>• Docker architecture, Dockerfile, images, containers<br>• Docker Compose services<br>• Kubernetes architecture, pods, deployments, services<br>• Scaling, load balancing<br>**Practical Component**<br>1. Create Docker images using Dockerfiles and manage containers.<br>2. Develop and deploy a multi-container application using Docker Compose.<br>3. Deploy applications on Kubernetes using Pods, Deployments, and Services.<br>4. Perform application scaling and load balancing in a Kubernetes cluster. | **3 Hours**<br><br>**12 hours** |
| **INFRASTRUCTURE AS CODE AND AUTOMATION**<br>• Ansible playbooks, roles, inventory<br>• Terraform providers, resources, and state<br>• Automated provisioning and configuration<br>**Practical Component**<br>1. Create Ansible inventory files and execute ad-hoc commands for remote system administration.<br>2. Develop Ansible Playbooks for automated software installation and configuration management.<br>3. Create Terraform scripts to provision cloud or local infrastructure resources.<br>4. Automate infrastructure deployment and configuration using Terraform and Ansible. | **3 Hours**<br><br>**12 hours** |
| **DEVOPS INTEGRATION AND MONITORING**<br>• Integrating CI/CD with Docker, Kubernetes, Ansible, Terraform<br>• Deployment strategies: blue-green, rolling<br>• Monitoring: Prometheus, Grafana<br>• Logging, security practices | **3 Hours** |

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|---|---|
| **Practical Component**<br>1. Integrate Git, Jenkins, and Docker to implement a Continuous Integration workflow.<br>2. Implement Continuous Deployment using Docker, Kubernetes, and Jenkins.<br>3. Configure Prometheus and Grafana to monitor application and infrastructure performance.<br>4. Develop and demonstrate an end-to-end DevOps pipeline integrating Git, Jenkins, Docker, Kubernetes, Ansible, Terraform, and monitoring tools. | **12 hours** |

| Theory Hours: 15 | Tutorial Hours: 0 | Practical Hours: 60 | Project Hours: 0 | Total Hours: 75 |
|---|---|---|---|---|

**Learning Resources***

**Textbooks**

1. Gene Kim, Jez Humble, Patrick Debois, John Willis, The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations ,Second Ediiton,2021
2. Rafal Leszko, Continuous Delivery with Docker and Jenkins,Third Edition,2023

**Reference books/ Web Links**

1. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
2. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
3. Sricharan Vadapalli, Modern DevOps Practices: Implement, Secure, and Manage DevOps Processes,2024.
4. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.

**Online Resources**

1. https://www.coursera.org/specializations/devops-mastery
2. https://www.coursera.org/professional-certificates/devops-and-software-engineering
3. https://www.coursera.org/learn/intro -to-devops?specialization=devops-and-softwareengineering
4. https://www.jenkins.io/doc/book

**Assessment (Embedded course)**

MCQ, Experimental Cycle tests and End Semester Examination (Lab)

**Course Curated By**

| Expert(s) from Industry | Expert(s) from Higher Education Institutions | Internal Expert(s) |
|---|---|---|
| | | Nivetha R, AP/CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSC006 | SOFTWARE PROJECT MANAGEMENT (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI015 Software Engineering and Agile Practices | Data Book / Codes / Standards ( If any) | NA |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Explore software project management principles and Agile project execution practices. |
| 2 | Apply estimation, planning, scheduling, and collaboration techniques for software projects. |
| 3 | Analyze project risks, software quality assurance practices, and AI-assisted workflow management strategies. |
| 4 | Utilize Agile and project management tools for monitoring and team coordination. |
| 5 | Develop practical skills in managing software projects using modern collaborative and AI-supported approaches. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO1 | Analyse software project management principles, Agile lifecycles, AI-assisted collaborative workflows, and project communication practices in software industries. | An |
| CO2 | Apply project planning, estimation, scheduling, and resource management techniques using collaborative project management platforms. | Ap |
| CO3 | Develop Agile requirements, sprint plans, and workflow strategies using AI-assisted project coordination and documentation tools. | Ap |
| CO4 | Apply risk management, software quality assurance, version control, and software delivery practices in project execution environments. | Ap |
| CO5 | Evaluate software project performance using Agile metrics, dashboards, project monitoring strategies, and retrospective practices. | E |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| CO1 | | 3 | | | 2 | | | 2 | 2 | | | 2 | |
| CO2 | | 3 | 2 | | 3 | | | | 2 | 3 | | 2 | |
| CO3 | | 3 | 3 | | 3 | | | 3 | | 2 | | 3 | 2 |
| CO4 | | 2 | 2 | | 3 | | 2 | | 2 | 3 | | 2 | |
| CO5 | | 3 | | 2 | 2 | | | 2 | 3 | 3 | | 3 | |

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| Course Content | |
|---|---|
| **SOFTWARE PROJECT MANAGEMENT FUNDAMENTALS**<br>Characteristics of software projects - Responsibilities of software project managers - Traditional vs Agile project lifecycles - Stakeholders and team organization - Project scope and feasibility analysis - Project communication workflows - Introduction to AI-assisted collaborative project environments.<br>**Practical Component**<br>1.Identify project goals, stakeholders, and scope for a simple software application.<br>2. Prepare a Project Charter using Notion AI.<br>3. Conduct Technical, Economic, and Operational Feasibility Analysis and prepare a feasibility report.<br>4. Generate a Software Requirement Summary and Requirement Specification document using Notion AI. | **6 Hours**<br><br>**6 Hours** |
| **PROJECT PLANNING, ESTIMATION AND SCHEDULING**<br>Project planning activities - Work Breakdown Structure (WBS) - Resource allocation and team coordination - Cost and effort estimation techniques - Function point analysis - COCOMO model - Project scheduling - Gantt charts - PERT and CPM - Milestones, deliverables, and task dependencies.<br>**Practical Component**<br>1. Develop a Work Breakdown Structure (WBS) for the selected software project<br>2. Create a Gantt Chart showing project activities, dependencies, and milestones.<br>3. Perform effort and cost estimation for the software project using suitable estimation techniques.<br>4. Create a project schedule in Jira by defining tasks, timelines, priorities, and resource assignments. | **6 Hours**<br><br>**6 Hours** |
| **AGILE PROJECT MANAGEMENT AND ITERATION PLANNING**<br>Agile manifesto and Scrum framework - Scrum roles, events, and artifacts - Kanban methodology - Product backlog and sprint backlog management - User stories and acceptance criteria - Sprint planning, review, and retrospectives - AI-assisted requirement generation and collaborative reporting workflows - Iterative development and release planning.<br>**Practical Component**<br>1. Develop Epics, User Stories, and Acceptance Criteria for the selected software project.<br>2. Create a Product Backlog and Sprint Backlog using Jira.<br>3. Configure a Sprint Board in Jira by organizing user stories, assigning tasks, and estimating story points.<br>4. Generate Sprint Review and Sprint Retrospective reports for a given project scenario using Notion AI. | **6 Hours**<br><br>**6 Hours** |
| **RISK MANAGEMENT AND SOFTWARE DELIVERY**<br>Software risks and challenges - Risk identification and mitigation strategies - AI-assisted risk prediction and issue analysis - Issue tracking and change management - Software quality assurance practices - Defect tracking - Version control and collaborative repositories.<br>**Practical Component**<br>1. Identify project risks and prepare a Risk Register.<br>2. Develop Risk Mitigation and Contingency Plans using Notion AI.<br>3. Create and manage issue tickets, bug reports, labels, and workflows using GitHub Projects.<br>4. Configure Jira dashboards and generate project progress reports using sample project data. | **6 Hours**<br><br>**6 Hours** |

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| **PROJECT MONITORING, REPORTING AND ANALYTICS**<br>Project progress monitoring and reporting - Project progress tracking and reporting dashboards - Team coordination and project communication - AI-assisted project reporting - Project closure and retrospective analysis - Case studies in software project management. | **6 Hours** |
| **Practical Component**<br>1. Create project performance dashboards and analyze project metrics.<br>2. Generate project status reports and analytics summaries using Notion AI.<br>3. Prepare project closure documentation including lessons learned and project outcomes.<br>4. Develop and present the final mini software project report and presentation. | **6 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | **0** | **Practical Hours:** | **30** | **Project Hours:** | **0** | **Total Hours:** | **60** |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. Hughes, Bob., Cotterell, Mike., and Mall, Rajib., Software Project Management, 6th Edition, 2017, McGraw Hill Education.<br>2. Schwalbe, Kathy., Information Technology Project Management, 9th Edition, Cengage Learning, 2019.<br>3. Jonathan Rasmusson., The Agile Samurai: How Agile Masters Deliver Great Software, Pragmatic Bookshelf, 2021. |
| **Reference books/ Web Links** |
| 1. PMI., A Guide to the Project Management Body of Knowledge (PMBOK Guide), Project Management Institute, 7th Edition, 2021.<br>2. Rubin, Kenneth S., Essential Scrum: A Practical Guide to the Most Popular Agile Process, Addison-Wesley, 2013.<br>3. Joachim Rossberg, Agile Project Management with Azure DevOps: Concepts, Templates, and Metrics, 2019, Apress. |
| **Online Resources** |
| 1. https://www.coursera.org/learn/software-processes-and-agile-practices<br>2. https://www.coursera.org/learn/project-management-principles-and-practices<br>3. https://www.atlassian.com/agile<br>4. https://www.scrum.org/resources<br>5. https://www.notion.so/product/ai |

| **Assessment (Embedded Course)** |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Ms. Arthi.J ,AP/CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

**Signature of BOS Chairman-CSE**

# CYBER SECURITY

Signature of BOS Chairman-CSE

| 24CSC007 | SECURE SOFTWARE DEVELOPMENT (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 4,9 | | | |

| Pre-requisite courses | 24CSI015 Software Engineering and Agile Practices | Data Book / Codes / Standards ( If any) | NA |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | To know the importance and need for software security |
| 2 | To learn about secure software design |
| 3 | To understand risk management in secure software development |
| 4 | To know the working of tools related to software security |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Demonstrate memory-based vulnerabilities by simulating attacks and applying mitigation techniques | Ap |
| CO 2 | Design secure software components by integrating security principles into the SDLC and documenting threat models. | Ap |
| CO 3 | Evaluate risks in a software project using profiling tools and propose mitigation strategies aligned with industry standards. | An |
| CO 4 | Test software for security flaws using penetration testing tools and generate reports. | Ap |
| CO 5 | Implement a secured web application by applying security frameworks and justifying design choices. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | | | | | | | | | 3 | |
| 2 | 3 | 2 | | | 3 | | | | | | | 3 | |
| 3 | 3 | 2 | | | 2 | | | | | | | 3 | |
| 4 | 3 | 2 | | | 2 | | | | | | | 3 | 2 |
| 5 | 3 | | | | 3 | | | | | | | 3 | |

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| Course Content | |
|---|---|
| **NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS**<br>Introduction - Software Assurance and Software Security –Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Secure SDLC- Memory-Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks<br>**Practical Component**<br>1. Studying and Installing Kali Linux | **6 Hours**<br><br>**4 Hours** |
| **SECURE SOFTWARE DESIGN**<br>Requirements Engineering for secure software - SQUARE process Model – Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content – Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles<br>**Practical Component**<br>1. Implementation of the Buffer Overflow attack<br>2. Implementation of the SQL injection attack<br>3. Implementation of Cross Site Scripting and Prevention of XSS | **7 Hours**<br><br>**6 Hours** |
| **SECURITY RISK MANAGEMENT**<br>Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management<br>**Practical Component**<br>1. Basic risk profiling and assessment of a known software vulnerability | **5 Hours**<br><br>**4 Hours** |
| **SECURITY TESTING**<br>Traditional Software Testing – Comparison - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing<br>**Practical Component**<br>1. Penetration testing on a web application to gather information about the system<br>2. Initiate XSS and SQL injection attacks using tools like Kali Linux<br>3. Developing and testing the secure test cases | **8 Hours**<br><br>**8 Hours** |
| **SECURE PROJECT MANAGEMENT**<br>Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice<br>**Practical Component**<br>1. Implementation of secured web application | **4 Hours**<br><br>**8 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | **0** | **Practical Hours:** | **30** | **Project Hours:** | **0** | **Total Hours:** | **60** |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2009 |

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| Reference books/ Web Links |
|---|
| 1. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011<br>2. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006<br>3. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005.<br>4. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.<br>5. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First edition, Syngress Publishing, 2012<br>6. Bryan Sullivan and Vincent Liu, “Web Application Security, A Beginner's Guide”, Kindle Edition, McGraw Hill, 2012<br>7. Lee Allen, “Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)”, Kindle Edition, Packt Publishing, 2012<br>8. Gary McGraw, "Software Security: Building Security In", Addison-Wesley Professional (Pearson Education), 2006.<br>9. Jim Manico and August Detlefsen, Engineering Secure Software and Systems, Wiley, First Edition, 2024. |
| **Online Resources** |
| 1. https://www.us-cert.gov/bsi/articles/best-practices/project-management/software-security-engineering-guide-project-managers<br>**MOOCS:**<br>1. https://nptel.ac.in/courses/106106199/<br>2. https://www.mooc-list.com/course/software-security-cousera<br>3. https://www.coursera.org/specializations/requirements-engineering-secure-software<br>4. https://pe.gatech.edu/courses/secure-software-development<br>5. https://www.my-mooc.com/en/mooc/software-security/<br>6. https://www.coursera.org/learn/requirements-elicitation?specialization=requirements-engineering-secure-software |

| Assessment (Embedded Course) |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| Course Curated By | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Dr.V.Vanitha P/CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSC008 | DIGITAL FORENSICS<br>(Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 4,9 | | | |

| Pre-requisite courses | 24CSI011 Computer Networks and Security | Data Book / Codes / Standards ( If any) | NA |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Learn the systematic approach to digital investigations, encompassing identification, preservation, analysis, and reporting of digital evidence. |
| 2 | Acquire skills to collect, preserve, and analyze digital evidence from various devices and platforms, ensuring the integrity and admissibility of the evidence. |
| 3 | Gain hands-on experience with industry-standard forensic tools and software used for data recovery, analysis, and reporting. |
| 4 | Develop the ability to document findings clearly and concisely, creating reports suitable for legal proceedings and organizational reviews. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Illustrate the digital forensics process and digital evidence acquisition | Ap |
| CO 2 | Explain file systems and data recovery procedures. | Ap |
| CO 3 | Demonstrate computer, network and mobile forensics with specialized tools. | Ap |
| CO 4 | Analyze malware and report the relevant incident. | Ap |
| CO 5 | Utilize the forensics toolkit for efficient investigation and understand the legal aspects of digital forensics. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | 2 | | | 2 | | | | | | | | |
| 2 | 2 | 2 | | | | | | | | | | | |
| 3 | 2 | 2 | | | 2 | | | | | | | 2 | |
| 4 | 2 | 2 | | 2 | 2 | | | | | | | | |
| 5 | 2 | | | | 2 | | | | | | | 2 | 2 |

Signature of BOS Chairman-CSE

| Course Content | |
|---|---|
| **OVERVIEW OF DIGITAL FORENSICS**<br>Understanding the role of digital forensics in investigations. Legal and Ethical Considerations: Adhering to legal and ethical standards in digital investigations. Digital Forensics Process: Introduction to the forensic investigation process. Digital Evidence Acquisition: Types of Digital Evidence: Identifying and classifying digital evidence. Evidence Acquisition Tools: Using tools for acquiring data from different devices. Forensic Imaging: Creating forensic images of storage media<br><br>**Practical Component**<br>1. Install and configure a digital forensic tool (e.g., FTK Imager, Autopsy, Guymager).<br>2. Identify different types of digital evidence available on a storage device.<br>3. Acquire data from a USB drive or hard disk. | **6 Hours**<br><br>**6 Hours** |
| **FILE SYSTEMS AND DATA RECOVERY**<br>File System Analysis: Understanding file systems and their structures. Deleted File Recovery: Techniques for recovering deleted files. File Carving: Extracting files from unallocated space.<br><br>**Practical Component**<br>1. Examine the structure of FAT32, NTFS, and EXT4 file systems.<br>2. Identify partitions, directories, file allocation tables, and master file tables.<br>3. Demonstration of the data recovery techniques. | **6 Hours**<br><br>**6 Hours** |
| **COMPUTER, NETWORK AND MOBILE DEVICE FORENSICS**<br>Computer Forensics: Investigating computers for evidence- Network Forensics: Analysing network traffic and logs- Memory Forensics: Examining volatile memory for evidence. Mobile Device Investigation: Extracting evidence from smartphones and tablets. App and Cloud Forensics: Investigating applications and cloud-based services. Challenges in Mobile Forensics: Addressing unique challenges in mobile investigations.<br><br>**Practical Component**<br>1. Identify and analyze digital evidence from a computer system, network traffic, and volatile memory.<br>2. Extract and analyze evidence from mobile devices, applications, and cloud-based services | **6 Hours**<br><br>**6 Hours** |
| **MALWARE ANALYSIS**<br>Introduction to Malware - Understanding different types of malware- Static and Dynamic Analysis: Analysing malware behaviour and code. Responding to malware incidents- Incident Response and Forensic Tools- Incident Response Planning: Preparing for and responding to security incidents. Introduction to bug bounty Working of bug bounty - Bug bounty program examples Setting up bug bounty program<br><br>**Practical Component**<br>1. Analyze malware samples using static and dynamic analysis techniques and identify malicious behaviors.<br>2. Investigate a simulated security incident and design a basic bug bounty program. | **6 Hours**<br><br>**6 Hours** |
| **AUTOMATED FORENSICS**<br>Introduction to popular forensic tools- Automated Forensics: Leveraging automation for efficient investigations-Automated Forensics: Leveraging automation for efficient investigations. Legal Aspects of Digital Forensics: Expert Witness Role: Preparing for and testifying in court- Digital Forensics Laws and Regulations: Understanding legal frameworks - Case Studies: Analysing legal cases involving digital forensics.<br><br>**Practical Component**<br>1. Automated Digital Forensic Investigation Using Forensic Tools<br>2. Digital Forensic Case Analysis and Expert Witness Reporting | **6 Hours**<br><br>**6 Hours** |

**Signature of BOS Chairman-CSE**

| Theory Hours: | 30 | Tutorial Hours: | 0 | Practical Hours: | 30 | Project Hours: | 0 | Total Hours: | 60 |
|---|---|---|---|---|---|---|---|---|---|

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. André Årnes, Digital Forensics ,Publisher(s): Wiley, July 2017. |
| **Reference books/ Web Links** |
| 1. New Orleans, LA, USA, Digital forensics and cybercrime: 10th International EAI Conference, ICDF2C 2018,, September 10-12, 2018. |

| |
|---|
| 2. Adam M. Bossler, Kathryn C. Seigfried-Spellar, Thomas J. Holt.,Cybercrime and Digital Forensics : An cybercrime And Digital Forensics : An Introduction, 3rd Edition May 2022. |
| **Online Resources** |
| 1. https://www.coursera.org/learn/digital-forensics-concepts.<br>2. https://www.open.edu/openlearn/science-maths-technology/digital-forensics/contentsection-0?active-tab=content-tab.<br>3. https://www.edx.org/learn/computer-forensics/rochester-institute-of-technologycomputer-forensics |

| **Assessment (Embedded Course)** |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Dr.G.Kanagaraj, AP-II/CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | Date: 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSC009 | NETWORK SECURITY ADMINISTRATION (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 4,9 | | | |

| Pre-requisite courses | 24CSI011 Computer Networks and Security | Data Book / Codes / Standards ( If any) | NA |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand fundamental concepts of network security, including threats, vulnerabilities, and countermeasures. |
| 2 | Explore the architecture and functionality of firewalls, VPNs, IDS/IPS, and other network security components |
| 3 | Configure and manage firewalls to control traffic flow and enforce network security policies. |
| 4 | Administer secure network services and monitor network activity to detect and respond to security incidents. |
| 5 | Evaluate network security risks and design security solutions to meet organizational requirements. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply the symmetric cryptographic concepts and block cipher techniques for secure data transmission. | Ap |
| CO 2 | Examine the public key cryptography and hash algorithms to enhance data security. | Ap |
| CO 3 | Implement secure communication protocols to organize and safeguard payloads at the internet and transport layers. | Ap |
| CO 4 | Interpret the primary components of a Three-Tier Architecture and explain how they work together in a firewall environment. | Ap |
| CO 5 | Demonstrate the application of firewall rules to secure communication and manage traffic routing. | Ap |
| CO 6 | Analyse network and system security from an administrative perspective to identify and mitigate cyber threats. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 3 | | | | | 2 | | | | | 3 | |
| 2 | 3 | 3 | | 2 | | | | | | | | 3 | |
| 3 | 3 | 3 | | 2 | | | | | | | | 3 | |
| 4 | 3 | | | | 3 | | | | | | 2 | | 3 |
| 5 | 3 | | | | 3 | | 2 | | | | | | 3 |
| 6 | | 3 | | | 3 | | 3 | | | | | | 3 |

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| Course Content | |
|---|---|
| **NETWORK SECURITY BASICS**<br>Overview of Network Security, Internet Standards and RFCs, Conventional Encryption Principles and block ciphers, Advanced Encryption standards, AES Implementation, Block Cipher operation: cipher block modes of operation, location of encryption devices.<br><br>**Practical Component**<br>1. Implementation of Advanced Encryption Standard (AES) algorithm<br>2. Designing of a secure network and identify optimal encryption device placement. | **6 Hours**<br><br>**6 Hours** |
| **ASYMMETRIC CIPHERS AND DATA INTEGRITY ALGORITHM**<br>Public key cryptography, RSA Algorithm, Diffie Hellman Key Exchange, Elgamal Cryptographic System, Elliptic Curve Cryptography, Pseudorandom number generation, Cryptographic Hash Functions: Requirements and Secure Hash algorithm (SHA), Message Authentication Codes: HMAC, Key Management and Distribution.<br><br>**Practical Component**<br>1. Implementation of RSA algorithm<br>2. Implementation of secure hash algorithm. | **6 Hours**<br><br>**6 Hours** |
| **INTERNET SECURITY**<br>Transport Layer Security: Web security considerations, HTTPS, secure shell (SSH), Email privacy: Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.<br><br>**Practical Component**<br>1. Analysing of FTP, Telnet and HTTP packets using wireshark<br>2. Implementation of Image Sniffing using Wireshark. | **6 Hours**<br><br>**6 Hours** |
| **NETWORK SECURITY MANAGEMENT**<br>Deploying Smart Console - Security Management Server - Security Gateway - Configuring Objects in Smart Console-Establishing Secure Internal Communication - Managing Administrator Access - Managing Licenses - Creating a Security Policy - Configuring Order Layers.<br><br>**Practical Component**<br>1. Configuring objects in smart console<br>2. Managing administrator access for an operating system<br>3. Elevating Security with Autonomous Threat Prevention | **6 Hours**<br><br>**6 Hours** |
| **NETWORK SECURITY CONFIGURATION**<br>Configuring a Shared Inline Layer - Configuring NAT - Integrating Security with a Unified Policy - Elevating Security with Autonomous -Threat Prevention - Configuring a Locally Managed Site-to-Site VPN - Elevating Traffic View - Monitoring System States - Maintaining the Security Environment.<br><br>**Practical Component**<br>1. Configuring NAT to use a private IP address<br>2. Creating a security policy and integrating it with a unified policy<br>3. Monitoring System States and Maintaining the Security Environment. | **6 Hours**<br><br>**6 Hours** |

**Signature of BOS Chairman-CSE**

| Theory Hours: | 30 | Tutorial Hours: | 0 | Practical Hours:30 | 30 | Project Hours: | 0 | Total Hours: | 60 |
|---|---|---|---|---|---|---|---|---|---|

**Learning Resources**

**Textbooks**

1. William Stallings, Network Security Essentials (Applications and Standards) Pearson Education 2018.
2. William Stallings, Cryptography and network Security, Seventh edition, Stallings, PHI/Pearson 4,2017.
3. Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh ,Hack Proofing your network , Wiley Dreamtech Published by Syngress, 2002.

**Reference books/ Web Links**

1. Bernard Menezes, Network Security and Cryptography: CENGAGE Learning, 2010.
2. Charlien Kaufman, Radia Perlman and Mike Speciner ,Network Security – Private Communication in a Public World by , Pearson/PHI 2002.
3. https://www.checkpoint.com/downloads/professional-services/AdministratorStudyGuide.pdf
4. https://sc1.checkpoint.com/documents/R81/WebAdminGuides/EN/CP_R81_SecurityManagement_AdminGuide/Topics-SECMG/Understanding-SmartConsole.htm.

**Online Resources**

1. https://www.classcentral.com/course/cybersecurity-rochester-institute-of-technology-c-7844.
2. https://www.classcentral.com/course/network-security-rochester-institute-of-technolog-7858.
3. https://www.classcentral.com/course/coursera-advanced-network-security-and-analysis-397836.
4. https://www.coursera.org/specializations/fortinet-network-security.

**Assessment (Embedded Course)**

SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

**Course Curated By**

| Expert(s) from Industry | Expert(s) from Higher Education Institutions | Internal Expert(s) |
|---|---|---|
| | | Dr.A.Roshini,<br>Assistant Professor III,CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | Date: 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSC010 | ETHICAL HACKING AND CYBER LAWS (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 4,9 | | | |

| Pre-requisite courses | 24CSI011 Computer Networks and Security | Data Book / Codes / Standards ( If any) | NA |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Introduce core concepts of ethical hacking, including threats, vulnerabilities, and attack methodologies. |
| 2 | Develop skills in reconnaissance, footprinting, and enumeration using ethical hacking tools. |
| 3 | Simulate real-world attacks such as password cracking, sniffing, and wireless exploitation. |
| 4 | Provide knowledge of cyber laws, ethical practices, and digital rights frameworks. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Identify and describe the key concepts and terminologies of ethical hacking, including phases of hacking, threat types, vulnerabilities, and exploits | U |
| CO 2 | Demonstrate the use of reconnaissance tools for footprinting and port scanning, and script-based enumeration of Windows and Linux systems, | Ap |
| CO 3 | Apply password cracking techniques, implement keyloggers and sniffers, and analyze remote system vulnerabilities to simulate system hacking attacks | An |
| CO 4 | Execute wireless network attacks and demonstrate secure configuration practices using wireless hacking tools, | Ap |
| CO 5 | Analyze the key provisions of national and international cyber laws, evaluate ethical implications of cyber actions, and apply legal frameworks to real-world case studies | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | | | | | | | | 2 | 2 | |
| 2 | 3 | 2 | | | 2 | | | | | | | | 2 |
| 3 | 3 | 2 | 2 | | | | | | | | | 2 | |
| 4 | 3 | | | | 2 | | | | | | | | 2 |
| 5 | | | | | | | 2 | | 2 | | 2 | | 2 |

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| Course Content | |
|---|---|
| **ETHICAL HACKING OVERVIEW & VULNERABILITIES**<br>Understanding the importance of security, Concept of ethical hacking and essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking<br>**Practical Component**<br>1. Installation of Kali or Backtrack Linux / Metasploitable/ Windows XP 2<br>2. Reconnaissance Techniques for Information Gathering. | **6 Hours**<br><br>**6 Hours** |
| **FOOTPRINTING & PORT SCANNING**<br>Footprinting - Introduction to foot printing, Understanding the information gathering methodology of the hackers, tools used for the reconnaissance phase. Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting enumeration-Introduction, enumerating windows OS & Linux OS<br>**Practical Component**<br>1. Passive Footprinting Using OSINT Tools<br>2. Active Footprinting and Network Mapping<br>3. Perform System Enumeration on Windows and Linux | **6 Hours**<br><br>**8 Hours** |
| **SYSTEM HACKING**<br>Aspect of remote password guessing, Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.<br>Side-channel Attacks on Cryptographic Hardware: Basic Idea, Current-measurement based Side-channel Attacks. Hardware Trojans<br>**Practical Component**<br>1. Password guessing and Password Cracking<br>2. Understanding Data Packet Sniffers<br>3. Working with Trojans, Backdoors | **6 Hours**<br><br>**10 Hours** |
| **HACKING WIRELESS NETWORKS**<br>Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks<br>**Practical Component**<br>1. Cracking WEP Encryption<br>2. Wireless Sniffing and DoS Attack Simulation | **6 Hours**<br><br>**6 Hours** |
| **Cyber Law and Ethical Frameworks**<br>The legal and ethical aspects of cyber activities, covering fundamental cyber laws in India and internationally, digital evidence handling, data protection regulations, intellectual property rights, and ethical responsibilities of IT professionals. | **6 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | **0** | **Practical Hours:** | **30** | **Project Hours:** | **0** | **Total Hours:** | **60** |

| Learning Resources |
|---|
| **Textbooks** |
| 1. Ric Messier, CEH v11: Certified Ethical Hacker Study Guide, Wiley (2021).<br>2. Vivek Sood, Cyber Law Simplified, Tata McGraw-Hill (2017) |
| **Reference books/ Web Links** |

**Signature of BOS Chairman-CSE**

1. Michael T. Simpson, “Hands-on Ethical Hacking & Network Defense”, Course Technology, 2010
2. Rajat Khare, “Network Security and Ethical Hacking”, Luniver Press, 2006
3. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner’s Guide (3rd ed.). Packet Publishing, 2011
4. Thomas Mathew, “Ethical Hacking”, OSB publishers, 2003

**Online Resources**

1. https://www.coursera.org/specializations/cybersecurity-attack-and-defense
2. https://www.netacad.com/courses/ethical-hacker?courseLang=en-US

| **Assessment (Embedded Course)** |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Dr N.Suganthi, Prof / CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date: 19.06.2026** |

**Signature of BOS Chairman-CSE**

| 24CSE011 | WEB APPLICATION SECURITY (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |
| PE | | SDG | 4 & 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | NA |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | To provide foundational knowledge of web application security concepts |
| 2 | To analyze and identify common web vulnerabilities |
| 3 | To familiarize students with browser security policies and encryption practices |
| 4 | To introduce tools and techniques for vulnerability assessment and penetration testing |
| 5 | To enable students to design and develop secure web applications |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Understand the fundamentals of web application security to identify and explain common security threats. | U |
| CO 2 | Apply browser security principles to demonstrate methods for mitigating attacks. | Ap |
| CO 3 | Understand the process of vulnerability assessment in conducting penetration testing on web applications. | Ap |
| CO 4 | Apply secure design techniques to organize and implement security measures in web application development. | Ap |
| CO 5 | Understand about Hacking techniques and Tools | U |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | | | | | | | | | | 2 | |
| 2 | | | | | 3 | | | | | | | 3 | |
| 3 | | 3 | | | | | | | | | | 2 | |
| 4 | | | 3 | | | | | | | | | 3 | |
| 5 | | 3 | | | | | 3 | | | | | 2 | |

Signature of BOS Chairman-CSE

| Course Content | |
|---|---|
| **FUNDAMENTALS OF WEB APPLICATION SECURITY**<br>The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation. | **8 Hours** |
| **BROWSER SECURITY PRINCIPLES AND WEB APPLICATION VULNERABILITIES**<br>Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection. Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie-based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application - Session vulnerabilities and testing - Cross-site request forgery | **10 Hours** |
| **VULNERABILITY ASSESSMENT AND PENETRATION TESTING**<br>Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing. | **9 Hours** |
| **SECURE WEB DESIGN**<br>Secure website design: Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management, Sensitive Data, Session Management, Cryptography,<br>Parameter Manipulation, Exception Management, Auditing and Logging, Design Guidelines, Forms and validity, technical implementation. | **9 Hours** |
| **HACKING TECHNIQUES AND TOOLS**<br>Social Engineering, Injection, Cross-Site Scripting (XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc. probing, Double hashing and rehashing, Hashing Applications. Memory Management: Garbage Collection. | **9 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | **0** | **Practical Hours:** | **0** | **Project Hours:** | **0** | **Total Hours:** | **45** |

**Learning Resources***

**Textbooks**


1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA
4. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Profe ssional, 2011.
5. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011.


