KUMARAGURU COLLEGE OF TECHNOLOGY,

An autonomous Institution affiliated to Anna University, Chennai

COIMBATORE – 641 049.

B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATION 2024

I to VIII Semesters (2024 Batch)

Department of Artificial Intelligence and Data Science

VISION

To embark as a school of innovation in the stream of data science for enabling global education, research and entrepreneurship.

MISSION

- Hone students to excel in the traits of data science technology and professionalism
- Empower students to develop solutions for mutated technological problems of the society
- Inculcate industrial and entrepreneurial culture for their professional furtherance

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The graduates of this program shall have:

1. A successful professional career in industry, government, and academia with capabilities to build innovative solutions using technology as a tool to solve real-world problems.
2. Research capabilities in advanced technologies and shall contribute to a new body of knowledge.
3. A learning mindset to continuously improve their knowledge, through on the job, formal and informal learning opportunities.
4. An ethical attitude and shall exhibit effective skills in communication, management, teamwork and leadership.
5. Engineering, problem-solving and critical thinking skills to create social, economical and sustainable impact

PROGRAM OUTCOMES (POs)

Graduates of the Artificial Intelligence and Data Science Undergraduate Program should have the 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

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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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

The Program Specific Outcomes of Artificial Intelligence and Data Science Undergraduate Program are:

PSO 1: Apply the principles of Artificial Intelligence and Data Science, to develop sustainable, data driven decisions for domain-specific applications using standard practices.

PSO 2: Demonstrate the ability to develop innovative solutions and address complex industry challenges utilizing emerging AI trends, tools, and technologies.

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KUMARAGURU COLLEGE OF TECHNOLOGY

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
REGULATION 2024
B.Tech. Artificial Intelligence and Data Science – 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	HS	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**

Semester III

S.No	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C

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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	24ADJ202	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	24MAT244	Random Process and Optimization	Theory	BS	3	0	0	0	3
2	24CSI014	Design and Analysis of Algorithms	Embedded	PC	3	0	2	0	4
3	24CSP012	Java Programming	Practical	PC	0	0	4	0	2
4	24ADI003	Machine Learning	Embedded	PC	3	0	2	0	4
5	24ADI204	Data Science and Visualization	Embedded	PC	2	0	0	2	3
6	24HSP007	Building Professional Readiness	Practical	HS	0	0	2	0	1
7	24INP202	Innovation Practicum - 4	Practical	ES	0	0	2	0	1
8	24ITP013	Aptitude and Reasoning - II	Practical	HS	0	0	2	0	1
9	24INM201	Universal Human Values-II	Theory	HS	1	0	0	0	1
								Total Credits	**20**
								Total Contact Hours/week	**26**

Semester V

S. No	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24ADT005	Computer Systems Architecture and Management	Theory	PC	3	0	0	0	3
2	24CSI013	Full Stack Development	Embedded	PC	3	0	2	0	4
3	24ADI006	Deep Learning	Embedded	PC	3	0	2	0	4
4	24ADI007	Cloud Data Analytics	Embedded	PC	2	0	2	0	3
5	24------	Professional Elective I	Embedded/ Theory	PE	2	0	2	0	3
6	24INM202	Environmental Science and Sustainability	Embedded	HS	1	0	2	0	2
7	24HSP014/ 24HSP015/ 24HSP016/ 24HSP017	Hindi Level 1/ French Level 1/ German Level 1/ Japanese Level 1	Practical	HS	0	0	4	0	2

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								Total Credits	**21**
								Total Contact Hours/week	**30**
Semester VI									
S.No	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24CSI011	Computer Networks and Security	Embedded	PC	3	0	2	0	4
2	24ADI008	Data Engineering	Embedded	PC	2	0	2	0	3
3	24ADI009	Computer Vision	Embedded	PC	2	0	0	2	3
4	24ADI010	Natural Language Processing	Embedded	PC	3	0	2	0	4
5	24CSI015	Software Engineering and Agile Practices	Embedded	PC	3	0	0	2	4
6	24------	Professional Elective II	Embedded/ Theory	PE	3	0	0	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 III	Embedded/ Theory	PE	2	0	2	0	3
2	24------	Professional Elective IV	Embedded/ Theory	PE	2	0	2	0	3
3	24------	Professional Elective V	Embedded/ Theory	PE	2	0	2	0	3
4	24------	Professional Elective VI	Embedded/ Theory	PE	2	0	2	0	3
5	24------	OE3	Theory	OE	3	0	0	0	3
6	24INM102	Indian Knowledge System in Science and Engineering	Theory	HS	1	0	0	0	1
7	24ADJ411	Project Phase-I	Project	PRJ	0	0	0	6	3
8	24ADJ412	Technical Internship/Certification	Project	PRJ	0	0	0	0	2
								Total Credits	**21**
								Total Contact Hours/week	**26**
Semester VIII									
S.No	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24ADJ413	Project Phase-II	Project	PRJ	0	0	0	24	12
								Total Credits	**12**
								Total Contact Hours/week	**24**
								Grand Total Credits	**163**

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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 design	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 Solution Architecture	Embedded	PE	1	0	0	4	3
37	24ITC008	Secure Computing and Networking	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 & ML Infrastructure Engineering	Embedded	PE	1	0	0	4	3

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SEMESTER I

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	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	3		3		
2							2	2	3		3		
3							2	2	3		3		

Course Content

Text Analysis 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**
Visual & Written Analysis Process writing (Drafting effective introduction, process and conclusion using appropriate	

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transition words and phrases) - Describing Visuals (Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram) - Note Making & Summarizing	**6 Hours**
Professional Correspondence 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 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 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 , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore		Dr. Arokia Lawrence Vijay Dr. Sreejana Dr. Tissaa Department of English
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 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**
Navigating Digital Media 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**

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Technical Writing Techniques Writing Reflective Essays / Experience Sharing, Process writing, Transcoding graphics (interpreting technical texts), Writing Reviews (Research Articles & Books).	**6 Hours**
Building a Professional Digital Presence 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 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 , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben,CIT, Coimbatore	Dr. Arokia Lawrence Vijay Dr. Hema Department of English

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

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

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

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 Research and Initial Project Planning Technical Writing and Documentation Creative Writing Drafting and Editing Techniques Teamwork and Peer Collaboration Public Speaking and Presentation Skills	**60 Hours**

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Challenges to Opportunities Cross-Cultural Communication and Global Ethics Intellectual Property and Copyrighting Publication – English for research Writing 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, Project Manager, Toppan Merrill, Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore	Dr. Arokia Lawrence Vijay Dr. SG Mohanraj

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

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)
	1	2	3	4	5	6	7	8	9	10	11	

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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 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. **Practical Component** Matrix operations like addition, subtraction, multiplication, inverse, rank and transpose, eigenvalues and eigenvectors of a given matrix and verify the diagonalization of the matrix. Cayley-Hamilton theorem to find the characteristic equation of a matrix and verify that the matrix satisfies its own characteristic equation.	**9 Hours** **6 Hours**
VECTOR SPACES 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) **Practical Component** Linearly independent and dependent vectors and Singular Value Decomposition. Curve Tracing, 3D and Surface plotting.	**9 Hours** **6 Hours**
APPLICATIONS OF CALCULUS Differentiation: Mean Value Theorem-Maxima and Minima – Integration: Arc Length, Area between two curves, Area of a Surface of Revolution, Volume of solids **Practical Component** First and second derivatives of a given function, area between two curves and the volume of a solid of revolution Optimization problems in single variables.	**9 Hours** **6 Hours**
FUNCTIONS OF SEVERAL VARIABLES 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 **Practical Component** Computing partial derivatives of multivariable functions	**9 Hours** **6 Hours**

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Optimization problems in multiple variables	
ORDINARY DIFFERENTIAL EQUATIONS Solutions of first order linear ODE: Leibnitz equation and Bernoulli's equation – Linear, homogeneous differential equations of second and higher order with constant coefficients.	**9 Hours**
Practical Component Solution of first order ordinary differential equations. Solution of second and higher order ordinary differential equations	**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-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., STEPS Knowledge Services Private Limited, Coimbatore. Mr.Jayakumar Venkatesan, Valles Marineris International Private Limited- Chennai. Mr. Imran Khan, GE Transportation Company, Bangalore	Dr.T.Govindan, Government College of Engineering, Srirangam, Trichy. Dr.C.Porkodi, PSG College of Technology, Coimbatore. Dr.P.Paramanathan, Amrita Vishwa Vidyapeetham, Coimbatore.	Dr. D. Arivuoli Dr. J. Dhivya Dr. Vijeta Iyer, Department of Mathematics
Recommended by BoS on	16.08.2024	
Academic Council Approval	No: 27	**Date** 24.08.2024

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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

	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											

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Course Content	
Applied optics 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** • 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	**9 Hours** **6 Hours**
Quantum physics 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** • Determination of band gap of a semiconductor • Determination of efficiency of solar cell • Determination of Planck's constant – Electroluminescence method	**9 Hours** **6 Hours**
Thermal Physics 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 & Charlton's disc method - Thermal Insulation – classification and properties – heat exchangers - applications – Thermal Physics in Virtual Reality and Haptics. **Practical Component** Lee's Disc method: Determination of thermal conductivity of a bad conductor	**9 Hours** **6 Hours**
Mechanics 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. **Practical Component** • Compound pendulum – Determination of acceleration due to gravity • Non-uniform bending – Determination of Young's modulus	**9 Hours** **6 Hours**
Acoustics 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	**9 Hours**

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affecting the acoustics of the buildings and their remedies. **Practical Component** Melde's string – Determination of frequency of a tuning fork	**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/

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)**
			Capt A.R.Arul Dr. S.Nithya Department of Physics
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

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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	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	3	2	1									3	
3		1										2	
4	3	2	1									3	

Course Content

FUNDAMENTALS OF COMPUTERS AND COMPUTING 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	**6 Hours**

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(process 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). **Practical Component** Exploring hardware and software components	 **4 Hours**
LOGICAL THINKING, REASONING AND TOOLS 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. **Practical Component** Algorithm writing and Flowcharts,	 **8 Hours** **4 Hours**
PROGRAMMING PARADIGMS AND INTRODUCTION TO C PROGRAMMING **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. **Practical Component** Programs on Operator precedence, Decision Making, Iterations	 **11 Hours** **10 Hours**
ARRAYS AND STRUCTURES **Collections**: Arrays – 2D Arrays – String Manipulation. **Structures and Unions**: Definition - declaration - accessing members - differences between structures and unions - applications. **Practical Component** Programs on Arrays, Structures, Union,	 **10 Hours** **6 Hours**
POINTERS AND FUNCTIONS **Pointers**: Definition - declaration - pointer arithmetic - pointers and arrays. **Functions**: Definition - declaration - types of functions (user-defined, library functions) - parameter passing (by value, by reference) pointers and functions, recursion. **Practical Component** Pointers and Functions. Additional programs on Files to be discussed.	 **10 Hours** **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 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.	**7 Hours**
Practical Component Study of logic gates 1. Implement Boolean functions using logic gates and validate the outputs with truth tables	**4 Hours**

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COMBINATIONAL LOGIC CIRCUITS 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.	**8 Hours**
Practical Component 1. Design and construct half adders, full adders, half subtractors, and full subtractors. 2. Create combinational circuits to solve real-world problems. 3. Develop a code converter circuit using logic gates. 4. Design and implement decoder and encoder circuits. **5.** Construct multiplexers and demultiplexers and incorporate them into circuit designs.	**14 Hours**
SEQUENTIAL LOGIC CIRCUITS 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).	**8 Hours**
Practical Component 1. Implement and test various types of shift registers. 2. Design and build a synchronous and asynchronous counter.	**8 Hours**
LOGIC FAMILIES AND PROGRAMMABLE DEVICES 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.	**7 Hours**
Practical Component 1. Study of VHDL models for combinatorial circuits.	**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

Course Curated by

Signature of the BOS Chairman, AI&DS

<table>
<tr><th>Expert(s) from Industry</th><th colspan="2">Expert(s) from Higher Education Institution</th><th colspan="2">Internal Expert(s)</th></tr>
<tr><td></td><td colspan="2"></td><td colspan="2">Ms. C. Bharathipriya, AP-II
Ms. P. Anitha, AP-I
Department of Computer Science and Engineering</td></tr>
<tr><td>Recommended by BoS on</td><td colspan="4">16.08.2024</td></tr>
<tr><td>Academic Council Approval</td><td>No: 27</td><td colspan="2">Date</td><td>24.08.2024</td></tr>
</table>

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24HST101	தமிழர மரப / 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. 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. 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. 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. Enhance the fundamental knowledge of Tamil language and literature	U
CO2	பழங்கால பாறை ஓவியங்கள், சிற்பம் என கலைகள் நவீன காலம்வரை எவ்வாறு பயணிக்கிறது என்பதை புரிந்துகொள்ளுதல். 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. 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

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)										**Program Specific Outcomes (PSO)**
	1	2	3	4	5	6	7	8	9	10	11	

Signature of the BOS Chairman, AI&DS

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 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. **LANGUAGE AND LITERATURE** 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 - பாற ை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வற ர - சிற்பக்கற ை 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. **HERITAGE – ROCK ART PAINTINGS TO MODERN ART SCULPTURES** 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 கற கைள் மற்றும் வீர விற யைாட்டுகள் தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள். **FOLK AND MARTIAL ARTS** Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Ciabatta, Valari, Tiger dance - Sports and Games of Tami	**3 Hours**
தமிழர்களின் திற ை க்க ாட்பாடுகள்	

Signature of the BOS Chairman, AI&DS

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. **THINAI CONCEPTS OF TAMIL** 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 கதசிய இயக்கம் மற்றும் இந்திய பணபாடடறகத் தமிழர்களின் பங்களிப்பு இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு. **CONTRIBUTIONS OF TAMIL TO INDIAN NATIONAL MOMENT AND INDIAN CULTURE** 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)

Online Educational Resources:

1. https://www.youtube.com/watch?v=IKPwEmsmuZc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e
2. https://www.youtube.com/watch?v=j6_ddjn_gLc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e&index=2

Signature of the BOS Chairman, AI&DS

3. https://docs.google.com/presentation/d/1pf0jbyuDTNdvlcKMnOfoPjbqha7JqdOc/edit#slide=id.p1
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 , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore	Suriya Prakash Department of Language	
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

Signature of the BOS Chairman, AI&DS

24INP102	INNOVATION PRACTICUM – 1 (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 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 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 How to build a basic custom hardware - Electronics fundamentals and components - Software for hardware control - Fabrication techniques.	**6 Hours**
System Thinking and Engineering 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 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 Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total 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 Director - Innovation Practicum Associate VP - Forge. Innovation	-	Dr. Samuel Ratna Kumar P S Assistant Professor – III Department Mechanical Engineering

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

Signature of the BOS Chairman, AI&DS

24HSP111	HOLISTIC WELLNESS-1 (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: • Overview of holistic wellness: physical, mental, emotional, and internal health. • The importance of balance in overall well-being. • Hands-on activity: Self-assessment of current wellness status.	**4 Hour**
PHYSICAL WELLNESS: • Importance of physical activity and exercise. • Understanding nutrition and its role in health. • Sleep hygiene and its impact on well-being. • Hands-on activity: Designing a personalized fitness and nutrition plan.	**14 Hours**
MENTAL AND EMOTIONAL WELLNESS:	**6 Hours**

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• Stress management techniques. • The role of Yoga, mindfulness and meditation in mental health. • Emotional intelligence and its impact on relationships. • Hands-on activity: Practicing Yoga, mindfulness and emotional regulation exercises.	
INTERNAL WELLNESS: • Exploring the concept of Internal wellness. • The role of purpose and meaning in life. • Introduction to meditation and reflective practices. • Hands-on activity: Developing a personal reflection, Yoga and meditation routine.	**4 Hours**
INTEGRATING WELLNESS PRACTICES: • Combining physical, mental, emotional, and Internal wellness practices into daily life. • Developing a balanced wellness plan. • 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)

Signature of the BOS Chairman, AI&DS

		Dr. Ezhilarasi Principal- KCT	
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

Signature of the BOS Chairman, AI&DS

24CSV001	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 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	**3 Hours**