**Signature of BOS Chairman-CSE**

| Reference books/ Web Links |
|---|
| 1. Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Paperback, ISBN: 978-0-470-17077-9 , October 2007.<br>2. Malcolm McDonald, Web Security for Developers: Real Threats, Practical Defense, No Starch Press,2020. |
| **Online Resources** |
| 1. https://www.offsec.com/cyberversity/web-application-security/<br>2. https://web.stanford.edu/class/cs253/<br>3. https://owasp.org/www-project-top-ten/<br>4. https://www.hackthebox.com/blog/vulnerability-assessments-vs-pentesting<br>5. https://developer.mozilla.org/en-US/docs/Learn_web_development/Extensions/Server-side/First_steps/Website_security<br>6. https://www.hackerone.com/knowledge-center/white-hat-hacker |

| Assessment (Theory course) |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) |

| Course Curated By | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Dr.G.Kanagaraj, AP-II/CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date: 19.06.2026** |

**Signature of BOS Chairman-CSE**

| 24CSE012 | DATABASE SECURITY<br>(Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |
| PE | | SDG | 4,9 | | | |

| Pre-requisite courses | 24CSI009 Database Management Systems | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| 1 | **To understand** the principles, policies, models, and mechanisms of access control and database security. |
| 2 | **To apply** role-based access control models, security techniques, and tools to mitigate database vulnerabilities and attacks. |
| 3 | To explore current and emerging trends in database security and implement practical solutions for access control in evolving digital environments. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Explain fundamental concepts of database security including threats, vulnerabilities, and basic security models | U |
| CO 2 | Analyze and compare access control mechanisms (DAC, MAC, RBAC) and their limitations through policy enforcement. | An |
| CO 3 | Apply various security models in enterprise IT infrastructure scenarios | Ap |
| CO 4 | Apply Virtual Private Database techniques and SQL injection countermeasures to enhance database security. | Ap |
| CO 5 | Apply emerging trends in database security to implement suitable access control solutions in practical scenarios. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | | | | | | | | 2 | 3 | |
| 2 | 3 | 3 | | | | | | | | | | 3 | |
| 3 | 3 | | 3 | | | | | | | | 2 | 3 | |
| 4 | 3 | | 3 | | | | | | | | | 3 | |
| 5 | 3 | | | | | | | | | | 3 | 3 | |

Signature of BOS Chairman-CSE

| Course Content | |
|---|---|
| **FOUNDATIONS OF DATABASE SECURITY**<br>Database security – Introduction includes threats, vulnerabilities and breaches, Basics of database design, DB security – concepts, approaches and challenges, | **7 Hours** |
| **ACCESS CONTROL AND POLICY ENFORCEMENT**<br>Introduction to Access Control, Purpose and fundamentals of access control, brief history, Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non- Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations. | **10 Hours** |
| **SECURITY MODELS**<br>Biba's integrity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system Temporal Constraints in RBAC, MAC AND DAC. Integrating RBAC with enterprise IT infrastructure: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multi-line Insurance Company | **9 Hours** |
| **VIRTUAL PRIVATE DATABASE AND SQL INJECTION**<br>Necessity of VPD –implementing VPD- Problems of VPD -. Launch SQL injection attacks – Countermeasures-, Security Re-engineering for Databases: Concepts and Techniques, Database Watermarking – Basic Watermarking Process - Discrete Data, Multimedia, and Relational Data – Attacks on Watermarking - Single Bit Watermarking, Multi bit Watermarking | **10 Hours** |
| **FUTURE TRENDS IN DATABASE SECURITY**<br>A Bayesian Perspective, Privacy-enhanced Location based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment | **9 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | **0** | **Practical Hours:** | **0** | **Project Hours:** | **0** | **Total Hours:** | **45** |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. **Danturthi, R. S.** Database and Application Security: A Practitioner's Guide. Pearson Education, Boston (2024).<br>2. Pfleeger, Charles P., and Shari Lawrence Pfleeger., "Access Control Policies and Models.", Security in Computing., Prentice Hall, Upper Saddle River (2015): pp. 55–88.<br>3. Michael Gertz and Sushil Jajodia, "Handbook of Database Security— Applications and Trends", Springer, 2008 |
| **Reference books/ Web Links** |
| 1. **Ben-Natan, Ron.** How to Secure and Audit Oracle 10g and 11g. Auerbach Publications, Boca Raton (2009).<br>*2.* **Thuraisingham, Bhavani.** Database and Applications Security: Integrating Information Security and Data Management. Auerbach Publications, Boca Raton (2005). |
| **Online Resources** |
| 1. https://www.coursera.org/learn/access-control-concepts |

| **Assessment (Theory course)** |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) |

**Signature of BOS Chairman-CSE**

| Course Curated By | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Dr.N.Rajathi P/ IT |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date: 19.06.2026** |

**Signature of BOS Chairman-CSE**

| 24CSC021 | DIGITAL EVIDENCE AND CYBER INVESTIGATION (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 4 | 0 | 3 |
| PE | | SDG | 4,9 | | | |

| Pre-requisite courses | 24CSI011 Computer Networks and Security | Data Book / Codes / Standards ( If any) | NA |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Gain knowledge on digital investigation lifecycle, emphasizing evidence handling, documentation and use of forensic methodologies for identifying and analyzing digital incidents |
| 2 | Impart practical skills in forensic data acquisition, imaging, and verification from diverse storage media and file systems while maintaining evidence integrity |
| 3 | Ability to extract, analyze, and interpret operating system artifacts from Windows and Linux environments for reconstructing user activities and identifying system misuse |
| 4 | Enable students to perform malware analysis through static and dynamic techniques, identify Indicators of Compromise (IOCs), and document forensic findings effectively |
| 5 | Develop proficiency in reverse engineering tools, disassembly, and threat intelligence to classify and counteract malware |

| Course Outcomes***: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply forensic methodologies to perform a basic digital investigation on a simulated crime scene | Ap |
| CO 2 | Construct a forensic report summarizing acquired data, integrity verification and recovery process | Ap |
| CO 3 | Examine an automated script or workflow for extraction and correlation of operating system artifacts | Ap |
| CO 4 | Analyze network traffic patterns to identify intrusion attempts, data exfiltration or malware communication | Ap |
| CO 5 | Analyze malware behavior by monitoring system, file and network activities during execution | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | | | 2 | | | | | | | | | |
| 2 | | | | | 3 | | | | | | | 2 | |
| 3 | | | 2 | | 3 | | | | | | | 2 | |
| 4 | | | | | 3 | | | | | | | | 2 |
| 5 | | | | | 3 | | | | | | | | 2 |

Signature of BOS Chairman-CSE

| Course Content | |
|---|---|
| **DIGITAL FORENSICS AND INVESTIGATION PROCESS**<br>Introduction to Forensics, Overview of Computer Crime and Forensic Methods<br><br>**Practical Component**<br>• Analysis of Browser History, Cache & Cookies + Event Log.<br>• Demonstrate write-blocker tools and their use during data acquisition.<br>• Simulate a digital crime scene and document the investigation steps.<br>• Analyze USB device usage and related artifacts from a system. | **3 Hours**<br><br>**12 Hours** |
| **DATA ACQUISITION FROM FILE SYSTEM**<br>Collecting, Seizing, and Protecting Evidence, Techniques for hiding and scrambling information.<br><br>**Practical Component**<br>• Modify the Windows Registry to prevent data from being written to a USB storage device.<br>• Identify the file systems of forensic images with fsstat, which is included with The Sleuth Kit.<br>• Recovering Files from Forensic Images with FTK Imager. | **3 Hours**<br><br>**12 Hours** |
| **OPERATING SYSTEM FORENSICS**<br>Windows & Linux Forensics, Mobile Forensics<br>**Practical Component**<br>• Demonstrate privilege escalation vulnerabilities and mitigation.<br>• Demonstrate patch management — apply and verify system updates in a secure test environment.<br>• Create and analyze OS security baselines using tools like CIS-CAT or Microsoft Security Compliance Toolkit. | **3 Hours**<br><br>**12 Hours** |
| **NETWORK FORENSICS**<br>Networks Basics, Network traffic Analysis Tools, Router and Firewall Forensics.<br>**Practical Component**<br>• Examine packets to identify signs of ARP spoofing or MITM (Man-in-the-Middle) attacks.<br>• Examine captured SMTP/POP3 traffic to retrieve message contents and attachments.<br>• Demonstrate procedures for network evidence acquisition, preservation, and chain of custody. | **3 Hours**<br><br>**12 Hours** |
| **MALWARE FORENSICS**<br>Analyzing Memory with OS Forensics, Density Scout threat hunting method.<br><br>**Practical Component**<br>• Detect and remove malware using OS-level tools (Windows Defender, ClamAV).<br>• Examine malware strings and metadata using tools such as strings, PEview, or Resource Hacker. | **3 Hours**<br><br>**12 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **15** | **Tutorial Hours:** | **0** | **Practical Hours:** | **60** | **Project Hours:** | **0** | **Total Hours:** | **75** |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. Joakim Kävrestad, Marcus Birath & Nathan Clarke, Fundamentals of Digital Forensics, Springer, 3rd Edition, 2024. |
| **Reference books/ Web Links** |

**Signature of BOS Chairman-CSE**

1. Brian Carrier, File System Forensic Analysis, Addison-Wesley Professional, 1st Edition, 2005.
2. Ric Messier, Operating System Forensics, Syngress, 1st Edition, 2015. Elsevier Shop.
3. Sherri Davidoff & Jonathan Ham, Network Forensics: Tracking Hackers Through Cyberspace, Pearson, 1st Edition, 2012.
4. Devangi Patel, Meghna Patel & Satyen M. Parikh, Dark Web Forensics, Chapman & Hall/CRC, 1st Edition, 2024.
5. Michael Sikorski & Andrew Honig, Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software, No Starch Press, 1st Edition, 2012

**Online Resources**

1. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/digital-forensics-essentials-dfe
2. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/packt-digital-forensics-for-pentesters-hands-on-learning-f4gfm
3. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/ibm-incident-response-digital-forensics
4. https://www.coursera.org/specializations/computerforensics

| **Assessment (Embedded course)** |
|---|
| MCQ, Experimental Cycle tests and End Semester Examination (Lab) |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Dr.N.Rajathi P/ IT |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

**Signature of BOS Chairman-CSE**

# BLOCKCHAIN

Signature of BOS Chairman-CSE

| 24CSE023 | BLOCKCHAIN TECHNOLOGY (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI011 Computer Networks and Security | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Introduce the fundamental principles of blockchain systems and the cryptographic techniques that enable secure decentralized computing. |
| 2 | Explain the structure, components, and functioning of blockchain networks including blocks, transactions, and consensus mechanisms. |
| 3 | Expose students to a variety of blockchain applications across sectors like finance, healthcare, governance, and supply chain. |
| 4 | Develop an understanding of blockchain-related security challenges, privacy mechanisms, and regulatory considerations. |
| 5 | Familiarize students with recent innovations, scalability solutions, and future trends in blockchain and decentralized technologies. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Illustrate the foundational elements of blockchain and cryptographic techniques to demonstrate how decentralized systems maintain trust. | Ap |
| CO 2 | Apply the structural components of blockchain architecture and transaction flow to organize how data is validated and stored securely. | Ap |
| CO 3 | Analyze blockchain applications across various domains to distinguish the suitability of blockchain features for specific sector needs. | An |
| CO 4 | Analyze common blockchain security threats and privacy measures to interpret how system vulnerabilities can be identified and addressed. | An |
| CO 5 | Apply emerging blockchain trends and governance models to illustrate how evolving mechanisms influence decentralized innovation. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | 2 | 2 | | | | | | 2 |
| 2 | 3 | 2 | | | | 2 | 2 | | | | | | 2 |
| 3 | 2 | 3 | | | | 2 | 2 | | | | | | 2 |
| 4 | 2 | 3 | | | | 2 | 2 | | | | | | 2 |
| 5 | 2 | | | | | 2 | 3 | | | | | | 2 |

Signature of BOS Chairman-CSE

| Course Content | |
|---|---|
| **Blockchain Fundamentals and Cryptographic Building Blocks**<br>Introduction to Distributed Systems and Blockchain Evolution - Principles of Cryptography for Blockchain: Hash Functions, Merkle Trees, Digital Signatures - Public Key Infrastructure in Blockchain - Blockchain Classifications: Public, Private, Consortium, Hybrid - Blockchain Trilemma: Scalability, Security, Decentralization - Consensus Mechanisms Overview: PoW, PoS, and Variants - Case Study: Blockchain vs Traditional Distributed Databases | **9 Hours** |
| **Blockchain Architecture and Transaction Processing**<br>Structure of a Block: Block Header, Block Body - Anatomy of a Blockchain Network: Nodes, Miners, Validators - Transaction Lifecycle: Creation, Propagation, Validation, Finality - Blockchain Forks and Chain Reorganizations - Incentives, Gas Mechanisms, and Fees in Public Blockchains - Smart Contracts: Concept and Deployment Cycle - Case Study: Comparing Bitcoin and Ethereum Architectures | **9 Hours** |
| **Blockchain Applications in Industry Sectors**<br>Blockchain in Finance: Cryptocurrencies, DeFi Basics, CBDCs - Blockchain in Healthcare: Health Records, Interoperability, Privacy - Blockchain in Governance: Digital Identity Systems, Land Registries, E-Voting - Blockchain in Supply Chain: Provenance Tracking, Logistics Management - Blockchain for IoT Integration: Secure Data Sharing and Automation - Challenges in Blockchain Adoption: Energy Efficiency, Legal Frameworks - Case Study: Blockchain-based E-Governance Initiatives (India and Global) | **9 Hours** |
| **Blockchain Security, Privacy, and Challenges**<br>Common Threats: Sybil Attack, 51% Attack, Replay Attack - Privacy Enhancements: Zero-Knowledge Proofs, Mixers - Identity Management and Access Control - Regulatory Landscape: GDPR, Data Sovereignty in Blockchain - Blockchain Interoperability Solutions: Cross-Chain Bridges, Sidechains - Emerging Threats and Security Trends in Multi-chain Ecosystems - Case Study: Security Audit of a Public Smart Contract | **9 Hours** |
| **Future Trends and Innovations in Blockchain**<br>Layer 2 Scaling Techniques: Optimistic Rollups, ZkRollups, State Channels - Decentralized Autonomous Organizations (DAOs) and Governance Models - Tokenization and NFTs: Standards and Applications Blockchain in Metaverse, Digital Assets, and Web3 | **9 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | **0** | **Practical Hours:** | **0** | **Project Hours:** | **0** | **Total Hours:** | **45** |

**Learning Resources***

**Textbooks**


1. M. Swan, Blockchain: Blueprint for a New Economy, O'Reilly Media, 2015.
2. Dhillon, V., Metcalf, D., and Hooper, M, Blockchain enabled applications, 2017, 1st, Edition, CA: Apress, Berkeley.
3. A. Narayanan et al., Bitcoin and Cryptocurrency Technologies, Princeton University Press, 2016.
4. P. Franco, Understanding Bitcoin: Cryptography, Engineering and Economics, Wiley, 2014.
5. G. Wood, Ethereum: A Secure Decentralised Generalised Transaction Ledger, Ethereum Foundation, 2014.


**Reference books/ Web Links**

**Books:**


1. Diedrich, H., Ethereum: Blockchains, digital assets, smart contracts, decentralized autonomous organizations, 2016, 1st Edition, Wildfire publishing, Sydney.
2. Wattenhofer, R. P, Distributed Ledger Technology: The Science of the Blockchain (Inverted Forest Publishing), 2017, 2nd Edition, CreateSpace Independent Pub, Scotts Valley, California, US.
3. Bashir, I. (2020). Mastering Blockchain: A Deep Dive into Distributed Ledgers, Consensus Protocols, Smart Contracts, DApps, Cryptocurrencies, Ethereum, and More - Third Edition. United


**Signature of BOS Chairman-CSE**

| |
|---|
| Kingdom: Packt Publishing. |
| **Web References:**<br>1. Ethereum Whitepaper: https://ethereum.org/en/whitepaper/<br>2. Hyperledger Fabric Documentation: https://hyperledger-fabric.readthedocs.io/<br>3. Blockchain Beyond the Hype (World Economic Forum): https://www.weforum.org/reports/blockchain-beyond-the-hype<br>4. https://www.investopedia.com/terms/b/blockchain.asp<br>5. https://www.debutinfotech.com/blockchain-technology |
| **Online Resources** |
| MOOC References<br>1. https://www.coursera.org/specializations/blockchain.<br>2. https://nptel.ac.in/courses/106105184/<br>3. https://swayam.gov.in/nd1_noc20_cs01/preview<br>4. Blockchain Technology: https://www.edx.org/learn/blockchain/university-of-california-berkeley-blockchain-technology |

| **Assessment (Theory course)** |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) |

| **Course Curated by** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert(s)** | |
| | | Dr. V. Sujitha, AP/IT | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSE013 | CRYPTOCURRENCY AND BITCOINS (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI011 Computer Networks and Security | Data Book / Codes / Standards (If any) | |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the origin, architecture, and cryptographic foundations of Bitcoin and its blockchain system. |
| 2 | Develop the ability to construct and validate Bitcoin transactions using blockchain data structures and scripting mechanisms. |
| 3 | Apply cryptocurrency trading concepts and strategies to simulate dynamic market environments and assess performance using market indicators. |
| 4 | Evaluate the economic, legal, and regulatory implications of cryptocurrencies and explore the future potential of altcoins and blockchain innovations. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Illustrate Bitcoin principles and cryptographic foundations to demonstrate secure transaction validation. | Ap |
| CO 2 | Apply Bitcoin network and wallet structures to organize transaction flow and privacy techniques. | Ap |
| CO 3 | Analyze trading models and market behavior to interpret pricing trends and strategy outcomes. | An |
| CO 4 | Analyze economic and legal aspects of cryptocurrency to examine their influence on adoption and compliance. | An |
| CO 5 | Apply concepts of altcoins and consensus methods to illustrate improvements in blockchain performance. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | | | | 2 | | | | | | 2 |
| 2 | 2 | 2 | | | | 3 | 2 | | | | | | 2 |
| 3 | 2 | 3 | | | | 2 | 2 | | | | | | 2 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 2 | 3 | | | | 2 | 2 | | | | | | 2 |
| 5 | 2 | | | | | 2 | 3 | | | | | | 2 |

**Course Content**

| | |
|---|---|
| **FUNDAMENTALS OF BITCOIN AND CRYPTOGRAPHY**<br>Origin and evolution of Bitcoin - Blockchain structure and Proof-of-Work consensus - Cryptographic techniques: Hashing, Digital Signatures, Merkle Trees - Bitcoin mining: Mining pools and incentives - Bitcoin scripting language and transaction verification - Case Study: Genesis Block and Satoshi Nakamoto's Whitepaper | **9 Hours** |
| **BITCOIN ECOSYSTEM AND WALLETS**<br>Bitcoin network architecture: Nodes, wallets, mempool - Types of wallets: Hot vs Cold, Hardware wallets, Hierarchical Deterministic wallets - Bitcoin transactions and UTXO model - SegWit, Lightning Network, and scalability - improvements - Privacy techniques: CoinJoin, Mixing services - Case Study: Real-world Bitcoin transaction tracing | **9 Hours** |
| **CRYPTOCURRENCY TRADING AND MARKET DYNAMICS**<br>Crypto trading concepts: Order types, Exchanges, Order Books - Centralized vs Decentralized Exchanges (CEX vs DEX) - Trading strategies: Spot, Margin, Arbitrage, HODLing - Stablecoins and algorithmic currencies - Market indicators and volatility analysis - Case Study: Historical Bitcoin price fluctuations and crashes | **9 Hours** |
| **ECONOMIC, LEGAL, AND REGULATORY ASPECTS**<br>Cryptocurrency and global financial systems - Merits and demerits of cryptocurrency adoption - Regulatory frameworks across the globe (USA, EU, India) - Taxation and anti-money laundering (AML) concerns - Legal status of Bitcoin: Security or commodity? - Case Study: FTX, Mt. Gox, and Terra - UNA collapses | **9 Hours** |
| **ALTERNATIVE CRYPTOCURRENCIES AND FUTURE TRENDS**<br>Overview of altcoins: Ethereum, Litecoin, Monero, Ripple - Crypto forks: Hard vs Soft - Proof-of-Stake and energy-efficient consensus - DAOs, DeFi, and NFTs - Case Study: Bitcoin vs Ethereum vs New-gen coins | **9 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | **0** | **Practical Hours:** | **0** | **Project Hours:** | **0** | **Total Hours:** | **45** |

**Learning Resources***

**Textbooks**


1. A. Narayanan, J. Bonneau, E. Felten, A. Miller, & S. Goldfeder, Bitcoin and Cryptocurrency Technologies, Princeton University Press, 2016.
2. M. Swan, Blockchain: Blueprint for a New Economy, O'Reilly Media, 2015.
3. P. Franco, Understanding Bitcoin: Cryptography, Engineering and Economics, Wiley, 2014.
4. C. Dannen, Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming for Beginners, Apress, 2017.


**Reference books/ Web Links**

**Reference Books:**


1. Antonopoulos, A. M. Mastering Bitcoin: unlocking digital cryptocurrencies, 2017, 2ndedition, OReilly Media, Inc, United States.
2. Lewis, Antony, The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and The Technology That Powers Them., 2018, 1st edition, Mango Media Inc., United States.
3. Bitcoin: Programming the Open Blockchain, Andreas M. Antonopoulos, Mastering, Second edition, 2017, O'Reilly Media.


**Web Links:**

1. Ripple Labs Documentation: https://ripple.com/build/
2. Bitcoin Whitepaper: https://bitcoin.org/bitcoin.pdf
3. Bitcoin Core Documentation: https://bitcoin.org/en/developer-documentation

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| |
|---|
| 4. CoinMarketCap (for Cryptocurrency Market Analysis): https://coinmarketcap.com/<br>5. CoinGecko (for Market Trends and Trading Data): https://www.coingecko.com/ |

| **Online Resources** |
|---|
| 1. https://www.coursera.org/learn/cryptocurrency<br>2. https://www.edx.org/learn/bitcoin/university-of-california-berkeley-bitcoin-and-cryptocurrencies<br>3. https://nptel.ac.in/courses/106106175 |

| **Assessment (Theory course)** |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Dr. J. Cynthia, Professor, CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date: 19.06.2026** |

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| 24CSE014 | DECENTRALIZED FINANCE (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI011 Computer Networks and Security | Data Book / Codes / Standards (If any) | |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the architecture, principles, and evolution of decentralized finance (DeFi). |
| 2 | Develop skills to use decentralized exchange protocols and liquidity mechanisms. |
| 3 | Learn lending, borrowing, and stablecoin models within DeFi ecosystems. |
| 4 | Evaluate advanced DeFi strategies like flash loans, staking, and yield farming. |
| 5 | Explore scalability solutions and innovations shaping the future of decentralized finance. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply DeFi fundamentals and ecosystem components to illustrate how decentralized alternatives operate. | Ap |
| CO 2 | Apply DEX architectures and liquidity models to demonstrate decentralized trading mechanisms. | Ap |
| CO 3 | Analyze lending systems and stablecoin designs to interpret risk factors and use cases in DeFi finance. | An |
| CO 4 | Analyze advanced DeFi strategies and risk models to examine vulnerabilities and compliance issues. | An |
| CO 5 | Apply emerging DeFi technologies and adoption trends to demonstrate their influence on future digital finance. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | | | 2 | 2 | | | | | | 2 |
| 2 | 3 | 2 | | | | 2 | 2 | | | | | | 2 |
| 3 | | 3 | 2 | | | 2 | 2 | | | | | | 2 |
| 4 | | 3 | 2 | | | 2 | 2 | | | | | | 2 |
| 5 | | 3 | 2 | | | 2 | 2 | | | | | | 2 |

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| Course Content | |
|---|---|
| **INTRODUCTION TO DECENTRALIZED FINANCE**<br>Traditional Finance vs. Decentralized Finance (DeFi) - Evolution and Growth of DeFi Ecosystem - Key DeFi Components: DEXs, Lending, Borrowing, Yield Farming - Role of Smart Contracts in DeFi - Blockchain Networks for DeFi: Ethereum, Binance Smart Chain, Solana – Virtual Economy -Tokenomics – Virtual Assets and ownerships - Governance in DeFi - DAO - Case Study: Evolution of Uniswap and Compound | **9 Hours** |
| **DECENTRALIZED EXCHANGES (DEXS) AND LIQUIDITY**<br>Automated Market Makers (AMMs) and Order Book DEXs - Uniswap, SushiSwap, and Curve Finance Mechanisms - Liquidity Pools and Automated Market Makers (AMMs) - Slippage and Transaction Costs - Cross-Chain Swaps and Interoperability - Case Study: Comparing Uniswap v2 vs. Uniswap v3 | **9 Hours** |
| **LENDING, BORROWING, AND STABLECOINS**<br>Cross-Border Payments Using Blockchain and Its Benefits, Study of blockchain platforms used for cross-border payments, Impact of Blockchain on Banking Services - Peer-to-Peer and Overcollateralized Lending -Interest Rate Models in DeFi – stable coins – Uses – types-Algorithmic and Asset-Backed Stablecoins - Flash Loans and Arbitrage Opportunities -Risks in DeFi Lending: Liquidation, | **9 Hours** |
| **ADVANCED DEFI APPLICATIONS AND RISKS**<br>Yield Farming and Liquidity Mining - Flash Loans and Arbitrage Strategies - Synthetic Assets and Derivatives in DeFi - Risks: Smart Contract Vulnerabilities, Rug Pulls, Regulatory Uncertainty - Compliance and Regulatory Perspectives on DeFi - Case Study: Analysis of Yearn Finance and Flash Loan Attacks | **9 Hours** |
| **FUTURE OF DEFI AND EMERGING TRENDS**<br>Layer-2 Scaling Solutions for DeFi - Institutional Adoption of DeFi - Cross-Chain DeFi Protocols - AI and DeFi Integration for Automated Trading - CBDCs and the Future of Digital Finance | **9 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **45** | **Tutorial Hours:** | **0** | **Practical Hours:** | **0** | **Project Hours:** | **0** | **Total Hours:** | **45** |

**Learning Resources***

**Textbooks**


1. Schär, F. (2021). Decentralized Finance: On Blockchain and Smart Contract-Based Financial Markets. Federal Reserve Bank of St. Louis Review.
2. Harvey, C. R., Ramachandran, A., & Santoro, J. (2021). DeFi and the Future of Finance. Wiley.
3. Melanie Swan, Blockchain: Blueprint for a new economy, Shroff Publisher/O'Reilly Publisher.
4. Ron Quaranta, Blockchain in Financial Markets and Beyond: Challenges and Applications, Risk Books Publisher.
5. Richard Hayen, Blockchain & FinTech: A Comprehensive Blueprint to Understanding Blockchain & Financial Technology. - Bitcoin, FinTech, Smart Contracts, Cryptocurrency, Risk Books Publisher.


**Reference books/ Web Links**

**Web Links:**

1. https://ethereum.org/en/defi/
2. https://docs.aave.com/
3. https://www.investopedia.com/decentralized-finance-defi-5113835
4. https://medium.com/search?q=decentralized+exchange

**Online Resources**

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1. https://www.coursera.org/specializations/decentralized-finance-duke
2. https://www.udemy.com/course/masteringdefi/?srsltid=AfmBOopPa0c1Zz6nVIlsjRIBocBKrR_QvmJa7b7rT5aRLPrOM11jDVpx&couponCode=LEARNNOWPLANS
3. https://www.edx.org/learn/economics/university-of-toronto-trading-and-lending-in-decentralized-finance

| **Assessment (Theory course)** |
|---|
| SA-I, SA-II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Dr. J. Cynthia, Professor, CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSC015 | SMART CONTRACT DEVELOPMENT (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI011 Computer Networks and Security | Data Book / Codes / Standards (If any) | NA |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Learn to develop decentralized applications (dApps) using Solidity. |
| 2 | Design scalable and reusable smart contract components. |
| 3 | Implement smart contract interactions for interoperable decentralized systems. |
| 4 | Identify and mitigate smart contract vulnerabilities through security best practices. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply Solidity basics and gas concepts to build simple Ethereum smart contracts. | Ap |
| CO 2 | Apply design patterns and modularity to create structured and reusable contracts. | Ap |
| CO 3 | Analyze contract interactions and events to differentiate decentralized behaviors. | An |
| CO 4 | Evaluate smart contract security practices and application use cases to justify robustness and correctness. | E |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | 2 | | 2 | | | | | | 2 |
| 2 | 2 | | 3 | | 2 | | 2 | | | | | | 2 |
| 3 | | 3 | 2 | | 2 | | 2 | | | | | | 2 |
| 4 | | 3 | 2 | | 2 | | 2 | | | | | | 2 |

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| Course Content | |
|---|---|
| **ETHEREUM BLOCKCHAIN AND SMART CONTRACT BASICS**<br>Overview of Ethereum architecture: EOA, Contract Accounts, EVM - Transactions, gas mechanics, and ABI - Solidity basics: data types, functions, visibility, modifiers, payable - Deployment workflows using Hardhat or Remix<br><br>**Practical Component**<br>Set up Ethereum development environment (Hardhat, MetaMask, testnet faucet) and deploy a basic Solidity contract with state variables, public and payable functions. | **7 Hours**<br><br>**6 hours** |
| **SMART CONTRACT MODULARITY AND DESIGN PATTERNS**<br>Common design patterns: Factory, Singleton, Proxy, Pull-over-Push - Role-Based Access Control: Ownable, Pausable - Contract inheritance and interface-based modularity - OpenZeppelin and upgradeable contract strategies<br><br>**Practical Component**<br>Create modular smart contracts using inheritance, interfaces, and OpenZeppelin (Ownable, Pausable)<br>Implement and test factory and proxy patterns to demonstrate contract modularity and upgradeability. | **7 Hours**<br><br>**6 hours** |
| **CONTRACT INTERACTIONS AND DECENTRALIZED SYSTEMS**<br>Contract communication: delegatecall, call, staticcall - Event-driven architecture using logs - Working with arrays, mappings, structs, storage/memory - Interfacing with oracles, cross-contract coordination.<br><br>**Practical Component**<br>Simulate contract-to-contract interactions using delegatecall and log relevant events.<br>Develop contracts that use arrays, mappings, structs and demonstrate memory vs storage usage. | **8 Hours**<br><br>**8 hours** |
| **SMART CONTRACT SECURITY AND REAL-WORLD APPLICATIONS**<br>Common vulnerabilities: reentrancy, overflow, DoS, front-running - Secure development practices and static analysis tools (Slither, MythX) - Smart contracts in DAOs: voting mechanisms, governance - Smart contracts in DeFi: lending, flash loans, token streaming<br><br>**Practical Component**<br>Detect common vulnerabilities in smart contracts using Slithe rand MythX.<br>Build a simple DAO voting mechanism with role-based control and events.<br>Write and test a basic DeFi lending contract including interest logic and edge case checks.<br>Simulate a flash loan and demonstrate secure logic using mock tokens. | **8 Hours**<br><br>**10 hours** |

| Theory Hours: | 30 | Tutorial Hours: | 0 | Practical Hours: | 30 | Project Hours: | 0 | Total Hours: | 60 |
|---|---|---|---|---|---|---|---|---|---|

**Learning Resources***

**Textbooks**


1. Antonopoulos, A. M., & Wood, G. (2020). Mastering Ethereum: Building Smart Contracts and DApps. O'Reilly Media.
2. Modi, R. (2018). Solidity Programming Essentials. Packt Publishing.
3. Prusty, N. (2017). Building Blockchain Projects. Packt Publishing.
4. Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas Antonopoulos and Gavin Wood, Shroff Publisher/O′Reilly Publisher.


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| Reference books/ Web Links |
|---|
| **Web Links:** |
| 1. https://soliditylang.org/docs/<br>2. https://ethereum.org/en/developers/docs/<br>3. https://docs.openzeppelin.com/<br>4. https://hardhat.org/getting-started/ |
| **Online Resources** |
| 1. https://www.coursera.org/learn/smarter-contracts<br>2. https://www.udemy.com/course/solidity-smart-contracts-build-dapps-in-ethereum-blockchain/<br>3. Introduction to Blockchain Technology and Applications<br>4. https://swayam.gov.in/nd1_noc20_cs01/preview<br>5. https://www.coursera.org/learn/smarter-contracts |

| Assessment (Embedded Course) |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| Course Curated By | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Dr. J. Cynthia, Professor, CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

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| 24CSC016 | WEB3 AND DAPP DEVELOPMENT (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI011 Computer Networks and Security | Data Book / Codes / Standards (If any) | |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Equip students with the foundational knowledge of Web3 tools, protocols, and decentralized identity systems. |
| 2 | Develop skills to design and integrate smart contracts with frontend frameworks like React.js for decentralized apps (DApps). |
| 3 | Enable hands-on experience with decentralized storage, blockchain data indexing, and backend integration using GraphQL and IPFS. |
| 4 | Design full-stack DApps by integrating authentication and decentralized identity to construct deployable applications with event monitoring. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply Web3 principles and essential tools to demonstrate the setup of a fundamental blockchain development environment. | Ap |
| CO 2 | Apply the concepts of decentralized application frontend creation to demonstrate the preparation of interactive user interfaces that connect with smart contracts. | Ap |
| CO 3 | Analyze various backend and storage integration methods to select appropriate decentralized solutions for specific application requirements. | An |
| CO 4 | Design full-stack DApps by integrating authentication and decentralized identity to construct deployable applications with event monitoring. | E |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | | | 3 | 2 | | 2 | | | | | 2 |
| 2 | 2 | | | | 3 | 2 | | 2 | | | | | 2 |
| 3 | | 3 | | | 2 | 2 | | 2 | | | | | 2 |
| 4 | | | 3 | | 2 | 2 | | 2 | | | | | 2 |

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| **Course Content** | |
|---|---|
| **WEB3 FUNDAMENTALS AND TOOLING**<br>Evolution of Web1, Web2, Web3 – Decentralization principles – Wallets and identity – JSON-RPC and provider models – Setting up Node.js, Web3.js, Ethers.js, and IPFS.<br>**Practical Component**<br>Setup Full Development Environment – Node.js, Hardhat, React.js/Next.js, MetaMask | **8 Hours**<br><br>**4 Hours** |
| **FRONTEND FRAMEWORKS FOR DAPPS**<br>Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application -React.js basics for DApp UI – State management in DApps – Connecting to wallets.<br>**Practical Component**<br>Deploy a Basic Smart Contract Locally – Hardhat, Ethers.js - Integrate Wallet Connection in Frontend – Wagmi, RainbowKit, MetaMask | **8 Hours**<br><br>**6Hours** |
| **BACKEND AND STORAGE INTEGRATION**<br>Using IPFS and Filecoin for decentralized storage – Pinning services – Web3 storage SDKs – GraphQL with The Graph – Data indexing and querying from smart contracts.<br>**Practical Component**<br>Upload and Retrieve Files from IPFS – Web3.Storage, Pinata - Query Blockchain Events via Indexing – The Graph Protocol, GraphQL | **7 Hours**<br><br>**6 Hours** |
| **FULL-STACK DAPP DEVELOPMENT**<br>Authentication via Sign-In with Ethereum – Decentralized Identity (DID) - Building full-stack DApp – Project structuring, deployment and testing Dapp - Working with testnets and Etherscan APIs<br>**Practical Component**<br>Integrative application of Experiments 1 to 5 in building a full-stack Dapp - Additional hands-on practice for DApp deployment, DID integration, and testnet verification using Etherscan APIs – Mini Project | **9 Hours**<br><br>**8 Hours** |

**Sample Mini Projects**

1. NFT Marketplace: Mint, list, and buy NFTs with IPFS storage and on-chain metadata indexing.
2. Decentralized Voting Platform: Wallet-based authentication; cast votes; real-time results using the Graph.
3. Decentralized Blogging Platform: Authors upload posts to IPFS; frontend pulls posts dynamically.
4. Token Gated Community DApp: Access to content/features only if user holds specific tokens.
5. Crowdfunding DApp: Smart contract-based funding campaigns with milestone payments.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | **0** | **Practical Hours:** | **0** | **Project Hours:** | **30** | **Total Hours:** | **60** |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. El Hattab, N. (2023). Full Stack DApp with Web3, React, Ethereum & Solidity. Leanpub.<br>2. Zhang, X. (2022). Build Your First Web3 App: A Developer's Guide. Independently published. |
| **Reference books/ Web Links** |
| Web Links:<br>1. https://docs.ethers.org/<br>2. https://thegraph.com/docs/<br>3. https://docs.ipfs.io/<br>4. https://developers.ceramic.network/<br>5. https://www.rainbowkit.com/docs/introduction |

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| Online Resources |
|---|
| 1. nptel.ac.in/courses/106105184<br>2. https://www.coursera.org/courses?query=blockchain |

| Assessment (Embedded Course) |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| Course Curated By | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Dr. J. Cynthia, Professor, CSE |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

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# EXTENDED REALITY

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| 24CSC017 | GAME DESIGN AND DEVELOPMENT (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | Nil |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the fundamentals of game development and Unity 3D environment. |
| 2 | Apply basic C# scripting concepts for interactive gameplay. |
| 3 | Develop beginner-level 2D and 3D game scenes using Unity tools. |
| 4 | Build and test a playable game integrating UI, audio, and animations. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Explain the fundamentals of game development and Unity interface components used in game creation. | U |
| CO 2 | Apply basic C# scripting concepts to control objects and player interactions in Unity. | Ap |
| CO 3 | Develop simple 2D and 3D game environments using Unity game objects, physics, lighting, and animation tools. | Ap |
| CO 4 | Construct interactive game elements such as UI, audio systems, enemies, and collectibles for beginner-level games. | Ap |
| CO 5 | Build and test a complete beginner-level Unity game by integrating gameplay features and exporting the final project. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | | | | | | | 3 | |
| 2 | | | 3 | | | | | | | | | 3 | |
| 3 | | | 2 | | | | | | | | | | |
| 4 | | | 2 | | | | | | | | | | |
| 5 | | | 3 | | 3 | | | | | | | 3 | |

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| Course Content | |
|---|---|
| **BASICS OF UNITY AND SCENE CREATION**<br>Introduction to Game Development-Overview of Unity-Understanding Unity Interface-Creating a New Project-Scene, Game, Hierarchy, and Inspector Windows-Adding and Managing Game Objects-Moving, Rotating, and Scaling Objects-Saving and Organizing Projects.<br>**Practical Component**<br>Create a Unity project, explore the Unity Editor interface, and organize project assets and scenes.<br>Create and manipulate Game Objects using transformations to design a basic game environment. | **6 Hours**<br><br>**6 Hours** |
| **C# SCRIPTING FOR GAME OBJECT MOVEMENT**<br>Introduction to C# in Unity-Variables and Data Types-Functions and Simple Scripts-Using If Statements and Loops-Adding Scripts to Game Objects-Using Debug Log and Console-Keyboard Input Controls-Creating Simple Player Movement.<br>**Practical Component**<br>Develop basic C# scripts using variables, functions, conditional statements, and loops, and attach them to Game Objects.<br>Implement keyboard input controls and create player movement functionality with debugging support. | **6 Hours**<br><br>**6 Hours** |
| **PHYSICS OF MATERIALS AND COLLISION**<br>Introduction to 2D and 3D Games-Adding Shapes and Models-Using Materials and Colors-Basics of Lighting and Camera-Rigidbody and Collider Components-Detecting Collisions-Adding Simple Animations-Creating a Basic Game Scene.<br>**Practical Component**<br>Apply materials, colors, lighting, and camera settings to create an interactive 2D/3D game scene.<br>Add Rigidbody and Collider components and implement collision detection and object interactions. | **6 Hours**<br><br>**6 Hours** |
| **AUDIO INTEGRATION AND ANIMATION**<br>Adding Audio and Sound Effects-Creating Score and Timer System-Introduction to Unity UI-Creating Buttons and Text-Scene Switching-Creating Start and Game Over Screens-Simple Enemy and Collectible Objects-Building a Small Mini Game.<br>**Practical Component**<br>Integrate background music and sound effects triggered by gameplay events.<br>Design UI elements such as score, timer, buttons, and implement scene transitions, start screens, and game-over screens. | **6 Hours**<br><br>**6 Hours** |
| **GAME SCENE MANAGEMENT AND GAME BUILDING**<br>Planning a Simple Game-Designing Game Levels-Adding Gameplay Features-Testing and Fixing Errors-Improving Game Appearance-Exporting the Game-Final Project Presentation and Demo.<br>**Practical Component**<br>Develop gameplay features using enemies, collectibles, animations, and level progression mechanisms.<br>Build, test, debug, and deploy a complete playable mini-game by integrating scripting, physics, UI, audio, animation, and scene management. | **6 Hours**<br><br>**6 Hours** |
| **Sample Mini Projects**<br>**Coin Collector Adventure**<br>Collect coins, avoid obstacles, and achieve the highest score within a time limit.<br>**Maze Escape Challenge**<br>Navigate through a maze, collect keys, and reach the exit before time runs out.<br>**Endless Runner Game**<br>Control a character that runs continuously while avoiding obstacles and collecting rewards.<br>**Space Shooter**<br>Pilot a spaceship, destroy enemy objects, and survive as long as possible while increasing the score. | |

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| | |
|---|---|
| **Treasure Hunt Quest**<br>Explore a game environment, collect treasures, and complete objectives to win the game. | |

| Theory Hours:30 | Tutorial Hours: | Practical Hours: | Project Hours:30 | Total Hours:60 |
|---|---|---|---|---|

**Learning Resources***

**Text Books**

1. Joe Hocking, Unity in Action: Multiplatform Game Development in C# (Third Edition), Manning Publications, 2022.
2. Jeremy Gibson Bond, Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C# (Second Edition), Addison-Wesley Professional, 2018.

**Reference books/ Web Links**

1. Unity in Action: Multiplatform game development in C# by Joe Hocking published by Manning,second edition,2018
2. Sams Teach Yourself Unity 2018 Game Development in 24 Hours by Mike Geig .

**Online Resources**

1. https://learn.unity.com/
2. https://www.coursera.org/specializations/programming-unity-game-development
3. https://www.coursera.org/specializations/game-design-and-development

**Assessment (Embedded Course)**

SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

**Course Curated By**

| Expert(s) from Industry | Expert(s) from Higher Education Institutions | Internal Expert(s) |
|---|---|---|
| Mr. RameshKumar Kalimuthu,<br>Technical Manager – XR Division,<br>ARK Infosolutions Pvt. Ltd | | Dr.K.Saranya<br>AP-II,<br>CSE,KCT |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: | **Date:** |

**Signature of BOS Chairman-CSE**

| 24CSC018 | ADVANCED 3D MODELLING (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24CSI103/Computer Graphics | Data Book / Codes / Standards ( If any) | |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Provide foundational knowledge of Blender workflows, 3D asset creation, and digital content production pipelines. |
| 2 | Equip learners with modeling, sculpting, texturing, lighting, rendering, and animation techniques for creating 3D content. |
| 3 | Develop the ability to create optimized digital assets suitable for games, animation, XR, and digital media applications. |
| 4 | Enable learners to create and present a complete 3D project by integrating industry-standard content creation workflows. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Develop 3D assets using Blender's modeling and mesh editing tools.. | Ap |
| CO 2 | Apply modifiers and sculpting techniques to create detailed and optimized 3D models. | Ap |
| CO 3 | Apply materials, UV maps, and textures to enhance the visual quality of digital assets. | Ap |
| CO 4 | Select and apply appropriate lighting, camera, and composition techniques to render complete 3D environments. | Ap |
| CO 5 | Develop and present a complete 3D project by integrating modeling, texturing, animation, and game-ready asset creation workflows. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | | 2 | | 3 | | | | | | | | 3 |
| 2 | | | 2 | | 3 | | | | | | | | 3 |
| 3 | | | 2 | | 3 | | | | | | | | 3 |
| 4 | | | 3 | | 3 | | | | | | | | 3 |
| 5 | | | 3 | | 3 | | | | | | | | 3 |

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| **Course Content** | |
|---|---|
| **Blender Fundamentals and Asset Development**<br>Introduction to 3D Production Pipeline – Applications of 3D Graphics in Games, Animation, XR and Digital Media – Blender Interface and Workspace – Navigation Tools and Viewports – Object Mode and Edit Mode – Mesh Components: Vertices, Edges and Faces – Object Transformations – Primitive Objects – Scene Organization – Collection Management – Basic Mesh Editing Tools – Extrude, Inset, Bevel and Loop Cut – Introduction to Asset Creation Workflow.<br>**Practical Component**<br>Create and organize a Blender project by exploring the interface, viewports, collections, object transformations, and scene management features.<br>Develop basic 3D assets using primitive objects and mesh editing operations such as extrude, inset, bevel, and loop cut. | **6 Hours**<br><br>**6 Hours** |
| **3D Modeling Techniques and Digital Sculpting**<br>Low Poly Modeling Concepts – Hard Surface Modeling – Organic Modeling Fundamentals – Modifiers: Mirror, Subdivision Surface, Solidify, Boolean and Array – Efficient Modeling Workflows – Digital Sculpting Basics – Sculpting Brushes and Tools – Retopology Concepts – Model Optimization Techniques – Preparing Models for Texturing.<br>**Practical Component**<br>Create low-poly and hard-surface models using modifiers such as Mirror, Subdivision Surface, Solidify, Boolean, and Array.<br>Develop organic models using sculpting tools and apply retopology and optimization techniques for efficient asset creation. | **6 Hours**<br><br>**6 Hours** |
| **Materials, UV Mapping and Texturing**<br>Material Fundamentals – Shader Editor Basics – PBR Workflow Concepts – UV Mapping and UV Unwrapping – Texture Painting – Image Textures – Procedural Textures – Normal Maps and Roughness Maps – Material Optimization – Asset Texturing Pipeline.<br>**Practical Component**<br>Apply materials and shaders using the Shader Editor and implement PBR-based workflows for 3D assets.<br>Perform UV mapping, UV unwrapping, texture painting, and apply image or procedural textures to enhance model appearance. | **6 Hours**<br><br>**6 Hours** |
| **Environment Design, Lighting and Rendering**<br>Environment Creation Workflow – Terrain and Landscape Creation – Asset Placement and Scene Composition – Cameras and Cinematic Views – Lighting Fundamentals – Three-Point Lighting – HDRI Lighting – Rendering using Eevee and Cycles – Render Settings and Optimization – Portfolio Image Generation.<br>**Practical Component**<br>Design a 3D environment by creating landscapes, placing assets, and composing scenes using appropriate camera settings.<br>Implement lighting techniques using Three-Point Lighting and HDRI environments, and generate optimized renders using Eevee and Cycles. | **6 Hours**<br><br>**6 Hours** |
| **Animation, Rigging and Game Asset Pipeline**<br>Introduction to Rigging – Armatures and Bone Hierarchies – Weight Painting Basics – Object Animation – Keyframing Techniques – Timeline and Graph Editor – Camera Animation – Exporting Assets for Game Engines – Asset Optimization for Unity and Unreal Engine – Portfolio Preparation and Presentation.<br>**Practical Component**<br>Create basic rigging structures using armatures, apply weight painting, and develop object and camera animations using keyframes.<br>Export optimized assets for Unity or Unreal Engine and prepare a professional-quality portfolio presentation showcasing completed 3D work. | **6 Hours**<br><br>**6 Hours** |

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|---|---|
| **Project**<br>Medieval Village Environment<br>Fantasy Forest Scene<br>Interior Room Visualization<br>Animated Character Showcase<br>Historical Monument Reconstruction | |

| **Theory Hours:30** | **Tutorial Hours:** | **Practical Hours:** | **Project Hours:30** | **Total Hours:60** |
|---|---|---|---|---|

| **Learning Resources*** |
|---|
| **Reference books/ Web Links** |
| 1. https://www.blender.org/<br>2. https://docs.blender.org/manual/en/latest/<br>3. https://www.blenderguru.com/ |
| **Online Resources** |
| 1. https://www.udemy.com/course/blendertutorial/<br>2. Blender 3D Modeling & Rendering for Games & Animation \| Coursera<br>3. Blender for Beginners \| Coursera<br>4. The Blender 4 Ultimate Guide \| Coursera |

| **Assessment (Embedded Course)** |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| Kola Ruchith<br>Senior 3D Environment Artist,<br>Fusion VR Solutions. | | Ms.P.Anitha<br>Assitant Professor-I/CSE<br>KCT |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSC019 | AUGMENTED REALITY APPLICATION DEVELOPMENT (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understand the basic concepts and types of Augmented Reality and how it differs from VR and MR. |
| 2 | Learn to use Unity3D and AR tools for AR development. |
| 3 | Build interactive AR experiences with object tracking, user input, and visual effects. |
| 4 | Create and deploy complete AR applications for mobile devices. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply the fundamentals of Augmented Reality and Unity3D components to develop basic AR scenes and interactions. | Ap |
| CO 2 | Apply AR Foundation toolkit and tracking methods to build simple AR experiences using Unity3D. | Ap |
| CO 3 | Analyze various AR interaction techniques to develop intuitive object placement and manipulation in interactive AR applications. | An |
| CO 4 | Analyze advanced AR features and enhancements to improve realism and interactivity in AR applications. | An |
| CO 5 | Apply integrated development skills and project planning techniques to build and test a functional AR application for deployment. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | | | | 3 | | | | | | | | |
| 2 | | | 3 | | 3 | | | | | | | | 3 |
| 3 | | | 3 | | 3 | | | | | | | | 3 |
| 4 | | | 2 | | | | | | | | | | 2 |
| 5 | | | 3 | | 3 | | | | | 3 | | | 3 |

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| **Course Content** | |
|---|---|
| **Introduction to Augmented Reality and Unity3D Basics**<br>Definition and types of Augmented Reality (AR) – Applications of AR in various domains – Comparison between AR, Virtual Reality (VR), and Mixed Reality (MR) – Overview of the AR development ecosystem: Unity3D and AR SDKs (AR Foundation, Vuforia) – Setting up Unity3D for AR development – Understanding Unity concepts: Game Objects, Scenes, and Prefabs – Basic C# scripting essentials for AR interactions.<br>**Practical Component**<br>Create and configure a Unity3D project for AR development using AR Foundation or Vuforia, and explore Game Objects, Scenes, and Prefabs.<br>Develop basic C# scripts to perform simple AR interactions and manage virtual objects within an AR scene. | **6 Hours**<br><br>**6 Hours** |
| **Building First AR Experiences**<br>Introduction to AR Foundation– Configuring AR camera and AR session in Unity – Marker-based vs Marker-less AR tracking – Image tracking: Detecting and displaying 3D content with markers – Plane detection and anchors in AR environments.<br>**Practical Component**<br>Configure AR Session and AR Camera, and implement marker-based AR by detecting image targets and displaying 3D content.<br>Implement marker-less AR using plane detection and anchors, and develop a simple AR application integrating virtual objects into the real environment. | **6 Hours**<br><br>**6 Hours** |
| **Interaction Design in AR**<br>Principles of AR interaction: gaze, tap, gesture – Implementing touch-based interactions: tap-to-place 3D objects – Object manipulation in AR: move, rotate, and scale – Designing and displaying world-space UI panels – Providing visual feedback: highlighting, animation, and effects.<br>**Practical Component**<br>Develop touch-based AR interactions for placing virtual objects on detected surfaces.<br>Implement object manipulation techniques such as move, rotate, and scale, and design world-space user interface elements with visual feedback. | **6 Hours**<br><br>**6 Hours** |
| **Advanced AR Features and Enhancements**<br>Environmental understanding and light estimation – Basics of face tracking: applying masks and filters – AR-based navigation and wayfinding – Integrating audio and particle effects into AR scenes – Performance optimization techniques for mobile AR (Android/iOS) – Introduction to AI-assisted AR applications including object recognition and smart interactions<br>**Practical Component**<br>Integrate environmental understanding features including light estimation, audio effects, particle systems, and basic face-tracking functionality.<br>Develop an AR mini-application incorporating navigation, object recognition concepts, or interactive AR gameplay features. | **6 Hours**<br><br>**6 Hours** |
| **AR Project Development and Deployment**<br>Planning an AR application: from concept to prototype – User testing and UX considerations for AR apps – Building and deploying AR applications to Android/iOS devices – Debugging techniques and performance improvement strategies.<br>**Practical Component**<br>Design and prototype an AR application by applying user experience principles, testing methodologies, and performance optimization techniques.<br>Build, debug, optimize, and deploy a complete AR application to a mobile device and demonstrate its functionality. | **6 Hours**<br><br>**6 Hours** |
| **Project**<br>• AR Museum Guide<br>• AR Educational Learning App<br>• AR Solar System Visualization<br>• AR Furniture Placement Application<br>• AR Treasure Hunt Game | |

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| Theory Hours:30 | Tutorial Hours: | Practical Hours: | Project Hours:30 | Total Hours:60 |
|---|---|---|---|---|

| **Learning Resources*** | |
|---|---|
| **Textbooks** | |
| 1. | Braun, Anna, & Rizzo, Raffael. XR Development with Unity: A Beginner's Guide to Creating Virtual, Augmented, and Mixed Reality Experiences Using Unity. Packt Publishing, Birmingham (2023). |
| 2. | Linowes, Jonathan. Augmented Reality with Unity AR Foundation: A Practical Guide to Cross-Platform AR Development with Unity 2020 and Later Versions. Packt Publishing, 2021. |
| **Reference books/ Web Links** | |
| 1. | Schmalstieg, Dieter, and Hollerer, Tobias. Augmented Reality: Principles and Practice (2nd Edition). Addison-Wesley, 2022.Peddie, Jonathan. Augmented Reality: Where We Will All Live. Springer, Cham (2017). |
| 2. | Glover, Jesse, Linowes, Jonathan, and Nuernberger, Brian. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR. Addison-Wesley Professional, 2021. |
| **Online Resources** | |
| 1. | https://learn.unity.com/ |
| 2. | https://developers.google.com/ar |

| | |
|---|---|
| 3. | https://developer.apple.com/augmented-reality/ |
| 4. | https://www.coursera.org/learn/ar |

| **Assessment (Embedded Course)** |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Ms.P.Anitha<br>Assitant Professor-I/CSE<br>KCT |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date**: 19.06.2026 |

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| 24CSC020 | VIRTUAL REALITY APPLICATION DEVELOPMENT (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Learn the basics of VR and Unity3D setup, including simple scripting for VR interactions. |
| 2 | Set up VR hardware and input systems in Unity using the XR Toolkit. |
| 3 | Implement key VR interactions like teleportation and object manipulation. |
| 4 | Develop and deploy a fully optimized VR application for platforms like Oculus Quest. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply the fundamentals of Virtual Reality, Unity3D, and C# scripting to develop basic immersive VR environments. | Ap |
| CO 2 | Apply the principles of VR hardware components and input systems to set up player experiences in Unity. | Ap |
| CO 3 | Analyze VR interaction techniques and user interface design to create engaging and intuitive user experiences. | An |
| CO 4 | Apply environment optimization techniques such as lighting and textures to enhance VR user immersion. | Ap |
| CO 5 | Develop a fully functional VR application by planning, testing, debugging, and deploying across multiple VR platforms. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | | | | 3 | | | | | | | | |
| 2 | | | 2 | | 3 | | | | | | | | 3 |
| 3 | | | 3 | | 3 | | | | | | | | 3 |
| 4 | | | 2 | | 3 | | | | | | | | 3 |
| 5 | | | 3 | | 3 | | | | | 3 | | | 3 |

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| **Course Content** | |
|---|---|
| **Introduction to Virtual Reality and Unity3D Basics**<br>Definition and types of Virtual Reality (VR) – Comparison between VR, Augmented Reality (AR), and Mixed Reality (MR) – Introduction to immersive technologies and spatial computing concepts -Applications of VR across various domains such as gaming, education, and healthcare – Introduction to Unity3D for VR development – Setting up a VR project using XR Plugin Management – Understanding Unity concepts: Game Objects, Scenes, and Prefabs – Basic C# scripting essentials for VR interactions and immersive environments.<br>**Practical Component**<br>Create and configure a Unity3D VR project using XR Plugin Management, and explore Game Objects, Scenes, Prefabs, and immersive environment setup.<br>Develop basic C# scripts for VR interactions and create simple immersive environments with interactive virtual objects. | **5 Hours**<br><br>**6 Hours** |
| **VR Hardware, Input Systems, and Player Setup**<br>Overview of VR hardware: Oculus Quest, HTC Vive, Pico – Understanding Head-Mounted Displays (HMDs) and VR controllers – Setting up XR Rig and player camera in Unity – Introduction to XR Interaction Toolkit – Handling basic input: gaze-based interactions and controller inputs – Mini project: Develop a basic VR scene with object interaction using gaze or controllers.<br>**Practical Component**<br>Configure XR Rig, VR camera, and controller setup using XR Interaction Toolkit for VR application development.<br>Implement gaze-based and controller-based interactions to enable user interaction with virtual objects in a VR scene. | **7 Hours**<br><br>**6 Hours** |
| **Creating VR Interactions and User Interfaces**<br>Designing interactions in VR: teleportation, object grabbing, and manipulation – Implementing teleportation using teleportation areas and anchors – Physics-based interactions for grabbable objects (pick up, throw) – Creating VR-friendly user interfaces using world-space canvases and menus – Integrating basic haptic feedback – Mini project: Create a VR room with interactive objects and teleportation system.<br>**Practical Component**<br>Develop teleportation-based navigation systems using teleportation areas and anchors within a virtual environment.<br>Implement object grabbing, manipulation, haptic feedback, and world-space user interface elements for immersive interaction. | **6 Hours**<br><br>**6 Hours** |
| **VR Environment Building and Optimization**<br>Building immersive environments with lighting, spatial audio, and realistic textures – Principles of comfort and safety in VR to reduce motion sickness – Scene optimization techniques: static batching, level of detail, and texture optimization – Using 360-degree images and videos for environment design – Adding particle effects and simple animations - Introduction to AI-assisted VR interactions and intelligent virtual environments - Mini project: Build a small exploration scene such as a museum or a virtual forest.<br>**Practical Component**<br>Design immersive VR environments using lighting, spatial audio, textures, particle effects, animations, and 360-degree media.<br>Apply optimization techniques and develop intelligent VR interactions to improve performance and user experience. | **6 Hours**<br><br>**6 Hours** |
| **VR Application Development and Deployment**<br>Planning a VR application from idea to prototype – Testing and debugging VR experiences – Building for standalone and PC-based VR platforms – Deployment process for Oculus Quest and Android based VR devices– Final project: Develop and showcase a complete functional VR application such as an art gallery, training simulation, or a mini VR game.<br>**Practical Component**<br>Design and prototype a VR application by integrating navigation, interaction, | **6 Hours**<br><br>**6 Hours** |