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accessible to all - apps for social teaching - Direction for learning to attain learning outcomes - Connecting learning with opportunities	
AGRICULTURE (CROPS, DAIRY, POULTRY) 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 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 **AI in Music:** Composition and Production - Sound Design and Mixing - Music Recommendation - Personalized Learning - Rights Management and Copyright **AI in Law:** Legal Research - Contract Analysis and Drafting - Predictive Analytics - Document Automation - Compliance Monitoring **AI in Textiles:** Design and Trend Prediction - Quality Control - Supply Chain Optimization - Personalization and Customization - Sustainability	**6 Hours**
GAMING 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 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 2. What future for education? | Coursera 3. Sustainable Agricultural Land Management | Coursera 4. IoT Enabled Farming | Coursera 5. Introduction to Healthcare | Coursera 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, Mr. V. Senthilkumar, Dr. N. Jeba, Department of Computer Science and Engineering Ms. G. Shobana, Department of IT, Ms. P. R. Rupashini, Ms. G. Preethi, Department of AI&DS

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

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SEMESTER II

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 work	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	
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 Social Interactions: - (Ordering food at a restaurant- Making a reservation at a hotel--Shopping at a store-- Attending a party or social gathering) Travel and Tourism:(Asking for directions- Booking a flight or hotel-- Exploring a new city- Interacting with local people) 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 Education and Personal Growth:(Setting goals- (Short term & Long term)- Creating a study plan- Participating in a workshop- Reflecting on personal growth) Technology and Online Interactions:(Participating in an online meeting- Creating a social media post- Writing an email or text message- Making an online purchase) 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 Critical Thinking :(Evaluating a news article-solving a moral dilemma-Decision with incomplete information-Assessing a historical event) Problem-Solving:(Resolving a conflict- Negotiating a deal - Making a complaint-Apologizing for a mistake) 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 Cultural Exchange:(Sharing customs and traditions- Discussing cultural differences-Exploring historical events- Participating in a cultural festival) Media and Entertainment:(Event planning- Creating an advertisement-Digital Marketing-Conducting interviews- Creating news broadcast- Writing and Performing a script- Enacting one act plays) 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 Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore	Dr. Arokia Lawrence Vijay Dr. Tissaa Tony Department of English	
Recommended by BoS on	16.08.2024		
Academic Council Approval	No:27	**Date**	24.08.2024

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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								

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4		2		2	2					2			
5	2			2	2								
6	2			2	2								

Course Content	
MULTIPLE INTEGRALS Double integration – Cartesian coordinates – Change of order of integration – Triple integration in Cartesian coordinates –Area as double integral and Volume as triple integral. **Practical Component** • Double and triple integration with constant and variable limits. • Area as double integral and volume as triple integral.	**9 Hours** **6 Hours**
VECTOR CALCULUS 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) **Practical Component** • Evaluation of gradient, divergence, and curl • Verification of Green's theorem in the plane	**9 Hours** **6 Hours**
CURVE FITTING AND FORECASTING 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). **Practical Component** • Fitting polynomials curve by Least Square method. • Fitting non-linear curves by Least Square method.	**9 Hours** **6 Hours**
TIME SERIES 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. **Practical Component** • Time series construction and Measurement of Trend by Moving Averages. • Simple Average, Ratio to Trend Method and Ratio to Moving Average Method to determine seasonal variations in a time series dataset	**9 Hours** **6 Hours**
NUMERICAL DIFFERENTIATION AND INTEGRATION 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 **Practical Component** • Numerical Differentiation - Newton's divided differences. • Numerical Integration using Trapezoidal and Simpson's rule.	**9 Hours** **6 Hours**

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

Learning Resources

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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., STEPS Knowledge Services Private Limited, Coimbatore. Mr. Jayakumar Venkatesan, Valles Marineris International Private Limited- Chennai. Mr. Imran Khan, GE Transportation Company, Bangalore	Dr.T. Govindan, Government College of Engineering, Srirangam, Trichy. Dr.C. Porkodi, PSG College of Technology, Coimbatore. Dr.P. Paramanathan, Amrita Vishwa Vidyapeetham, Coimbatore.		Dr. Vijeta Iyer Dr.K.P. Thilagavathy Ms. Princy Flora Department of Mathematics
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

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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 work	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	

Course Content

Concepts of 2D Graphics and Digital Imaging 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 Vector Graphics Basics & Design Principles and Techniques: Vector vs. Raster:	

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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. **Practical Component** 1. Creating a Pixel Art Character 2. Design a Vector Logo 3. Apply Image Manipulation Techniques	**8 Hours** **8 Hours**
Exploring 3D Graphics: Key Applications and Workflow 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. **Practical Component** 1. Create a Custom Texture for a 3D Object	**6 Hours** **4 Hours**
3D Object Manipulation and Transformation Techniques 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. **Practical Component** 1. Model a Simple Object Using Primitives 2. Extrude and Shape a Simple 3D Model	**6 Hours** **8 Hours**
Advanced 3D Modeling, Sculpting, and Texturing Methods 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. **Practical Component** 1. Apply Materials to a 3D Object 2. Sculpt a Simple Organic Shape 3. Model a Low-Poly Character. 4. Create a UV Map for a 3D Object. 5. Design and Apply a Texture to a 3D Object	**6 Hours** **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
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)
Lab Workbook, Experimental Cycle tests, viva-voce

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<table>
<tr><th colspan="4">Course Curated by</th></tr>
<tr><th>Expert(s) from Industry</th><th colspan="2">Expert(s) from Higher Education Institution</th><th>Internal Expert(s)</th></tr>
<tr><td>Ramesh Kumar K
Sr.Technical Consultant -Xr Ark Solutions</td><td colspan="2">-</td><td>Dr.K.Saranya
Department of Computer Science Engineering</td></tr>
<tr><td>Recommended by BoS on</td><td colspan="3">16.08.2024</td></tr>
<tr><td>Academic Council Approval</td><td>No:27</td><td>Date</td><td>24.08.2024</td></tr>
</table>

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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	NIL	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	

Course Content

INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS 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 **Practical Component**	**6 Hours**

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Implementation of List ADT using arrays	**4 Hours**
LINEAR DATA STRUCTURES 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). **Practical Component** Implement the applications of Linear Data structures	**12 Hours** **8 Hours**
NON-LINEAR DATA STRUCTURES 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). **Practical Component** Implement the applications of Non-Linear Data structures	**12 Hours** **8 Hours**
SORTING AND SEARCHING ALGORITHMS 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. **Practical Component** Implement the Sorting and searching Algorithms	**12 Hours** **8 Hours**
HASHING TECHNIQUES Hashing: Hash Functions, Collision Resolution Techniques, Linear probing, Quadratic probing, random probing, Double hashing and rehashing, Hashing Applications. Memory Management: Garbage Collection **Practical Component** Implementation of Hash Table	**3 Hours** **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).

Online Resources (Weblinks)

1. https://open.umn.edu/opentextbooks/textbooks/an-open-guide-to-data-structures-and-algorithms
2. https://www.oreilly.com/library/view/data-structures-and/9780133437483/
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/data-structures/

Signature of the BOS Chairman, AI&DS

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)**
			Dr. S. Kavitha, Department of Information Technology
Recommended by BoS on	16.08.2024		
Academic Council Approval	No:27	**Date**	24.08.2024

Signature of the BOS Chairman, AI&DS

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

	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	9 Hours
Overview of Embedded Systems: Characteristics, system architecture, and design	

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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 **Practical Component** 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. 2. Control an I/O connected to a microcontroller	**6 Hours**
MICROCONTROLLER ARCHITECTURE 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 1. Interfacing sensor with a microcontroller and display the sensor readings on an LCD. 2. Combine data from an accelerometer and gyroscope to estimate the orientation of a device. 3. Use interrupts to toggle an LED based on a button press.	**8 Hours**
EMBEDDED PROGRAMMING 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 Develop and optimize firmware for a simple embedded application.	**8 Hours**
SENSOR INTEGRATION 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 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.)	**8 Hours**

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)

Signature of the BOS Chairman, AI&DS

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 Department of IT

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

Signature of the BOS Chairman, AI&DS

24HST102	தமிழர ம ததாழிலந டபம ம/ 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. 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. 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. 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. 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. 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. know agriculture and irrigation technology. Understanding Scientific Tamil and Computer Tamil.	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

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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	
தநசவ மறற ம பாற தை ததாழிலந டபம: சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள். Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW)-Graffiti on Potteries.	**3 Hours**
வடவற மபப மறற ம டடடத ததாழிலந டபம: 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. 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**
உறபததித ததாழில ந டபம: 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. 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**
கவணாணற ம மறற ம நர்பபாசதை ததாழில ந டபம: அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம்- கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள்- வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு -	

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மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம். 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**
அஙிவியல தமிழ மறற ம ிைததமிழ: அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள்- சொற்குவைத் திட்டம். 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

Assessment (Theory course)

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

Course Curated by

Signature of the BOS Chairman, AI&DS

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 the BOS Chairman, AI&DS

24INP103	INNOVATION PRACTICUM – 2 (Common to All branches)	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	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 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 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**

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SOFTWARE PROTOTYPING AND TOOLS 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 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 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 Director - Innovation Practicum Associate VP - Forge. Innovation	-	Dr. Samuel Ratna Kumar P S Assistant Professor – III Department Mechanical Engineering	
Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

Signature of the BOS Chairman, AI&DS

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

Pre-requisite courses	24HSP111 / Holistic Wellness-1	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: • Deepening mindfulness practices for enhanced mental clarity. • Exploring different forms of meditation (e.g., guided, transcendental, movement-based). • Hands-on activity: Daily meditation practice and journaling reflections.	6 Hours
EMOTIONAL RESILIENCE AND MENTAL HEALTH: • Building emotional resilience through positive psychology practices. • Cognitive-behavioural strategies for managing stress and anxiety. • Hands-on activity: Developing and practicing a resilience toolkit.	6 Hours

SOCIAL AND ENVIRONMENTAL WELLNESS:	6 Hours

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• The impact of social connections and community on wellness. • Creating a supportive environment for personal growth. • Hands-on activity: Building a community wellness project or group activity.	
INTERNAL GROWTH AND PURPOSE: • Exploring the deeper aspects of internal wellness and self-actualization. • Reflective practices for discovering life purpose and meaning. • Hands-on activity: Creating a vision board or personal mission statement.	**6 Hours**
SUSTAINING WELLNESS PRACTICES: • Strategies for maintaining wellness habits over the long term. • Adapting wellness plans to life changes and challenges. • 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.

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<table>
<tr><th colspan="4">Course Curated by</th></tr>
<tr><th>Expert(s) from Industry</th><th colspan="2">Expert(s) from Higher Education Institution</th><th>Internal Expert(s)</th></tr>
<tr><td></td><td colspan="2"></td><td>Dr. Ezhilarasi
Principal- KCT</td></tr>
<tr><td>Recommended by BoS on</td><td colspan="3"></td></tr>
<tr><td>Academic Council Approval</td><td>No: 27</td><td>Date</td><td>24.08.2024</td></tr>
</table>

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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 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	

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Techniques for understanding user needs, including observation, interviews, **surveys** and **focus groups**-Importance of secondary research as a complement for the above-mentioned methods-Introduction to empathy cycles: involve students in two empathy cycles before and after problem definition-Finetuning problem definition based on user insights.	**6 Hours**
Ideation and Concept Modelling 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 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 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 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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<table>
<tr><th colspan="4">Course Curated by</th></tr>
<tr><th>Expert(s) from Industry</th><th colspan="2">Expert(s) from Higher Education Institutions</th><th>Internal Expert(s)</th></tr>
<tr><td></td><td colspan="2"></td><td>Dr. Padhmanand Sudhagar R
Department of Bio-Tech
Dr. Arul H
Department of Physics</td></tr>
<tr><td>Recommended by BoS on</td><td colspan="3">16.08.2024</td></tr>
<tr><td>Academic Council Approval</td><td>No: 27</td><td>Date</td><td>24.08.2024</td></tr>
</table>

Signature of the BOS Chairman, AI&DS

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 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 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 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 -	**3 Hours**

UAV Technologies: Urban Air Mobility (UAM), Vertically Integrated Drones, Drone Swarms - Counter-Drone Technology- Energy Efficiency and Sustainability - Trends – Opportunities – Skills.	
CLOUD AND EDGE COMPUTING 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 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 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 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 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 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.

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10. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education; Seventh edition, 2017.
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)**
CO1	Explain the basic principles of OOP and structure of C++ programs.	U
CO2	Illustrate the use of classes, objects, and access control in program design.	U
CO3	Apply constructors, destructors, and various inheritance types in solving real-world problems.	Ap
CO4	Demonstrate function overloading, operator overloading, and polymorphism using pointers.	Ap
CO5	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 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	2			3								3	
3		2		3								3	
4	2			3								3	
5			3	3								3	

Course Content

PRINCIPLES OF OOP AND INTRODUCTION TO C++ 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**

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Practical Component Simple C++ programs to demonstrate control flow, arithmetic operations, and console I/O	**6 Hours**
CLASSES AND OBJECTS 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 **Practical Component** Programs on class and object creation, object arrays, and member access	**9 Hours** **6 Hours**
CONSTRUCTORS AND INHERITANCE Constructors- Default, Parameterized, Copy Constructor , Destructors -Inline Functions, Default Arguments- Inheritance: Types -Single, Multilevel, Multiple, Hierarchical- Friend Functions- Abstract Classes **Practical Component** Demonstrate all types of inheritance along with constructors using C++	**9 Hours** **6 Hours**
POLYMORPHISM AND POINTERS Function Overloading-Operator Overloading- Unary, Binary-Rules for Overloading-constructor overloading- Pointers to Objects, this Pointer-Virtual Functions, Runtime Polymorphism **Practical Component** Programs to demonstrate compile time and runtime polymorphism along with pointers	**9 Hours** **6 Hours**
EXCEPTION HANDLING ,FILES AND GENERIC PROGRAMMING 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. **Practical Component** 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** **6 Hours**

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

Learning Resources

Textbooks

1. E. Balagurusamy, Object Oriented Programming with C++, 8th Edition, McGraw Hill Education, 2021.
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.
2. Herbert Schildt, *C++: The Complete Reference*, 4th Edition, McGraw-Hill Education, 2008.
3. Joyce Farrell, *Object-Oriented Programming Using C++*, 4th Edition, Cengage Learning, 2008.

Online Resources

1. https://www.programiz.com/cpp-programming
2. https://www.geeksforgeeks.org/c-plus-plus/
3. https://cplusplus.com/doc/tutorial/
4. https://www.tutorialspoint.com/cplusplus/

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

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Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert
-	-	Ms. R. Nivetha Department of Computer Science and Engineering

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

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24CSI009	DATABASE MANAGEMENT SYSTEMS (Common to AD, CS, IT)	L	T	P	J	C
PC		3	0	2	0	4
		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)
CO1	Apply relational database concepts to define structures and manage data effectively.	Ap
CO2	Design and normalize relational database schemas using Entity-Relationship modelling and normalization techniques to ensure data integrity.	Ap
CO3	Implement relational operations and join strategies using relational algebra and SQL to retrieve and combine data efficiently.	Ap
CO4	Analyze transaction processing concepts, concurrency issues, and recovery techniques to ensure the consistency and correctness of database systems.	An
CO5	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 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. **Practical Component** 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** **6 Hours**
RELATIONAL MODELLING AND DATABASE DESIGN 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. **Practical Component** 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** **6 Hours**
PHYSICAL DATABASE DESIGN AND QUERY PROCESSING 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. **Practical Component** Simulation of relational Algebra operations – Performing joins using Relational Algebra – Implementation of various SQL joins.	**9 Hours** **6 Hours**
TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL 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. **Practical Component** Implement multiple transactions using SQL involving BEGIN, COMMIT & ROLLBACK – Write SQL Queries for Nested Transactions.	**9 Hours** **6 Hours**
NOSQL DATABASE MANAGEMENT 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 **Practical Component:** Creation of Database and Performing CRUD operations in NoSQL – Querying with NoSQL databases.	**9 Hours** **6 Hours**

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

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 the BOS Chairman, AI&DS

24ADI001	ARTIFICIAL INTELLIGENCE AND AUTOMATION (Common to AD, CS, IT)	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 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 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.	**9 Hours**
Practical Component	**6 Hours**

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Intelligent Agent Simulation - Propositional Logic and Knowledge-Based Agent - First Order Logic and Inference (Chaining and Resolution)	
PROBLEM SOLVING 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. **Practical Component** 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** **6 Hours**
REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 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. **Practical Component** Build and evaluate a Bayesian Network for a real-world problem - Implement Hidden Markov Models (HMM) for sequence prediction tasks	**9 Hours** **6 Hours**
DECISION-MAKING 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. **Practical Component** Implement a simple MDP for decision-making in a dynamic environment - Develop a game-theoretic model for AI-based strategic decision-making	**9 Hours** **6 Hours**
ARTIFICIAL INTELLIGENCE FOR AUTOMATION 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. Introduction to Robotic Process Automation- Benefits of RPA, Components of RPA-RPA Platforms-About Ui Path. **Practical Component** 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** **6 Hours**