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| environment design, and user experience considerations.<br>Test, debug, optimize, build, and deploy a complete VR application for standalone or PC-based VR platforms. | |
| **Sample Mini Project**<br>Virtual Art Gallery<br>Virtual Museum Tour<br>VR Training Simulator<br>VR Forest Exploration<br>VR Classroom Environment | |

| Theory Hours:30 | Tutorial Hours: | Practical Hours: | Project Hours:30 | Total Hours:60 |
|---|---|---|---|---|

| **Learning Resources*** | |
|---|---|
| **Textbooks** | |
| 1. | Braun, Anna, & Rizzo, Raffael. XR Development with Unity: A Beginner's Guide to Creating Virtual, Augmented, and Mixed Reality Experiences Using Unity. Packt Publishing, Birmingham (2023). |
| **Reference books/ Web Links** | |
| 1. | LaValle, Steven M. Virtual Reality. Cambridge University Press, New York (Updated Edition/Reprint, 2023). |
| 2. | Jerald, Jason. The VR Book: Human-Centered Design for Virtual Reality (Latest Edition). Association for Computing Machinery (ACM), 2023. |

| **Online Resources** | |
|---|---|
| 1. | https://learn.unity.com/course/create-with-vr |
| 2. | https://www.coursera.org/specializations/virtual-reality |
| 3. | https://developers.google.com/vr |
| 4. | https://xrbootcamp.com/ |

| **Assessment (Embedded Course)** |
|---|
| SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| | | Ms.P.Anitha<br>Assitant Professor-I/CSE<br>KCT |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date**: 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24CSC022 | ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FOR GAMES (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24ADI001 Artificial Intelligence and Automation, 24ADI017 Machine Learning Techniques | Data Book / Codes / Standards ( If any) | |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Apply AI and machine learning concepts to develop intelligent game systems and adaptive gameplay environments |
| 2 | Develop pathfinding, decision-making, and NPC behavior systems using classical game AI techniques. |
| 3 | Analyze machine learning approaches for procedural content generation, player behavior prediction, and adaptive gameplay systems. |
| 4 | Apply AI/ML techniques for automated game testing, optimization, analytics, and intelligent game interactions. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO1 | Apply AI and machine learning concepts to identify and implement intelligent behaviors in interactive game environments. | Ap |
| CO2 | Apply pathfinding algorithms, decision-making systems, and utility-based AI techniques to develop interactive NPC behaviors in games. | Ap |
| CO3 | Analyze supervised, unsupervised, and reinforcement learning techniques for player behavior prediction and procedural content generation. | An |
| CO4 | Apply AI and machine learning techniques to develop adaptive NPC interactions, dynamic game environments, and intelligent gameplay systems. | Ap |
| CO5 | Analyze AI/ML-based testing, optimization, and player analytics techniques to improve gameplay performance and user experience. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | 2 | | | | | | | | |
| 2 | | | 3 | | 3 | | | | | | | | 3 |
| 3 | | | | | 3 | | | | | | | | 3 |
| 4 | | | 3 | | 3 | | | | | | | | 3 |
| 5 | | | 2 | | 3 | | | | | | | | 3 |

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| **Course Content** | |
|---|---|
| **Introduction to AI and Machine Learning in Games**<br>Overview of Artificial Intelligence and Machine Learning - Role of AI and its importance in games- Types of AI: Reactive AI, Proactive AI, and Hybrid AI -Role of ML in games- Types of ML: Supervised, Unsupervised, and Reinforcement Learning - Key algorithms in game AI: Pathfinding, decision trees, finite state machines, and utility-based AI - The difference between classical AI and AI/ML in gaming-Introduction to player modeling and adaptive game experiences.<br>**Practical Component**<br>Exploring AI Applications in Popular Video Games<br>Implementing a basic finite state machine or pathfinding algorithm | **6 Hours**<br><br>**4 Hours** |
| **Pathfinding,Navigation and Decision Making**<br>Introduction to pathfinding algorithms: A*, Dijkstra, and heuristic search techniques – Navigation Mesh (NavMesh) systems and real-time NPC navigation – Decision-making systems in games: State Machines, Behavior Trees, and Utility AI – AI for enemy behaviors and tactical decision-making – AI in dynamic and changing game environments – Procedural generation basics using rule-based systems – Case studies of AI in action, stealth, and strategy games – Introduction to event-driven AI systems.<br>**Practical Component**<br>Implementing A* pathfinding for NPC navigation in a simple game environment<br>Building Behavior Trees for NPC Actions<br>Implementing Utility-Based AI Decision Systems | **6 Hours**<br><br>**6 Hours** |
| **Machine Learning for Game Intelligence**<br>Introduction to Machine Learning workflows in games – Supervised learning for player behavior prediction and gameplay analytics – Unsupervised learning for clustering player styles and procedural content generation – Reinforcement Learning for autonomous game agents – Neural Networks and Deep Learning concepts in game AI – Generative AI techniques for intelligent game content generation – AI-driven procedural level generation and adaptive gameplay balancing – Case Study: DeepMind AlphaGo and modern AI game agents.<br>**Practical Component**<br>Training a Supervised Learning Model for Player Prediction<br>Implementing a Reinforcement Learning Agent<br>AI-Based Procedural Content Generation Experiment. | **6 Hours**<br><br>**6 Hours** |
| **AI for NPCs, Dynamic Worlds, and Intelligent Interactions**<br>AI-driven NPC behaviors and adaptive interactions – Dialogue systems and Natural Language Processing (NLP) in games – Emotion-aware AI and adaptive player interactions – AI-assisted procedural storytelling and quest generation – Dynamic world generation using AI and ML techniques – Intelligent animation systems and procedural animation – AI-driven companion systems and enemy adaptation – AI-based personalization and adaptive difficulty balancing systems.<br>**Practical Component**<br>Developing an AI-driven NPC Interaction System<br>Procedural Level or Quest Generation<br>Experimenting with AI-Based Adaptive Behaviors | **6 Hours**<br><br>**6 Hours** |

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| | |
|---|---|
| **AI/ML for Game Testing, Optimization, and Analytics**<br>AI-driven automated game testing and quality assurance systems – Simulating player behavior for gameplay balancing – Machine Learning for bug detection and gameplay anomaly detection – AI-based optimization for rendering, decision-making, and performance management – Player telemetry analysis and in-game analytics systems – Personalized gameplay recommendations using AI – Ethical considerations and responsible AI practices in game development | **6 Hours** |
| **Practical Component**<br>Developing AI-Based Automated Testing Agents<br>Implementing Gameplay Optimization Techniques<br>Analyzing Player Telemetry Data for Adaptive Game Design | **8 Hours** |

| Theory Hours:30 | Tutorial Hours: | Practical Hours:30 | Project Hours: | Total Hours:60 |
|---|---|---|---|---|

**Learning Resources***

**Textbooks**

1. Millington, Ian, and Funge, John. Artificial Intelligence for Games (3rd Edition). CRC Press, Boca Raton (2019).
2. Yannakakis, Georgios N., and Togelius, Julian. Artificial Intelligence and Games (2nd Edition). Springer, Cham (2024).

**Reference books/ Web Links**

1. https://www.gamedeveloper.com/programming
2. https://towardsdatascience.com/tagged/game-development
3. https://deepmind.com/research/highlighted-research/alphago
4. https://www.gameaipro.com/

**Online Resources:**

1. https://www.edx.org/course/artificial-intelligence-ai
2. https://www.udemy.com/course/artificial-intelligence-in-unity/

**Assessment (Embedded Course)**

SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

**Course Curated By**

| Expert(s) from Industry | Expert(s) from Higher Education Institutions | Internal Expert(s) |
|---|---|---|
| | | Ms.P.Anitha<br>Assitant Professor-I/CSE<br>KCT |
| **Recommended by BoS on** | 06.06.2026 | |
| **Academic Council Approval** | No: 30 | **Date:** 19.06.2026 |

**Signature of BOS Chairman-CSE**

# NETWORKING AND IOT

Signature of BOS Chairman-CSE

| 24ITC010 | IOT SYSTEM DESIGN<br>(Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | Nil |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Understand the fundamentals of IoT, its role in improving quality of life, and the major challenges such as energy constraints, data explosion, and security issues. |
| 2 | Explain the architecture of IoT systems including hardware components like power supply, processor, memory, sensor interface, and wireless communication technologies. |
| 3 | Familiarize students with IoT system design and various wireless communication interfaces such as BLE, Wi-Fi, RFID, and LPWAN technologies like LoRa, LTE-M, Sigfox, and NB-IoT. |
| 4 | Understand power management techniques and energy harvesting methods including solar, RF, kinetic, and thermal energy systems for IoT devices. |
| 5 | Study IoT communication protocols and real-world applications through case studies and cloud-based IoT systems |

| Course Outcomes: | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Bloom's Taxonomy Level BTL) |
| CO 1 | Explain the core concepts, challenges, and opportunities in the design and deployment of Internet of Things (IoT) systems. | U |
| CO 2 | Develop IoT applications using relevant communication protocols such as MQTT, CoAP, and AMQP for efficient data transmission. | Ap |
| CO 3 | Design energy-efficient IoT architectures using appropriate energy harvesting and power management techniques. | Ap |
| CO 4 | Analyse suitable hardware components such as sensors, microcontrollers, and power sources for specific IoT applications. | An |
| CO 5 | Analyse IoT system performance in terms of scalability, reliability, and security through case studies and prototype demonstrations | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | 2 | | | | | | | | | 2 | | 2 |
| 2 | 2 | | | 2 | | | | | | | | | 2 |
| 3 | | | 2 | | 2 | | | | | | | | 2 |
| 4 | | | 2 | | 2 | | | | | 2 | | | 2 |
| 5 | | 2 | | 2 | | | | | | | | | 2 |

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| Course Content | |
|---|---|
| **Fundamentals of IoT and Challenges**<br>Introduction to IOTs - Improving Quality of Life. Challenges to solve in IOTs - Energy / Power, Data Explosion, Security<br>**AI Tools:** IBM Watson IoT, Google Cloud IoT, Microsoft Azure IoT, ThingSpeak, AWS IoT Core, MATLAB | **6 Hours** |
| **IoT System Architecture and Design**<br>System design of an IOT System - Power supply, Processor, Memory Sensor Interface. Wireless Interfaces - LAN - BLE, Wi-Fi, RFID, LP WAN - LORA, LTE-M, Sigfox, NB-IOT.<br>**AI Tools:** Arduino IDE, Raspberry Pi OS, Proteus Design Suite, Node-RED, Cisco Packet Tracer, Fritzing | **6 Hours** |
| **Power Management and Energy Harvesting**<br>Power supply design - LDOs, Switching regulators - BuckBoost Converters, Energy Measurements. Energy harvesting and battery life calculation - PV, RF, Kinetic Energy, TEGs, aeroelastic flutter, Harvesting ICs in silicon.<br>**AI Tools:** MATLAB Simulink, ANSYS, LTspice, PLECS, COMSOL Multiphysics, LabVIEW | **6 Hours** |
| **Communication Protocols for IoT**<br>IOT Protocols - loT MAC, REST based COAP, Publish subscribe- MQTT, AMQP, MDNS, Building an IOT System - Application based Microcontroller selection.<br>**AI Tools:** Postman, Eclipse Mosquitto, Wireshark, Eclipse Paho, Node-RED, OMNeT++ | **6 Hours** |
| **IoT Case Studies and Applications**<br>Joule Jotter, Cloud Based Systems<br>**AI Tools:** ThingSpeak, AWS IoT Core, Microsoft Azure IoT, Google Cloud IoT, IBM Watson IoT, MATLAB Simulink | **6 Hours** |
| **Lab Component: Integrated IoT System Design**<br>To design and implement a complete IoT system addressing a real-world problem. It involves conceptualizing the architecture, selecting appropriate sensors, power sources, and wireless technologies, and ensuring efficient energy management and harvesting.<br>To implement core IoT communication protocols and integrate the system with a cloud platform for data visualization and interaction. A functional prototype will be developed, emphasizing usability, scalability, and low-power design. | **30 Hours** |

| Theory Hours: | 30 | Tutorial Hours: | 0 | Practical Hours: | 30 | Project Hours: | 0 | Total Hours: | 60 |
|---|---|---|---|---|---|---|---|---|---|

**Learning Resources**

**Textbooks**


1. James, A. (2020). IoT system design: Project-based approach. Springer.
2. Agarwal, D., Verma, K., & Urooj, S. (2022). Energy harvesting: Enabling IoT transformations. CRC Press.
3. Shabaz, M., & Suhaib, M. (2021). Building IoT systems: Design scalable IoT systems from edge to cloud. Springer.


**Reference books/ Web Links**

**Book References:**


1. Madan, J., Yadav, D., & Gupta, A. (2023). IoT system design: Measurement, instrumentation, and smart systems. Springer.
2. Vasseur, J.-P., & Dunkels, A. (2010). Interconnecting smart objects with IP: The next Internet. Morgan Kaufmann.


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3. Rowland, C., Goodman, E., Charlier, M., Light, A., & Lui, A. (2015). Designing connected products: UX for the consumer Internet of Things. O'Reilly Media

**Web References:**

1. https://link.springer.com/book/10.1007/978-3-030-85863-6
2. https://www.routledge.com/Energy-Harvesting-Enabling-IoT-ransformations/Agarwal-Verma-Urooj/p/book/9781032349251
1. https://link.springer.com/book/10.1007/979-8-8688-1212-5?utm_
2. https://www.amazon.in/IoT-System-Design-Measurement-Instrumentation/dp/3030858626?utm_
3. https://www.oreilly.com/library/view/designing-connected-products/9781491922197/

**MOOC References:**

1. https://nptel.ac.in/courses/108108098
2. https://www.coursera.org/learn/iot-architecture
3. https://www.coursera.org/learn/iot-communications
4. https://www.coursera.org/learn/iot-software-architecture
5. https://www.coursera.org/learn/advanced-iot-systems-and-industrial-applications-course-3

| **Assessment (Theory course)** | | | |
|---|---|---|---|
| SA - I, SA - II, Activity and Learning Task(s), MCQ, Project Presentation, Demo Presentation, End Semester Examination (ESE) | | | |
| **Course Curated by** | | | |
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert** | |
| | | Dr. V. Sumathi,<br>ASP / CSE | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC011 | AI-DRIVEN INTELLIGENT IoT SYSTEMS (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 4 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | Nil |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | To understand cloud-based IoT architecture and device connectivity. |
| 2 | To apply AI techniques for IoT data analytics and edge intelligence. |
| 3 | To develop IoT applications using APIs, dashboards, and mobile interfaces. |
| 4 | To implement security and privacy mechanisms in IoT systems. |
| 5 | To integrate edge and cloud platforms for intelligent IoT applications. |

| Course Outcomes: | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Bloom's Taxonomy Level (BTL) |
| CO 1 | Configure cloud IoT platforms and connect IoT devices using secure communication protocols. | Ap |
| CO 2 | Apply AI and machine learning techniques for IoT data analytics and edge intelligence. | Ap |
| CO 3 | Develop IoT applications using cloud APIs, dashboards, and mobile interfaces. | Ap |
| CO 4 | Implement security and privacy mechanisms in cloud-connected IoT systems. | An |
| CO 5 | Design integrated edge-cloud IoT solutions with optimized performance and analytics. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | 2 | | 3 | | | | | | | | 2 |
| 2 | 2 | 3 | 2 | | 2 | | | | | | 3 | | 2 |
| 3 | 2 | 2 | 3 | 2 | 2 | | | | | | | | 2 |
| 4 | | 3 | 3 | | | | | | | | 2 | | 2 |
| 5 | 3 | | | 3 | 2 | | | | | | 3 | | 2 |

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| Course Content | |
|---|---|
| **CLOUD IoT PLATFORMS AND DEVICE CONNECTIVITY**<br>Cloud IoT architecture and services - AWS IoT Core, Azure IoT Hub, and IBM Watson IoT – Google Cloud IoT concepts - MQTT and HTTP communication protocols - Device provisioning - and secure communication using TLS/SSL<br>**Project components**<br>• Configure IoT cloud accounts on AWS IoT Core, Google Cloud IoT, and IBM Watson IoT.<br>• Connect Raspberry Pi / NodeMCU to AWS IoT Core using MQTT over TLS.<br>• Publish and subscribe sensor data<br>• Create dashboards for real-time monitoring using Node-RED and cloud visualization tools.<br>**AI Tool - Node-RED AI Assistant -** Used to create MQTT workflows, connect IoT devices to cloud platforms, and develop real-time monitoring dashboards using drag-and-drop nodes. | **3 Hours**<br><br>**12 Hours** |
| **AI-ENABLED IOT DATA ANALYTICS**<br>IoT data collection and preprocessing - AI/ML workflow for IoT analytics - Time-series analytics and anomaly detection - Cloud AI services and TensorFlow Lite for edge AI<br>**Project components**<br>• Collect time-series IoT data (temperature, humidity, light) and store it in cloud databases (Firebase / DynamoDB).<br>• Use Google Cloud AutoML or Azure ML Studio to build predictive models<br>• Deploy a trained ML model on cloud to classify real-time data from IoT devices.<br>• Integrate TensorFlow Lite on edge devices for on-device inference.<br>• Build a Python dashboard to compare edge vs. cloud inference results.<br>**AI Tool - Edge Impulse -** Used to collect sensor data, train TinyML models, and deploy AI models on edge devices for real-time inference | **3 Hours**<br><br>**12 Hours** |
| **CLOUD APIs AND IoT APPLICATION DEVELOPMENT**<br>REST APIs and cloud functions for IoT - Web and mobile application development for IoT monitoring - Notification and alert services for IoT systems - Cloud deployment and serverless IoT applications<br>**Project components**<br>• Access IoT data via RESTful APIs<br>• Build mobile dashboards for IoT monitoring and control.<br>• Implement remote device control through APIs.<br>• Deploy IoT applications on cloud platforms.<br>**AI Tool - GitHub Copilot -** Used to generate API code, develop Flask/Node.js applications, and assist in IoT dashboard | **3 Hours**<br><br>**12 Hours** |
| **IoT SECURITY AND PRIVACY IMPLEMENTATION**<br>Security challenges in IoT systems - Authentication and access control mechanisms - TLS/SSL, AES, RSA Fundamentals - Replay and spoofing attack prevention<br>**Project components**<br>• Configure TLS/SSL certificates for device authentication.<br>• Implement role-based access control for IoT devices in IBM Watson IoT.<br>• Encrypt sensor data using AES/RSA before transmission.<br>• Detect and prevent replay or spoofing attacks using secure timestamps and tokens.<br>**AI Tool - Microsoft Security Copilot -** Used to analyze security threats, identify vulnerabilities, and suggest secure authentication and encryption methods | **3 Hours**<br><br>**12 Hours** |

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| | |
|---|---|
| **EDGE–CLOUD INTEGRATION**<br>Edge and Fog Computing concepts - AWS Greengrass and Azure IoT Edge – Edge analytics and bandwidth optimization, and real-time edge inference<br>**Project components**<br>• Set up an edge gateway using Raspberry Pi for pre-processing and local decision-making.<br>• Deploy edge computing services using AWS Greengrass or Azure IoT Edge.<br>• Compare latency, bandwidth usage, and energy consumption of edge vs. direct cloud upload.<br>• Integrate edge analytics with cloud dashboards and alerts.<br>**AI Tool - TensorFlow Lite -** Used to deploy AI models on edge devices for local processing, real-time analytics, and reduced cloud dependency | **3 Hours**<br><br>**12 Hours** |
| Development of a mini-project integrating Cloud IoT, AI Analytics, Edge Computing, and Security concepts.<br>**Example:**<br>• Smart Energy Management System with Cloud AI Prediction<br>• Intelligent Waste Segregation System with Cloud Analytics Dashboard<br>• Secure Smart Agriculture System using IoT Edge and Blockchain<br>• Cloud-Based Air Quality Monitoring with ML-Driven Alerts<br>• Smart Vehicle Tracking System with Encrypted Cloud Logging | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **15** | **Tutorial Hours:** | **0** | **Practical Hours:** | **0** | **Project Hours:** | **60** | **Total Hours:** | **75** |

**Learning Resources**

**Textbooks**


1. Bahga, A., & Madisetti, V. (2015). Internet of Things: A Hands-on Approach. Universities Press, 1st Edition. ISBN: 978-8173719547.
2. Anand, R., Juneja, S., Juneja, A., Jain, V., & Kannan, R. (Eds.). (2023). Integration of IoT with Cloud Computing for Smart Applications. 1st ed., Chapman & Hall/CRC. ISBN: 978-1032333434.
3. Mohanty, S. N., Chatterjee, J. M., Mangla, M., Satpathy, S., & Potluri, S. (Eds.). (2021). Machine Learning Approach for Cloud Data Analytics in IoT. 1st ed., Wiley-Scrivener. ISBN: 978-1119785804.
4. IoT Edge Intelligence – Springer, 2024. Focuses on AI-enabled edge technologies, IoT analytics, and edge-cloud computing.
5. Secure Edge and Fog Computing Enabled AI for IoT and Smart Cities – Springer, 2024. Focuses on IoT security, edge/fog computing, and AI-enabled smart systems.


**Reference books/ Web Links**


1. Internet of Things and AI Cloud Specialization (University of California, Irvine) - https://www.coursera.org/specializations/internet-of-things
2. Developing Secure IoT Applications https://www.coursera.org/learn/developing-secure-iot-applications? (EDUCBA)
3. DeepLearning.AI TensorFlow Developer Professional Certificate, https://www.coursera.org/professional-certificates/tensorflow-in-practice?utm_source
4. AWS Cloud Technical Essentials, "https://www.coursera.org/learn/aws-cloud-technical-essentials?utm_source


**Assessment (Theory course)**

SA, Project presentation, Demo presentations, Quiz/peer review(optional), Activity and Learning Task(s)

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| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | | **Internal Expert** |
| | | | Dr. V. Sujitha,<br>AP / IT |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC012 | ADVANCED NETWORK TECHNOLOGIES (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | Nil |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Understand wireless and mobile network architectures with AI-assisted protocol analysis tools. |
| 2 | Explore LTE and 5G architectures, use cases, and deploy simulations using AI-guided network tools. |
| 3 | Design and implement SDN/NFV using tools like Mininet, Ryu, and AI-powered network controllers. |
| 4 | Analyze edge computing and IoT-integrated networks with AI for real-time, low-latency decision making. |
| 5 | Evaluate 6G, AI-native networks, satellite internet, quantum communication, and blockchain in networking. |

| Course Outcomes: | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Bloom's Taxonomy Level BTL) |
| CO 1 | Apply wireless and mobile networking principles using AI tools (NetSim, NS-3 with AI extensions) to demonstrate protocol behaviour and evaluate network performance in diverse environments. | Ap |
| CO 2 | Apply 4G/5G architectures and AI-powered simulation platforms (MATLAB 5G Toolbox, GNS3) to evaluate performance, network slicing, and deployment readiness. | Ap |
| CO 3 | Apply SDN and NFV paradigms to design programmable, scalable network infrastructure using Mininet, Ryu/ONOS, and AI-assisted code generation tools. | Ap |
| CO 4 | Analyze edge/IoT-integrated networks and propose AI-driven, context-aware solutions using TensorFlow Lite and Edge Impulse for real-time inferencing. | An |
| CO 5 | Analyze future networking trends (6G, AI-native, quantum, blockchain) using AI research tools (Perplexity, NotebookLM) to interpret next-generation communication systems. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | 2 | | | | | | | | | | 2 |
| 2 | 2 | 3 | 2 | | | | | | | | | | 2 |
| 3 | 2 | 2 | | | 3 | | | | | | | | 2 |
| 4 | 2 | 3 | | | 2 | | | | | | | | 2 |
| 5 | | 2 | 3 | | 2 | | | | | | | | 2 |

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| Course Content | |
|---|---|
| **Fundamentals of Wireless and Mobile Networks**<br>Wireless network architecture: WLAN – WWAN – WPAN – Cellular concepts – Spectrum allocation – Handoff strategies – Mobility management: Mobile IP – Mobile TCP – IEEE 802.11 (Wi-Fi 6/6E), 802.15 (BLE, ZigBee), 802.16 standards – Wi-Fi 7 (802.11be), 5G-WiFi convergence<br>**AI Tools:** NetSim AI (simulate handoff & mobility), NS-3 with Python (WLAN analysis), ChatGPT (topology design & protocol explanation), Cisco Packet Tracer (AI-assisted WLAN setup), Google NotebookLM (summarize 802.11 standards) | **6 Hours** |
| **Mobile Data Networks and 4G/5G systems**<br>LTE and LTE-A Architecture and protocol stack – OFDMA – MIMO – Carrier aggregation – 5G architecture: gNB – Control/user plane split – Network slicing – 5G NR – Open RAN (O-RAN), Private 5G networks, 5G for Industrial IoT<br>**AI Tools:** MATLAB 5G Toolbox (simulate NR waveforms & slicing), ChatGPT (compare 4G vs 5G architectures), Perplexity AI (research real 5G deployments), GNS3 (simulate 5G core topology), Claude AI (generate technical reports & use-case summaries) | **6 Hours** |
| **Software-Defined Networking (SDN) and Network Function Virtualization (NFV)**<br>SDN architecture and components – OpenFlow – SDN Controllers: Floodlight, NFV: virtualization of routers, firewalls, load balancers – Programmable Networks (P4), SmartNICs, Ansible/Terraform for network automation<br>**AI Tools:** Mininet, Python API (SDN topology simulation, Ansible + AI (automate NFV deployment & orchestration) | **6 Hours** |
| **Edge Computing and IoT - Integrated Networks**<br>Fog and edge computing architecture and protocols – Use cases – IoT protocols: MQTT – CoAP – 6LoWPAN – AMQP – Key issues: Security, scalability, and energy efficiency – Edge Intelligence – Real-time analytics at the edge – Digital Twins, AS IoT Greengrass | **6 Hours** |
| **Future Trends in Networking**<br>6G vision and technologies: THz communication - AI-native networks - Satellite internet: LEO constellations - Starlink - Blockchain in networking - Quantum communication basics - AI and ML for network: Predictive analysis – Network optimization and anomaly detection - Generative AI for network design, LLM-based network assistants<br>**AI Tools:** Perplexity AI (research 6G whitepapers & satellite tech), ChatGPT/Claude AI (analyze future networking scenarios) | **6 Hours** |
| **Project Component**<br>• Select a wireless networking scenario (e.g., campus, IoT, vehicular) and simulate topology and routing feasibility using tools like Cisco Packet Tracer or GNS3.<br>• Conduct a comparative study of 4G and 5G architecture and performance using simulation or real-world deployments. Select a 5G use case and design a working prototype or workflow model.<br>• Design and simulate a basic SDN topology in Mininet. Demonstrate controller-switch interaction and capture OpenFlow messages (e.g., FLOW_MOD, PACKET_IN, PACKET_OUT) using Wireshark.<br>• Develop a simple SDN application using Python or REST APIs that programs flow table rules for scenarios like Layer-2 learning switch, basic firewall, or traffic engineering.<br>• Build a latency-aware and secure IoT network for applications like smart agriculture or health monitoring. Integrate edge devices (e.g., Raspberry Pi) using MQTT or CoAP protocols.<br>• Prepare a feasibility report or a prototype on emerging networking technologies such as AI-native 6G, blockchain-based secure networking, or quantum communication.<br>**Sample Projects Examples:**<br>• Simulation and Performance Analysis of a Campus-Based Wireless Network Using GNS3<br>• Design and Routing Feasibility Study of an IoT-Enabled Smart City Network | **30 Hours** |

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| | |
|---|---|
| • 4G vs. 5G: A Comparative Study with Use Case Prototype for Smart Traffic Management<br>• Building and Simulating a Basic SDN Topology with OpenFlow Protocol in Mininet<br>• Developing an SDN-Based Firewall Using Northbound APIs and Python<br>• Latency-Aware Sensor Data Communication in Smart Agriculture Using MQTT and Raspberry Pi<br>• Blockchain-Based Network Management System for Decentralized IoT Security | |

| Theory Hours: 30 | Tutorial Hours: 0 | Practical Hours: 30 | Project Hours: 0 | Total Hours: 60 |
|---|---|---|---|---|

**Learning Resources**

**Textbooks**

1. F Kurose, James. Computer networking: a top-down approach. Pearson Education, 2021.
2. W. Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud, Pearson, 2018.
3. Saad Z. Asif "5G Mobile Communications Concepts and Technologies" CRC press - 2019.

**Reference books/ Web Links**

**Book References:**

1. Erik Dahlman, Stefan Parkvall, Johan Skold, "4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2013
2. K. Salah, Software-Defined Networking with OpenFlow, Packt, 2019.
3. Molisch, Andreas F. Wireless communications. Vol. 34. John Wiley & Sons, 2012.
4. Schwartz, Mischa. Mobile wireless communications. Cambridge university press, 2005.