Theory Hours:45	Tutorial Hours:0	Practical Hours: 30	Project Hours:0	Total 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). 2. Alok Mani Tripathi, “Learning Robotic Process Automation: Create Software

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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 2. https://www.coursera.org/specializations/roboticprocessautomation

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 Chandrakala D Professor/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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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

Course Content

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MANAGERIAL ECONOMICS & DEMAND ESTIMATION 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 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 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 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 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 (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 Assistant Professor & Program Head/MBA IEV

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

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24ITP012	APTITUDE AND REASONING -I (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)
CO1	Apply fundamental arithmetic concepts to solve real-life and exam-based problems.	Ap
CO2	Solve time-based problems with logical approaches.	Ap
CO3	Demonstrate the ability to simplify and solve number system-related problems.	Ap
CO4	Use deductive reasoning in topics like direction sense, blood relations, and coding-decoding problems.	An
CO5	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	

Course Content

RATIO AND PROPORTION, NUMBER SYSTEM	3 Hours

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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	
AVERAGES AND PERCENTAGES, PROFIT AND LOSS 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	**3 Hours**
TIME AND WORK, PIPES AND CISTERNS 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	**3 Hours**
BLOOD RELATIONS, CODING AND DECODING 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	**3 Hours**
SEATING ARRANGEMENTS, DIRECTION SENSE Linear Arrangements, Circular, Square and Rectangular (Facing centre and Facing Outward) Arrangements, Complex Arrangements, Cardinal directions, Angle and distance calculation, Shadow-based reasoning	**3 Hours**

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

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 CAT, 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, CEO and Founder – Masters Academy	-	Dr. D. Sudharson, 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 IV

24MAT244	RANDOM PROCESS AND OPTIMIZATION (AD)	L	T	P	J	C
		3	0	0	0	3
BS		SDG	7,9			

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

Course Objectives:

The purpose of taking this course is to:

1	understand and classify random processes including stationary, ergodic, Markov and Poisson for engineering system analysis.
2	study the correlation of random processes and understand the properties of spectral densities.
3	apply queueing theory to analyse single and multi-server systems using Markov models and performance measures using little's formula.
4	formulate real-world optimization problems as linear programming models and solve them effectively using graphical, simplex and Big-M methods for optimal decision making.
5	solve optimization problems with and without constraints using Lagrange multipliers and Kuhn-tucker conditions.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	classify and model random processes such as stationary, ergodic, Markov, and Poisson in engineering contexts.	Ap
CO 2	analyse correlation functions and spectral densities to interpret system behavior in time and frequency domains.	An
CO 3	analyse queuing systems using Markovian models and performance metrics using Little's formula.	An
CO 4	formulate and solve linear programming problems using graphical, simplex, and Big-M methods.	Ap
CO 5	analyse and determine the extreme values of functions under unconstrained, equality constrained and inequality constrained conditions.	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	PSO-3
1	2	2	2											
2	3	3		2										
3	2	2												
4	3	2												
5	2	2												

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Course Content	
RANDOM PROCESSES Classification of Random Processes – Stationary Process – Wide sense stationary and Ergodic processes— Markov process – Markov chain (Discrete) – Poisson process.	**9 Hours**
CORRELATION AND SPECTRAL DENSITIES Auto correlation and its properties - Cross correlation and its properties – Wiener-Khinchine relation - Power spectral density – Cross spectral density and its properties.	**9 Hours**
QUEUEING MODELS Markovian Queues – Single server and multi-server models: finite and infinite capacity – Little's formula.	**9 Hours**
LINEAR PROGRAMMING Introduction to Operations Research – Formulation of Linear Programming Problem – graphical solution – Simplex algorithm – Artificial variables technique: Big-M method.	**9 Hours**
CLASSICAL OPTIMIZATION THEORY Unconstrained extremal problems – Equality constraints – Lagrange's method – Inequality constraints - Kuhn -Tucker conditions.	**9 Hours**

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

Learning Resources

Textbooks

6. Taha H.A., "Operations Research: An Introduction", 10th Edition, Pearson Education, 2017.
7. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill, 4th Edition, New Delhi, 2017.
8. J.K. Sharma, "Operations Research: Theory and Applications", 6th Edition, New Delhi: Macmillan Publishers India Pvt. Ltd., 2017.

Reference books

6. Cooper. G.R., Mc Gillem. C.D., "Probabilistic Methods of Signal and System Analysis", 3rd Indian Edition, Oxford University Press, New Delhi, 2012.
7. Miller S.L. and Childers D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", 2nd Edition, Academic Press, 2012.
8. Stark H, and Woods J.W., "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education, Asia, 2002.
9. Wagner H.M., "Operations Research", Prentice Hall of India, 2011.
10. Bhaskar S., "Operations Research", Anuradha Agencies, 2nd Edition, 2014.
11. Singiresu S Rao., "Engineering Optimization Theory and Practice", 5th Edition, John Wiley & Sons, Inc. 2020.

Online Resources (Web Links)

6. **Random Process**
   https://www.coursera.org/learn/random-processes
7. **Correlation and Spectral Densities (MIT open courseware)**
   Signals, Systems and Inference, Chapter 10: Power Spectral Density (mit.edu)
8. **Queueing Models**
   Lecture 5/6 Queueing.ppt (mit.edu)
9. **Linear Programming**
   https://nptel.ac.in/courses/111102012

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10. **Optimization Theory**
    [Operations Research (1): Models and Applications | Coursera]

Assessment
SA I, SA II, Activity and Learning Task(s), Written Assignment on Problem based learning, MCQ, End Semester Examination (ESE).

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
1. Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore.	1. Dr. M. Sivakumar Assistant Professor Sr. Grade Vellore Institute of Technology, Vellore 2. Dr. Ramesh Babu Assistant Professor (SG) Amrita University Coimbatore, Tamil Nadu.	Dr.D.Arivuoli Assistant Professor III Department of Mathematics, KCT Dr.Vijeta Iyer Assistant Professor III Department of Mathematics, KCT

Recommended by BoS on	28.11.2025		
Academic Council Approval	No:	**Date**	

Signature of the BOS Chairman, AI&DS

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	

Course Content

FOUNDATIONS OF ALGORITHM ANALYSIS	7 Hours
Fundamentals of algorithmic problem solving – Important problem types – Analysis	

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framework – Asymptotic notations and basic efficiency classes – Mathematical Analysis: Recursive algorithms, non-recursive algorithms - Brute Force String matching. **Practical Component** Implement and compare recursive vs. iterative algorithms - Analyze different algorithmic performance – Brute Force String matching.	 **4 Hours**
DIVIDE AND CONQUER Divide and conquer: Solving recurrences: Substitution method, recursion-tree method, master method. The maximum-subarray problem - Multiplication of large integers – Strassen's matrix multiplication. **Practical Component** Implement and analyze the maximum subarray problem using divide and conquer – Implement Strassen's matrix multiplication algorithm.	**10 Hours** **6 Hours**
GREEDY STRATEGY AND DYNAMIC PROGRAMMING 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. **Practical Component** 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** **8 Hours**
BACKTRACKING, BRANCH AND BOUND 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. **Practical Component** 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** **8 Hours**
COMPUTATIONAL COMPLEXITY AND APPROXIMATION ALGORITHMS 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. **Practical Component** Implement the Vertex-Cover Problem using a Greedy Approximation Algorithm.	**7 Hours** **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). 3. Horowitz, Ellis., Sahni, Sartaj., Fundamentals of Computer Algorithms, Galgotia Publications, New Delhi (2008).
Reference books/ Web Links

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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 the BOS Chairman, AI&DS

24CSP012	JAVA PROGRAMMING (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			

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4	3	3	2						1	2		2	
5	2	2	3										

Course Content	
JAVA PROGRAMMING BASICS OOP Basics – Java Features -Java Programming Concepts, Control statement, Arrays, Method Overloading, Abstract Classes, Inheritance, Method Overriding	**12 Hours**
PACKAGES, INTERFACES AND EXCEPTION HANDLING 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 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 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, Queue – Stack and Map – Generic Collections – Introduction to Lambda Expressions.	**12 Hours**
EVENT HANDLING AND DATABASE CONNECTIVITY 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 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.
2. Kathy Sierra and Bert Bates, Head First Java, 2nd Edition, O'Reilly Media, 2005.
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.
2. Josh Long, Cloud Native Java: Designing Resilient Systems with Spring Boot, Spring Cloud, and Cloud Foundry, O'Reilly Media, 2017.
3. Craig Walls, Spring in Action, 5th Edition, Manning Publications, 2018.
4. Paul Deitel and Harvey Deitel, Java How to Program, 11th Edition, Pearson, 2017.

Online Resources

1. https://www.coursera.org/specializations/java-programming
2. https://www.edx.org/learn/java
3. https://www.codecademy.com/learn/learn-java
4. https://docs.oracle.com/en/java/javase/

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

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-	-	Dr.S.Sathyavathi, Ms.G.Shobana Ms.M.Jhansisridevi Assistant Professor Department of Information Technology	
Recommended by BoS on	09.05.2025		
Academic Council Approval	No: 28	**Date**	26.06.2025

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24ADI003	MACHINE LEARNING	L	T	P	J	C
		3	0	2	0	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	Introduce the fundamental concepts of machine learning, its life cycle and ethical considerations.
2	Explore various supervised and unsupervised learning techniques and optimization strategies.
3	Examine recommendation systems, and its evaluation techniques.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Apply appropriate data pre-processing techniques to build machine learning models with ethical considerations.	Ap
CO2	Analyze and optimize regression models using estimation techniques, regularization, and gradient-based methods through error analysis.	An
CO3	Build and evaluate the effectiveness of different classification models and ensemble techniques.	E
CO4	Analyze complex datasets using advanced clustering, associative rule mining and dimensionality reduction algorithms to uncover meaningful patterns and groupings.	An
CO5	Develop recommendation systems to personalize user needs.	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

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4	3	2			2						2	3	2
5	3	2			2						2	3	2

Course Content	
INTRODUCTION Introduction to Machine Learning-Types of machine learning: Supervised, Unsupervised, Semi supervised and Reinforcement Learning-Applications of machine learning in various fields- Ethics in machine learning- Fairness, accountability and interpretability -Machine learning workflow- Data Preprocessing-Feature engineering- Correlation analysis- Model training and evaluation- Model monitoring and maintenance. **Practical Component** Introduction to Python libraries for Machine Learning-Preprocessing of dataset	**7 Hours** **4 Hours**
REGRESSION MODELS Linear regression- Simple Regression-Least Square Estimator-Maximum Likelihood Estimator– Multiple Regression –Polynomial Regression-Performance Metrices-Bias Variance Tradeoff- Information Criteria-Based Model Selection- Overfitting – Underfitting – Gradient descent – Regularization – Assumptions in linear regression – Error analysis **Practical Component** Implementation of multi variable regression problem- Optimization of regression model	**8 Hours** **8 Hours**
CLASSIFICATION MODELS Logistic Regression-Naive Bayes Classifiers-Decision Tree-K-Nearest Neighbors-Support Vector Machine – Evaluation metrices – AUC ROC- Class Imbalance – SMOTE – Cross-Validation Techniques-Ensemble Learning-Bagging- Random Forests-Boosting - AdaBoost -Gradient Boosting **Practical Component** Implementation of classification models- Evaluation of models using performance metrices.	**12 Hours** **6 Hours**
UNSUPERVISED LEARNING Clustering- K-means Clustering- Gaussian Mixture Models -Hierarchical Clustering-Density-Based Clustering (DBSCAN)- Mean-Shift Clustering- Spectral Clustering-Association Rule Learning- Apriori Algorithm- FP-Growth Algorithm-Dimensionality Reduction- Principal Component Analysis (PCA)- Linear Discriminant Analysis (LDA) **Practical Component** Implementation of clustering algorithms- Identification of patterns- Detection of outliers	**10 Hours** **6 Hours**
RECOMMENDATION SYTEMS Introduction to Recommendation Systems-Types- Challenges- Collaborative Filtering Techniques- User-Based-Collaborative Filtering- Item-Based-Collaborative Filtering- Matrix Factorization Techniques- Content-Based Recommendation- Hybrid Recommendation Systems- Evaluation of Recommendation Systems	**8 hours**

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Practical Component Implementation of Collaborative Filtering-based Recommendations- Implementation of Matrix Factorization-based recommendations- Building a Recommendation system based on item features	**6 Hours**

Theory Hours:45	**Tutorial Hours:0**	**Practical Hours: 30**	**Project Hours:0**	**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).

Reference

1. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rd Edition (1997).
2. Sebastain Raschka, Vahid Mirjalili , Python Machine Learning, Packt publishing 3rd Edition, (2019).
3. M.Gopal, Applied Machine Learning, McGraw Hill Education, New York, (2018).

Online Resources (Weblinks)

1. https://www.coursera.org/specializations/machine-learning-introduction
2. https://onlinecourses.nptel.ac.in/noc19_cs53/preview
3. https://pll.harvard.edu/course/data-science-machine-learning

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)
-	-		Ms. Tharsanee R M, AP/Artificial Intelligence & Data Science
Recommended by BoS on	09.05.2025		
Academic Council Approval	No: 28	**Date**	26.06.2025

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24ADI204	DATA SCIENCE AND VISUALIZATION	L	T	P	J	C
		2	0	0	2	3
PC		SDG	9, 13			

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

Course Objectives:

The purpose of taking this course is to:

1	Understand the fundamental concepts of data science and develop basic skills in data loading, inspection, and visualization using Python.
2	Learn descriptive statistical methods to summarize data, detect patterns, and identify outliers through visual and numerical techniques.
3	Apply data transformation techniques such as scaling, encoding, and discretization to prepare datasets for analysis.
4	Explore dimensionality reduction methods like PCA to select and extract meaningful features from high-dimensional data.
5	Develop the ability to create clear data stories and build complete data science pipelines that communicate insights effectively.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Apply foundational concepts of data science to visualize and introspect data.	Ap
CO2	Perform Exploratory Data Analysis by applying descriptive statistics and univariate/bivariate visualizations to uncover data distributions, patterns, and relationships, while analyzing data quality through the detection of outliers and exploration of missing value patterns.	An
CO3	Analyze data transformation techniques using Python libraries and their impact on feature distribution.	An
CO4	Apply dimensionality reduction techniques to optimize feature selection.	Ap
CO5	Recommend actionable insights integrating storytelling techniques and Assess dashboards for clarity, effectiveness, and representation.	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	3	2			3							2	
2		3			3							3	
3			2		3							2	
4	3				3							2	

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5			3	2	2	2			2		2	2	

Course Content

FOUNDATIONS OF DATA SCIENCE Defining Data Science - The Data Science Process - Data Types and Attributes - Python Essentials: NumPy & Pandas - Data Loading and Inspection - Data Visualization Goals - Introduction to Matplotlib & Seaborn - Basic Plotting and Customization.	**6 Hours**
DESCRIPTIVE STATISTICS Advanced Attribute Types - Measures of Central Tendency - Measures of Dispersion - Skewness and Kurtosis - Visual Outlier Identification - Missing Data Visualization - Exploratory Data Analysis (EDA) Techniques - Histograms, KDEs, Box Plots, and Violin Plots.	**6 Hours**
DATA TRANSFORMATION Introduction to Data Transformation - Feature Scaling and Normalization - Standardization and Min-Max Scaling - Skewness Correction Transformations - Categorical Feature Encoding - One-Hot and Label Encoding - Binning and Discretization - Applying and Visualizing Transformations.	**6 Hours**
DIMENSIONALITY REDUCTION Feature Selection and Extraction - Variance Thresholding - Correlation-Based Feature Selection - Mitigating Multicollinearity - Principal Component Analysis (PCA) Introduction - Applying and Visualizing PCA results.	**6 Hours**
DATA STORYTELLING Introduction to Data Storytelling - Narrative Structuring - Choosing Effective Visuals - Visual Design Principles - Introduction to Dashboards - Interactive Plotting Concepts - Ethical Considerations in Visualization - Mini-Project: End-to-End EDA and Storytelling.	**6 Hours**
PROJECT To design and develop a complete data science pipeline that processes real-world structured/unstructured datasets through data loading, descriptive statistics, transformation, dimensionality reduction, and insight-driven storytelling. The pipeline should integrate foundational data analysis techniques, advanced visualization, PCA-based feature extraction, and end-to-end EDA culminating in an interactive narrative or dashboard-level presentation. **Final Deliverables (Presentation & Report)** • GitHub repo with code, data samples, and README • 10-minute project presentation with visuals • Final report summarizing problem, methods, datasets, results, and future work	**30 Hours**
Theory Hours: 30 **Tutorial Hours: 0** **Practical Hours: 0** **Project Hours: 30** **Total Hours:60**	

Learning Resources
Textbooks
1. Python Data Science Handbook, Jake VanderPlas, O'Reilly Media, 2016. 2. Fundamentals of Data Visualization, Claus O. Wilke (O'Reilly, 2019). 3. Storytelling with Data: A Data Visualization Guide for Business Professionals, Cole Nussbaumer Knaflic,(Wiley 2019).
Reference
1. Python for Data Analysis, Wes McKinney (O'Reilly, 3rd Ed., 2022). Practical Statistics for Data Scientists,50+ Essential Concepts Using R and Python - Peter Bruce, Andrew Bruce, Peter Gedeck, O'Reilly, 2nd Ed., (2020).

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2. Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow, Aurélien Géron , O'Reilly, 3rd Ed., (2022).
3. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. M¸ller & Sarah Guido, O'Reilly, (2016).

Online Resources (Weblinks)

1. MITx (via edX): https://www.edx.org/course/introduction-to-computer-science-and-programming-using-python-2
2. MITx (via edX): https://www.edx.org/course/introduction-to-computational-thinking-and-data-science-2
3. MIT OCW: https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2014/
4. MIT OCW: https://ocw.mit.edu/courses/6-036-introduction-to-machine-learning-fall-2020/
5. IBM : Data Visualization with Python - https://www.edx.org/course/data-visualization-with-python
6. University of Michigan (via Coursera or edX): Applied Plotting, Charting & Data Representation in Python - https://www.coursera.org/learn/python-plotting
7. NPTEL: Data Analytics with Python (Jan 2024 offering example) - https://onlinecourses.nptel.ac.in/noc24_cs39/preview
8. NPTEL: Data Science for Engineers (Jan 2024 offering example) - https://onlinecourses.nptel.ac.in/noc24_cs111/preview
9. NPTEL: Statistical Methods For Data Science (Jan 2024 offering example) - https://onlinecourses.nptel.ac.in/noc24_ma77/preview

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)	
-	-	Ms. Rupashini P R, AP/Department of Artificial Intelligence & Data Science	
Recommended by BoS on	29.11.2025		
Academic Council Approval	No: 29	**Date**	24.12.2025

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24HSP007	BUILDING PROFESSIONAL READINESS	L	T	P	J	C
		0	0	2	0	1
Practical		SDG	4&8			

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

Course Objectives:	The purpose of taking this course is to:
1	To familiarize students with various interview formats and equip them with essential techniques for effectively handling personal, behavioural, stress, and panel interviews.
2	To develop self-awareness and career readiness by guiding students in analysing job roles, articulating career goals, and confidently presenting their skills and experiences.
3	To enhance students' adaptability in diverse career pathways by exploring alternative job opportunities, entrepreneurial ventures, and global career options beyond traditional engineering roles.

Course Outcomes***:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Effectively navigate various interview formats by applying appropriate techniques for personal, behavioural, stress, and panel interviews, demonstrating confidence and professionalism in different interview scenarios.	Ap
CO 2	Exhibit career readiness and self-awareness by analysing job roles, articulating career aspirations, and presenting skills and experiences in alignment with employer expectations.	An
CO 3	Evaluate and explore diverse career pathways beyond traditional engineering roles, demonstrating adaptability in pursuing opportunities in entrepreneurship, global careers, public sector roles, and other emerging industries.	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	PSO-3
1						2	2	3	3		3			
2						2	2	3	3		3			
3						2	2	3	3		3			

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Course Content

Topic	Hours

Career Awareness and Goal Setting
• Exploring Varied Career Options Beyond Engineering
    • Industry Roles
    • Startups and Entrepreneurial Ventures
    • Research Opportunities and Higher Education
    • Public Sector and Non-Profit Careers
• Self-Assessment and Personal Reflection
• Identifying Strengths, Weaknesses, Skills, and Career Aspirations
    • Setting Short-Term and Long-Term Career Goals
	6 Hours

Fundamentals of Interview Preparation • Analysing Company Background and Understanding Job Roles • Aligning Career Goals with Job Opportunities • Professional Etiquette and Appearance • Interview Dress Code, Grooming, and First Impression • Resume and Digital Profile Readiness Types of interviews: personal, behavioural, stress, virtual, and panel	**6 Hours**
Behavioural Interviews – Responding with Purpose • Introduction to behavioural interviews: What and Why? • Common behavioural interview questions • The STAR technique (Situation – Task – Action – Result) • Identifying and reflecting on past experiences • Mapping soft skills to behavioural questions • Practicing concise storytelling Active listening and adapting responses	**6 Hours**
Stress Interviews – Performing Under Challenging Situations • Understanding stress interviews: Purpose and setting • Types of stress tactics (rapid-fire questions, silence, disagreement, interruptions) • Strategies to stay composed and confident • Emotional regulation and response control • Maintaining clarity, tone, and respect under pressure • Practicing assertive and professional body language Turning pressure moments into strengths	**6 Hours**
Panel Interviews • What is a panel interview? Structure and expectations • Understanding panel roles (HR, technical, managerial) • Techniques for engaging with a diverse panel • Managing eye contact, addressing questions, and body posture • Preparing multi-perspective answers • Handling follow-up or cross-questions Strategies for closing the interview with impact	**6 Hours**

Theory Hours:	-	**Tutorial Hours:**	-	**Practical Hours:**	2	**Project Hours:**	-	**Total Hours:**	30

Learning Resources
Reference books/ Web Links

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1. Amos, J. (2004). Handling Tough Job Interviews: Be Prepared, Perform Well, Get the Job. United Kingdom: How To Books.
2. Clark, A. (2019). Cracking the Behavioral Interview Code!!! How to Answer Behavioral Interview Questions and Answer with a Preparation Guide + 20 Most Popular Behavioral Interview Questions and Answers.. (n.p.): Amazon Digital Services LLC - KDP Print US.
3. Collins, A. (2015). HR Interview Secrets: How to Ace Your Next Human Resources Interview, Dazzle Your Interviewers and LAND the JOB YOU WANT!. United States: Success in HR Publishing.
4. Downes, C. (2008). Cambridge English for Job-hunting Student's Book with Audio CDs (2). Germany: Cambridge University Press.
5. Hatcher, S. (2015). Group Interview Preparation: Learn How to Use Group Discussion to Your Advantage and Be Comfortable, Confident, and Likeable While Standing Out in a Group Interview. (n.p.): CreateSpace Independent Publishing Platform.
6. McKay, D. R. (2013). The Everything Job Interview Question Book: The Best Answers to the Toughest Interview Questions. United States: Adams Media.
7. Ryan, R. (2016). 60 Seconds and You're Hired!: Revised Edition. United States: Penguin Publishing Group.
8. Winter, S. (2020). Job Interview Preparation and Conversation Skills 2-in-1 Book: Learn How to Crush Your Next Job Interview and Develop A Magnetic Charisma to Enhance Your Communication Skills. United States: Native Publish

Online Resources

1. https://www.coursera.org/projects/preparation-for-job-interviews
2. https://www.coursera.org/projects/accomplishment-star-techniques-for-job-interviews
3. https://www.coursera.org/specializations/english-interview-resume

Assessment	
Formative	Summative
-----	1. Participation in Mock interviews (80%) 2. Career Readiness Portfolio Submission (20%)

Course Curated By

Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
Mr. Bhuvana Sundar Soorappaiah Program Manager Bosch, Coimbatore	Dr Kishore Selva Babu Head and Associate Professor Department of English and Cultural Studies	Dr. J Srikala- AP III Dr. C Tissaa Tony - AP III Dr. S G Mohanraj – AP III Dr. S Sreejana – AP III

Signature of the BOS Chairman, AI&DS

	Christ University Bangalore-560029	Dr. R Hema – AP II Dr. A S Mythili - AP II

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	BOS **25.04.2025**

Signature of the BOS Chairman, AI&DS

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

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SIMPLE AND COMPOUND INTEREST, PROBABILITY 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	**6 Hours**
Total Distance, Average Speed Calculations, Relative Speed, Train Crossing a Pole, Train Crossing a Platform, Bridge, Tunnel, Two Trains Crossing Each other.	
BOATS AND STREAMS, SYLLOGISM 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 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 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: 0	**Tutorial Hours: 0**	**Practical Hours: 30**	**Project Hours: 0**	**Total Hours: 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

Signature of the BOS Chairman, AI&DS

Expert(s) from Industry	Expert(s) from Higher Education Institution		Internal Expert
Mr. Vivekanand, CEO and Founder – Masters Academy	-		Dr. D. Sudharson, 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 the BOS Chairman, AI&DS

24INM201	UNIVERSAL HUMAN VALUES II: UNDERSTANDING HARMONY (COMMON TO ALL BRANCHES)	L	T	P	J	C
		1	0	0	0	1
HS		SDG	3,4,5,10,12,13,14,15,16,17			

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

Course Objectives:

The purpose of taking this course is to:

1	Introduce the concept and significance of value education in shaping a meaningful and fulfilling life.
2	Enable students to understand the human being as a co-existence of self and body and the harmony within.
3	Develop an understanding of harmony in relationships, family, and society.
4	Help students appreciate the interconnectedness and harmony in nature and existence.
5	Instill the importance of ethical behaviour in personal, professional, and social contexts.

Course Outcomes

	After successful completion of this course, the students shall be able to	Revised Bloom's Taxonomy Levels (RBT)
CO1	Understand the foundational concepts of value education and human aspirations.	U
CO2	Analyze the human being as a holistic entity comprising self and body.	An
CO3	Evaluate and cultivate harmonious relationships within the family and society.	E
CO4	Interpret the interconnectedness in nature and recognize harmony in existence.	U
CO5	Apply holistic understanding to professional ethics and sustainable living.	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	PSO-3
1						3	3	3	3		3			
2						3	3	3	3		3			
3						3	3	3	3		3			
4						3	3	3	3		3			
5						3	3	3	3		3			

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Course Content	
Introduction to Value Education Value Education- Self-exploration as the Process for Value Education- Basic Human Aspirations and their Fulfilment- Right Understanding, Relationship and Physical Facility- Happiness and Prosperity – Current Scenario- Method to Fulfil the Basic Human Aspirations.	**3 Hours**
Harmony in the Human Being Human Being as Co-existence of the Self and the Body- Distinguishing between the Needs of the Self and the Body- The Body as an Instrument of the Self- Understanding Harmony in the Self- Harmony of the Self with the Body- Programs to Ensure Self-regulation and Health.	**3 Hours**
Harmony in the Family and Society Harmony in the Family –The Basic Unit of Human Interaction-'Trust' – The Foundational Value in Relationship-Respect – As the Right Evaluation- Other Values in Human-to-Human Relationship- Understanding Harmony in the Society Lecture Vision for the Universal Human Order.	**3 Hours**
Harmony in the Nature (Existence) Understanding Harmony in Nature- Interconnectedness, Self-regulation and Mutual Fulfilment among the Four Orders of Nature- Realizing Existence as Co-existence at All Levels- The Holistic Perception of Harmony in Existence.	**3 Hours**
Implications of the Holistic Understanding- A Look at Professional Ethics Basis for Universal Human Values-Definitiveness of (Ethical) Human Conduct - professional Ethics in the Light of Right Understanding-A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Holistic Technologies, Production Systems-and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession	**3 Hours**

Theory Hours: 15	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:** 15

Learning Resources
Textbooks:
Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
References:
Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, Jeevan Vidya:Publishers, 1999.
Online Resources (Weblinks)
https://www.uhv.org.in/uhv-ii
Assessment (Theory course)
Presentation, MCQ, Assignment, Case Study and E Chart.

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<table>
<tr><th colspan="4">Course Curated by</th></tr>
<tr><th>Expert(s) from Industry</th><th>Expert(s) from Higher Education Institution</th><th colspan="2">Internal Expert(s)</th></tr>
<tr><td></td><td>Sh. Umesh Jadhav, NCCIP (National Co-oridnation Committee)-AICTE</td><td colspan="2">Dr.S.Sivakumar,
Associate Professor, SFS
Dr.R.Prakasam,
Assistant Professor,
Department of Physics
Mr.J.Sivaguru,

Assistant Professor,
Department of Mechatronics</td></tr>
<tr><td>Recommended by BoS on</td><td colspan="3">03-05-2025</td></tr>
<tr><td>Academic Council Approval</td><td></td><td>Date</td><td>26-06-2025</td></tr>
</table>

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24INP202	INNOVATION PRACTICUM - 4	L	T	P	J	C
		0	0	0	2	1
ES		SDG	4,8,9,12,17			

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

Course Objectives:

The purpose of taking this course is to:

1	Learn and apply the Forge Innovation Handbook (FIH) to problem-solving.
2	Develop a minimum usable prototype (MUP) through iterative design, development, and testing.
3	Effectively demonstrate the developed MUP.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Proficiency in using the FIH to identify and solve problems.	An
CO 2	Experience in designing, building, and demonstrating a MUP.	C
CO 3	Improved ability to communicate and present project outcomes effectively.	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	3	2	2	2	2									
2			3	2			2		2					
3									2	3				

Course Content

Innovation Fundamentals Master Class 1: Explore the core concepts of product design and development. Master Class 2: Introduction to the Forge Innovation Handbook (FIH) and its applications. Workshop 1: Utilize the FIH Canvas to identify challenges, validate problems, understand user needs, and define pain points, gains, and value propositions.	**3 Hours**
Advanced Prototyping Techniques Master Class 3: Rapid Prototyping Techniques - 1. Master Class 4: Rapid Prototyping Techniques - 2. Hack Time 1: Engage in hands-on experimentation to test core assumptions, refine the Proof of Concept (PoC). Incorporate rapid prototyping techniques and iterate on the design to enhance functionality.	**6 Hours**
Intellectual Property and Proof of Concept Master Class 5: Gain insights into intellectual property (IP) and prior art search. Hack Time 2: Develop and refine a working prototype. Build a Minimum Usable Prototype (MUP) based on feedback and iteration.	**6 Hours**
Build the Minimum Usable Prototype (MUP) Hack Time 3: Enhance the prototype through iterative improvements. Utilise feedback from mentoring sessions to make targeted adjustments and refinements, optimising the prototype's functionality and design based on practical insights. Hack Time 4: Develop the Minimum Usable Prototype (MUP). Build the final version of the MUP incorporating all iterative refinements. Ensure that it meets the defined criteria and is ready for comprehensive testing and presentation.	**7 Hours**

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Perfect Pitch and Product Showcase Hack Time 5: Conduct a final demonstration and technical testing of the prototype. Create a compelling pitch to articulate the value proposition and potential impact of the innovation, aimed at securing support or funding. **Pitch Presentation and MUP Demonstration:** Students showcase their completed prototype through a comprehensive demonstration, highlighting its key features and functionalities to Industry experts, incubators and investors. They deliver a compelling pitch that clearly communicates the innovations's impact, market potential, and benefits. This presentation aims to effectively convey the value of the prototype, engage potential stakeholders, and secure support or funding opportunities.	**8 Hours**

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

Learning Resources

Textbooks:

1. Rapid Prototyping And Engineering Applications: A Toolbox For Prototype Development - Frank W.Liou, 2007
2. Rapid Prototyping Technology: Selection And Application - COOPER K. G, 2001

References:

1. Jazz Factory - All about Presentations and http://blog.jazzfactory.in/
2. Pretotyping Methodology - https://www.pretotyping.org/methodology.html
3. How to give a killer presentation - https://hbr.org/2013/06/how-to-give-a-killer-presentation
4. Evaluating Product Innovations — proof, potential, & progress:https://blog.forgeforward.in/evaluating-product-innovations-e8178e58b86e

Course Curated by

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

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SEMESTER V

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24ADT005	COMPUTER SYSTEM ARCHITECTURE AND MANAGEMENT	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 basics of computer system architecture and functional units of a computer.
2	Describe processor organization, arithmetic operations, and processor performance techniques.
3	Introduce memory organization, storage hierarchy, and input/output mechanisms in computer systems.
4	Discuss operating system concepts, process management, scheduling, and synchronization techniques.
5	Familiarize advanced operating system concepts such as virtual memory, virtualization, and distributed systems.