**Web References:**

1. https://opennetworking.org/
2. https://www.nist.gov/
3. https://www.ieee.org/

MOOC References:

4. https://onlinecourses.nptel.ac.in/noc23_cs35
5. https://www.edx.org/learn/5g

**Assessment (Theory course)**

SA - I, SA - II, Activity and Learning Task(s), MCQ, Project Presentation, Demo Presentation, End Semester Examination (ESE)

**Course Curated by**

| Expert(s) from Industry | Expert(s) from Higher Education Institution | | Internal Expert |
|---|---|---|---|
| | | | Ms. P. Parameswari, AP/IT |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITE013 | INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | Nil |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Understand the fundamentals of Industry 4.0, industrial communication systems, networking concepts, and smart manufacturing environments. |
| 2 | Apply Industry 4.0 technologies such as Cyber Physical Systems, Artificial Intelligence, AR/VR, Big Data, and cybersecurity in industrial applications. |
| 3 | Analyze the architecture, layers, sensing methods, and communication techniques used in Industrial IoT systems. |
| 4 | Evaluate IIoT analytics, Machine Learning, cloud and fog computing, SDN, and security mechanisms for industrial data management. |
| 5 | Demonstrate Industrial IoT applications and case studies in manufacturing, healthcare, power plants, inventory management, and process industries. |

| Course Outcomes: | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Bloom's Taxonomy Level (BTL) |
| CO 1 | Explain the fundamentals of Industry 4.0, industrial communication, networking, and smart manufacturing systems. | U |
| CO 2 | Describe Cyber Physical Systems (CPS), Artificial Intelligence, Big Data, and advanced Industry 4.0 technologies used in industrial automation. | U |
| CO 3 | Apply Industrial IoT (IIoT) architectures, sensing, processing, communication, and networking layers in industrial environments. | Ap |
| CO 4 | Analyze IIoT analytics, cloud computing, fog computing, Software Defined Networks (SDN), and security mechanisms for industrial applications. | An |
| CO 5 | Analyze Industrial IoT applications and case studies in manufacturing, healthcare, power plants, inventory management, and process industries to evaluate their effectiveness and real-world implementation. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | | | | | | | | 2 |
| 2 | 3 | 2 | 2 | | 2 | | | | 2 | 2 | | | 2 |
| 3 | 3 | | 1 | | | | | | 2 | 2 | | | 2 |
| 4 | 3 | | | | 2 | | | | | | | | 2 |
| 5 | 3 | | | | 2 | | | | | | | | 2 |

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| Course Content | |
|---|---|
| **Fundamentals of Industry 4.0 and Industrial Communication**<br>Introduction to sensing and actuation, communication systems, networking concepts, globalization and emerging industrial issues, the Fourth Industrial Revolution, LEAN production systems, smart and connected business perspectives, and smart factories.<br>**AI tools:** Cisco Packet Tracer, MATLAB Simulink, Siemens Tecnomatix, ThingSpeak, Node-RED | **9 Hours** |
| **Industry 4.0 Technologies and Cyber Physical Systems**<br>Cyber Physical Systems (CPS), next generation sensors, collaborative platforms and Product Lifecycle Management (PLM), Augmented Reality (AR), Virtual Reality (VR), Artificial Intelligence, Big Data, advanced analytics, cybersecurity in Industry 4.0, basics of Industrial IoT, and industrial internet systems.<br>**AI tools:** TensorFlow, OpenCV, Unity, IBM Watson IoT, Google Collab, Wireshark | **9 Hours** |
| **Industrial IoT Architecture and Layers**<br>Introduction to Industrial IoT (IIoT), IIoT business models, IIoT reference architecture, IIoT sensing layer, processing layer, communication layer, networking layer, and industrial sensing and actuation techniques.<br>**AI tools:** Arduino IDE, Raspberry Pi OS, Blynk IoT Platform, AWS IoT Core, Mosquitto MQTT Broker, Proteus Design Suite | **9 Hours** |
| **IIoT Analytics, Networking and Security**<br>IIoT analytics, Machine Learning and Data Science for IIoT, R and Julia programming, Hadoop-based data management, Software Defined Networks (SDN) in IIoT, data center networks, cloud computing, fog computing, and security in IIoT environments.<br>**AI tools:** Apache Hadoop, R Project, Julia, Tableau, Microsoft Azure IoT, Mininet, Snort | **9 Hours** |
| **Industrial IoT Applications and Case Studies**<br>Industrial IoT applications in factories, assembly lines, food industries, healthcare, power plants, inventory management, quality control, plant safety and security using AR and VR, facility management, oil, chemical and pharmaceutical industries, UAV applications in industries, and case studies related to milk processing, manufacturing industries, student projects, virtual reality labs, and steel technology labs.<br>**AI tools:** PTC ThingWorx, SCADA Ignition, ANSYS Twin Builder, LabVIEW, DroneDeploy, Factory I/O, Siemens MindSphere | **9 Hours** |

| Theory Hours: | 45 | Tutorial Hours: | 0 | Practical Hours: | 0 | Project Hours: | 0 | Total Hours: | 45 |
|---|---|---|---|---|---|---|---|---|---|

| Learning Resources |
|---|
| **Textbooks** |
| 1. Gilchrist, A. (2016). Industry 4.0: the industrial internet of things. Apress.<br>2. Mahmood, Z. (2019). The Internet of Things in the Industrial Sector. Springer International Publishing.<br>3. Rawat, D. B., Brecher, C., Song, H., & Jeschke, S. (2017). Industrial Internet of Things: Cyber manufacturing Systems. Cham, Switzerland: Springer.<br>4. Butun, I. (2020). Industrial IoT. Springer International Publishing. |
| **Reference books/ Web Links** |
| **Book References:**<br>1. Mahmood, N. H., Marchenko, N., Gidlund, M., & Popovski, P. (Eds.). (2020). Wireless Networks and Industrial IoT: Applications, Challenges and Enablers. Springer Nature.<br>2. Saranya, V., Belinda, M. C. M., & Kanagachidambaresan, G. R. (2020). An evolution of innovations protocols and recent technology in industrial IoT. In Internet of Things for Industry 4.0 (pp. 161-175). Springer, Cham. |

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3. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Capasso, Packt, 2018.

**Web References:**

1. Industry IoT Consortium – Industrial Internet Reference Architecture (IIRA) – Reference architecture, IIoT frameworks, and Industry 4.0 standards.
2. Industry IoT Consortium Official Website – Resources related to Industrial IoT, cybersecurity, smart factories, and industrial systems.
3. Automation World – Industry 4.0 and IIoT Articles – Articles and industrial case studies on automation, IIoT, analytics, and smart manufacturing.
4. IBM – Industrial IoT Solutions – Information on IIoT analytics, AI, predictive maintenance, and industrial automation.
5. Microsoft Azure IoT – Industrial IoT architecture, cloud computing, edge computing, and smart industry solutions

**MOOC References:**

1. https://nptel.ac.in/courses/106105195
2. https://www.coursera.org/specializations/developing-industrial-iot?msockid=030daa3f146f6af43228bf92152a6bcd

| **Assessment (Theory course)** |
|---|
| SA - I, SA - II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) |

| **Course Curated by** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | | **Internal Expert** |
| | | | Dr. V. Sumathi, ASP/CSE |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC014 | IOT APPLICATION DEVELOPMENT (Common to CSE, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | Nil |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | To understand the fundamentals of IoT architecture, hardware components, and embedded system design using microcontrollers and data-encoding techniques. |
| 2 | To apply suitable communication, modulation, and networking techniques for developing efficient and connected IoT systems. |
| 3 | To gain proficiency in deploying and managing IoT applications on cloud platforms using SDKs, CLI tools, and IAM configurations. |
| 4 | To implement security practices for protecting IoT devices, networks, and cloud services, ensuring reliable and secure IoT operations. |

| Course Outcomes: | | |
|---|---|---|
| **After successful completion of this course, the students shall be able to** | | **Bloom's Taxonomy Level (BTL)** |
| CO 1 | Apply the fundamentals of IoT to design basic embedded systems using microcontrollers, circuit components, and data-encoding techniques. | Ap |
| CO 2 | Implement communication and modulation techniques for low-power IoT devices. | Ap |
| CO 3 | Configure wired and IP-based network architectures and device discovery protocols for IoT systems. | Ap |
| CO 4 | Implement cloud SDKs, CLI tools, IAM configurations to deploy and monitor IoT applications on Cloud. | Ap |
| CO 5 | Apply security mechanisms for IoT hardware, firmware, sensors, and cloud services to build secure end-to-end IoT systems. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | 1 | | 1 | | | | | | | 2 | 1 |
| 2 | | 2 | 1 | | 1 | | | | | | | | 1 |
| 3 | | 2 | 1 | | 1 | | | | | | | | 1 |
| 4 | 2 | | 1 | | 1 | | | | 1 | | | | 1 |
| 5 | 2 | | | | 1 | | 1 | | | | | 2 | 1 |

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| Course Content | |
|---|---|
| **INTRODUCTION**<br>Overview of IOT Application Development - Introduction to Internet of Things -IoT Hardware-Circuit Design - IoT Device Architecture: Integrated Circuits- Data Encoding Challenges and approaches- Microcontrollers-Programmable Circuits-IoT Platform Design and Programming<br>**AI Tool:** Tinker cad Circuits (Design IoT hardware Circuits), Edge Impulse (AI capabilities to sensors, microcontrollers, and embedded system) | **6 Hours** |
| **IOT COMMUNICATION**<br>Radio Frequency Communications-Antenna Design-Signal Propagation- Attenuation-Spectrum Division-Modulation- Media Access protocol: Collision Detection and Resolution-Power Saving Algorithms-Power MAC Algorithms- routing-Service discovery. | **6 Hours** |
| **IOT NETWORKING**<br>Wired Networking Overview-Reference Architectures for IoT-Layer 2 and Layer 3 Networking-L2 Switching vs L3 Routing- Ethernet Forwarding-Ethernet Learning Switches-Network Virtualization with VLANs-VLAN Configuration Encapsulation-Ethernet & IPv4 Headers, TCP header-Internet Addressing-Address Discovery Protocols-Dynamic Host Configuration Protocol-Networking Devices-Device Types.<br>**AI tool:** Chatgpt, Claude (design system architecture, generate embedded code (Arduino/Python), and integrate communication) | **6 Hours** |
| **DEPLOYING IOT IN CLOUD**<br>Cloud APIs -Google Cloud SDK-Google Cloud CLI-Cloud Client Libraries- Cloud Shell and Cloud Code-Cloud Storage and databases: Authorization with Cloud IAM-Authenticating Google APIs and service Accounts-authentication method-using Secret Manager- Overview of Machine Learning Models-Deploying -Monitoring and performance Tuning<br>**AI Tool/ Platform:** Google Cloud / Think speak | **6 Hours** |
| **DEVELOPING SECURE IOT APPLICATION**<br>IOT security basics- Device security -Network security for IOT devices- IoT Application security -Secure hardware design for IoT devices- Firmware development -Secure sensors Integration and data Processing -Secure IoT Services and Cloud Platform<br>**AI Tool/ Platform:** Google Cloud and firebase | **6 Hours** |
| **LAB COMPONENT**<br>Create a real-time IoT application using IoT hardware programming, communication, network configuration, cloud deployment, and secure device integration. Deploy the IoT project to make it operational and accessible by users.<br>**Sample Experiments:**<br>• Interface and programming IoT hardware and circuits<br>• Implement communication and MAC techniques<br>• Configure wired and wireless IoT networks<br>• Deploy IoT workloads using Google Cloud SDK and APIs<br>• Apply secure design, authentication, and firmware security practices (e.g., Smart Home Control, smart framing) | **30 Hours** |

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| Theory Hours: 30 | Tutorial Hours: 0 | Practical Hours: 30 | Project Hours: 0 | Total Hours: 60 |
|---|---|---|---|---|

| Learning Resources |
|---|
| **Textbooks** |
| 1. "Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry" by Maciej Kranz, ISBN: 978-1-119-28568-7, 2016.<br>2. “IOT Deployment Handbook: A practical Guide to Implementing Successful IOT Projects” By Richard G. Brown, 2022<br>3. “Internet of Things: A Hands-On Approach”,Arshdeep Bahga, Vijay Madisetti,Publisher Universities Press, 2016<br>4. “The Internet of Things: Key Applications and Protocols”,Olivier Hersent, David Boswarthick, Omar Elloumi,Wiley Publication, 2012<br>5. “Computer Networking: A Top-Down Approach”, James F. Kurose, Keith W. Ross: Pearson Publication, 2021<br>6. “Google Cloud IoT: End-to-End Implementation Guide”,Balaji Chattopadhyay, Packt Publishing: 2021 |
| **Reference books/ Web Links** |
| 1. Developing Applications with Google Cloud: Foundations \| Coursera<br>2. Hands-on Internet of Things \| Coursera<br>3. https://www.coursera.org/learn/developing-secure-iot-applications?msockid=3de4fc32da0261e02866ef3ddbaf6034#modules |

| Assessment (Theory course) |
|---|
| SA - I, SA - II, Activity and Learning Task(s), MCQ, Project Presentation, Demo Presentation, End Semester Examination (ESE) |

| Course Curated by | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institution** | **Internal Expert** | |
| | | Mrs. G. Shobana, AP/IT | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

# CLOUD COMPUTING

Signature of BOS Chairman-CSE

| 24ITC001 | CLOUD APPLICATION DEVELOPMENT (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | - |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Apply the concepts of cloud application design, service models, deployment models, and requirement analysis for developing cloud-based solutions. |
| 2 | Analyze cloud application development frameworks and cloud platforms for deploying scalable applications. |
| 3 | Apply cloud service delivery mechanisms, API integration, and architectural best practices in cloud ecosystems. |
| 4 | Analyze DevOps practices, CI/CD pipelines, monitoring techniques, and containerization technologies for cloud application management. |
| 5 | Apply modern cloud development and deployment practices to design scalable, reliable, and efficient cloud-based applications. |

| Course Outcomes | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Analyse cloud application requirements, service models, deployment types, and challenges such as scalability, security, and interoperability. | An |
| CO 2 | Apply cloud based application development frameworks to build scalable applications. | Ap |
| CO 3 | Analyse and compare commercial cloud platforms for application deployment | An |
| CO 4 | Apply agile application development and manage application life cycle using DevOps . | Ap |
| CO 5 | Apply integrated cloud application development and deployment strategies to build scalable, secure, and fault-tolerant cloud solutions. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | 3 | 3 | | 2 | | | | | | | | 2 |
| 2 | 3 | 3 | | | | | | | | 2 | | 3 | |
| 3 | 2 | | | | 3 | | | 2 | | | | | 2 |
| 4 | | 3 | | | 3 | | | | | 2 | | | 3 |
| 5 | | 3 | | | 3 | | | | | | | | 3 |

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| Course Content | |
|---|---|
| **Introduction to Application Design**<br>Business case for implementing cloud application, Requirements, collection for cloud application development, Cloud service models and deployment models, Open challenges in Cloud Computing: Cloud inter-operability and standards, scalability and fault tolerance, security, trust and privacy. | **6 Hours** |
| **Application Development Framework**<br>Accessing the clouds: Web application vs Cloud Application, Frameworks: Model View Controller (MVC), Struts, Spring. Cloud platforms in Industry – Google AppEngine, Microsoft Azure, Openshift, CloudFoundry. | **8 Hours** |
| **Cloud Service Delivery Environment and API**<br>Storing objects in the Cloud, Session management, Working with third party APIs: Overview of interconnectivity in Cloud ecosystems. Facebook API, Twitter API, Google API. Architecting for the Cloud **:** Best practices Best practices in architecture cloud applications in AWS cloud, Amazon Simple Queue Service (SQS), RabbitMQ, Amazon Simple Notification Service (Amazon SNS), multi-player online game hosting on cloud resources, Building content delivery networks using clouds. | **8 Hours** |
| **DEVOPS in Cloud**<br>Continuous Integration/Continuous Deployment (CI/CD), collaboration among development, operations, and other stakeholders, Agile and lean principles: Embracing agile methodologies and lean practices to enable faster development and delivery cycles. Automating development pipelines, Monitoring and Logging, Implementing monitoring solutions for cloud applications, Containerization: Docker basics and container orchestration with Kubernetes. | **8 Hours** |
| **PROJECT:**<br>Projects involving Google AppEngine, Microsoft Azure, Openshift, Cloud Foundry services will be done. | **30 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | | **Practical Hours:** | | **Project Hours:** | **30** | **Total Hours:** | **60** |

| Learning Resources* |
|---|
| **Textbooks** |
| 1. George Reese , Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, Oreilly Publication, 2021.<br>2. Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation by, Addison-Wesley Professional, 2020. |
| **Reference books/ Web Links** |
| 1. https://www.coursera.org/specializations/ibm-cloud-application-development-foundations<br>2. https://www.udemy.com/course/cloud-computing-development-essentials/<br>3. https://www.coursera.org/learn/cloud-native-devops-agile-nosql?specialization =ibm-cloud-application-development-foundations<br>4. https://www.edx.org/certificates/professional-certificate/ibm-cloud-and-application-development-foundations |

| Assessment | |
|---|---|
| Assignments / Mini project), Quiz, Lab | SA - I, SA – II and End Semester Examination (ESE) |

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| Course Curated By | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
| | | Dr. L. Dhanabal, MCA | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC002 | INFRASTRUCTURE FOR PRIVATE CLOUD (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | |
|---|---|---|---|

| Course Objectives**: | The purpose of taking this course is to: |
|---|---|
| 1 | Providing a foundational understanding of OpenStack architecture, key components, workflow, and API functionalities used in cloud infrastructure. |
| 2 | Develop the skills required to configure, launch, and manage compute instances using the OpenStack Horizon dashboard and Command Line Interface (CLI). |
| 3 | Learning about object storage using Swift, including file uploads, permission management, and understanding of data lifecycle operations. |
| 4 | Exploring the techniques to manage cloud-based virtual networks, including configuration of routers, floating IP addresses, and security groups using Neutron. |
| 5 | Introducing identity and access management principles in OpenStack and managing users, roles, and permissions using Keystone services. |

| Course Outcomes***: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply OpenStack architecture, components, workflows, and API functionalities to deploy and manage cloud infrastructure services. | Ap |
| CO 2 | Configure and manage compute resources using Command Line Interface. | Ap |
| CO 3 | Deploy and manage object storage services, configure access permissions, and apply data lifecycle policies in a cloud environment. | Ap |
| CO 4 | Configure and manage virtual networks, routers, and floating IPs with cloud networking services. | Ap |
| CO 5 | Implement identity and access management by configuring users, roles, and authentication services in a cloud environment. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 2 | | 3 | | | | | 2 | | | | | 2 |
| 2 | 2 | | | | 3 | | | | 2 | | | | 2 |
| 3 | | 2 | | | 3 | | | 2 | | | | | 2 |
| 4 | | | 2 | | 3 | | | | | 2 | | | 2 |
| 5 | | 3 | | | 2 | | | | | 2 | | | 2 |

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| Course Content | |
|---|---|
| **Introduction to Cloud Infrastructure**<br>Introduction to cloud Infrastructure/virtual infrastructure, General Architecture of virtual infrastructure: Architecture of OpenStack, project, services, mode of deployment, workflow, Openstack Components: Nova, Swift, cinder, Nuetron, Glance, Keystone, Horizon. Virtualization environment with KVM. OpenStack API.<br>**Practical Component**<br>Single node private cloud setup using Devstack/Packstack | **7 Hours**<br><br>**6 Hours** |
| **Cloud Compute Architecture**<br>Configuring Horizon Dashboard, OpenStack CLI client - Create and manage flavors, compute instances, generate and manage SSH keys, accessing instances, configure an instance with a floating IP address, create instances with security groups, manage Nova host consoles, instance snapshots. Openstack image service: image repository, manage images, metadata, image types, bundling, exporting, migrating images.<br>**Practical Component**<br>Configure NOVA compute Node - Build a horizon node – Monitor node | **7 Hours**<br><br>**9 Hours** |
| **Cloud Storage Architecture**<br>Swift: features, architecture of swift, swift installation and configuration, data management lifecycle, backup and archival, media storage with swift. Use the command line client to upload and manage files to Swift containers, manage permissions on a container in object storage,<br>Cinder: Architecture of cinder clock storage, Volume provisioning and management- create and manage volumes, attach volumes to instances, manage volume quotas, backup and restore volumes, manage volume snapshots.<br>**Practical Component**<br>Configure Swift object storage - Construct a cinder block node | **8 Hours**<br><br>**7 Hours** |
| **Cloud Network Architecture**<br>Software defined networking, Neutron Architecture, Manage network resources, create external/public networks, create project networks, create project routers, attach routers to public and project networks, manage network services for a virtual environment, manage network quotas, manage network interfaces on compute instances, create and manage project security groups and rules, assign security group to instance, create and manage floating IP addresses, assign floating IP address to instance, detach floating IP address from instance. Identity and access management- keystone: users, roles, groups.<br>**Practical Component**<br>Launching an instance- Register an account at openstack, Create SSH Key, validate network - Sharing project environment among multiple users. | **8 Hours**<br><br>**8 Hours** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | | **Practical Hours:** | **30** | **Project Hours:** | **Total Hours:** 60 |

**Learning Resources***

**Textbooks**

1. Ben Silverman., Michael Solberg., OpenStack for Architects :Design Production-ready Private Cloud Infrastructure., 2nd Edition, Packt Publishing (2018).
2. Michael Solberg, Ben Silverman., OpenStack for Architects., Packt Publishing (2017).

**Reference books/ Web Links**

1. Alok Shrivastwa., Sunil Sarat, Kevin Jackson, Cody Bunch, Egle Sigler, Tony Campbell., OpenStack: Building a Cloud Environment., Packt Publishing (2016).
2. James Denton, Learning OpenStack Networking (Neutron)., Packt Publishing (2015).

**Online Resources**

1. https://www.coursera.org/learn/juniper-openstack-and-kubernetes?

**Signature of BOS Chairman-CSE**

| Assessment | |
|---|---|
| Assignments / Mini project), Quiz, Lab | SA- I, SA – II and End Semester Examination (ESE) |

| Course Curated By | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
| | | Dr. R.Kalaiselvi, CSE | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC003 | CLOUD STORAGE MANAGEMENT (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | - |
|---|---|---|---|

| Course Objectives**: | The purpose of taking this course is to: |
|---|---|
| 1 | To introduce the fundamental concepts of cloud computing and cloud-based storage systems. |
| 2 | To provide knowledge of different types of cloud storage solutions and how they are used in modern computing environments. |
| 3 | To explain how data is stored, accessed, secured, and managed in the cloud. |
| 4 | To familiarize students with the tools and technologies used for backup, disaster recovery, and data lifecycle management in the cloud. |
| 5 | To develop practical skills in using cloud platforms for setting up and managing storage services effectively. |

| Course Outcomes | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply basic principles of cloud storage design and deployment methods to set up storage systems. | Ap |
| CO 2 | Analyze different cloud storage types and protocols to identify the best solutions for specific application needs. | Ap |
| CO 3 | Implement data protection strategies using cloud-native tools and services. | Ap |
| CO 4 | Analyze cloud storage strategies to optimize enterprise data management, scalability, security, and performance. | An |
| CO 5 | Analyze security and compliance issues in cloud storage for secure data handling. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | 3 | | | | | 2 | | 3 | |
| 2 | 3 | 3 | | | 2 | | | | | | | 3 | |
| 3 | 3 | | 3 | | 3 | | | | | | | | 3 |
| 4 | | 3 | | 3 | | 2 | | | | | | | 3 |
| 5 | 3 | | | | 3 | | 2 | | | | | | 3 |

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| Course Content | |
|---|---|
| **Introduction to Cloud Storage and Infrastructure**<br>Basics of Cloud Storage - Evolution of data storage - Traditional vs. Cloud-based storage systems - Cloud storage benefits and limitations - Types of Cloud Storage - Block Storage - File Storage - Object Storage - Cloud Deployment Models - Public, Private, Hybrid, Multi-cloud models - Storage Infrastructure - Physical storage: HDD, SSD, Tape, NVMe - RAID: Levels 0, 1, 5, 6, 10 – purpose and configurations - Storage Architectures - NAS vs. SAN – architectures, use cases - Fibre Channel, iSCSI protocols - Virtual storage and storage pools<br>**Practical Component**<br>Set up AWS S3 and upload/download objects using console and CLI - Create and configure block storage (EBS) and attach to EC2 | **6 Hours**<br><br>**6 Hours** |
| **Cloud Storage Access and Protocols**<br>Cloud Storage Access Mechanisms - File-based access: NFS, SMB - Block-level access: iSCSI - Object-level access: REST APIs, HTTP/S3 commands - APIs and Command-line Access - RESTful interface: buckets, objects, metadata - Tools: AWS CLI, Azure CLI, AzCopy, Rclone - Software Defined Storage (SDS) - Introduction and platforms: Ceph, GlusterFS, vSAN - Use cases in cloud-native apps - Storage Provisioning and Automation - Dynamic provisioning - Infrastructure-as-code basics: Terraform, Ansible - Cloud Storage Gateways - Functionality and use in hybrid environments<br>**Practical Component**<br>Create and deploy storage bucket policies and lifecycle rules (S3/Azure Blob) | **10 Hours**<br><br>**4 Hours** |
| **Data Lifecycle Management, Backup, and Compliance**<br>Data Lifecycle and Tiering - Hot, cool, cold, archive storage tiers - Auto-tiering and cost optimization - Data Protection Mechanisms - Data replication: synchronous and asynchronous - Snapshots, cloning, checkpoints - Backup and Disaster Recovery (DR) - Backup types: full, incremental, differential - Cloud-native tools: AWS Backup, Azure Backup - RTO, RPO, and DR strategies - Data Governance and Compliance - Compliance frameworks: GDPR, HIPAA, ISO - Data privacy, retention policies, audit trails - Cloud SLAs and service reliability<br>**Practical Component**<br>Automate backup and restore using AWS Backup or Azure Recovery Services - Perform versioning and lifecycle configuration on object storage - Simulate data replication and snapshot in a lab setup | **7 Hours**<br><br>**10 Hours** |
| **Security, Monitoring, and Emerging Trends**<br>Storage Security - IAM roles, policies, access controls - Encryption at rest and in transit - Key Management Services (AWS KMS, Azure Key Vault) - Threats and Risk Mitigation - Data leakage, insider threats, ransomware - Security best practices and configurations - Monitoring and Optimization - Storage metrics: IOPS, latency, throughput - Monitoring tools: AWS CloudWatch, Azure Monitor - Real-world Case Studies & Hands-on Tools - Healthcare, media, IoT, education use cases.<br>**Practical Component**<br>Implement IAM policies to restrict access to storage buckets - Encrypt data in S3 using SSE-S3 and SSE-KMS - Monitor storage metrics using AWS CloudWatch or Azure Monitor | **7 Hours**<br><br>**10 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | **0** | **Practical Hours:** | **30** | **Project Hours:** | **0** | **Total Hours:** | 60 |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. The Art of Service. Data Storage Solutions: A Complete Guide – 2023 Edition. The Art of Service - Data Storage Solutions Publishing, Brisbane (2023). |

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2. Feng, Xiaohua., Siarry, Patrick., Han, Liangxiu., Yang, Longzhi. Cloud Computing: 12th EAI International Conference, CloudComp 2024, Luton, UK, September 9–10, 2024, Proceedings. Springer, Cham (2025).
3. Quick, Darren. Cloud Storage Forensics. Syngress, Elsevier, Waltham (2013).
4. Erl, Thomas., Puttini, Ricardo., Mahmood, Zaigham. Cloud Computing: Concepts, Technology & Architecture. Prentice Hall, Boston (2013).

**Reference books/ Web Links**

1. Voulodimos, Athanasios, Kyriazis, Dimosthenis P., Gogouvitis, Spyridon V., Varvarigou, Theodora. Data Intensive Storage Services for Cloud Environments. Business Science Reference, (2013).
2. O'Dell, Michael, Corey, Michael. Cloud Storage Management in Contemporary IT Environments. Packt Publishing, (2012).
3. Furht, Borko, Escalante, Armando. Handbook of Cloud Computing. Springer Science+Business Media, LLC, (2010).
4. Emc Education S. Information Storage and Management. John Wiley & Sons, Incorporated, 2012.
5. Gareth Stevens Publishing. The Cloud: Understanding Modern Data Storage. Gareth Stevens Publishing, New York (2022).
6. Tariq, Muhammad Imran., Balas, Valentina Emilia., Tayyaba, Shahzadi. Security and Privacy Trends in Cloud Computing and Big Data. CRC Press, Boca Raton (2022).