Course Outcomes:

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the fundamentals of computer organization, architecture, instruction sets, and processor evolution.	U
CO 2	Apply arithmetic operations, ALU design concepts, and processor execution techniques in computer systems.	Ap
CO 3	Apply memory hierarchy, cache organization, virtual memory, and storage management techniques in computer systems.	Ap
CO 4	Analyze operating system concepts including process management, scheduling, synchronization, and deadlock handling mechanisms.	An
CO 5	Apply file management, virtual memory, virtualization, and advanced operating system concepts in modern computing 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	3	2									2	2	
2	3	3	2		2							2	
3	3	2	2		2							2	2
4	3	2			2						2	2	2
5	3	3	2	2	2			2	2		2	3	2

Course Content

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FUNDAMENTALS OF COMPUTER SYSTEM ARCHITECTURE Introduction to Computer Systems – Computer Organization and Architecture – Functional Units of a Computer – Von Neumann Architecture – Data Representation and Number Systems – Register Transfer and Micro Operations – Bus Structures – Instruction Set Architecture – Addressing Modes – Instruction Cycle – System Performance Metrics – Intel and ARM Processor Overview.	**7 Hours**
PROCESSOR ORGANIZATION AND COMPUTER ARITHMETIC Arithmetic and Logic Unit (ALU) – Signed Number Representation – Addition and Subtraction Algorithms – Multiplication and Division Algorithms – Floating Point Representation – Processor Registers and Register Organization – Hardwired and Microprogrammed Control – Instruction Pipelining – Pipeline Hazards – RISC and CISC Architectures – Multicore Processors – Processor Performance Enhancement Techniques.	**11 Hours**
MEMORY ORGANIZATION AND INPUT/OUTPUT ARCHITECTURE Memory Hierarchy – Cache Memory Organization – Cache Mapping Techniques – Main Memory Organization – Virtual Memory Concepts – Secondary Storage Devices – RAID Organization – Memory Protection – Interrupts and Interrupt Handling – Direct Memory Access (DMA) – I/O Interfaces and Controllers – Bus Arbitration – Storage Management Concepts.	**9 Hours**
OPERATING SYSTEMS AND PROCESS MANAGEMENT Operating System Overview – Functions and Services of Operating Systems – Operating System Structures – System Calls – Process Concept and Process States – Process Scheduling – CPU Scheduling Algorithms – Threads and Multithreading – Inter process Communication – Process Synchronization – Semaphores and Mutex – Deadlocks – Deadlock Prevention and Avoidance.	**10 Hours**
FILE AND ADVANCED OPERATING SYSTEM Paging and Segmentation – Virtual Memory – Page Replacement Algorithms – Thrashing – File Concept and File Allocation Methods – Directory Structure – Disk Scheduling Algorithms – I/O Systems – Virtual Machines and Virtualization – Mobile Operating Systems: Android and iOS – Cloud and Distributed Operating Systems.	**8 Hours**

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

Learning Resources

Textbooks

1. Andrew S Tanenbaum, Modern Operating Systems, Pearson, 5th Edition, New Delhi, 2022.
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, 11th Edition, Prentice Hall, 2019.

Reference books/ Web Links

1. M. Moris Mano, Computer System Architecture, Revised 3rd Edition, Pearson, 2017.
2. William Stallings, Operating Systems: Internals and Design Principles,9th Edition, Prentice Hall, 2022
3. Andrew S. Tanenbaum, Structured Computer Organization, 7th Edition Pearson Education, 2022
4. Achyut Godbole, Atul Kahate, Operating Systems, McGraw Hill Education, 2016

Online Resources (Weblinks)

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)

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

<table>
<tr><th colspan="4">Course Curated by</th></tr>
<tr><th>Expert(s) from Industry</th><th colspan="2">Expert(s) from Higher Education Institution</th><th>Internal Expert</th></tr>
<tr><td>Bhuvaneshwari Kanagaraj
Electronics Engineer KGISL|
Founder – Spell Daily</td><td colspan="2">Aruna Nagaraj Assistant Professor 1
Department of CSE
Sri Krishna College of Engineering</td><td>Shalini R K, Assistant Professor 1
Department of Artificial Intelligence and Data Science.</td></tr>
<tr><td>Recommended by BoS on</td><td colspan="3">06.06.2026</td></tr>
<tr><td>Academic Council Approval</td><td>No:30</td><td>Date</td><td>19.06.2026</td></tr>
</table>

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

Pre-requisite courses	**Object Oriented Programming**	**Data Book / Codes / Standards (If any)**	

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)												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**PSO**	
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	2											3	
4			2									3	
5					3							3	

Course Content

HTML, CSS AND JAVASCRIPT	**9 Hours**
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,	

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LAMP, Ruby on Rails, Django, NET, JAMSTACK **Practical Component** 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 – CoPilot, ChatGPT	**6 Hours**
REACTJS Introduction to React – Components – JSX – props – lifecycle - state - Advanced React – Hooks - context API - basic routing **Practical Component** Application building using React and API integration – Implementation of Hooks and context API in the platform– AI tools – Copilot, Claude	**9 Hours** **6 Hours**
NODEJS AND EXPRESSJS NodeJS – Basics – modules - npm – ExpressJS - Setting up a server – routing - middleware **Practical Component** Setting up a RESTful API - middleware implementation for user authentication– AI tools – Copilot, Claude	**9 Hours** **6 Hours**
INTEGRATION WITH MONGODB 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 **Practical Component** Record management system using MongoDB – schema creation using Mongoose– AI tools – Copilot, Claude	**9 Hours** **6 Hours**
DEPLOYMENT WITH GIT 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. **Practical Component** Deploy a full stack application to Heroku or Vercel - Manage version control for a collaborative project using Git branching and merging. – AI tools – Claude, ChatGPT	**9 Hours** **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.
2. "Node.js Web Development: Server-side web development " by David Herron, 5th Edition, 2020.
3. "React Up & Running" by Stoyan Stefanov, O'Reilly Media, Inc, 2021.
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
2. "Node.js Design Patterns" by Luciano Mammino and Mario Casciaro, 3rd Edition, 2025.
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
2. Getting Started with Git and GitHub | Coursera
3. Developing Back-End Apps with Node.js and Express | Coursera
4. Introduction to MongoDB | Coursera
5. [Project] Build a CRUD Node.js and MongoDB employee management web-app | Coursera

Assessment (Embedded course)

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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.Sai Shankar, Project Manager, Ernst & Young	-	Nivetha R, AP/CSE Sathyaseelan N, AP/CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	**Date**	19.06.2026

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24ADI006	DEEP LEARNING	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9			

Pre-requisite courses	24ADI003 Machine Learning	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.
2	Develop convolutional neural network models for image classification tasks.
3	Investigate sequential models for natural language processing applications.
4	Analyze generative and unsupervised deep learning models for AI applications.
5	Explore transformer models and advanced deep learning techniques for modern AI systems.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Apply neural network architectures, activation functions, optimization methods, and regularization techniques to develop and evaluate deep learning models for predictive tasks.	Ap
CO2	Implement deep learning techniques for feature extraction, image analysis, and computer vision applications.	Ap
CO3	Develop sequential learning models for processing and analyzing sequential and natural language data.	Ap
CO4	Analyze generative and unsupervised deep learning techniques for representation learning, feature extraction, and synthetic data generation.	An
CO5	Analyze attention-based architectures and advanced deep learning techniques to develop intelligent applications for language and multimodal AI tasks.	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	2	2			2							3	3
2	2	2			2							3	3
3	2			3	2							3	3
4	2			3	2							3	3
5	2			3	2	2	2					3	3

Course Content

INTRODUCTION TO DEEP LEARNING Introduction to Artificial Neural Networks - MP Neurons and Perceptrons - Feedforward Neural Networks and Network Layers - Activation Functions: Sigmoid,	**9 Hours**

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Tanh and ReLU - Training Neural Networks: Weights, Biases, Loss Functions and Backpropagation - Optimization Methods: Gradient Descent and Variants - Batch Normalization - Hyperparameter Tuning - Overfitting and Underfitting - Regularization Techniques - Evaluation Metrics for Deep Learning Models **Practical Component** 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	**6 Hours**
CONVOLUTIONAL NEURAL NETWORKS Introduction to Convolutional Neural Networks (CNNs) - Convolution Operation - Filters, Stride, Padding and Parameter Sharing - Pooling Layers - Fully Connected Layers - Regularization Techniques for CNNs - Data Augmentation - Transfer Learning and Fine-Tuning of Pretrained Models -Popular CNN Architectures: AlexNet, VGGNet and ResNet **Practical Component** 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** **6 Hours**
SEQUENTIAL MODELING 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 **Practical Component** 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** **6 Hours**
GENERATIVE AND UNSUPERVISED DEEP LEARNING MODELS Introduction to Representation Learning - Unsupervised Deep Learning - Energy-Based Models - Boltzmann Machines - Deep Belief Networks - Autoencoders and Variants - Generative Adversarial Networks (GANs) -Diffusion Models **Practical Component** Train a simple Autoencoder for dimensionality reduction and feature learning - Generate synthetic images using a Generative Adversarial Network (GAN)	**9 Hours** **6 Hours**
TRANSFORMERS & ADVANCED DEEP LEARNIG TECHNIQUES 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- Retrieval-Augmented Generation (RAG) - AI Hallucination and Safety in LLMs - Introduction to Multimodal AI **Practical Component** 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	**9 hours** **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. 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)
-	M. Karthiga, Associate Professor, Bannari Amman Institute of Technology		Tharsanee R M, AP/Artificial Intelligence & Data Science
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	**Date**	19.06.2026

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24ADI007	CLOUD DATA ANALYTICS	L	T	P	J	C
		2	0	2	0	3
PC		SDG	9			

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

Course Objectives:	
The purpose of taking this course is to:	
1	Acquire knowledge of core cloud computing concepts and the landscape of cloud-based data analytics services.
2	Develop practical skills in utilizing major cloud platforms to manage and query data and apply basic cloud Machine Learning services.
3	Gain competency in analyzing the suitability of different cloud services for specific analytical tasks, architectural patterns, cost considerations, and security basics for cloud data analytics.
4	Develop the ability to evaluate cloud services based on requirements and best practices.
5	Develop the ability to design, visualize, govern, and evaluate cloud-based analytics solutions considering security, scalability, and cost optimization.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO1	Apply fundamental concepts of cloud computing, data analytics lifecycle, and cloud service models deploying and managing analytics workflows using virtual machines	Ap
CO2	Identify cloud-based data storage, ingestion techniques, and their relevance in real-world analytics scenarios.	Ap
CO3	Examine and use cloud-based data processing tools and pre-built Machine Learning services to analyze datasets and generate insights.	An
CO4	Analyze the impact of different cloud services on performance, cost, and scalability in data analytics workflows.	An
CO5	Analyze the functionality and performance of dashboards and Machine Learning models deployed on the cloud to identify areas for optimization and improvement.	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	2		3							2		2
2	2	2		3							2		2
3	3		2	2							2		3
4	3	3	2									3	3

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5	2	2								2		3	2

Course Content	
INTRODUCTION TO CLOUD AND ANALYTICS SERVICES Cloud Computing Fundamentals. Overview of Major Providers. Core Cloud Services Overview: Compute, Object Storage, Databases -Managed SQL, Landscape of Cloud Analytics: Key Service Categories - Data Warehousing, Data Lakes, ETL/ELT, ML Platforms, Visualization Tools Overview – Big data – characteristics – Big data processing on cloud – Hadoop and Spark. **Practical Component** Navigate cloud console, launch a basic VM, create a storage bucket/container, explore basic database service setup-Map reduce demonstration	**6 Hours** **6 Hours**
CLOUD STORAGE AND DATA LAKES FOR ANALYTICS Object Storage Deep Dive: Use cases for analytics, performance, storage tiers. Analysing suitability. Building Data Lakes on the Cloud: Architecture patterns, metadata management, data catalog services. Storage Formats for Analytics: Parquet, Avro, ORC. **Practical Component** Upload/manage data in cloud object storage, use CLI/SDK, work with Parquet files in cloud context. Set up a basic data catalog crawler.	**6 Hours** **6 Hours**
CLOUD DATA WAREHOUSING AND QUERYING Cloud Data Warehouse Architectures: Key features -Redshift, Synapse, BigQuery, Compute/storage separation. Data Loading and Management: Best practices, distribution/partitioning. SQL for Cloud Warehouses & Serverless Querying: Advanced SQL, Performance tuning. Athena, Synapse Serverless, BigQuery. Analyzing query performance and cost. **Practical Component** Set up cloud DWH, apply loading techniques, run analytical SQL queries, compare performance, apply querying on data lake using serverless tools. Use a graphical ETL tool to clean a dataset	**6 Hours** **6 Hours**
CLOUD DATA PIPELINES AND MACHINE LEARNING Managed ETL/ELT Services: AWS Glue, Azure Data Factory, Google Cloud Dataflow/Dataproc , Apache Airflow – visual pipelines. Serverless Data Processing & Orchestration: AWS Lambda, Azure Functions. Managed ML Platforms: SageMaker, Azure ML, Vertex AI – feature overview - notebooks, training jobs, endpoint deployment, AutoML. Applying ML services. Pipeline Architecture Analysis: Batch vs. Streaming patterns on the cloud. Introduction to real-time streaming services - Kafka. **Practical Component** Build and orchestrate a simple ETL pipeline using Apache Airflow in a containerized cloud-native environment. Perform distributed data processing using Apache Spark. Train and track a machine learning model. Deploy the trained model as a REST API endpoint using FastAPI in Docker containers. Demonstrate real-time streaming analytics concepts using Apache Kafka. Analyze scalable cloud-native pipeline architectures involving storage, processing, orchestration, and machine learning components.	**6 Hours** **6 Hours**
VISUALIZATION, GOVERNANCE AND EVALUATION Cloud Visualization Tools: Power BI-cloud integration– connecting to cloud data sources, creating dashboards. Cost Management and Optimization: Pricing models, monitoring costs, tagging, optimization strategies. Evaluating cost-effectiveness. Security & Governance: IAM policies, encryption, network security -VPC, Security Groups-, compliance considerations. Evaluating security posture. Evaluating Solutions Holistically: Assessing against requirements-performance, scale, cost, considering trade-offs, security, and governance. **Practical Component** Connect Power BI to a cloud data warehouse. Explore cost explorer/advisor tools. Configure basic IAM roles/policies. Lab exercises focused on evaluation criteria. Create simple charts like bar, line, and pie	**6 Hours** **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. Erl, Thomas, Ricardo Puttini, and Zaigham Mahmood. Cloud Computing: Concepts, Technology & Architecture. Pearson Education, Boston, 2013.
2. Eagar, Gareth. Data Engineering with AWS. Packt Publishing, Birmingham, 2020.
3. Cebeci, Emrah. Big Data Analytics with AWS. Packt Publishing, Birmingham, 2019.

References:

4. Kleppmann, Martin. Designing Data-Intensive Applications. O'Reilly Media, Sebastopol, 2017.
5. Karau, Holden, Andy Konwinski, Patrick Wendell, and Matei Zaharia. Learning Spark: Lightning-Fast Data Analytics. O'Reilly Media, Sebastopol, 2020.

Online Educational Resources:

1. AWS Documentation: https://docs.aws.amazon.com/
2. Microsoft Azure Documentation: https://docs.microsoft.com/en-us/azure/
3. Google Cloud Documentation: https://cloud.google.com/docs/
4. AWS Well-Architected Framework: https://aws.amazon.com/architecture/well-architected/
5. AWS Skill Builder: https://explore.skillbuilder.aws/
6. Microsoft Learn: https://learn.microsoft.com/en-us/training/azure/
7. Google Cloud Skills Boost: https://www.cloudskillsboost.google/

Assessment (Embedded course)

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

<table>
<tr><th colspan="4">Course Curated by</th></tr>
<tr><th>Expert(s) from Industry</th><th colspan="2">Expert(s) from Higher Education Institution</th><th>Internal Expert(s)</th></tr>
<tr><td>Sanjay Krishna R
Cloud Engineer – Ascend Engineering Foundation Innovation & Technology
Deloitte Consulting India Pvt Ltd</td><td colspan="2">Ms I N Sountharia
Lecturer
PSG Polytechnic College
Coimbatore</td><td>Saran Kirthic R,
Assistant Professor
Department of Artificial Intelligence and Data Science</td></tr>
<tr><td>Recommended by BoS on</td><td colspan="3">06.06.2026</td></tr>
<tr><td>Academic Council Approval</td><td>No: 30</td><td>Date</td><td>19.06.2026</td></tr>
</table>

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24INM202	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to All Branches)	L	T	P	J	C
		1	0	2	0	2
HS		SDG	6, 13, 15			

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

Course Objectives:

The purpose of taking this course is to:

1	To introduce the importance, types, and conservation strategies of natural resources, with a focus on sustainable practices in water and food management.
2	To understand the structure and function of ecosystems and biodiversity, and explore the need for conservation through the study of hotspots and global environmental concerns.
3	To examine the causes and effects of environmental degradation, including pollution and waste management, and to promote mitigation strategies for sustainable development.
4	To provide knowledge of the legal and institutional frameworks for environmental protection in India and globally, including critical environmental acts and enforcement challenges.
5	To explore conventional and alternative energy resources, and to assess methods for energy conservation and carbon footprint reduction through audits and sustainability measures.