**Online Resources**

1. https://docs.aws.amazon.com/storage
2. https://cloud.google.com/storage/docs
3. https://learn.microsoft.com/en-us/azure/storage
4. https://www.coursera.org/learn/introduction-to-networking-and-storage
5. https://www.coursera.org/learn/computer-networking#modules
6. https://www.coursera.org/learn/essential-aspects-of-software-hardware-and-data-backup#modules
7. https://www.coursera.org/learn/aws-storage

| **Assessment** | |
|---|---|
| Assignments / Mini project), Quiz, Lab | SA- I, SA – II and End Semester Examination (ESE) |

| **Course Curated By** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
| | | Dr. S.Kanagaraj, IT | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC004 | VIRTUALIZATION AND RESOURCE MANAGEMENT (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | - |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Learning the basic concepts of virtualization, recognize various types of virtualization |
| 2 | Exploring binary translation and trap-and-emulate techniques utilized in full virtualization. |
| 3 | Enabling learners to apply virtual memory management concepts for efficient address translation and memory management in virtualized computing environments. |
| 4 | Learning the principles and architecture of Network Function Virtualization (NFV) and Software-Defined Networking (SDN) |
| 5 | Enabling learners to design and implement virtualized cloud data center infrastructures by integrating compute, memory, storage, and network resource management for efficient, scalable, and reliable cloud environments. |

| Course Outcomes | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Apply virtualization concepts to create and manage virtual machine environments using hypervisors, virtualization platforms. | Ap |
| CO 2 | Analyze and implement CPU virtualization including Virtual Machine live migration and checkpointing. | An |
| CO 3 | Apply memory virtualization techniques and perform ballooning and memory sharing in a hypervisor-managed environment. | Ap |
| CO 4 | Deploy Virtual Network Functions to examine network isolation and analyze resource utilization in a virtualized network environment. | Ap |
| CO 5 | Design a virtualized infrastructure integrating compute, memory, storage, and network resource management for cloud data center environments. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | | 2 | | 3 | | | 2 | | | | | 2 |
| 2 | | | | 3 | 2 | | | | | 2 | | | 3 |
| 3 | | | 2 | | 3 | | | 2 | | | | | 3 |
| 4 | 2 | | | | 3 | | | | | 2 | | | 2 |
| 5 | | 3 | | | 2 | | | | | 2 | | | 2 |

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| **Course Content** | |
|---|---|
| **Introduction**<br>Introduction to Virtualization - Physical infrastructure and virtual infrastructure - Difference between cloud and virtualization -– Challenges to Virtualization - Virtualization approaches - Partitioning - Hosting - Isolation - Hardware independence - Virtual machine - Virtual machine manager – Hypervisor – Trap and emulate VMM - Problems with trap and emulate - Popek Goldberg theorem.<br>**Practical Component**<br>Setup a virtualized environment using Virtaualbox/ KVM – launch a Linux VM – create a snapshot - Explore how VMs are isolated in KVM using top and htop. | **6 Hours**<br><br>**6 Hours** |
| **CPU Virtualization**<br>Hardware assisted virtualization: Libvirt and QEMU/KVM - QEMU architecture - QEMU/KVM operation - VMX mode - VM control structure (VMCS) – VMX Mode Execution.<br>Full virtualization: Full virtualization VMM architecture - Host and VMM - Binary translation - Dynamic binary translation - Use of segmentation for protection.<br>Para Virtualization: Introduction - Xen and Paravirtualization - Xen Architecture - CPU virtualization in Xen - Trap handling in Xen. VM Live migration: Flavors of migration techniques – performance optimization. VM Checkpointing and cloning: Techniques for reliability – VM cloning – VM Fork.<br>**Practical Component**<br>Verify virtualization support using egrep '(vmx\|svm)' /proc/cpuinfo in QEMU/KVM on a Linux machine - Launch a Virtual Machine in KVM - Bringing Virtualization to the x86 Architecture with the Original VMware Workstation - Paravirtualization in Xen - VM live migration. | **8 Hours**<br><br>**8 Hours** |
| **Memory virtualization techniques**<br>Introduction: Physical Vs Virtual Memory - Virtual memory and address translation - Techniques for memory virtualization - Demand Paging and Page Faults - Extended page tables(Intel) / Nested Page Tables (NPT – AMD) - Shadow page tables - Two-dimensional paging - MMU virtualization (hardware vs. software-assisted). Hypervisor and Guest Memory Mapping: Guest virtual to guest physical mapping - Guest physical to host physical mapping - Memory mapping strategies in Type-1 and Type-2 hypervisors. Memory reclamation techniques: Uncooperative swapping, Ballooning, Memory sharing.<br>**Practical Component**<br>Kernel Same-page Merging(KSM) and Ballooning in KVM/QEMU – Adjust Balloon Size Dynamically from host using libvert in a VM - clone/ identical memory content in two VMs. | **6 Hours**<br><br>**6 Hours** |
| **Network Virtualization**<br>Network Function Virtualization: NFV vs Traditional networking - Benefits and challenges of NFV - NFV vs. Software-Defined Networking (SDN). NFV Architecture : NFV Infrastructure (NFVI) - Virtual Network Functions (VNFs) - NFV Management and Orchestration (MANO). Security in NFV: VNF isolation and sandboxing -Secure VNF provisioning - Protecting MANO components - Threats in multi-tenant NFV environments.<br>**Practical Component**<br>Set up a basic traditional network service using a physical router and firewall (or simulate using iptables) and Replace the firewall and load balancer with VNFs (e.g., firewalld, nginx) running in virtual machines. Measure Elasticity and Resource Utilization in KVM/QEMU, using Virt-Manager, stress-ng, htop. | **5 Hours**<br><br>**6 Hours** |
| **Resource Management**<br>Network Optimization - Configure and manage vSphere distributed switches - Migrate virtual machines from standard switches to distributed switches - Explain distributed switch features such as port mirroring - LACP - QoS tagging - and NetFlow - CPU | **5 Hours** |

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| | |
|---|---|
| Optimization - Explain the CPU scheduler operation - NUMA support - and other features that affect CPU performance - Monitor key CPU performance metrics - Memory Optimization - Explain ballooning - memory compression - and host swapping techniques for memory reclamation when memory is overcommitted - Monitor key memory performance metrics - Storage Optimization - Diagnose storage access problems - Configure VMware vSphere Flash Read Cache - Monitor key storage performance metrics.<br>**Practical Component**<br>Deploy a multi-vCPU VM - Configure and Manage vSphere Distributed Switches and observe Configure and Manage vSphere Distributed Switches | **4 Hours** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Theory Hours:** | 30 | **Tutorial Hours:** | | **Practical Hours:** | 30 | **Project Hours:** | **Total Hours:** 60 |

**Learning Resources***

**Textbooks**

1. Dac-Nhuong Le (Author), Raghvendra Kumar (Author), Gia Nhu Nguyen (Author), Cloud Computing and Virtualization, Wiley-Scrivener(2018).
2. Dan Kusnetzky, Virtualization: A Manager's Guide, Stone publisher, (2011).

**Reference books/ Web Links**

1. Brij B Gupta, Amrita Dahiya, Elhadj Benkhelifa , SDN and NFV: A New Dimension To Virtualization, 2024.
2. Rajendra Chayapathi, Rajendra Chayapathi. Syed Hassan Farrukh. Paresh Shah, Syed Farrukh Hassan, Paresh Shah, Network Functions Virtualization (NFV) with a Touch of SDN.( 2016)

**Online Resources**

1. https://www.coursera.org/programs/kumaraguru-college-of-technology-on-coursera-emrt8/projects/ azure-create-a-virtual-machine-and-deploy-a-web-server? =search

| **Assessment** | |
|---|---|
| Assignments / Mini project), Quiz, Lab | SA- I, SA – II and End Semester Examination (ESE) |

**Course Curated By**

| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
|---|---|---|---|
| | | Dr. R.Kalaiselvi, CSE | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC005 | CLOUD SECURITY<br>(Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 4,9,16 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | - |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | To understand the fundamental principles of cloud computing and identify key security challenges associated with various deployment and service models. |
| 2 | To design secure cloud architectures and virtual network configurations. |
| 3 | To analyze compliance, governance, and risk management practices to ensure secure and lawful use of cloud services. |
| 4 | To apply secure development practices throughout the development lifecycle to protect cloud-native applications. |
| 5 | To explore emerging trends in cloud security, including edge computing, zero-trust models, and AI/ML-based threat detection approaches. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO1 | Apply core cloud security concepts and models to identify and address security requirements in cloud environments. | Ap |
| CO2 | Apply access control, encryption, and network isolation techniques to secure cloud environments. | Ap |
| CO3 | Analyze security risks, compliance needs, and governance frameworks for maintaining secure deployments | An |
| CO4 | Apply DevSecOps practices in cloud-native applications by integrating automation tools and secure coding techniques. | Ap |
| CO5 | Analyze AI-based threat detection to evaluate their role in shaping the future of cloud security. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | | | | | | | 2 | | 2 | |
| 2 | 2 | 3 | | | 3 | | | | 2 | | | 3 | |
| 3 | 3 | 3 | | | | | | | | 2 | | 3 | |
| 4 | | 2 | | | 3 | | | | | 2 | | 3 | |
| 5 | | 2 | | | 3 | | | | 2 | | | 3 | |

**Course Content**

Signature of BOS Chairman-CSE

| | |
|---|---|
| **Introduction to Cloud Security**<br>Overview of Cloud Computing and Security Challenges, Importance of Cloud Security for Organizations, Shared Responsibility Model, Cloud Deployment Models – Public, Private, Hybrid, Community, CIA Triad in Cloud Security, Cloud Service Models – IaaS, PaaS, SaaS – Security Considerations and Risks, Case Studies on Cloud Security Vulnerabilities.<br>**Practical Component:**<br>Securing free tier account in cloud platform - Securing Free Tier Account with IAM Users and Roles | **6 Hours**<br><br>**6 Hours** |
| **Cloud Security Architecture and Data Protection**<br>Designing Secure Cloud Architectures, Identity and Access Management (IAM), Network Security in Cloud Environments, Virtualization and Container Security, Encryption for Data at Rest and in Transit, Key Management Practices, Data Loss Prevention (DLP), Secure Cloud Configuration and Monitoring.<br>**Practical Component:**<br>Creating IAM Roles, Groups, and Policies for Role-Based Access Control - Securing Instances Using Virtual Private Cloud (VPC) - Data encryption and decryption using cloud platforms | **6 Hours**<br><br>**8 Hours** |
| **Compliance, Governance, and Risk management**<br>Compliance Requirements – GDPR, HIPAA, PCI DSS, Risk Assessment and Mitigation in Cloud, Governance Frameworks – ISO 27001, NIST, CSA CCM, Cloud Threats and Vulnerabilities, Business Continuity and Disaster Recovery, Third-Party Risk and SLA Management, Security Monitoring and Incident Response.<br>**Practical Component:**<br>Configuring networking firewall for an application - Securing and restricting access to storage | **6 Hours**<br><br>**6 Hours** |
| **Secure Development and DevSecOps**<br>Security in Cloud-Native Applications, Secure Coding Practices, CI/CD Pipeline Security, DevSecOps Principles and Tools, Best practices for DevSecOps in the cloud-Infrastructure as Code (IaC) Security – Cross cloud platforms in Terraform, Security Policies in Ansible, Detecting vulnerabilities Dynamic Code Analysis.<br>**Practical Component:**<br>Securing code with automated vulnerability scanning in CI/CD pipeline. | **6 Hours**<br><br>**4 Hours** |
| **Emerging Trends and Future of Cloud Security**<br>Edge Computing Security, Zero Trust Architecture, Serverless Security, AI/ML for Threat Detection, Quantum Computing and Cloud Security, Future Research Directions, Open Challenges.<br>**Practical Component:**<br>Securing an ERP or Healthcare App in the Cloud - Simulating a Cloud Security Threat Detection Model Using ML | **6 Hours**<br><br>**6 Hours** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | | **Practical Hours:** | **30** | **Project Hours:** | **Total Hours:** 60 |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. Preeti Mishra, Emmanuel S. Pilli, R.C. Joshi, “Cloud Security Attacks, Techniques, Tools and Challenges,” 2021.<br>2. Brij B. Gupta, “Cloud Security: Concepts, Applications and Perspectives,” 2021. |
| **Reference books/ Web Links** |
| 1. Vic (J.R.) Winkler, “Securing the Cloud: Cloud Computer Security Techniques and Tactics,” n.d.<br>2. Ronald L. Krutz, Russell Dean Vines, “Cloud Security: A Comprehensive Guide to Secure Cloud Computing,” 2010. |

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3. Tim Mather, Subra Kumaraswamy, Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance,” 1st Edition, 2009.
4. Kief Morris, “Infrastructure as Code: Dynamic Systems for the Cloud Age”, 2nd Edition, O’Reilly Media, 2020.

**Online Resources**

1. https://www.coursera.org/learn/cloud-security-basics
2. https://www.coursera.org/learn/sscp-4th-ed-course-6
3. https://www.coursera.org/learn/cloud-data-security
4. https://www.checkpoint.com/cyber-hub/cloud-security/what-is-cloud-security/
5. https://www.zscaler.com/resources/security-terms-glossary/what-is-cloud-security
6. https://medium.com/@goodycyb/exploring-cloud-security-in-depth-labs-and-insights-for-aws-and-gcp-50ca038478c4
7. https://goodycyb.hashnode.dev/

| **Assessment** | |
|---|---|
| Assignments / Mini project), Quiz, Lab | SA- I, SA – II and End Semester Examination (ESE) |

| **Course Curated By** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
| | | Dr. R Asmithashree, CSE | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC006 | CLOUD AUTOMATION<br>(Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | - |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Understanding the principles and practices of automating cloud infrastructure and operational tasks. |
| 2 | Applying the concept of Infrastructure as Code (IaC) to provision, configure, and manage cloud resources efficiently. |
| 3 | Implementing continuous integration and continuous deployment (CI/CD) pipelines to streamline application delivery in cloud environments. |
| 4 | Learning to automate cloud resource management to improve scalability, cost-effectiveness, and operational efficiency. |
| 5 | Exploring cloud-based services to troubleshoot and ensure optimal performance for reliability. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Deploying tools to automate the set up for cloud infrastructure. | Ap |
| CO 2 | Build a Continuous Integration / Continuous Delivery pipeline and automate testing and deployment. | Ap |
| CO 3 | Manage and optimize cloud resources provisioning automatically using containers. | An |
| CO 4 | Compare different monitoring tools to track cloud performance. | An |
| CO 5 | Analyze and integrate public cloud services to design and implement a complete cloud automation project. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | | 2 | | | 3 | | | | | 3 | | 3 | |
| 2 | | | 3 | | 2 | | | | | 3 | | 2 | |
| 3 | | 3 | | | 3 | | | | | 2 | | 3 | |
| 4 | | 3 | | | | | | | | 3 | | 2 | |
| 5 | | | 3 | | 3 | | | | | 3 | | 3 | |

Signature of BOS Chairman-CSE

| **Course Content** | |
|---|---|
| **Introduction to Cloud Automation**<br>Benefits of cloud automation - Types of cloud automation tools - Use cases for cloud automation. Managing and provisioning infrastructure through code (using tools like Terraform, Ansible, Puppet, Chef), Automating code integration and verification through tools like Jenkins, GitLab CI, or CircleCI, Automating the deployment process to push code changes into production environments reliably. | **7 Hours** |
| **Cloud Resource Scaling and Storage Automation**<br>Automating resource allocation, de-allocation, and right-sizing of resources based on usage. Kubernetes - Salt -CircleCI - Ansible and puppet, AWS DataSync, Azure Data Factory. | **8 Hours** |
| **Cloud Automation Tools for DEVOPS**<br>DuploCloud - Puppet - Heroku -HashiCorp, Monitoring and Logging Tools – Prometheus, Grafana, Docker, Raygun, Splunk, Git, Ansible, Jenkins, Bamboo. | **7 Hours** |
| **Cloud Deployment Automation**<br>NetApp Cloud Volumes ONTAP - CFEngine -VMware vs Realize Automation - Cisco Intelligent - Automation for Cloud - Microsoft Azure Automation - Google Cloud Deployment Manager – AWS CloudFormation - IBM Cloud Schematics. | **8 Hours** |
| **PROJECT CONTENTS** | |
| Projects involving different cloud platform services like Puppet, Heroku, HashiCorp and monitoring & Logging Tools – Prometheus, GrSafana, Docker, Raygun, Splunk, Git, Ansible, Jenkins, Bamboo. | **30 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | **0** | **Practical Hours:** | **0** | **Project Hours:** | **30** | **Total Hours:** | 60 |

| **Learning Resources*** |
|---|
| **Textbooks** |
| 1. Morris, Kief. *Infrastructure as Code: Managing Servers in the Cloud.* O'Reilly Media, Sebastopol (2021).<br>2. Kim, Gene., Humble, Jez., Debois, Patrick., Willis, John. *The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations.* IT Revolution Press, Portland (2021). |
| **Reference books/ Web Links** |
| 1. Burns, Brendan., and Grant, Joe Beda. *Kubernetes: Up and Running: Dive into the Future of Infrastructure.* O'Reilly Media, Sebastopol (2022).<br>2. Turnbull, James. *The Terraform Book.* Turnbull Press, San Francisco (2022).<br>3. Huttermann, Michael. *DevOps for Developers.* Apress, New York (2012). |
| **Online Resources**<br>1. https://www.coursera.org/learn/gcp-fundamentals/home/module/1<br>2. https://www.coursera.org/learn/information-technology-and-aws/home/week/1<br>3. https://www.coursera.org/learn/devops-capstone-project/home/welcome |
| |

| **Assessment** | |
|---|---|
| Assignments / Mini project), Quiz, Lab | SA- I, SA – II and End Semester Examination (ESE) |

**Signature of BOS Chairman-CSE**

| Course Curated By | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
| [Name, Organization] | [Name, Institution] | [S.Kanagaraj, IT] | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC007 | CLOUD ADMINISTRATION AND SOLUTIONS ARCHITECT (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 4 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | - |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | To provide a comprehensive understanding of AWS global infrastructure, core services, and security mechanisms essential for building and managing cloud solutions. |
| 2 | To enable learners to design, deploy, and manage scalable, secure, and cost-efficient compute, storage, database, and networking solutions on AWS. |
| 3 | To develop the ability to architect serverless, hybrid, and container-based solutions aligned with AWS best practices for governance, management, and automation. |
| 4 | To impart knowledge and practical skills in building modern data architectures and data lakes using AWS services such as Glue, Athena, Quick Sight, and Lake Formation. |
| 5 | To prepare learners for the AWS Certified Solutions Architect – Associate examination by reinforcing skills in designing resilient, high-performing, secure, and cost-optimized cloud architectures. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Understanding AWS core services to build a secure and scalable cloud application. | Ap |
| CO 2 | Deploy serverless, hybrid, and container-based architectures using AWS services adhering to best practices in scalability and security. | Ap |
| CO 3 | Construct modern data lake solutions on AWS utilizing services for efficient data ingestion, processing, and analytics. | An |
| CO 4 | Apply AWS design principles to develop resilient, cost-effective, and high-performing solutions aligning with AWS Well-Architected Framework guidelines. | An |
| CO 5 | Analyze and optimize AWS architectures for performance, cost, and sustainability while demonstrating readiness for AWS Certified Solutions Architect – Associate certification. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | | | | | | | 3 | 3 |
| 2 | | 3 | | | 3 | | | | | | | 3 | |
| 3 | | | 3 | | | | | | 2 | | | | |
| 4 | | | 2 | | | | 3 | | | | | | |
| 5 | | | | | 3 | | | | | | 2 | | |

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| Course Content | |
|---|---|
| **AWS CLOUD TECHNICAL ESSENTIALS LAB**<br>AWS Overview and Security, Compute and Networking, Storage and databases on AWS, Monitoring & Optimization.<br>**Project Component:**<br>Develop and deploy a secure AWS-based cloud infrastructure by implementing IAM-based access control with MFA, hosting a web application on an EC2 instance using secure role-based communication, and configuring CloudWatch monitoring for performance, availability, and resource utilization management. | 3 Hours<br><br>15 Hours |
| **ARCHITECTING SOLUTIONS ON AWS LAB**<br>Designing a serverless web backend on AWS, Designing a serverless data analytics solution on AWS, Designing a hybrid solution for container based workload, Designing a solution following account governance and management, IAM Roles<br>**Project Component:**<br>Design and implement a serverless cloud application by developing RESTful APIs using AWS Lambda and API Gateway, integrating DynamoDB for data storage, hosting a static website with a serverless backend, automating data processing using S3 event triggers, and enforcing governance through AWS Organizations and Service Control Policies (SCPs). | 4 Hours<br><br>15 Hours |
| **BUILDING DATA LAKES ON AWS LAB**<br>Introduction to Data lakes, Data Ingestion, Cataloging and preparation, Building a data lake with AWS lake Formation, Data Processing and Analytics, AWS Lake Formation additional configurations, Modern Data Architecture on AWS.<br>Creating and Running a Glue Crawler, Querying CSV data with Amazon Athena, Columnar data formats with Amazon Athena - a performance and cost comparison, Building a Data Lake using AWS Lake Formation, Glue Databrew, Glue Studio, LF-Tags, Visualizing Data with QuickSight, Automate Data Lake Creation Using AWS Lake Formation Blueprints, Publishing and Managing Data Product in AWS Lake Formation.<br>**Project Component:**<br>Design and implement a cloud-based data analytics platform by ingesting and cataloging data using AWS Glue and S3, querying and optimizing data using Amazon Athena and columnar storage formats, building a secure data lake with AWS Lake Formation, preparing datasets using AWS Glue DataBrew, and generating interactive business insights through Amazon QuickSight visualizations. | 4 Hours<br><br>15 Hours |
| **EXAM PREP: AWS CERTIFIED SOLUTIONS ARCHITECT – ASSOCIATE LAB**<br>Designing Resilient Architectures, Designing High-performing Architectures, Designing Secure Applications and Designing Cost-optimized Architectures.<br>**Project Component:**<br>Design and implement a secure and fault-tolerant AWS cloud architecture by deploying applications across multiple Availability Zones, enabling disaster recovery using S3 Cross-Region Replication, optimizing performance through CloudFront and caching layers, securing data at rest and in transit, and improving cost efficiency and reliability using AWS Trusted Advisor, Compute Optimizer, and the AWS Well-Architected Tool. | 4 Hours<br><br>15 Hours |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **15** | **Tutorial Hours:** | **0** | **Practical Hours:** | **0** | **Project Hours:** | **60** | **Total Hours:** | 75 |

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| Learning Resources* |
|---|
| **Textbooks** |
| 1. Alberto Artasanchez, AWS for Solutions Architects: Design your cloud infrastructure by implementing DevOps, containers, and Amazon Web Services, Packt Publishing Limited, 2024.<br>2. Joseph Conley, Advanced Data Analytics with AWS: Explore Data Analysis Concepts in the Cloud to Gain Meaningful Insights and Build Robust Data Engineering Workflows Across Diverse Data Sources, Orange Education Pvt Ltd, 2024.<br>3. Greyson Chesterfield, Serverless Architectures with AWS: Build Scalable Backends Without Managing Servers, 2025<br>4. Laurent Mathieu, Mastering AWS Security - Second Edition: Strengthen your cloud environment using AWS security features coupled with proven strategies, Second Edition, Packt Publishing, 2024. |
| **Reference books/ Web Links** |
| 1. Pravin Mishra, Cloud Computing with AWS: Everything You Need to Know to be an AWS Cloud Practitioner, Apress. 2023, ISBN, 1484291719, 9781484291719.<br>2. Mark Wilkins, Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud, Pearson Education, 2019, ISBN: 9780135301098, 0135301092. |
| **Online Resources** |
| 1. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/professional-certificates/aws-cloud-solutions-architect?source=search |

| Assessment | |
|---|---|
| Formative | Summative |
| Assignments / Mini project), Quiz, Lab | SA- I, SA – II and End Semester Examination (ESE) |

| Course Curated By | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
| | | Dr. R.Kalaiselvi, CSE | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC008 | SECURE COMPUTING AND NETWORKING (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 4 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards ( If any) | - |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | To provide foundational knowledge of computer systems, operating systems, and enterprise-level business applications. |
| 2 | To introduce principles of computer networking, network security, and cloud-based connectivity for secure data communication. |
| 3 | To develop the ability to configure secure software and hardware systems, and implement robust data backup and recovery mechanisms. |
| 4 | To build awareness of cybersecurity practices, privacy measures, and methods for safeguarding sensitive information in computing environments. |
| 5 | To enhance problem-solving and analytical skills through the application of troubleshooting methodologies and productivity tools within the Microsoft 365 ecosystem. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Demonstrate understanding of computer fundamentals, operating systems, and enterprise applications used in business environments. | Ap |
| CO 2 | Apply knowledge of computer networking, protocols, and network security mechanisms to establish secure communication systems. | Ap |
| CO 3 | Configure and maintain secure software and hardware environments, implementing effective data backup and recovery strategies. | Ap |
| CO 4 | Analyze and apply cybersecurity and privacy concepts to protect computing resources and ensure secure data transmission. | An |
| CO 5 | Employ Microsoft 365 tools and troubleshooting techniques to improve system performance, automation, and business productivity. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | 2 | | | | | | | | | 2 | 2 |
| 2 | | 3 | | | | 2 | | | | | 2 | 2 | |
| 3 | 2 | | 3 | 2 | 3 | | | | | | | | |
| 4 | 2 | | | | | | | 3 | | 2 | 2 | | 2 |
| 5 | | 2 | | | | | | | | | 3 | | 2 |

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| Course Content | |
|---|---|
| **INTRODUCTION TO COMPUTERS & SECURE NETWORKING LAB**<br>Introduction to computers and operating systems, Enterprise systems and security, Business systems Applications.<br>**Project Component:**<br>Design and implement a secure enterprise computing environment by assembling and configuring computer systems, managing operating system users and permissions, performing file system and networking operations, exploring enterprise applications, and applying basic cybersecurity measures including firewall configuration, antivirus protection, and malware detection. | 3 Hours<br><br>15 Hours |
| **INTRODUCTION TO SECURE NETWORKING LAB**<br>Computer Networking, Network Devices and protocols , Network Security, Cloud Computing and Networking<br>**Project Component:**<br>Design and implement a secure computer networking environment by simulating network topologies, configuring IP addressing and network devices, analyzing communication protocols using packet analysis tools, implementing firewall and VPN-based security mechanisms, and deploying secure cloud-based virtual networking infrastructure. | 4 Hours<br><br>15 Hours |
| **ESSENTIAL ASPECTS OF SOFTWARE, HARDWARE, AND DATA BACKUP LAB**<br>Secure Software Configurations, Secure Hardware Configuration, Robust data backup and Recovery, Project - Developing a data strategy<br>**Project Component:**<br>Design and implement a secure computing environment by configuring secure software and hardware settings, applying BIOS-level protections, automating data backup and recovery processes, and enforcing data encryption and access control mechanisms to ensure system reliability and data security. | 4 Hours<br><br>15 Hours |
| **CYBERSECURITY AND PRIVACY**<br>Advanced password management and privacy measures, Cyber Security Concepts, Computing Environments, Project - Developing a secure data transmission<br>**Project Component**:<br>Design and implement a secure communication and cybersecurity framework by configuring advanced password policies, applying encryption and SSL/TLS-based secure communication, simulating and analysing cyberattacks in a controlled environment, and developing a secure data transmission system with authentication, privacy controls, and incident response mechanisms. | 4 Hours<br><br>15 Hours |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Theory Hours:** | 15 | **Tutorial Hours:** | 0 | **Practical Hours:** | 0 | **Project Hours:** | 60 | **Total Hours:** | 75 |

**Learning Resources***

**Textbooks**


1. CompTIA Security+: Guide to Network Security Fundamentals, 8th Edition, Cengage Learning, 2024.
2. Jeremy Green, Andy Taylor, David Alexander, Amanda Finch, David Sutton, Information Security Management Principles, 4th Edition, O`Reilly, 2024.
3. Amelia Phillips , Bill Nelson , Christopher Steuart, Guide to Computer Forensics and Investigations, 7th Edition, Course Technology Inc, 2024
4. William Chuck Easttom, Computer Security Fundamentals, 5th Edition, O'Relly, 2023.


**Reference books/ Web Links**


1. William Stallings, Network Security Essentials, Pearson Education, 2018.
2. Charles J. Brooks, Christopher Grow, Philip Craig, Cybersecurity Essentials Paperback – Illustrated, Sybex publication, 2018.


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| **Online Resources** |
|---|
| 1. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/professional-certificates/aws-cloud-solutions-architect?source=search |
| |

| **Assessment** | |
|---|---|
| Formative | Summative |
| Assignments / Mini project), Quiz, Lab | SA- I, SA – II and End Semester Examination (ESE) |

| **Course Curated By** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
| | | Dr. R.Kalaiselvi, CSE | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ITC009 | SECURE CLOUD INFRASTRUCTURE MANAGEMENT (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 4 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | Nil | Data Book / Codes / Standards (If any) | - |
|---|---|---|---|

| Course Objectives: | The purpose of taking this course is to: |
|---|---|
| 1 | Introduce the fundamental concepts, architecture, and services of modern computing environments. |
| 2 | Develop the ability to configure, manage, and secure computing and networking resources. |
| 3 | Enable learners to analyze and apply suitable cloud and security models for real-world scenarios. |
| 4 | Strengthen problem-solving skills in deploying and troubleshooting IT infrastructure. |
| 5 | Foster ethical and professional practices in managing data, privacy, and security compliance. |

| Course Outcomes: | After successful completion of this course, the students shall be able to | Bloom's Taxonomy Level (BTL) |
|---|---|---|
| CO 1 | Explore components of computing and cloud environments to configure and manage cloud-based solutions. | Ap |
| CO 2 | Configure and manage virtualized or networked systems using industry-relevant tools. | Ap |
| CO 3 | Apply cybersecurity and privacy measures to protect computing assets. | Ap |
| CO 4 | Analyse system or network issues and implement effective troubleshooting strategies. | An |
| CO 5 | Design and evaluate a secure, scalable, and efficient IT or cloud-based solution for a given problem. | Ap |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | | | | | | | | | | | 2 | |
| 2 | | 2 | 2 | | 3 | | | | | | | 2 | |
| 3 | 3 | | | 2 | | | | 3 | | | | 3 | |
| 4 | 2 | | 2 | | | | | 2 | | | 2 | 2 | |
| 5 | | | 3 | | | | 2 | | 2 | 3 | 2 | 3 | |

| Course Content | |
|---|---|
| **CLOUD COMPUTING ESSENTIALS AND AZURE MANAGEMENT LAB**<br>Introduction to cloud Computing, Exploring Core Azure services, Azure management and Governance, Project - Cloud computing essentials with Azure Management<br>**Project Component**:<br>Design and implement a secure Azure cloud solution by configuring Azure Storage services, virtual networks, and Role-Based Access Control (RBAC), monitoring cloud | 3 Hours<br><br><br><br><br>12 Hours |

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| | |
|---|---|
| resources using Azure Monitor and Alerts, and integrating compute, storage, and networking services to deploy and manage an end-to-end application with performance monitoring and cost governance. | |
| **AZURE CLOUD SERVICES LAB**<br>Azure Compute, Azure Networking, Azure Security, Project - Implement a secure, scalable Azure environment incorporating virtual infrastructure.<br>**Project Component**:<br>Design and implement a secure and resilient Azure cloud infrastructure by configuring virtual networks, security controls, load balancing, identity and access management, and threat monitoring services to deploy a multi-tier application architecture with secure access, high availability, compliance, and cost optimization. | 3 Hours<br><br>12 Hours |
| **AZURE IDENTITY AND NETWORKING ESSENTIALS LAB**<br>Configuring Microsoft Entra ID, Configuring Resources, Configuring virtual networks for advanced security and performance.<br>**Project Component**:<br>Design and implement a secure and scalable Azure infrastructure by configuring Microsoft Entra ID–based identity and access management, enforcing MFA and least-privilege policies, deploying and organizing cloud resources with Azure networking services, and establishing secure inter-network connectivity with performance optimization and governance controls. | 3 Hours<br><br>12 Hours |
| **AZURE NETWORK CONFIGURATION**<br>Configuring Lad Balancer, Configuring Storage Accounts, Configuring Azure storage security, Project - Azure Infrastructure: Design, deploy, optimize<br>**Project Component**:<br>Design and implement a secure and highly available Azure infrastructure by configuring storage services with secure access controls, enabling encryption and secret management, deploying load balancing and web application protection mechanisms, monitoring resource performance and cost efficiency, and automating integrated infrastructure deployment and optimization. | 3 Hours<br><br>12 Hours |
| **AZURE MONITORING AND ANALYTICS FUNDAMENTALS**<br>Introduction to Azure monitor, Configuring Alerts in Azure, Advanced monitoring Techniques, Azure monitoring Implementation<br>**Project Component**<br>Design and implement an Azure-based monitoring and analytics solution by configuring Log Analytics, alerts, Application Insights, and Azure Network Watcher to collect, analyze, and visualize system performance, network activity, SLA compliance, and operational insights for proactive issue detection and optimization. | 3 Hours<br><br>12 Hours |
| **AZURE BACKUP, SECURITY, AND COMPLIANCE ADMINISTRATION LAB**<br>Configuring backups, Patching / Updating Virtual machines, Azure Cloud compliance, backup and disaster recovery, Project - Comprehensive backup and disaster recovery plan for a simulated Azure environment<br>**Project Component**<br>Design and implement a secure Azure backup, disaster recovery, and compliance management solution by configuring backup policies, automated recovery mechanisms, patch management, cross-region replication using Azure Site Recovery, and regulatory compliance controls to ensure business continuity, data protection, and operational resilience. | 3 Hours<br><br>12 Hours |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | 15 | **Tutorial Hours:** | 0 | **Practical Hours:** | 0 | **Project Hours:** | 60 | **Total Hours:** | 75 |

| **Learning Resources*** |
|---|
| **Textbooks** |

**Signature of BOS Chairman-CSE**

1. Jonah Carrio Andersson, Learning Microsoft Azure**,** O`Reilly, 2023**.**
2. Yuri Diogenes and Tom Janetscheck, Introduction to Azure Security Center, IT Best Practices - Microsoft Press series, 2021.
3. Ritesh Modi, Jack Lee, Rithin Skaria, Azure for Architects: Create secure, scalable, high-availability applications on the cloud, 3rd Edition, 2020.
4. Mahmood Z, Cloud Computing: Concepts, Technology & Architecture,2013.
5. Richard Nuckolls, Azure Storage, Streaming, and Batch Analytics, O`Reilly, 2020**.**
6. Florian Klaffenbach, Jan-Henrik Damaschke, Oliver Michalski, Implementing Azure Solutions, Packt Publishing, 2017.
7. Mustafa Toroman, Hands-On Cloud Administration in Azure: Implement, monitor, and manage important Azure services and components including IaaS and PaaS, Packt Publishing, 2018.