Course Outcomes

	After successful completion of this course, the students shall be able to	Revised Bloom's Taxonomy Levels (RBT)
CO1	Apply the concept of natural resource conservation to demonstrate sustainable practices	Ap
CO2	Analyse the structure, function, and adaptive capacity of ecosystems to categorize threats and conservation strategies for biodiversity.	An
CO3	Analyse various forms of environmental degradation and propose management and preventive solutions.	An
CO4	Apply national environmental laws and frameworks in the personal and professional contexts	Ap
CO5	Design strategies using renewable energy principles to develop sustainable energy utilization plans through audits and footprint analysis to transfer a healthy environment for future generations.	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	PSO-3
1	2	–	–	–	–	2	3	–	1	–	–	2	–	–
2	2	2	–	–	–	2	3	1	–	–	–	2	2	–
3	2	3	–	2	–	3	3	1	–	–	–	2	3	–
4	–	2	–	–	–	3	3	3	1	2	2	–	2	–
5	2	2	3	2	2	3	3	–	1	2	2	2	2	3

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Course Content	
NATURAL RESOURCES **Introduction to Natural resources :** Types, significance, and conservation strategies **Water resources:** Utilization, management practices, and conservation strategies - rainwater harvesting methods.– Water distribution system audit **Food resources:** Challenges of food security in India - impact of modern agriculture, and environmental concerns related to fertilizers and pesticides. **Practical Component:** • Parameter Testing : Water / Effluent / Soil/Fertiliser • Simulation Experiments • Online Course	**3 Hours** **10 Hours**
ECOSYSTEM AND BIODIVERSITY **Ecosystem:** Structure and function of an ecosystem - ecosystem resilience and adaptive capacity **Biodiversity:** Values of biodiversity - Hot Spot of biodiversity (in the Himalayas, the Western Ghats, the Indo-Burma region, and the Gulf of Mannar) - Threats to biodiversity. **Conservation Strategies:** Emerging Issues in Biodiversity Conservation - Citizen science - In-situ and Ex-situ conservation of biodiversity. **Practical Component:** • Documentation of biodiversity in the campus	**3 Hours** **6 Hours**
ENVIRONMENTAL DEGRADATION AND MANAGEMENT **Pollution**: Causes, effects and control measures of Air pollution, Water pollution - Role of an individual in prevention of pollution **Waste management**: Circular Economy vs. Linear Economy - Disposal of solid wastes - Treatment of Liquid wastes **Disaster Management**: Mitigation strategies and Readiness **Practical Component:** • Waste Management and Resource recovery in Campus • Documentation of Environmental Data Resources and Monitoring Tools.	**3 Hours** **6 Hours**
LEGAL FRAMEWORK FOR ENVIRONMENTAL PROTECTION IN INDIA **Global and National Initiatives**: United Nations Sustainable Development Goals - Coastal Regulation Zone - Environmental impact assessment **Environmental Legislation in India**: Key Legal and Regulatory Terminology in India – Valuation of Ecosystem Services and integration of Acts in the workplace - Plastic Waste Management Rules - E-Waste Management Rules - Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act **Implementation Challenges**: Issues involved in enforcement of environmental legislation **Practical Component:** • Online Course	**3 Hours** **2 Hours**
ENERGY MANAGEMENT **Energy Resources:** Energy Demand and Urban energy Challenges - Necessity of alternate energy methods - Renewable and Non- renewable energy resources - Carbon footprint and carbon credit – Sustainable energy utilization – Case study **Energy Audits** – Purpose, methodology, and common instruments used **Practical Component**: • Documentation of Energy usage through Carbon foot print calculation -	**3 Hours**

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Personal aswell as Institutional	**6 Hours**

Theory Hours:	**15**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

References:

1. Bharucha, E. (2021). Textbook of environmental studies for undergraduate courses (3rd ed.). Orient BlackSwan / Universities Press - Hyderabad, India.
2. Miller, G. T., & Spoolman, S. E. (2014). Environmental science (14th ed.). Cengage India
3. Anubha Kaushik & C.P. Kaushik (2024). Perspectives in Environmental Studies (8th ed.). New Age International Publishers, New Delhi.
4. Masters, G. M., & Ela, W. P. (2013). Introduction to environmental engineering and science (3rd ed.). Pearson Education, New Delhi.
5. Leelakrishnan, P. (2018). Environmental law in India (3rd ed.). LexisNexis Butterworths, New Delhi.
6. Botkin, D. B., & Keller, E. A. (2014). Environmental science: Earth as a living planet (9th ed.). Wiley, Hoboken, NJ.
7. Armstrong, J. (2023). The future of energy: The 2023 guide to the energy transition. Independently published.
8. Easton, T. (Ed.). (2017). Taking sides: Clashing views on environmental issues (17th ed.). McGraw-Hill Education, New York, NY.
9. Ishwaran, N. (2022). Ecosystem services and economic valuation. New Delhi: TERI Press.

Online Resources (Weblinks)

1. https://www.youtube.com/watch?v=j4Z6WmTnhRQ How to Conduct a Water Audit in Institutions
2. https://www.youtube.com/watch?v=_OKYio2Yk9U India's Food Security Challenge
3. https://www.youtube.com/watch?v=IjNT9Z2OLf4 India's Biodiversity Hotspots
4. https://www.youtube.com/watch?v=_c_sJIEJY4M What is Citizen Science?
5. https://www.youtube.com/watch?v=1HZR3GyzFZc What is a Circular Economy
6. https://www.youtube.com/watch?v=6_tLYyR_3Vo Environmental Law and Acts in India
7. https://www.youtube.com/watch?v=kGcrYkHwE80 Introduction to SDGs
8. https://www.youtube.com/watch?v=V__eNSHdChA Conducting an Energy Audit
9. https://www.youtube.com/watch?v=dUqTt5Qrxn8 - What is Your Carbon Footprint?

Assessment (Embedded course)

SA, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)
Lab Workbook, Report Submission

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
Dr. Muthuraja Perumal General Manager - Research & Development Rohith Industries, APIIC Industrial Park, Andhra Pradesh	Dr. Mathivanan Packiarajan University of Michigan Ann Arbor, MI USA Dr. Venkatakrishnan	Faculty Of Chemistry Department of Chemistry

Signature of the BOS Chairman, AI&DS

	Professor, School of Chemical Sciences Indian Institute of Technology (Mandi) Himachal Pradesh India	
Recommended by BoS on		
Academic Council Approval	No.	**Date**

Signature of the BOS Chairman, AI&DS

24INM002	DISASTER MANAGEMENT AND PREPAREDNESS	L	T	P	J	C
		2	0	0	0	2
MC		SDG	03, 09 11 & 15			

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

Course Objectives:

The purpose of taking this course is to:

1	Provide foundational knowledge on natural and anthropogenic disasters, their causes, impacts, and risk frameworks.
2	Understand DRR concepts, early warning principles, and preparedness planning
3	Foster awareness of national and global disaster management policies and frameworks
4	Build skills for disaster mitigation using digital tools

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	understand disaster types, key terminologies, and major global and Indian disaster profiles.	U
CO 2	analyse disaster impacts and evaluate early warning systems and agencies.	An
CO 3	apply disaster risk reduction (DRR) principles and the disaster management cycle for preparedness and response.	Ap
CO 4	understand disaster management roles, policies, and institutional frameworks.	U
CO 5	apply digital tools and technologies for disaster mitigation and resilient planning.	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
CO1	3	2	1	-	-	3	2	1	1	-	2	1	1
CO2	2	3	2	3	-	2	-	-	-	-	2	3	2
CO3	1	2	3	3	2	3	1	2	1	-	2	3	2
CO4	2	1	2	2	3	2	1	3	2	-	1	3	2
CO5	2	2	1	-		3	3	1	2	2	3	3	2

Course Content

Introduction to Disaster - Types of disasters - Natural, anthropogenic, hybrid; global and Indian disaster profiles; key terminologies (hazard, vulnerability, exposure, resilience); historical case studies (tsunamis, earthquakes, floods, pandemics); overview of Sendai Framework priorities	**06 Hours**

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Disaster Impacts and Early Warning Systems Disaster Impacts - Environmental, Physical, Social, Ecological, Economic, Political; Health, Psycho-social issues; Demographic aspects (gender, age, special needs); Hazard locations; Global and National disaster trends; Climate change and Urban disasters - Community-based EWS; Role of IMD, INCOIS, CWC, ISRO.	**06 Hours**
Disaster Preparedness and Response Mechanism (4 hours) Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response; Incident Response System (IRS), emergency communication systems; relief distribution planning.	**06 Hours**
Disaster Management Roles & Frameworks Roles and responsibilities of government, Community and youth participation, NDRF/SDRF/ NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority. DM Act 2005, National/State disaster plans; International frameworks -UNOCHA, UNDRR; Climate change linkages	**06 Hours**
Digital Tools and Mitigation Strategies for DRR NDMA/SDMA/DDMA structures, GIS, remote sensing, drones, AI-based early warning, satellite data; social media analytics; ICT tools for humanitarian logistics; digital twins for simulation - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (sustainable and environmentally friendly recovery; reconstruction and development methods	**06 Hours**

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

Learning Resources

Textbooks:

1. Bhandani, R. K. (2006). *An overview on natural and man-made disasters and their reduction*. Council of Scientific and Industrial Research (CSIR).
2. Sharma, V. K. (2013). *Disaster management in India: Challenges and strategies*. Indian Institute of Public Administration.
3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
4. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
5. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
6. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

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References:
1. Srivastava, H. N., & Gupta, G. D. (2018). *Management of natural disasters in developing countries*. Daya Publishing House 2. Murthy, D. B. N. (2007). *Disaster management: Text and case studies*. Deep & Deep Publications Pvt. Ltd.
Online Educational Resources:
1. http://ndma.gov.in/ (Home page of National Disaster Management Authority) 2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

Assessment (Theory course)
Project based learning on real time case Studies (programme specific/trans-disciplinary) - Project Reviews and Report Submission.

*

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on	05.12.2025		
Academic Council Approval	No.29	**Date**	24/12/2025

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SEMESTER VI

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 Team work	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	

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Course Content	
DATA COMMUNICATIONS Basics of Data Communication, Network Models: The OSI Model, TCP/IP Protocol Suite, Addressing, Transmission Media, Networking Devices, Network Topologies. **Practical Component** Demonstrate the use of network Diagnostic tools such as PING, TRACEROUTE, IPCONFIG , NSLOOKUP AND NETSTAT	**8 Hours** **6 Hours**
DATA LINK LAYER Encoding, Error Detection, Reliable Transmission, MAC Protocols, Multiple Access Protocols: Random Access, Controlled Access and Channelization. **Practical Component** 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** **6 Hours**
Network Layer 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 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. **Practical Component** 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** **10 Hours**
NETWORKS SECURITY CONCEPTS 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. **Practical Component** Implementation of substitution and transposition technique.	**9 Hours** **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)
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, Department of Computer Science and Engineering	
Recommended by BoS on	09.05.2025		
Academic Council Approval	No:28	**Date**	26.06.2025

Signature of the BOS Chairman, **AI&DS**

24ADI008	DATA ENGINEERING	L	T	P	J	C
		2	0	2	0	3
PC		SDG	9			

Pre-requisite courses	24ADI204 Data Science and Visualization	Data Book / Codes / Standards (If any)	NIL

Course Objectives

The purpose of taking this course is to:

1	Acquire knowledge of core data engineering principles, common architectures, data modeling techniques, and pipeline concepts.
2	Develop practical skills in implementing data ingestion, storage, processing and orchestration tasks using standard tools.
3	Gain competency in analysing requirements and comparing different data storage and processing strategies.
4	Understand key aspects of data pipeline integration, data quality and governance.
5	Develop the ability to evaluate data engineering approaches based on defined requirements and standard practices.

Course Outcomes

After successful completion of this course- the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Apply core data engineering principles by implementing data ingestion and storage pipelines using both relational and NoSQL databases.	Ap
CO2	Analyze and design data ingestion processes using industry standard tools and frameworks for batch and real-time data handling.	An
CO3	Analyze the suitability of various storage and modeling approaches for different types of data processing and retrieval needs.	An
CO4	Investigate the interaction and integration of components within automated data pipelines including orchestration and cloud deployment.	An
CO5	Analyze the performance scalability and reliability of complete data engineering solutions by examining established metrics and best practices	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	

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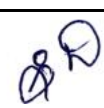
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	2		3							2	3
2	3	3	2									2	
3	3	3	2									2	
4	3	3	2									2	
5	3	2	2								2	3	2

Course Content	
FOUNDATIONS OF DATA ENGINEERING AND DATA SOURCES Role of Data Engineer – Data Engineering Lifecycle – Modern Data Architectures: Data Warehouse, Data Lake, Lakehouse – Data Sources: Relational Databases, NoSQL Databases, APIs, Logs, Streaming Sources – Cloud Fundamentals: IaaS, PaaS, SaaS – Data Modeling Concepts: ER Diagrams, Normalization and Denormalization – Introduction to Version Control using Git & GitHub. Practical Component Advanced SQL Practice – Python-based API Data Ingestion – PostgreSQL Setup and Querying – Local Object Storage using MinIO (S3-compatible) – Git & GitHub Workflow – AI-assisted SQL Query Generation using GitHub Copilot/ChatGPT – ER Diagram Generation using Mermaid/dbdiagram.io – Automated Data Profiling using Pandas Profiling/Sweetviz.	**6 Hours** **6 Hours**
DATA STORAGE SYSTEMS AND MODELING Data Lakes vs Data Warehouses – OLTP vs OLAP Systems – Dimensional Modeling: Star and Snowflake Schema – Introduction to NoSQL Databases – CAP Theorem – Slowly Changing Dimensions (SCDs) – Introduction to Vector Databases for AI Applications. **Practical Component** Loading Data using CSV, Parquet and Avro Formats – PostgreSQL and DuckDB Interaction – MongoDB CRUD Operations – Designing Star Schemas – Schema Design using dbdiagram.io – AI-assisted Schema Optimization – Introduction to ChromaDB/Weaviate for Vector Storage.	**6 Hours** **6 Hours**
DATA PROCESSING AND ETL/ELT PIPELINES ETL vs ELT Workflows – Batch vs Stream Processing – Distributed Computing Concepts – Introduction to MapReduce – Apache Spark Architecture – PySpark DataFrame API – Spark SQL – Data Cleaning and Transformation Strategies. **Practical Component** Apache Spark & PySpark Environment Setup – Building ETL Pipelines using PySpark – Spark SQL Transformations – Basic MapReduce Demonstration – AI-assisted PySpark Code Generation using GitHub Copilot/ChatGPT – Debugging Spark Jobs and DAG Visualization.	**6 Hours** **6 Hours**



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WORKFLOW ORCHESTRATION AND PIPELINE INTEGRATION Need for Workflow Orchestration – DAG Concepts – Apache Airflow Architecture – Operators, Tasks and Scheduling – Pipeline Dependency Management – Logging and Monitoring – Introduction to CI/CD for Data Pipelines – Production Deployment Basics.	**6 Hours**
Practical Component Apache Airflow Installation and Configuration – Writing and Scheduling DAGs – Task Dependency Mapping – Pipeline Integration Testing – GitHub Actions for Simple CI/CD Automation – AI-assisted DAG Generation using ChatGPT/Copilot.	**6 Hours**
DATA GOVERNANCE AND QUALITY EVALUATION Data Quality Dimensions – Data Governance Concepts – Metadata and Data Catalogues – Introduction to Kafka – Spark Structured Streaming – Performance Optimization – Cost Optimization – Security and Reliability Metrics – Data Observability Basics.	**6 Hours**
Practical Component Data Quality Validation using Great Expectations – Kafka Streaming Basics – Spark Structured Streaming Implementation – Performance Evaluation – Monitoring using Grafana & Prometheus – AI-assisted Data Validation Rule Generation – Data Drift and Anomaly Detection Basics.	**6 Hours**

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

Learning Resources

Textbooks

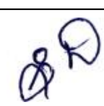
1. Reis, Joe. *Generative AI for Data Engineers*. O'Reilly Media, 2024.
2. Harenslak, and Julian de Ruiter. *AI-Powered Data Pipelines*. Manning Publications, 2024.
3. Crickard, Paul. *Data Engineering with Python*. 2nd ed. Packt Publishing, 2023.
4. Reis, Joe, and Matt Housley. *Fundamentals of Data Engineering: Designing and Building Modern Data Systems*. O'Reilly Media, 2022.
5. Chambers, Bill, and Matei Zaharia. *Spark: The Definitive Guide: Big Data Processing Made Simple*. O'Reilly Media, 2018.
6. Kimball, Ralph, and Margy Ross. *The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling*. 3rd ed. Wiley, 2013.

Reference

1. Kleppmann, Martin. *Designing Data-Intensive Applications*. O'Reilly Media, 2017.
2. Harenslak, Bas P., and Julian Rutger de Ruiter. *Data Pipelines with Apache Airflow*. Manning Publications, 2021.

Online Resources (Weblinks)

1. Apache Spark Documentation: https://spark.apache.org/docs/latest/
2. Apache Airflow Documentation: https://airflow.apache.org/docs/
3. AWS Skill Builder – Learning paths including S3- Redshift- EMR https://www.aws.training/
4. Microsoft Learn – Azure Data Lake- Synapse- and cloud fundamentals https://learn.microsoft.com/en-us/training/
5. Google Cloud Skills Boost – GCS- BigQuery- Dataflow- and data engineering labs https://www.cloudskillsboost.google/
6. Udacity – Data Engineer Nanodegree (covers pipelines- Spark- Airflow- cloud tools) https://www.udacity.com/course/data-engineer-nanodegree--nd027



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7. Databricks Academy: https://www.databricks.com/learn/training/home

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

<table>
<tr><th colspan="4">Course Curated by</th></tr>
<tr><th>Expert(s) from Industry</th><th colspan="2">Expert(s) from Higher Education Institution</th><th>Internal Expert(s)</th></tr>
<tr><td>Mr.Vijesh Solomon,
IT Architect,
IBM</td><td colspan="2">Dr. C. Sharmila
Assistant Professor Senior Grade 1
School of Computer Science and Engineering,
Vellore Institute of Technology.</td><td>Dr. Sophia.B,
Assistant Professor -III,
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</table>

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24ADI009	COMPUTER VISION	L	T	P	J	C
		2	0	0	2	3
PC		SDG	9			

Pre-requisite courses	24ADI306 Deep Learning	Data Book / Code book (If any)	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the fundamental principles of computer vision, including image processing, feature extraction, and object recognition.
2	Implement geometric computer vision techniques such as camera calibration, stereo vision, homography estimation, optical flow, and 3D reconstruction.
3	Implement deep learning models such as CNNs, YOLO, Faster R-CNN, U-Net, and Vision Transformers for image classification, object detection, segmentation, and OCR tasks.
4	Explore advanced techniques in transformer-based vision models, multi-modal learning, motion analysis, and vision-based decision-making systems.
5	Utilize computer vision techniques to real-world applications in healthcare, autonomous vehicles, augmented reality, large-scale image search, and intelligent surveillance systems.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO1	Apply fundamental concepts of digital image processing by implementing edge detection, morphological operations, and feature extraction techniques for computer vision applications.	Ap
CO2	Apply geometric techniques camera calibration, epipolar geometry, optical flow and 3D reconstruction, to estimate depth and motion in visual data.	Ap
CO3	Develop deep learning models for object detection, image classification, text recognition, and document analysis in real-world applications.	Ap
CO4	Examine vision transformers and multi-modal learning models to enhance image recognition and integrate vision with natural language processing.	An
CO5	Analyze advanced computer vision techniques to solve complex real-world challenges across diverse application domains.	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**	

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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
2	2	2										3	3
3	2											3	3
4	2		3									3	3
5					2	2						3	3

Course Content	
FUNDAMENTALS OF COMPUTER VISION Digital Image Processing: Image Formation- Image Filtering- Image Representation and Color Spaces- Edge Detection- Principal Component Analysis- Corner Detection- Morphological Operations and Image Segmentation -Thresholding- Watershed- Feature Extraction: SIFT- SURF- ORB- Applications: Large Scale Image Search.	**7 Hours**
GEOMETRIC TECHNIQUES Projective Geometry in Computer Vision- Camera Models & Calibration- Epipolar Geometry & Stereo Vision- Feature Detection and Matching- Homographies and Image Alignment- Optical Flow and Motion Estimation- Structure from Motion and 3D Reconstruction- Visual Simultaneous- Localization and Mapping- Pose Estimation and Augmented Reality- Geometric Deep Learning for 3D Vision and motion analysis.	**8 Hours**
MODERN COMPUTER VISION Transfer Learning with Pretrained Models -VGG-ResNet- EfficientNet- Basics of object detection- Region Proposals-Selective search- Bounding box- IoU-Non max suppression- Mean average precision- Anchor boxes-RCNN- Faster R-CNN- YOLO- Image Segmentation: U-Net- Mask R-CNN- Deep Learning-Based OCR- Text Detection and Localization- Post-Processing and OCR Optimization.	**8 Hours**
VISION TRANSFORMERS AND ADVANCED APPLICATIONS Introduction to Vision Transformers- Self-Attention Mechanism and Applications- Multi-Modal Vision Models -CLIP- DINO- Computer Vision in Healthcare- Autonomous Vehicles -Augmented Reality.	**7 Hours**
PROJECT To design and develop a comprehensive computer vision pipeline that processes images/videos for feature extraction, 3D understanding, object recognition, and vision-based decision-making using classical and deep learning approaches, culminating with transformer-based and multi-modal methods. **Final Deliverables (Presentation & Report)** • GitHub repo with code, data samples, and README • 10-minute project presentation with visuals • Final report summarizing problem, methods, datasets, results, and future work	**30 Hours**

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

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Learning Resources

Textbooks:

1. Simon J. D. Prince. Computer Vision: Models, Learning, and Inference. Cambridge University Press, 2012.
2. Richard Szeliski. Computer Vision: Algorithms and Applications. Springer Nature, 2022.

References:

1. Richard Hartley and Andrew Zisserman. Multiple View Geometry in Computer Vision. Cambridge University Press, 2003.
2. David A. Forsyth and Jean Ponce. Computer Vision: A Modern Approach. Prentice Hall Professional Technical Reference, 2002.
3. Christopher M. Bishop. Pattern Recognition and Machine Learning. Springer, 2006.
4. Adrian Rosebrock. Deep Learning for Computer Vision with Python. PyImageSearch, 2019

Online Educational Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs101/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs126/preview
3. https://cs231n.stanford.edu
4. OpenCV: OpenCV modules https://www.coursera.org/specializations/deep-learning
5. https://course.fast.ai
6. https://www.udacity.com/course/computer-vision-nanodegree--nd891
7. Google Research – Vision AI and Transformers. https://research.google
8. PyImageSearch Computer Vision Tutorials. https://pyimagesearch.com

Assessment (Embedded course)
SA I, SA II, Activity and Learning Task(s), Mini project, Case Study, MCQ, End Semester Examination (ESE)

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24ADI010	NATURAL LANGUAGE PROCESSING	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9			

Pre-requisite courses	24ADI003 Machine Learning	Data Book / Code book (If any)	NIL

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the foundational concepts, terminologies, and applications of Natural Language Processing.
2	Apply core NLP techniques such as text preprocessing, tokenization, stemming, lemmatization, and parsing to transform raw text into structured representations.
3	Analyze language models, including n-grams, probabilistic approaches, and neural network-based models, for tasks like text generation and translation.
4	Evaluate the effectiveness of NLP techniques in advanced tasks such as sentiment analysis, topic modeling, and named entity recognition.
5	Gain practical exposure to build robust NLP systems for real-world applications, such as chatbots, virtual assistants, and text summarization, using state-of-the-art frameworks and tools.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply foundational concepts of natural language processing in solving complex real-world challenges.	Ap
CO 2	Implement pre-processing and text structuring techniques to transform raw textual data into analysable formats.	Ap
CO 3	Analyze the strengths, limitations, and trade-offs of various language models for text generation and translation.	An
CO 4	Examine the effectiveness of NLP models using evaluation metrics BLEU, perplexity, and accuracy.	An
CO 5	Develop NLP-based applications by integrating ethical principles.	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

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1	3				2							2	2
2		3			2							2	2
3		2			2							2	2
4				2	2							2	2
5			2		2	2					2	2	2

Course Content	
INTRODUCTION TO NATURAL LANGUAGE PROCESSING Introduction to NLP: Definition of Natural Language Processing-The role of NLP in artificial intelligence-Challenges in NLP: ambiguity, variability -Applications of NLP: Machine Translation, Speech Recognition, Chatbots. Text Pre-processing: Tokenization: Breaking text into words, sentences- Removing stop words, punctuation, and special characters- Lowercasing and handling case sensitivity- Stemming and Lemmatization- Text normalization: handling contractions, special characters. NLP Libraries: Introduction to popular NLP libraries: NLTK, spaCy, Gensim, Hugging Face Transformers. **Practical Component:** Tokenize a given text and pre-process it by removing stop words, punctuation, and performing stemming - Perform lemmatization using spaCy to reduce words to their base form - Perform basic text preprocessing using Hugging Face pipeline.	**9 Hours** **6 Hours**
TEXT REPRESENTATION AND LANGUAGE MODELS Text Representation Methods:Bag-of-Words (BoW) model- Term Frequency-Inverse Document Frequency (TF-IDF)- Word embeddings (Word2Vec, GloVe). Language Models: Definition and importance of language models- N-grams and n-gram models: Bigram, Trigram- Smoothing techniques (Laplace Smoothing, Good-Turing smoothing). Introduction to contextual embeddings using transformer models (BERT, RoBERTa). Evaluation metrics: BLEU score, perplexity, and BERTScore for semantic similarity evaluation. Applications: Text classification, information retrieval, and machine translation. **Practical Component:** Convert a collection of text into a Bag-of-Words representation using Scikit-learn - Create a bigram model and calculate probabilities of word sequences in a sample text, Compute similarity using BERTScore.	**9 Hours** **6 Hours**
PART-OF-SPEECH TAGGING AND SEQUENCE LABELING Part-of-Speech Tagging: Definition and importance of POS tagging- Tagging schemes: Penn Treebank tagset- Rule-based and statistical methods for POS tagging- Hidden Markov Models (HMM) for sequence labeling. Sequence Labeling: Definition and applications: Named Entity Recognition (NER), Chunking, Sequence labeling with HMMs and transformer-based models. **Practical Component:** Perform POS tagging using NLTK's built-in POS tagger - Extract named entities from a given text using spaCy.- Hugging Face Transformers (mBERT/XLM-R for multilingual NER)	**9 Hours** **6 Hours**
SYNTACTIC, SEMANTIC AND DISTRIBUTIONAL ANALYSIS Constituency Parsing: Parse trees and structure of a sentence, Context-Free Grammar	**9 Hours**

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(CFG), Bottom-up and top-down parsing strategies. Dependency Parsing: Dependency relations between words, Dependency tree structures, Using spaCy for dependency parsing. Word Embeddings : Introduction to distributed representations of words- Word2Vec, GloVe, FastText- Similarity and analogy tasks with embeddings. Semantic Analysis: Word similarity and relatedness, Evaluating semantic similarity using cosine similarity. **Practical Component:** Parse a sentence using Context-Free Grammar and NLTK's ChartParser - Parse a sentence to extract its dependency structure using spaCy. Train a Word2Vec model on a corpus and calculate word similarity - Use pre-trained GloVe embeddings to calculate word similarity - Perform semantic similarity using BERT-based embeddings.	**6 Hours**
ADVANCED NLP APPLICATIONS Named Entity Recognition (NER): Definition and types of named entities (person, location, organization), NER with spaCy, Applications of NER in information extraction. Text Classification and Sentiment Analysis : Introduction to text classification, Sentiment analysis: detecting positive, negative, and neutral sentiments, Applications in social media and customer feedback analysis , Ethics in NLP. **Practical Component:** Build a simple text classifier using Scikit-learn for sentiment analysis - Extract named entities from text using spaCy- RAG-based QA systems and bias detection in NLP Models.	**9 Hours** **6 Hours**

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

Learning Resources

Textbooks:

1. Bird, Steven, Ewan Klein, and Edward Loper. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit (2nd Edition). O'Reilly Media, Sebastopol, CA, 2024.
2. Chollet, François. Deep Learning with Python. Manning Publications, Shelter Island, NY, 2021.
3. Goldberg, Yoav. Neural Network Methods for Natural Language Processing. Morgan & Claypool Publishers, San Rafael, CA, 2021.
4. Jurafsky, D., & Martin, J.H., Speech and Language Processing (3rd Edition), Pearson, London (2023).
5. Manning, C.D., & Sch¸ tze, H., Foundations of Statistical Natural Language Processing, MIT Press, Cambridge, MA (2022).

References:

1. Mikolov, T., Sutskever, I., Chen, K., Corrado, G.S., & Dean, J., Distributed Representations of Words and Phrases and Their Compositionality, Advances in Neural Information Processing Systems (NIPS), Vol. 26, pp. 3111-3119. DOI: 10.5555/2999792.2999959 (2013).
2. Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A., Kaiser, Ł., & Polosukhin, I., Attention is All You Need, Proceedings of NeurIPS: pp. 5998-6008. DOI: 10.5555/3295222.3295344 (2017).
3. Peters, M.E., Neumann, M., Iyyer, M., Gardner, M., Clark, C., Lee, K., & Zettlemoyer, L., Deep Contextualized Word Representations, Proceedings of NAACL-HLT: pp. 2227-2237. DOI: 10.5555/3185612.3185655 (2018).

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4. Lample, G., Ballesteros, M., Subramanian, S., Kawakami, K., & Dyer, C., Neural Architectures for Named Entity Recognition, Proceedings of NAACL: pp. 1-11. DOI: 10.5555/2996568.2996571 (2016).
5. Vinyals, O., & Le, Q.V., A Neural Network for Machine Translation, at Scale, Proceedings of NeurIPS: pp. 361-369. DOI: 10.5555/3044824.3044914 (2015).
6. Devlin, J., Chang, M.W., Lee, K., & Toutanova, K., BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding, Proceedings of NAACL: pp. 4171-4186. DOI: 10.5555/3295222.3295344 (2018).

Online Resources (Weblinks)

1. https://nltk.org - Natural Language Toolkit Documentation
2. https://spacy.io - SpaCy Documentation
3. https://onlinecourses.nptel.ac.in/noc19_cs56/preview - NPTEL Course on NLP
4. https://huggingface.co - Hugging Face Tutorials
5. https://huggingface.co/docs/transformers
6. https://radimrehurek.com/gensim/ - Gensim
7. https://www.coursera.org/specializations/natural-language-processing - Coursera – NLP Specialization (DeepLearning.AI)
8. https://github.com/anoopkunchukuttan/indic_nlp_library - Indic NLP Library
9. https://ai4bharat.org/ - AI4Bharat (Indic NLP models & datasets)
10. https://web.stanford.edu/class/cs224n/

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dharaniswaran C J, Cloud Engineer, Krutrim, Bengaluru.	Dr. C. Sharmila Assistant Professor Senior Grade 1 School of Computer Science and Engineering, Vellore Institute of Technology.		Dr. Sophia.B, Assistant Professor, Artificial Intelligence & Data Science
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	**Date**	19.06.2026

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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	Apply software project management techniques including planning, scheduling, estimation, risk management, and team organization.
3	Comprehend Agile values, principles, and frameworks such as Scrum, Kanban, and Extreme Programming (XP).
4	Implement software testing strategies including unit, integration, system, and acceptance testing in both traditional and Agile contexts.
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; analyze 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**	

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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
4		3			3						3	3	
5		3			3						3	3	3

Course Content	
SOFTWARE ENGINEERING FUNDAMENTALS 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.	**9 Hours**
Project Component: Requirements and Design Phase 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.	**6 Hours**
AGILE METHODOLOGIES 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.	**9 Hours**
Project Component: Agile Sprint Simulation 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	**6 Hours**

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retrospective notes	
SOFTWARE TESTING 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. **Project Component: Testing Phase** 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** **6 Hours**
SOFTWARE PROJECT MANAGEMENT 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. **Project Component: Planning Phase** 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** **6 Hours**
SOFTWARE QUALITY, PROCESS IMPROVEMENT AND DEVOPS 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. **Project Component: Quality, DevOps and Final Delivery** 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	**9 Hours** **6 Hours**

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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.	