**Reference books/ Web Links**

1. Julian Soh, Marshall Copeland, Anthony Puca, Micheleen Harris, Microsoft Azure: Planning, Deploying, and Managing the Cloud, Apress, 2020, ISBN: 978-1-4842-5957-3
2. Nate J, Microsoft azure: Your personal guide from beginning to pro 2018, ISBN: 978-1719180221.

**Online Resources**

1. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/professional-certificates/microsoft-cloud-support-associate?source=search

| **Assessment** | |
|---|---|
| Formative | Summative |
| Assignments / Mini project), Quiz, Lab | SA- I, SA – II and End Semester Examination (ESE) |

| **Course Curated By** | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
| | | Dr. R.Kalaiselvi, CSE | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

# ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Signature of BOS Chairman-CSE

| 24ADC001 | BUSINESS INTELLIGENCE (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | | 8,9 | | |

| Pre-requisite courses | 24ADI017 Machine Learning Techniques | Data Book / Code book (If any) | NIL |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Introduce the foundational concepts of Business Intelligence and Business Analytics, including system architectures, types of analytics, and the end-to-end analytics process from problem definition to deployment. |
| 2 | Develop practical skills in data preparation, exploration, and visualization using industry-standard BI tools such as Qlik, with emphasis on data warehousing, OLAP operations, and knowledge management. |
| 3 | Equip students with predictive analytics and machine learning techniques for business forecasting, competitive analysis, and data-driven organizational decision-making. |
| 4 | Enable the application of domain-specific analytics for HR and Supply Chain Management by integrating cross-functional data and AI-assisted tools to generate operational insights. |
| 5 | Foster the ability to apply and analyze BI solutions for marketing and sales analytics, incorporating ethical considerations and critical evaluation of AI-assisted outputs. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO1 | Explain the Business Analytics process — from problem definition and data preparation to model deployment — and demonstrate the use of industry-standard BI tools for insight generation. | Un |
| CO2 | Analyze Business Intelligence architectures, data warehousing principles, OLAP operations, and analytic functions to extract actionable intelligence from enterprise data. | An |
| CO3 | Apply predictive analytics and machine learning techniques for business forecasting, competitive analysis, and data-driven decision-making. | Ap |
| CO4 | Apply analytics techniques for HR and Supply Chain domains by integrating cross-functional data and AI-assisted tools to generate operational insights and support workforce and logistics decisions. | Ap |
| CO5 | Analyze an end-to-end BI application for marketing and sales analytics by examining AI tool contributions, advanced visualization effectiveness, and ethical implications of data-driven decisions. | An |

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| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Teamwork | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| CO1 | 2 | 3 | | | 3 | | | | | | 2 | 3 | 2 |
| CO2 | 2 | 3 | | 2 | 3 | | | | | | 2 | 3 | 2 |
| CO3 | | 3 | | 3 | 3 | | | | | | 2 | 3 | 3 |
| CO4 | | 3 | | 2 | 3 | | | 2 | | 2 | | 3 | 2 |
| CO5 | | 3 | 2 | 3 | 3 | 2 | 2 | | | | 2 | 3 | 3 |

| **Course Content** | |
|---|---|
| **INTRODUCTION TO BUSINESS ANALYTICS**<br>Analytics and Data Science – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration.<br><br>**Practical Component:**<br>Explore the interface and basic features of the BI tool (Qlik) – Load and visualize a sample dataset – Navigate the analytics workflow from data ingestion to basic insight generation. | **6 Hours**<br><br>**6 Hours** |
| **BUSINESS INTELLIGENCE**<br>Data Warehouses and Data Mart – Knowledge Management – Types of Decisions – Decision Making Process – Decision Support Systems – Business Intelligence – OLAP – Analytic Functions.<br><br>**Practical Component:**<br>Import a dataset into the BI tool – Cleanse data by handling missing values, outliers, and inconsistencies – Transform data to suit BI reporting requirements. | **6 Hours**<br><br>**6 Hours** |
| **BUSINESS FORECASTING AND COMPETITIVE ANALYSIS**<br>Introduction to Business Forecasting and Predictive Analytics – Logic and Data-Driven Models – Data Mining and Predictive Analysis Modelling – Machine Learning for Predictive Analytics – Industry Analysis – Profit Frontier, Risk vs. Return, Competition Positioning – Enterprise Diagnosis.<br><br>**Practical Component:**<br>Apply BI tools for forecasting and predictive analytics – Build and evaluate a predictive model for a business scenario – Interpret model outputs and translate findings into actionable business recommendations. | **6 Hours**<br><br>**6 Hours** |
| **ANALYTICS – HR AND SUPPLY CHAIN**<br>Human Resources – Planning and Recruitment – Training and Development – Supply Chain Network – Planning Demand, Inventory and Supply – Logistics – Analytics Applications in HR and Supply Chain – Applying HR Analytics to predict the demand for talent. | **6 Hours** |

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| | |
|---|---|
| **Practical Component:**<br>Integrate data from various sources for comprehensive cross-functional analysis (SCM/HR) – Apply analytics techniques to monitor key performance indicators via an HR/SCM dashboard.<br>AI Tool Integration: Use an AI assistant (GitHub Copilot or Claude) to help write data transformation scripts and automate KPI calculations for the HR/SCM dashboard – Use AI-generated DAX or SQL suggestions to accelerate cross-functional data integration – Critically evaluate AI-generated code for correctness, bias in HR predictions, and appropriateness for supply chain contexts. | **6 Hours** |
| **MARKETING AND SALES ANALYTICS**<br>Marketing Strategy – Marketing Mix – Customer Behaviour – Selling Process – Sales Planning – Analytics Applications in Marketing and Sales – Predictive Analytics for customers' behaviour in marketing and sales.<br><br>**Practical Component:**<br>AI-Assisted Mini Project: Apply BI tools to build an end-to-end dashboard for a real-world marketing or sales scenario – Use AI tools (GitHub Copilot, Cursor, or Claude) to assist with data wrangling scripts, visualization code, and predictive model integration – Implement advanced chart types (tree maps, heatmaps) and interactive customer segmentation features – Document all AI tool interactions and prompts used – Analyze the dashboard outputs and present a critical examination of the AI's contribution, output quality, limitations, and ethical considerations in marketing analytics. | **6 Hours**<br><br>**6 Hours** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Theory Hours:** | **30** | **Tutorial Hours:** | **0** | **Practical Hours:** | **30** | **Project Hours:** | **0** | **Total Hours:** | 60 |

| **Learning Resources** |
|---|
| **Textbooks** |
| 1. Camm, Jeffrey D., James J. Cochran, Michael J. Fry, and Jeffrey W. Ohlmann. Business Analytics. 5th ed. Cengage Learning, 2024.<br>2. Hair, Joseph F., Dana E. Harrison, and Haya Ajjan. Essentials of Marketing Analytics. 2nd ed. McGraw-Hill Education, 2024. |
| **Reference** |
| 1. Kimball, Ralph, and Margy Ross. The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling. 3rd ed. Wiley, 2013.<br>2. Provost, Foster, and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking. O'Reilly Media, 2013.<br>3. Ivanov, Dmitry. Introduction to Supply Chain Analytics: With Examples in AnyLogic and anyLogistix Software. Springer, 2024. |
| **Online Resources (Weblinks)** |
| 1. Business Analytics Specialization, University of Pennsylvania – Coursera: https://www.coursera.org/specializations/business-analytics<br>2. Business Intelligence and Analytics, IIT Madras – NPTEL/SWAYAM (2025): https://onlinecourses.nptel.ac.in/noc25_cs09/preview<br>3. Business Analytics Courses – edX: https://www.edx.org/learn/business-analytics |

| **Assessment (Embedded course)** |
|---|
| SA I, SA II, Activity and Learning Task(s), Mini Project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle Tests, Viva-Voce |

**Signature of BOS Chairman-CSE**

| Course Curated By | | | |
|---|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** | |
| Mr. Karthick K<br>Operations Manager, Fractal Analytics, Chennai | Dr. Antony Seba P<br>Assistant Professor Grade I,<br>School of Computer Science and Engineering<br>Computational Intelligence<br>VIT, Vellore | Ms. Preethi G<br>AP/ Department of Artificial Intelligence and Data Science | |
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ADC002 | DEEP LEARNING APPLICATIONS (Common to CS, IT) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | 24ADI001 Automation and Artificial Intelligence | Data Book / Code book (If any) | NIL |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Introduce the fundamentals of deep learning and artificial neural networks for intelligent systems. |
| 2 | Develop convolutional neural network models for image classification and computer vision applications. |
| 3 | Explore sequential deep learning models for natural language processing tasks. |
| 4 | Analyze generative and unsupervised deep learning models for feature learning and data generation. |
| 5 | Examine transformer architectures and large language models for modern AI applications. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO1 | Implement neural network training mechanisms, activation functions, optimization strategies, and regularization methods to construct deep learning models for regression and classification problems. | Ap |
| CO2 | Apply convolution-based deep learning techniques and pretrained models for solving image analysis and recognition tasks. | Ap |
| CO3 | Develop deep learning models for sequential data processing and natural language applications using sequence learning techniques. | Ap |
| CO4 | Analyze unsupervised and generative deep learning approaches for feature representation, dimensionality reduction, and data generation tasks. | An |
| CO5 | Analyze transformer-based architectures and advanced language modeling techniques for developing intelligent AI-driven applications. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| CO1 | 3 | 2 | | | 2 | | | | | | | 3 | 2 |
| CO2 | 3 | 2 | 2 | | 2 | | | | | | | 3 | 2 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 3 | 3 | 3 | | 2 | | | | | | | 3 | 2 |
| CO4 | 3 | 3 | 3 | | 2 | | | | | | | 3 | 2 |
| CO5 | 3 | 3 | 3 | | 2 | 2 | 2 | | | | | 3 | 2 |

| **Course Content** | |
|---|---|
| **INTRODUCTION TO DEEP LEARNING**<br>Introduction to Artificial Neural Networks - MP Neurons and Perceptrons - Feedforward Neural Networks and Network Layers - Activation Functions: Sigmoid, Tanh and ReLU - Training Neural Networks: Weights, Biases, Loss Functions and Backpropagation - Optimization Methods: Gradient Descent and Variants - Regularization Techniques<br><br>**Practical Component**<br>Build and train a simple Artificial Neural Network (ANN) using TensorFlow or PyTorch for regression and classification tasks - Visualize Sigmoid, Tanh and ReLU activation functions and compare their effects on model performance - Experiment with Gradient Descent optimization variants and analyze convergence behavior during training - Implement and manage Deep Learning experiments using Google Colab and GitHub | **9 Hours**<br><br>**6 Hours** |
| **CONVOLUTIONAL NEURAL NETWORKS**<br>Introduction to Convolutional Neural Networks (CNNs) - Convolution Operation - Filters, Stride, Padding and Parameter Sharing - Pooling Layers - Fully Connected Layers - Regularization Techniques for CNNs - Popular CNN Architectures: AlexNet, VGGNet and ResNet<br><br>**Practical Component**<br>Implement CNN model for image classification - Apply transfer learning using ResNet/AlexNet for image recognition - Use Kaggle datasets and Hugging Face pre-trained vision models for experimentation. | **9 Hours**<br><br>**6 Hours** |
| **SEQUENTIAL MODELING**<br>Recurrent Neural Networks (RNNs) - Vanishing and Exploding Gradient Problems in RNNs - Bidirectional RNNs - Long Short-Term Memory (LSTM) Networks - Gated Recurrent Units (GRUs) - Tokenization and Word Embeddings - Natural Language Processing using RNNs<br><br>**Practical Component**<br>Train a Recurrent Neural Network (RNN) for text generation - Implement LSTM for sentiment analysis - Perform text preprocessing and embedding generation using NLP libraries. | **9 Hours**<br><br>**6 Hours** |
| **GENERATIVE AND UNSUPERVISED DEEP LEARNING MODELS**<br>Introduction to Representation Learning - Unsupervised Deep Learning - Energy-Based Models - Boltzmann Machines - Deep Belief Networks - Autoencoders and Variants - Generative Adversarial Networks (GANs)<br><br>**Practical Component**<br>Train a simple Autoencoder for dimensionality reduction and feature learning - Generate synthetic images using a Generative Adversarial Network (GAN) | **9 Hours**<br><br>**6 Hours** |
| **TRANSFORMERS & ADVANCED DEEP LEARNIG TECHNIQUES**<br>Transformer Architecture - Self-Attention and Multi-Head Attention Mechanism- Pretrained Language Models: BERT and GPT- Large Language Models (LLMs)- Prompt Engineering Techniques and Applications in LLMs<br><br>**Practical Component** | **9 hours**<br><br>**6 Hours** |

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| | |
|---|---|
| Fine-tune BERT for text classification - Develop a simple sequence-to-sequence application using Transformers - Build a simple chatbot or AI application using Transformer-based Large Language Models (LLMs) and deploy using Streamlit/Gradio | |

| Theory | Tutorial | Practical | Project | Total |
|---|---|---|---|---|
| Hours:30 | Hours:0 | Hours:30 | Hours:0 | Hours:60 |

**Learning Resources**

**Textbooks:**

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", First Edition, MIT Press, 2016.
2. François Chollet," Deep Learning with Python, Second Edition", Manning, 2021.

**References:**

1. David Foster, Generative Deep Learning, 2nd Edition, O'Reilly Media, Inc, 2023.
2. Vaswani, Ashish, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Łukasz Kaiser, and Illia Polosukhin. "Attention is all you need." Advances in neural information processing systems 30, 2017.
3. Aggarwal, C. C. Neural networks and deep learning (Vol. 10, No. 978, p. 3). Cham: Springer, 2018.

**Online Educational Resources:**

1. https://onlinecourses.nptel.ac.in/noc19_cs85/preview
2. https://ocw.mit.edu/courses/6-s191-introduction-to-deep-learning-january-iap-2020/

**Assessment (Embedded course)**

SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

**Course Curated by**

| Expert(s) from Industry | Expert(s) from Higher Education Institution | Internal Expert(s) |
|---|---|---|
| - | Dr M Karthiga, Associate Professor, Bannari Amman Institute of Technology | Tharsanee R M, AP/Artificial Intelligence & Data Science |

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| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ADE003 | RESPONSIBLE AI<br>(Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |
| PE | | SDG | 9, 13 | | | |

| Pre-requisite courses | 24ADI017 Machine Learning Techniques | Data Book / Codes / Standards (If any) | NIL |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Understand the importance of Responsible AI and its impact on society. |
| 2 | Examine fairness, accountability, and ethical issues in AI systems. |
| 3 | Use tools and techniques to improve transparency, privacy, and trust in AI models. |
| 4 | Learn sustainable and Green AI practices to reduce environmental impact. |
| 5 | Understand AI ethics frameworks, legal regulations, and responsible AI practices. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO1 | Analyze the principles of Responsible AI and the societal benefits, challenges, and impacts of AI systems. | An |
| CO2 | Apply bias detection and mitigation techniques to improve fairness in AI systems. | Ap |
| CO3 | Analyze privacy, security, transparency, and explainability issues in trustworthy AI systems using appropriate methods and tools. | An |
| CO4 | Apply sustainable AI strategies and Green AI tools to evaluate and reduce the environmental impact of AI models. | Ap |
| CO5 | Analyze global AI ethics frameworks, legal standards, and case studies to support responsible AI practices. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Course Outcomes (CO) | Engineering Knowledge |
| CO1 | 2 | 3 | | | | 3 | 3 | | | | | 2 | |
| CO2 | | 3 | 2 | | 2 | | 3 | | | | | 3 | |
| CO3 | | 3 | | 2 | 3 | | 2 | | | | | 3 | |
| CO4 | 2 | | 2 | | 3 | 3 | | | | | 2 | | 3 |
| CO5 | | 3 | 2 | 2 | | 3 | 3 | 2 | 2 | | 2 | | 2 |

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| Course Content | |
|---|---|
| **INTRODUCTION TO RESPONSIBLE AI**<br>Role of AI in society: Benefits and challenges - Need for Responsible AI: Ethical, legal, social, and environmental perspectives - Core principles: Fairness, Accountability, Transparency, Safety, Sustainability - Stakeholders of AI: Developers, Users, Affected communities, Policymakers - Case studies of AI failures and unintended consequences - Introduction to Responsible AI tools and platforms. | **7 Hours** |
| **BIAS DETECTION AND MITIGATION**<br>Types of bias in AI: Historical bias, Representation bias, Measurement bias, Aggregation bias - Fairness in machine learning: Definitions, Trade-offs, Limitations - Detection and mitigation of bias: Pre-processing, In-processing, Post-processing techniques - Case studies: AI in hiring, Loan approval, Predictive policing - Tools and frameworks for fairness auditing: AI Fairness 360, Fairlearn, What-If Tool. | **10 Hours** |
| **SECURE AND TRUSTWORTHY AI SYSTEMS**<br>Privacy issues in AI: Data collection, Surveillance, Consent - Privacy-preserving techniques: Anonymization, Differential privacy, Federated learning - Adversarial threats: Model stealing, Adversarial examples, Membership inference - Trust and transparency in AI systems: Interpretability, Explainability (XAI) - Interpretable Models: Linear Regression, Logistic Regression, Decision Tree - Tools for explainability and privacy: LIME, SHAP, Captum, TensorFlow Privacy. | **10 Hours** |
| **SUSTAINABLE AND GREEN AI**<br>Introduction to Green AI: Definition, Red vs Green AI paradigm - Carbon footprint of large-scale AI models: GPT, BERT, Training and inference phases - Estimating emissions: Experiment tracking, Energy profiling tools, ML CO2 - Infrastructure and sustainability: GPU vs TPU, Data centres, Renewable energy use - Strategies for sustainable AI: Efficient model design, Pruning, Quantization, Transfer learning - Green AI tools: CodeCarbon, ML CO2 Calculator, Energy monitoring tools. | **10 Hours** |
| **GLOBAL ETHICS, LEGAL STANDARDS, PROJECT AND CASE STUDY**<br>Overview of global AI ethics frameworks: OECD, UNESCO, EU AI Act, India's NITI Aayog - Legal and governance frameworks: GDPR, AI Bill of Rights - Algorithmic accountability and audit mechanisms - Open-source ethics initiatives: Partnership on AI, AI Now Institute - Future directions in Responsible AI: Human-in-the-loop AI and Ethics by design - Mini project or case study analysis related to Responsible AI, Bias detection, Explainable AI, Privacy-preserving AI, or Green AI systems. | **8 Hours** |

| Theory Hours:45 | Tutorial Hours: 0 | Practical Hours: 0 | Project Hours: 0 | Total Hours:45 |
|---|---|---|---|---|

**Learning Resources**

**Textbooks**


1. Agarwal, Sray., Mishra, Shashin. Responsible AI: Implementing Ethical and Unbiased Algorithms. Switzerland: Springer International Publishing (2021).
2. Ammanath, Beena. Trustworthy AI: A Business Guide for Navigating Trust and Ethics in AI. United States: Wiley (2022).
3. Gambelin, Olivia. Responsible AI: Implement an Ethical Approach in Your Organization. United Kingdom: Kogan Page (2024).
4. Alloghani, Mohamed Ahmed. Artificial Intelligence and Sustainability. Germany: Springer Nature Switzerland (2023).


**Reference**


1. Dignum, Virginia. Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way. Germany: Springer International Publishing, 2019.
2. R. Schmidpeter., Reinhard, Altenburger., Responsible Artificial Intelligence: Challenges for Sustainable Management. Germany: Springer International Publishing , 2023.
3. Coeckelbergh, Mark. AI Ethics. United Kingdom: MIT Press ,2020.


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| 4. Tzimas, Themistoklis. Legal and Ethical Challenges of Artificial Intelligence from an International Law Perspective. Switzerland: Springer International Publishing .2021. |
| **Online Resources (Weblinks)** |
| 1. https://onlinecourses.nptel.ac.in/noc24_cs132/preview<br>2. https://www.coursera.org/learn/principles-ethical-considerations-responsible-ai<br>3. https://www.coursera.org/learn/ethics-of-artificial-intelligence |

| **Assessment (Theory course)** |
|---|
| SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| Revathi S<br>Senior specialist, HPE Nonstop Database Products, Hewlett-Packard Enterprise R&D Division,<br>Mahadevapura, Bangalore. | Dr. Sangeetha S<br>ASP/ Department of Artificial Intelligence and Data Science,<br>PSG Institute of Technology and Applied Research, Coimbatore. | Ms Shriaarthy E<br>AP/Department of Artificial Intelligence and Data Science. |

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| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No:30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ADC004 | GENERATIVE AI (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 4,8 | | | |

| Pre-requisite courses | 24ADI001 Artificial Intelligence and Automation | Data Book / Codes / Standards (If any) | NIL |
|---|---|---|---|

**Course Objectives:**

The purpose of taking this course is to:

| | |
|---|---|
| 1 | Provide an understanding of the foundational principles, history, and capabilities of Generative AI, including its tools and economic potential. |
| 2 | Familiarize students with Large Language Models, transformer architectures, Retrieval-Augmented Generation, and prompt engineering techniques. |
| 3 | Introduce vision, code-capable, and multimodal generative models for applying image generation, code synthesis, and automated testing in practical scenarios. |
| 4 | Present video generation techniques using GANs, VAEs, diffusion models, and transformer-based architectures with practical video synthesis workflows. |
| 5 | Explore Agentic AI frameworks and real-world Generative AI applications, with emphasis on analyzing ethical considerations, societal impacts, and regulatory challenges. |

**Course Outcomes**

| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
|---|---|---|
| CO1 | Explain the foundational concepts of Generative AI, including its history, capabilities, tools, and prompt engineering techniques. | Un |
| CO2 | Apply Large Language Models and Retrieval-Augmented Generation techniques to perform natural language processing tasks using transformer-based architectures. | Ap |
| CO3 | Apply vision-capable and code-generation models to produce, edit, and test outputs from natural language prompts across image generation and code synthesis tasks. | Ap |
| CO4 | Analyze video generation techniques using GANs, diffusion models, and transformers, comparing their effectiveness for various synthesis tasks. | An |
| CO5 | Analyze real-world Generative AI applications and autonomous agent architectures, examining ethical, societal, and regulatory implications of their deployment. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative | Communication | Project Management and | Life-Long Learning | PSO-1 | PSO-2 |
| CO1 | 3 | 2 | | | 3 | | | | | | | | 2 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | 3 | 3 | | | 3 | | | | | | | | 2 |
| CO3 | | 2 | | 2 | 3 | | | | | | | | 2 |
| CO4 | | | 2 | 2 | 2 | | | | | | | | 2 |
| CO5 | | 2 | | | | | 2 | | | | 2 | | 2 |

**Course Content**

| | |
|---|---|
| **INTRODUCTION TO GENERATIVE AI**<br>Capabilities - History and Evolution - Benefits - Challenges - Applications of Generative AI – Tools for Text, Image, Code, Audio and Video generation – Economic Potential of Generative AI - Prompt Creation - Writing effective prompts - Techniques for using text prompts: Zero-shot and few-shot prompt techniques – Prompt engineering approaches: Interview pattern, Chain-of-Thought, Tree-of-Thought - Benefits of using text prompts - Challenges in generating meaningful and coherent prompts.<br>**Practical Component:**<br>Text Generation - Image Generation - Chain-of-Thought Approach - Interview Pattern Approach - Tree-of-Thought Approach - Write a function that accepts English sentences and converts them into predicate logic format using a rule-based approach. | **6 Hours**<br><br>**6 Hours** |
| **LARGE LANGUAGE MODELS**<br>Overview - Transformer architecture - Types of LLM - Small language models – Tokens - Embeddings - Prompt engineering - Model adaptation - Metrics - Working through an API – RAG - Vector databases - RAG architecture - RAG metrics - Overcoming challenges for chunking.<br>**Practical Component:**<br>Interacting with a Large Language Model through an API - Perform text summarization and question answering - Retrieval-Augmented Generation pipeline using a small language model and a vector database. | **6 Hours**<br><br>**6 Hours** |
| **GENERATING IMAGES AND CODE**<br>Vision models - Vision Transformer – Diffusion models – Multimodal models - Editing and enhancing images using Stable Diffusion - Code generation - Code explanation - Generate tests.<br>**Practical Component:**<br>Apply a Stable Diffusion model to generate, edit, and enhance images based on textual prompts. Use a code-capable language model to generate code from natural language prompts, explain given code snippets, and automatically generate unit tests. | **6 Hours**<br><br>**6 Hours** |
| **GENERATING VIDEO**<br>GANs for video - Variational Autoencoders for video - Transformer-based video generation - Diffusion models for video - Text-to-Video Generation - Image-to-Video Translation - Pose-guided video synthesis - Audio-to-lip synchronization - Deepfakes and facial reenactment.<br>**Practical Component:**<br>Text-to-Video Generation using Transformer or Diffusion-based Models – Audio-to-Lip Synchronization and Pose-Guided Video Synthesis. AI Tool Integration: Use GitHub Copilot or Claude to assist in writing and debugging the video generation pipeline code – Compare and critically evaluate AI-assisted vs. manually written code for the same video generation task. | **6 Hours**<br><br>**6 Hours** |
| **AGENTIC AI AND GENERATIVE AI APPLICATIONS**<br>Agentic AI - Definition – LangGraph Overview - Agent Architecture - Agent Autonomy - The Impacts of Generative AI on Business and Society - Emerging Trends and Technologies in Generative AI - Ethical Challenges and Regulatory Frameworks - Real-world Applications of Large Language Models - Challenges and Limitations of Current Approaches.<br><br>**Practical Component:** | **6 Hours** |

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|---|---|
| AI-Assisted Mini Project: Apply Generative AI capabilities to build a small end-to-end application integrating at least two GenAI components (e.g., LLM + RAG, image generation + agent, or video + agentic workflow) – Use AI tools throughout the development process to assist with code generation, debugging, and documentation – Analyze the AI's role, output quality, limitations, and ethical considerations and present findings.<br>Designing an Autonomous Agent using LangGraph Framework – Case Study on Real-World Application of Generative AI with Ethical and Societal Impact Analysis. | **6 Hours** |

| Theory Hours:30 | Tutorial Hours:0 | Practical Hours: 30 | Project Hours:0 | Total Hours:60 |
|---|---|---|---|---|

**Learning Resources**

**Textbooks**

1. Rehmani, Altaf. Generative AI for Everyone: Understanding the Essentials and Applications of this Breakthrough Technology. O'Reilly Media Inc., 2024.
2. Sabesan, Karthikeyan, Sivagamisundari, and Nilip Dutta. Generative AI for Everyone: Deep Learning, NLP and LLM for Creative and Practical Applications. BPB Publications, 2025.

**Reference**

1. Dhamani, Numa. Introduction to Generative AI. Kindle Edition, 2024.
2. Sprinter, Jesse. Generative AI in Software Development: Beyond the Limitations of Traditional Coding. 2023.
3. Kalin, Josh. Generative Adversarial Networks Cookbook: Over 100 Recipes to Build Generative Models using Python, TensorFlow, and Keras. Packt Publishing, 2018.

**Online Resources (Weblinks)**

1. Introduction and Applications of Generative AI – Coursera: https://www.coursera.org/learn/generative-ai-introduction-and-applications?specialization=generative-ai-for-everyone
2. Generative AI Learning Path – Google Cloud Skills Boost: https://www.cloudskillsboost.google/paths/118
3. Generative AI with Large Language Models – DeepLearning.AI (Coursera): https://www.coursera.org/learn/generative-ai-with-llms

**Assessment (Embedded course)**

SA I, SA II, Activity and Learning Task(s), Mini Project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle Tests, Viva-Voce

**Course Curated By**

| Expert(s) from Industry | Expert(s) from Higher Education Institutions | Internal Expert(s) |
|---|---|---|
| Mr. Vignesh Rajendran<br>Senior Principal Engineer,<br>Oracle,<br>Bengaluru, Karnataka, India. | Dr. S. Sangeetha<br>Associate Professor<br>Department of Artificial intelligence and data science<br>PSG Institute of Technology and Applied Research, Neelambur | Ms. Preethi G<br>AP/ Department of Artificial Intelligence and Data Science |

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| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No: 30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ADC005 | SOCIAL NETWORK ANALYTICS (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9,16 | | | |

| Pre-requisite courses | 24ADI017 Machine Learning Techniques | Data Book / Code book (If any) | NIL |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Acquire knowledge of fundamental graph theory concepts, network data types, and key metrics used in social network analysis. |
| 2 | Develop practical skills in collecting, processing, analyzing, and visualizing network data using standard Python libraries and visualization tools. |
| 3 | Gain competency in interpreting network structures, identifying key actors and communities, and understanding basic network dynamics. |
| 4 | Understand the application of SNA techniques in various domains, particularly social media and organizational contexts, while considering ethical implications. |
| 5 | Develop the ability to critically evaluate network analysis results and communicate findings effectively through visualizations. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO1 | Apply graph representation methods, software libraries, and algorithms to model social networks and compute key metrics. | Ap |
| CO2 | Analyze network structures to identify key actors, communities, and overall network properties. | An |
| CO3 | Analyze patterns of connection, influence, and information flow within networks using concepts like homophily, structural holes, and basic diffusion models. | An |
| CO4 | Analyze the suitability and limitations of different SNA metrics and algorithms for specific analytical goals or research questions. | An |
| CO5 | Analyze the broader implications, ethical considerations, and potential applications of social network analysis findings across various domains | An |

| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | 2 | 3 | | | | | | | | 2 |
| 2 | 3 | 2 | | 2 | 3 | | | | | | | 2 | 2 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 3 | 3 | | 2 | | | | | | | | 2 | 2 |
| 4 | 3 | 3 | 2 | 2 | | | | | | | | 2 | 2 |
| 5 | 3 | 2 | | 2 | | | | 3 | | | | 2 | 3 |

| **Course Content** | |
|---|---|
| **INTRODUCTION TO NETWORK ANALYSIS AND DATA**<br>SNA Definition & Applications-Graph Basics: Nodes, Edges, Weights-Network Representation: Matrices, Edge Lists-Data Collection: APIs & Web Scraping-Intro to NetworkX & Basic Properties.<br>**Practical Component**<br>Installing NetworkX environment-Creating/Manipulating graph objects-Loading network data from files-Basic graph inspection & property checks-Cursor/GitHub Copilot-Automated NetworkX script generation and graph schema design-GPT-4o Vision-AI interpretation of complex network visualizations and layout patterns | **6 Hours**<br><br>**6 Hours** |
| **NETWORK METRICS: CONNECTION AND CENTRALITY**<br>Connection Metrics: Density & Degree Dist.-Distance Metrics: Geodesics, Diameter Node Centrality: Degree, Closeness, Betweenness-Eigenvector Centrality & PageRank Identifying 'Brokers' & Key Players.<br>**Practical Component**<br>Calculate density & degree distributions-Compute centrality measures (Centrality Suite)-Centrality visualization with Matplotlib-Node resizing based on influence scores-LLM Centrality Analyst-AI-driven interpretation of node influence based on network metadata-GraphGPT-Natural language queries for identifying critical paths in complex networks. | **6 Hours**<br><br>**6 Hours** |
| **NETWORK STRUCTURE: COHESION AND COMMUNITIES**<br>Cohesion: Connected Components-Clustering Coefficients: Global vs Local-Community Detection Algorithms (Louvain)-Modularity Optimization & Graph Partitioning-Introduction to Gephi Visualization.<br>**Practical Component**<br>Finding connected components-Implementing Louvain for community detection-Graph data export for Gephi-Justice & Peace influence mapping-Node2Vec Embeddings-AI-based node feature learning for improved community clustering-AI Community Labeller-LLM-powered automatic naming of detected communities based on member attributes. | **6 Hours**<br><br>**6 Hours** |
| **NETWORK DYNAMICS AND POSITIONS**<br>Topology: Small-World & Scale-Free-Homophily & Assortativity Measurement-Structural Holes & Brokerage Theory (Burt)-Information Diffusion (SI/SIR Models)-Link Prediction & Contagion Concepts.<br>**Practical Component**<br>Calculating network assortativity-Identifying structural hole spanners-Simulating SI diffusion processes-Computing link prediction scores-Deep Graph Library (DGL)-Modeling network dynamics with Graph Neural Networks-Predictive Diffusion AI-AI-driven simulation of information flow in social system. | **6 Hours**<br><br>**6 Hours** |
| **VISUALIZATION, APPLICATIONS AND EVALUATION**<br>Advanced Gephi Layouts (Force Atlas 2)-Social Media Data Analysis Strategies-Organizational Network Analysis (ONA)-Evaluating SNA Results & Ethical Reviews-Reporting Findings via Interactive Visuals.<br>**Practical Component**<br>Gephi attribute mapping (Size, Color)-Filtering networks in Gephi-Social media dataset deep-dive-Ethical review of network monitoring-Visallo / Polinode AI-AI-enhanced investigation and fraud detection in graphs-Auto-Report SNA-AI generation of executive summaries from network metric snapshots.<br>Map and analyze a social subgroup to predict influential communication bridges using graph intelligence and AI-driven simulation. | **6 Hours**<br><br>**6 Hours** |

**Signature of BOS Chairman-CSE**

| Theory Hours:30 | Tutorial Hours: 0 | Practical Hours: 30 | Project Hours: 0 | Total Hours:60 |
|---|---|---|---|---|

**Learning Resources**

**Textbooks**


1. Musselwhite, Ben. *Graph Data Science with Python*. 2nd ed. Packt Publishing, 2024.
2. Harris, Elena. *Network Science & AI: A Modern Approach*. Wiley, 2024.
3. Leskovec, Jure. *Machine Learning with Graphs*. Stanford University, 2023.
4. Tsvetovat, Maksim, and Alexander Kouznetsov. *Social Network Analysis for Startups*. O'Reilly Media, 2011.
5. Barabási, Albert-László. *Network Science*. Cambridge University Press, 2016. Available online at: Network Science Book.


**Reference**


1. Hanneman, Robert A., and Mark Riddle. Introduction to Social Network Methods. Online textbook, 2005. Available online at: Introduction to Social Network Methods.
2. Easley, David, and Jon Kleinberg. Networks, Crowds, and Markets: Reasoning About a Highly Connected World. Cambridge University Press, 2010.
3. Wasserman, Stanley, and Katherine Faust. Social Network Analysis: Methods and Applications. Cambridge University Press, 1994.
4. Borgatti, Stephen P., Martin G. Everett, and Jeffrey C. Johnson. Analyzing Social Networks. 2nd ed. SAGE Publications, 2018


**Online Resources (Weblinks)**

1. NetworkX Library Documentation: https://networkx.org/documentation/stable/
2. Gephi Quick Start & Tutorials: https://gephi.org/users/
3. Stanford CS224W: Machine Learning with Graphs (Course Website/Videos): http://web.stanford.edu/class/cs224w/
4. Coursera: Social Network Analysis (University of Michigan): https://www.coursera.org/learn/social-network-analysis
5. https://onlinecourses.nptel.ac.in/noc22_cs117/preview

**Assessment (Embedded course)**

SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

**Course Curated By**

| Expert(s) from Industry | Expert(s) from Higher Education Institutions | Internal Expert(s) |
|---|---|---|
| Mr.Gokul Kumar R D<br>Senior Consultant<br>EY | Dr. Vishnuvarthan R<br>Assistant Professor- School of Computing- Amrita Vishwa Vidyapeetham- Coimbatore | Ms. Rupashini P R,<br>AP/Department of Artificial Intelligence and Data Science |

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| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No:30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ADC006 | DIGITAL TWIN ANALYTICS (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| PE | | SDG | 9-12 | | | |

| Pre-requisite courses | 24ADI017 Machine Learning Techniques<br>24CSI105 Embedded Computing Systems | Data Book / Code book (If any) | NIL |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Acquire knowledge of Digital twin concepts, architectures, enabling technologies, IoT, Cloud, Simulation, AI and application domains. |
| 2 | Develop practical skills in acquiring, processing, managing, and analyzing time-series data from sensors relevant to Digital Twins using appropriate tools and Machine Learning algorithms. |
| 3 | Gain competency in analyzing Digital Twin architectures, data flows, and the suitability of different modelling approaches. |
| 4 | Understand the challenges related to model fidelity, data synchronization, and integration within Digital Twin systems. |
| 5 | Develop the ability to evaluate the effectiveness, business value, implementation challenges, and ethical considerations of Digital Twin solutions. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course- the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO1 | Apply techniques for ingesting, cleaning, storing, and managing time, series sensor data relevant to Digital Twins. | Ap |
| CO2 | Apply machine learning algorithms such as anomaly detection, forecasting to analyse Digital Twin data streams for prediction or diagnostics. | Ap |
| CO3 | Analyse the data flow, integration points, synchronization challenges, and fidelity requirements within a Digital Twin architecture linking physical and digital components. | An |
| CO4 | Analyse the suitability and trade-offs of different modelling approaches for representing physical asset behaviour within a Digital Twin. | An |
| CO5 | Analyze the effectiveness, potential ROI, scalability, security, and implementation considerations of a Digital Twin solution by examining its predictive accuracy and impact on operational KPIs | An |

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| Course Outcomes (CO) | Program Outcomes (PO) (Strong-3- Medium – 2- Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team work | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| 1 | 3 | 2 | | | 2 | | | | | | | | 2 |
| 2 | 3 | 2 | 2 | | 2 | | | | | | | 3 | 3 |
| 3 | 3 | 3 | | 2 | 2 | | | | | | | 2 | 2 |
| 4 | 3 | 3 | 2 | | 2 | | | | | | | 2 | 2 |
| 5 | 3 | 2 | 2 | | 2 | 2 | | | | | | 3 | 2 |

| **Course Content** | |
|---|---|
| **INTRODUCTION AND TIME-SERIES DATA MANAGEMENT**<br>Digital Twin Definition- Evolution- & Enabling Technologies-IoT Protocols: MQTT- CoAP for Data Ingestion-Time-Series Databases: InfluxDB- TimescaleDB-Sensor Data Characteristics: Frequency- Noise- Filtering-Data Modeling & Querying for Temporal Assets.<br>**Practical Component**<br>Set up InfluxDB/TimescaleDB environment-Set up InfluxDB/TimescaleDB environment-Preprocessing: Resampling- Cleaning with Pandas-Exploring IoT Platform connectivity- Auto-Cleaning AI-AI-driven automated outlier removal and missing value imputation for sensors-Timescale AI-Generative AI for SQL query optimization in time-series workloads. | **6 Hours**<br><br>**6 Hours** |
| **MACHINE LEARNING FOR DT DATA STREAMS**<br>Feature Engineering: Windowing & Statistical Features-Anomaly Detection: LOF- Isolation Forests- Autoencoders-Forecasting Models: ARIMA vs. ML Regression-Remaining Useful Life (RUL) Estimation Concepts-Failure Prediction & Temporal Pattern Handling.<br>**Practical Component**<br>Implement rolling window feature engineering-Apply Isolation Forest for sensor anomaly detection-Build a basic RUL prediction model using regression-Training/Testing on real-world temporal data-PyCaret / Auto-TS AI-automated selection of the best forecasting model for DT streams-Isolation Forest AI-Enhanced AI anomaly detection with domain-specific rule embedding. | **6 Hours**<br><br>**6 Hours** |

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| | |
|---|---|
| **DIGITAL TWIN ARCHITECTURE AND INTEGRATION ANALYSIS**<br>Architecture Deep Dive: Physical to Digital layers-Levels of Integration: Data Flow & Decision Loops-Synchronization Challenges: Aligning Real-time & Models-Model Fidelity Requirements & Calibration-Integration Technologies: APIs- AWS IoT Core- Azure IoT Hub.<br>**Practical Component**<br>Diagram data flow for complex system twins-Analyze synchronization latency simulated data-Discuss fidelity requirements for specific use cases-Explore cloud IoT platform connectivity options-DTDL Generator-AI-assisted generation of Digital Twin Definition Language models-Network Latency AI-Predictive modeling of synchronization delays in distributed DT architectures. | **6 Hours**<br><br>**6 Hours** |
| **MODELING APPROACHES AND ANALYSIS**<br>Physics-based (FEM- CFD) vs. Data-driven Models-Hybrid Modeling: Combining Physics & ML-Surrogate Modeling: Faster Approximations using AI-Model Calibration & Validation using Sensor Data-Trade-off Analysis: Accuracy vs. Computational Cost.<br>**Practical Component**<br>Train a data-driven surrogate model from simulation data-Compare physics-based vs. data-driven outputs-Discuss model validation with real sensor data-Implement model calibration loops. PINN Architect-AI design of Physics-Informed Neural Networks for high-fidelity mirroring-Ansys AI+AI acceleration of computational fluid dynamics simulations for DT. | **6 Hours**<br><br>**6 Hours** |
| **PLATFORM DESIGN AND IMPLEMENTATION**<br>Commercial Platforms: TwinMaker- Azure Digital Twins-Evaluating Effectiveness: KPIs & Predictive Accuracy-ROI Measurement & Implementation Challenges-Security- Privacy- & Ethical Considerations-Visualisation: 3D Dashboards & Reality Comparison<br>**Practical Component**<br>Explore Azure/AWS DT cloud consoles-Define a simple model graph on cloud platforms-Design evaluation criteria for a DT project-Ethical review of pervasive system twin monitoring. | **6 Hours**<br><br>**6 Hours** |

| Theory | Tutorial | Practical | Project | Total |
|---|---|---|---|---|
| Hours:30 | Hours:0 | Hours:30 | Hours:0 | Hours:60 |

**Learning Resources**

**Textbooks**


1. Grieves, Michael. Digital Twin: Master the Virtual World. Updated ed. McGraw Hill, 2024.
2. Karniadakis, George. Physics-Informed Machine Learning for Digital Twins. Springer, 2024.
3. Capasso, Antonio. Scalable Digital Twin Analytics. Wiley, 2024.
4. Grieves, Michael. Digital Twin: Manufacturing Excellence through Virtual Factory Replication. McGraw Hill, 2019.
5. Veneri, Giacomo, and Antonio Capasso. Hands-On Industrial Internet of Things. Packt Publishing, 2018.
6. Shumway, Robert, and David Stoffer. Time Series Analysis and Its Applications. 4th ed. Springer, 2017.


**Reference**


1. Official Documentation for AWS IoT TwinMaker: https://aws.amazon.com/iot-twinmaker/
2. Official Documentation for Azure Digital Twins: https://azure.microsoft.com/en-us/products/digital-twins/
3. IEEE international conference on Digital Twins and Parallel Intelligence (DTPI): https://2025.ieee-dtpi.org/
4. https://www.siemens.com/global/en/products/automation/products-for-specific-requirements/tunnel-automation/whitepaper-tunnel-digital-twin.html
5. https://www.ge.com/digital/lp/predictive-diagnostics-digital-twin-blueprints


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6. https://azure.microsoft.com/en-us/services/digital-twins/
7. https://aws.amazon.com/solutions/guidance/industrial-digital-twin-on-aws/
8. Introduction to Time Series and Forecasting- 3rd Edition- Peter Brockwell & Richard Davis (Springer- 2016). https://link.springer.com/book/10.1007/b97391

**Online Resources (Weblinks)**

1. AWS Training & Certification (IoT- TwinMaker): https://aws.amazon.com/iot-twinmaker/
2. Microsoft Learn (Azure IoT- Digital Twins): https://learn.microsoft.com/en-us/azure/iot/concepts-digital-twin
3. https://www.coursera.org/learn/practical-time-series-analysis
4. https://www.coursera.org/learn/tensorflow-sequences-time-series-and-prediction
5. https://www.coursera.org/specializations/internet-of-things/?msockid=04b41c400bd76a551b5c0a420ab56b6d
6. https://www.edx.org/learn/computer-architecture/waseda-university-iot-system-architecture-design-and-evaluation
7. https://www.udacity.com/course/embedded-systems-iot-and-aiot--cd12870
8. https://www.ge.com/digital/ot-insights-it-webinar-series
9. https://www.ansys.com/en-in/events/ansys-academic-webinar-series
10. https://innovationspace.ansys.com/event/ansys-discovery-webinar-series/
11. https://nptel.ac.in/courses/106105159

**Assessment (Embedded course)**

SA I- SA II- Activity and Learning Task(s)- MCQ- End Semester Examination (ESE)
Lab Workbook- Experimental Cycle tests- viva-voce.

**Course Curated By**

| Expert(s) from Industry | Expert(s) from Higher Education Institutions | Internal Expert(s) |
|---|---|---|
| - | - | Ms Rupashini P R<br>AP/Department of Artificial Intelligence and Data Science |

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|---|---|---|---|
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No:30 | **Date** | 19.06.2026 |

**Signature of BOS Chairman-CSE**

| 24ADC007 | AGENTIC AI<br>(Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 4 | 3 |
| PE | | SDG | 9 | | | |

| Pre-requisite courses | NIL | Data Book / Codes / Standards (If any) | NIL |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Build basic Generative AI applications using LLMs, prompts, and simple RAG workflows. |
| 2 | Use vector databases and embedding models to perform similarity search and improve retrieval. |
| 3 | Create intelligent agents that can call tools, use memory, and solve tasks through reasoning. |
| 4 | Develop multi-step agent workflows using LangGraph for structured and collaborative tasks. |
| 5 | Implement multi-agent systems using frameworks like CrewAI or AutoGen, including simple multimodal tasks. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO1 | Apply foundational Generative AI techniques to build LLM-based applications. | Ap |
| CO2 | Develop Retrieval-Augmented Generation systems using vector databases and advanced retrievers. | Ap |
| CO3 | Design agentic systems using LangChain agents, tool calling, and multi-step reasoning frameworks. | Ap |
| CO4 | Build stateful, multi-agent RAG and reasoning workflows using LangGraph and other agentic orchestration frameworks. | Ap |
| CO5 | Analyze multimodal reasoning with advanced agentic frameworks to design and justify intelligent end-to-end applications. | An |

| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| CO1 | 3 | | 2 | | 3 | | | | | | 2 | 3 | |
| CO2 | 2 | 3 | 2 | 2 | 3 | | | | | | | 3 | 3 |
| CO3 | | 3 | 3 | | 3 | | | 2 | | | 2 | 3 | 3 |
| CO4 | | 2 | 3 | 3 | 3 | | | 2 | | | 2 | 3 | 3 |
| CO5 | | | 2 | 2 | 3 | 2 | 2 | 3 | 2 | | 3 | 2 | 3 |

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| Course Contents | |
|---|---|
| **FOUNDATIONS OF GENERATIVE AI & RAG**<br>Introduction to Large Language Models (LLMs) – Prompt Engineering – In-context Learning – Generative AI Applications – Retrieval-Augmented Generation (RAG) – LangChain and LlamaIndex Basics – Document Loading and Chunking – Embeddings and Similarity Search – Retrieval Evaluation – Hallucination Reduction Techniques – Building Simple RAG Applications. | **3 Hours** |
| **VECTOR DATABASES & ADVANCED RETRIEVERS**<br>Introduction to Vector Databases – Similarity Search Techniques – Retrieval Optimization – Embedding Models – Metadata Filtering – Hybrid Retrieval – Advanced Retrievers – Contextual Compression Retrievers – Parent Document Retrievers – Retrieval Evaluation – Building Retrieval Pipelines. | **3 Hours** |
| **LANGCHAIN AGENTS & TOOL CALLING**<br>Introduction to AI Agents – LangChain Agent Workflows – Tool Calling – Agent Memory – LCEL Chaining – External Tool Integration – SQL and Python Tools – API Integration – ReAct Framework – Structured Output Generation – Agent Debugging and Optimization. | **3 Hours** |
| **LANGGRAPH & AGENTIC RAG WORKFLOWS**<br>Introduction to LangGraph – Stateful Agent Workflows – Graph-based Orchestration – Multi-step Reasoning Workflows – Reflection and Reflexion Agents – Agentic RAG Pipelines – Knowledge Base Integration – Workflow State Management – Multi-agent Coordination – Workflow Monitoring and Evaluation. | **3 Hours** |
| **ADVANCED MULTI-AGENT SYSTEMS**<br>Introduction to Multi-Agent Systems – CrewAI Framework – AutoGen Framework – BeeAI Framework – Agent Coordination and Collaboration – Evaluator–Optimizer Patterns – Task Planning and Delegation – Multimodal AI Agents – Image Captioning – Document Inspection – Visual Question Answering (VQA) – Ethical and Responsible Agentic AI. | **3 Hours** |
| **PROJECT**<br>To design and develop an end-to-end Agentic AI application that integrates Retrieval-Augmented Generation (RAG), vector databases, intelligent agents, and multi-agent workflows. The system should support document retrieval, semantic search, tool calling, multi-step reasoning, and collaborative agent interactions through frameworks such as LangChain, LangGraph, CrewAI, AutoGen, or BeeAI, culminating in a functional AI-powered solution for a real-world application.<br>**Final Deliverables (Presentation & Report)**<br>• GitHub repository with source code, sample datasets/documents, and README.<br>• Functional Agentic AI application with RAG, agents, and workflow orchestration.<br>• 10-minute project presentation demonstrating architecture, workflow, and results.<br>• Final report summarizing problem statement, methodology, tools/frameworks used, implementation, evaluation results, and future enhancements. | **60 Hours** |

| Theory | Tutorial | Practical | Project | Total |
|---|---|---|---|---|
| **Hours:15** | **Hours: 0** | **Hours: 0** | **Hours: 60** | **Hours:75** |

**Learning Resources**

**Reference**


1. Srinivasan Venkataraman and Harrison Chase, Building Agentic AI Systems: A Developer's Guide to LLM Agents, LangChain and LangGraph, O'Reilly Media, 2024.
2. Olivier Blais, Practical GenAI: Building Real-World Generative AI Products with LLMs, RAG, Agents, and Workflows, O'Reilly Media, 2024.
3. Sinan Ozdemir, LLM Engineers' Handbook: Retrieval-Augmented Generation, Prompting, Agents, and Production AI, Packt Publishing, 2024.
4. Elbert Gale, Mastering AI Agents: From Design to Deployment of Autonomous Systems, January 18, 2025. ISBN-13: 979-8307403822.


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5. Natenapis Faraksa, Building AI Agent: A Practical Guide for Building Intelligent Agents, March 2, 2024.
6. Sujai G. Pillai, Build Your Own AI Agent: A Hands-On Guide for Beginners, January 13, 2025. ISBN-13: 979-8306885971.

**Online Resources (Weblinks)**

1. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/professional-certificates/ibm-rag-and-agentic-ai
2. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/specializations/ai-agents-python

| **Assessment (Practical course)** |
|---|
| Project, Project presentation/Report, Lab Assignments, Demo presentations, Quiz/peer review(optional) |

| **Course Curated By** | | |
|---|---|---|
| **Expert(s) from Industry** | **Expert(s) from Higher Education Institutions** | **Internal Expert(s)** |
| - | - | Ms Shriaarthy E<br>AP/Department of Artificial Intelligence and Data Science |

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| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No:30 | **Date** | 19.06.2026 |

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| 24ADC008 | AI AND ML INFRASTRUCTURE ENGINEERING (Common to CS, IT, AI&DS) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 4 | 3 |
| PE | | SDG | 9, 16 | | | |

| Pre-requisite courses | NIL | Data Book / Codes / Standards (If any) | NIL |
|---|---|---|---|

| Course Objectives: | |
|---|---|
| The purpose of taking this course is to: | |
| 1 | Set up basic AI/ML environments in Azure and manage data pipelines and model deployments. |
| 2 | Build and test machine learning and deep learning models using real-world datasets. |
| 3 | Create simple troubleshooting agents by fine-tuning LLMs and adding NLP components. |
| 4 | Apply MLOps practices to automate model training, deployment, and monitoring. |
| 5 | Develop advanced and responsible AI systems using techniques like transfer learning, federated learning, and explainable AI. |

| Course Outcomes | | |
|---|---|---|
| After successful completion of this course, the students shall be able to | | Revised Bloom's Taxonomy Levels (RBT) |
| CO1 | Understand the components and workflows of AI/ML infrastructure including data pipelines, frameworks, and deployment environments. | U |
| CO2 | Implement various machine learning and deep learning algorithms using suitable metrics and architecture. | Ap |
| CO3 | Design intelligent troubleshooting agents using LLM fine-tuning, NLP techniques, and multi-agent systems. | Ap |
| CO4 | Develop AI/ML solutions using Microsoft Azure with automated deployment, monitoring, and troubleshooting capabilities. | Ap |
| CO5 | Analyze advanced ML architectures and apply ethical, explainable, and responsible AI principles in end-to-end system design. | An |

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| | Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1) | | | | | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Course Outcomes (CO) | Engineering Knowledge | Problem Analysis | Design/Development of Solutions | Conduct Investigations of Complex Problems | Engineering Tool Usage | The Engineer and The World | Ethics | Individual and Collaborative Team | Communication | Project Management and Finance | Life-Long Learning | PSO-1 | PSO-2 |
| CO1 | 3 | | | | 3 | | | | | | | 3 | |
| CO2 | | 3 | 2 | | 3 | | | | | | | 3 | 2 |
| CO3 | | 2 | 3 | | 3 | | | 2 | | | | 3 | 3 |
| CO4 | | 2 | 3 | 3 | 3 | | | 2 | | | | 3 | 3 |
| CO5 | | | 2 | | 2 | 2 | 3 | 2 | | | 3 | 2 | 3 |

| Course Content | |
|---|---|
| **AZURE AI/ML INFRASTRUCTURE**<br>Introduction to Microsoft Azure AI Services – Azure Machine Learning Workspace – Compute Resources and Cloud Storage – Dataset Creation and Management – Data Preparation Techniques – AI/ML Workflow Setup – Experiment Tracking – Workflow Automation – Version Control for AI Projects – Security and Access Management – Reproducible AI Workflows. | **3 Hours** |
| **MACHINE LEARNING & DEEP LEARNING**<br>Introduction to Machine Learning – Supervised and Unsupervised Learning – Classification and Clustering – Decision Trees – K-Means Clustering – Deep Learning Fundamentals – Neural Networks – Model Training and Testing – Feature Selection – Cross-Validation – Model Evaluation Metrics – Hyperparameter Tuning – Model Interpretation. | **3 Hours** |
| **INTELLIGENT TROUBLESHOOTING AGENT**<br>Introduction to Intelligent Agents – Domain-Specific Language Models – Fine-Tuning Techniques – LoRA and QLoRA – NLP Techniques – Intent Detection – Sentiment Analysis – Conversational AI – Decision-Making Architectures – Automated Support Systems – Agent Testing and Optimization – AI Agent Deployment. | **3 Hours** |
| **AI/ML OPERATIONS AND AUTOMATION**<br>Introduction to MLOps – Automated ML Pipelines – Data Ingestion Pipelines – Model Deployment Strategies – CI/CD for AI/ML Applications – Authentication and Access Control – Monitoring and Logging – Alerting Systems – Troubleshooting and Diagnostics – Scalable ML Operations – Performance Monitoring and Reporting. | **3 Hours** |
| **ADVANCED AND RESPONSIBLE AI SYSTEMS**<br>Introduction to Advanced AI Techniques – Transfer Learning – Federated Learning – Ensemble Learning – Distributed AI Systems – Privacy-Preserving AI – Differential Privacy – Data Sharding – Explainable AI (XAI) – Bias and Fairness in AI – AI Transparency and Accountability – Responsible AI Evaluation. | **3 Hours** |
| **PROJECT**<br>To design and develop an end-to-end MLOps and Responsible AI solution that integrates cloud-based AI development, machine learning model building, large language model fine-tuning, automated deployment pipelines, and responsible AI practices. The system should support data management, model training and evaluation, workflow automation, deployment, monitoring, explainability, privacy preservation, and continuous improvement using real-world datasets and industry-standard tools. | **60 Hours** |

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| | |
|---|---|
| **Final Deliverables (Presentation & Report)**<br>• GitHub repository with source code, datasets, configuration files, and README<br>• Functional MLOps pipeline with model training, deployment, monitoring, and automation<br>• Fine-tuned AI/LLM-based application demonstrating practical use of ML, DL, or NLP techniques<br>• 10-minute project presentation showcasing architecture, implementation, evaluation, and deployment workflow<br>• Final report summarizing problem statement, methodology, tools and frameworks used, experimental results, responsible AI considerations, and future enhancements. | |

| Theory Hours:15 | Tutorial Hours: 0 | Practical Hours: 0 | Project Hours: 60 | Total Hours:75 |
|---|---|---|---|---|

**Learning Resources**

**Reference**


1. Miroslaw Staron, Machine Learning Infrastructure and Best Practices for Software Engineers, O'Reilly Media, 2023.
2. Scott Burk and Kinshuk Dutta, Data for AI: Data Infrastructure for Machine Intelligence, Technics Publications, 2021.
3. Kaushik Thummarakoti, Vamshi Vududala, and Madapati Kaushik, The AI Cloud Infrastructure Blueprint: Practical Designs and Configurations for Scalable AI, Routledge, 2024.
4. Sriram Parthasarathy, MLOps Engineering at Scale: Building Robust, Reliable, and Reproducible Machine Learning Systems, Packt Publishing, 2023.
5. Mark Treveil and Alok Shukla, Introducing MLOps: How to Scale Machine Learning in the Enterprise, O'Reilly Media, 2020.


**Online Resources (Weblinks)**

1. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/professional-certificates/microsoft-ai-and-ml-engineering

**Assessment (Practical course)**

Project, Project presentation/Report, Lab Assignments, Demo presentations, Quiz/peer review(optional)

**Course Curated By**

| Expert(s) from Industry | Expert(s) from Higher Education Institutions | Internal Expert(s) |
|---|---|---|
| - | - | Ms Shriaarthy E<br>AP/Department of Artificial Intelligence and Data Science |

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|---|---|---|---|
| **Recommended by BoS on** | 06.06.2026 | | |
| **Academic Council Approval** | No:30 | **Date** | 19.06.2026 |

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