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.
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)

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

<table>
<tr><th colspan="4">Course Curated by</th></tr>
<tr><th>Expert(s) from Industry</th><th colspan="2">Expert(s) from Higher Education Institution</th><th>Internal Expert</th></tr>
<tr><td>-</td><td colspan="2">-</td><td>Dr. Sathyavathi, AP/IT</td></tr>
<tr><td>Recommended by BoS on</td><td colspan="3">06.06.2026</td></tr>
<tr><td>Academic Council Approval</td><td>No: 30</td><td>Date</td><td>19.06.2026</td></tr>
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ELECTIVES

WEB AND SOFTWARE DEVELOPMENT

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24CSC001	UI AND UX DESIGN	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 Understanding UI vs. UX Design, Design Thinking Framework, Innovative Thinking Methods, Empathy Techniques for User Insights. **Practical Component** 1. Create User Personas and Empathy Maps for a selected product idea. 2. Apply Design Thinking methodology to identify and solve a user problem. 3. Design a project board and visual theme using Canva.	**6 Hours** **6 Hours**
UI DESIGN PRINCIPLES FOR INDUSTRY Visual Design Standards, UI Components and Design Patterns, User Interaction and Engagement, Branding Integration and Style Guides. **Practical Component** 1. Explore and analyze common UI components and interaction patterns. 2. Design a responsive user interface layout using Figma. 3. Create a UI Style Guide with colors, typography, and components.	**6 Hours** **6 Hours**
UX RESEARCH AND STRATEGY IN THE INDUSTRY UX Fundamentals for Business Impact Design Process, Industry Research Techniques, Aligning User and Business Goals **Practical Component** 1. Perform competitor analysis and user research for a digital product. 2. Develop user journey maps aligning user and business goals. 3. Create a pattern library including fonts, colors, and reusable assets.	**6 Hours** **6 Hours**
WIREFRAMING, PROTOTYPING AND TESTING 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. **Practical Component** 1. Design low-fidelity wireframes and wireflow diagrams for an application. 2. Develop an interactive prototype using Figma 3. Conduct usability testing and refine the prototype based on feedback.	**6 Hours** **6 Hours**
LOW CODE -NO CODE TOOLS 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. **Practical Component** 1. Configure a Figma workspace and create basic UI screens. 2. Create and manage layout grids and Auto Layout features in Figma. 3. Design reusable components and build a shared design library.	**6 Hours** **6 Hours**

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

Learning Resources*
Textbooks

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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.
2. Don Norman, The Design of Everyday Things: Revised and Expanded Edition, Basic Books, 2013.
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) 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 Assistant Professor 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	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 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. **Practical Component** 1. Implement basic arithmetic and logical operations using Swift Playground 2. Develop programs using conditional statements (if–else and switch). 3. Design and develop a simple Calculator application using Swift.	**6 Hours** **6 Hours**
XCODE ENVIRONMENT AND INTERFACE BUILDER ESSENTIALS Xcode - Xcode Files Types - Xcode Preference - Building, Running, and Debugging an App - Interface Builder Basics - Storyboards - Interface Builder Layout - Outlets And Actions. **Practical Component** 4. Explore Xcode environment, project structure, and debugging tools 5. Create user interfaces using Storyboards, Outlets, and Actions 6. Design and develop a Light App using Interface Builder.	**6 Hours** **6 Hours**
UIKIT FUNDAMENTALS AND USER INTERFACE 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. **Practical Component** 1. Develop applications using strings, functions, collections, and loops. 2. Create interactive user interfaces using UIKit controls and Auto Layout. 3. Design and develop a Color Picker or Xylophone application.	**6 Hours** **6 Hours**
ADVANCED SWIFT CONCEPTS AND NAVIGATION TOOLS Optionals - Functions and Optionals - Type Casting and Inspection - Guard - Guard with Optionals - Constant and Variable Scope - Enumerations - Segues and Navigation Controllers. .**Practical Component** 1. Implement programs using optionals, type casting, and enumerations. 2. Create multi-screen applications using Segues and Navigation Controllers. 3. Design and develop a Traffic Light application with screen navigation.	**6 Hours** **6 Hours**
APP NAVIGATION AND VIEW CONTROLLER LIFECYCLE Navigation Controllers - Tab Bar Controllers - View Controller Life Cycle- View Did Load - View Event Management **Practical Component** 1. Develop applications using Navigation Controllers and Tab Bar Controllers. 2. Demonstrate View Controller Life Cycle events and event management. 3. Design and develop a Simple Alarm application using Tab Bar Controller.	**6 Hours** **6 Hours**

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

Learning Resources*
Textbooks
1. Develop in Swift, Fundamentals, Apple Education, https://books.apple.com/in/book/develop-in-swi,-fundamentals/id1581182804. 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). 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). 3. Mark, Ray., iOS Apprentice: Beginning iOS Development with Swift., Razeware LLC (2022). 4. Sadun, Erica., Swift Pocket Reference., O'Reilly Media Sebastopol (2015).
Online Resources
1. https://coursera.org/learn/programming-fundamentals-swift 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 Project Manager Ernst & Young		Nivetha R, AP/CSE
Recommended by BoS on	06.06.2026	
Academic Council Approval	No: 30	**Date:** 19.06.2026

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24CSC003	MOBILE APPLICATION DEVELOPMENT	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

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1	2				2								3
2			3		2								3
3			3		2								3
4			3		2								3
5			3		2								3

<u>Course Content</u>	
FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, Overview of Flutter architecture, Installing flutter SDK **Practical Component** 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** **6 Hours**
DART PROGRAMMING FUNDAMENTALS Variables, data types, operators, expressions, functions, object oriented programming, classes, collections, null safety, async programming. **Practical Component** Develop a hello world using Dart Implement OOP examples. Implement few mini projects, for example student grade calculator	**6 Hours** **6 Hours**
CROSS-PLATFORM APP DEVELOPMENT USING FLUTTER 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 **Practical Component** Flutter environment setup create hello world app using flutter environment. Implement basic user interface with forms, display collections of data, integrate multiple screens with navigation	**6 Hours** **6 Hours**
DATA HANDLING AND API INTEGRATION JSON parsing, REST API Integration, HTTP package, future builder, stream builder, local storage and firebase basics, flutter packages, camera integration, gps, notifications, file handling. **Practical Component** Fetch API data Parse JSON data 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** **6 Hours**
DEPLOYMENT AND PUBLISHING Build APK and app bundle, release configuration, publishing to google play store, app store, CI/CD overview **Practical Component** Develop a small mobile app, release and simulate deployment. **AI Tools:** ChatGPT, GitHub Copilot	**6 Hours** **6 Hours**

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

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 Mr. N. SathyaSeelan N Assistant Professor II 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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24CSC004	SOFTWARE TESTING AND AUTOMATION	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

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4			2										3
5					2								3

<u>Course Content</u>

FOUNDATIONS OF SOFTWARE TESTING 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 **Practical Component** 1. Analyze a simple software application and identify its functional and non-functional requirements for testing. **2.** Classify test scenarios using Black-Box and White-Box testing techniques. 3. Prepare a Software Testing Life Cycle (STLC) and V-Model mapping for a selected application. 4. Perform Unit Testing on selected program modules and document the results.	**6 Hours** **6 Hours**
TEST PLANNING 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. **Practical Component** 1. Identify test objectives, scope, assumptions, and risks for a selected application. 2. Develop a comprehensive Test Plan document. 3. Create a Test Schedule and Resource Allocation Plan. 4. Design a Bug Reporting Template and define testing metrics for project monitoring.	**6 Hours** **6 Hours**
TEST DESIGN AND EXECUTION 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 **Practical Component** 1. Identify testable requirements and derive test scenarios. 2. Design test cases using Equivalence Class. 3. Design test cases using Boundary Value Analysis. 4. Design and execute test cases using Path Testing and Data Flow Testing techniques.	**6 Hours** **6 Hours**
ADVANCED TESTING CONCEPTS 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. **Practical Component** 1. Perform Compatibility and Usability Testing on a web or mobile application. 2. Conduct Security Testing and document identified vulnerabilities. 3. Perform Load, Stress, and Volume Testing using suitable testing tools. 4. Execute test cases, record defects, and prepare a Bug Life Cycle report.	**6 Hours** **6 Hours**

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TEST AUTOMATION AND TOOLS 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.	6 Hours
Practical Component 1. Configure Selenium WebDriver and automate basic browser operations. 2. Automate form validation and navigation test cases using Selenium. 3. Develop and execute TestNG test suites and generate automated test reports. 4. Automate end-to-end testing of a web application and generate execution reports.	**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 Assistant Professor Department of Computer Science and Engineering
Recommended by BoS on	06.06.2026	
Academic Council Approval	No: 30	**Date:** 19.06.2026

Signature of the BOS Chairman, AI&DS

24CSC005	**DEVOPS MASTERY**	**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

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3			3	3	3								3
4			3	3	3								3
5			3	3	3								3

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

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DEVOPS INTEGRATION AND MONITORING • Integrating CI/CD with Docker, Kubernetes, Ansible, Terraform • Deployment strategies: blue-green, rolling • Monitoring: Prometheus, Grafana • Logging, security practices	**3 Hours**
Practical Component 1. Integrate Git, Jenkins, and Docker to implement a Continuous Integration workflow. 2. Implement Continuous Deployment using Docker, Kubernetes, and Jenkins. 3. Configure Prometheus and Grafana to monitor application and infrastructure performance. 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

Signature of the BOS Chairman, AI&DS

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

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24CSC006	SOFTWARE PROJECT MANAGEMENT	L	T	P	J	C
PE		2	0	2	0	3
		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	

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CO5		3		2	2			2	3	3		3	

Course Content	
SOFTWARE PROJECT MANAGEMENT FUNDAMENTALS 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. **Practical Component** 1.Identify project goals, stakeholders, and scope for a simple software application. 2. Prepare a Project Charter using Notion AI. 3. Conduct Technical, Economic, and Operational Feasibility Analysis and prepare a feasibility report. 4. Generate a Software Requirement Summary and Requirement Specification document using Notion AI.	**6 Hours** **6 Hours**
PROJECT PLANNING, ESTIMATION AND SCHEDULING 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. **Practical Component** 1. Develop a Work Breakdown Structure (WBS) for the selected software project 2. Create a Gantt Chart showing project activities, dependencies, and milestones. 3. Perform effort and cost estimation for the software project using suitable estimation techniques. 4. Create a project schedule in Jira by defining tasks, timelines, priorities, and resource assignments.	**6 Hours** **6 Hours**
AGILE PROJECT MANAGEMENT AND ITERATION PLANNING 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. **Practical Component** 1. Develop Epics, User Stories, and Acceptance Criteria for the selected software project. 2. Create a Product Backlog and Sprint Backlog using Jira. 3. Configure a Sprint Board in Jira by organizing user stories, assigning tasks, and estimating story points. 4. Generate Sprint Review and Sprint Retrospective reports for a given project scenario using Notion AI.	**6 Hours** **6 Hours**
RISK MANAGEMENT AND SOFTWARE DELIVERY 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. **Practical Component** 1. Identify project risks and prepare a Risk Register. 2. Develop Risk Mitigation and Contingency Plans using Notion AI. 3. Create and manage issue tickets, bug reports, labels, and workflows using GitHub Projects. 4. Configure Jira dashboards and generate project progress reports using sample project data.	**6 Hours** **6 Hours**

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PROJECT MONITORING, REPORTING AND ANALYTICS 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 1. Create project performance dashboards and analyze project metrics. 2. Generate project status reports and analytics summaries using Notion AI. 3. Prepare project closure documentation including lessons learned and project outcomes. 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.
2. Schwalbe, Kathy., Information Technology Project Management, 9th Edition, Cengage Learning, 2019.
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.
2. Rubin, Kenneth S., Essential Scrum: A Practical Guide to the Most Popular Agile Process, Addison-Wesley, 2013.
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
2. https://www.coursera.org/learn/project-management-principles-and-practices
3. https://www.atlassian.com/agile
4. https://www.scrum.org/resources
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

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CYBER SECURITY

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24CSC007	SECURE SOFTWARE DEVELOPMENT	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 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 **Practical Component** 1. Studying and Installing Kali Linux	**6 Hours** **4 Hours**
SECURE SOFTWARE DESIGN 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 **Practical Component** 1. Implementation of the Buffer Overflow attack 2. Implementation of the SQL injection attack 3. Implementation of Cross Site Scripting and Prevention of XSS	**7 Hours** **6 Hours**
SECURITY RISK MANAGEMENT Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management **Practical Component** 1. Basic risk profiling and assessment of a known software vulnerability	**5 Hours** **4 Hours**
SECURITY TESTING 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 **Practical Component** 1. Penetration testing on a web application to gather information about the system 2. Initiate XSS and SQL injection attacks using tools like Kali Linux 3. Developing and testing the secure test cases	**8 Hours** **8 Hours**
SECURE PROJECT MANAGEMENT Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice **Practical Component** 1. Implementation of secured web application	**4 Hours** **8 Hours**

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

Learning Resources*

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Textbooks
1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2009

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
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
3. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005.
4. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.
5. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First edition, Syngress Publishing, 2012
6. Bryan Sullivan and Vincent Liu, “Web Application Security, A Beginner's Guide”, Kindle Edition, McGraw Hill, 2012
7. Lee Allen, “Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)”, Kindle Edition, Packt Publishing, 2012
8. Gary McGraw, "Software Security: Building Security In", Addison-Wesley Professional (Pearson Education), 2006.
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

MOOCS:

1. https://nptel.ac.in/courses/106106199/
2. https://www.mooc-list.com/course/software-security-cousera
3. https://www.coursera.org/specializations/requirements-engineering-secure-software
4. https://pe.gatech.edu/courses/secure-software-development
5. https://www.my-mooc.com/en/mooc/software-security/
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

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24CSC008	DIGITAL FORENSICS	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

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Course Content	
OVERVIEW OF DIGITAL FORENSICS 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	**6 Hours**
Practical Component 1. Install and configure a digital forensic tool (e.g., FTK Imager, Autopsy, Guymager). 2. Identify different types of digital evidence available on a storage device. 3. Acquire data from a USB drive or hard disk.	**6 Hours**
FILE SYSTEMS AND DATA RECOVERY File System Analysis: Understanding file systems and their structures. Deleted File Recovery: Techniques for recovering deleted files. File Carving: Extracting files from unallocated space.	**6 Hours**
Practical Component 1. Examine the structure of FAT32, NTFS, and EXT4 file systems. 2. Identify partitions, directories, file allocation tables, and master file tables. 3. Demonstration of the data recovery techniques.	**6 Hours**
COMPUTER, NETWORK AND MOBILE DEVICE FORENSICS 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.	**6 Hours**
Practical Component 1. Identify and analyze digital evidence from a computer system, network traffic, and volatile memory. 2. Extract and analyze evidence from mobile devices, applications, and cloud-based services	**6 Hours**
MALWARE ANALYSIS 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	**6 Hours**
Practical Component 1. Analyze malware samples using static and dynamic analysis techniques and identify malicious behaviors. 2. Investigate a simulated security incident and design a basic bug bounty program.	**6 Hours**
AUTOMATED FORENSICS 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.	**6 Hours**
Practical Component 1. Automated Digital Forensic Investigation Using Forensic Tools 2. Digital Forensic Case Analysis and Expert Witness Reporting	**6 Hours**

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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. 2. https://www.open.edu/openlearn/science-maths-technology/digital-forensics/contentsection-0?active-tab=content-tab. 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 the BOS Chairman, AI&DS

24CSC009	NETWORK SECURITY ADMINISTRATION	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

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6		3			3		3						3

Course Content	
NETWORK SECURITY BASICS 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. **Practical Component** 1. Implementation of Advanced Encryption Standard (AES) algorithm 2. Designing of a secure network and identify optimal encryption device placement.	**6 Hours** **6 Hours**
ASYMMETRIC CIPHERS AND DATA INTEGRITY ALGORITHM 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. **Practical Component** 1. Implementation of RSA algorithm 2. Implementation of secure hash algorithm.	**6 Hours** **6 Hours**
INTERNET SECURITY 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. **Practical Component** 1. Analysing of FTP, Telnet and HTTP packets using wireshark 2. Implementation of Image Sniffing using Wireshark.	**6 Hours** **6 Hours**
NETWORK SECURITY MANAGEMENT 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. **Practical Component** 1. Configuring objects in smart console 2. Managing administrator access for an operating system 3. Elevating Security with Autonomous Threat Prevention	**6 Hours** **6 Hours**
NETWORK SECURITY CONFIGURATION 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. **Practical Component** 1. Configuring NAT to use a private IP address 2. Creating a security policy and integrating it with a unified policy 3. Monitoring System States and Maintaining the Security Environment.	 **6 Hours** **6 Hours**

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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, Assistant Professor III,CSE
Recommended by BoS on	06.06.2026	
Academic Council Approval	No: 30	Date: 19.06.2026

Signature of the BOS Chairman, AI&DS

24CSC010	ETHICAL HACKING AND CYBER LAWS	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 Understanding the importance of security, Concept of ethical hacking and essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking **Practical Component** 1. Installation of Kali or Backtrack Linux / Metasploitable/ Windows XP 2 2. Reconnaissance Techniques for Information Gathering.	**6 Hours** **6 Hours**
FOOTPRINTING & PORT SCANNING 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 **Practical Component** 1. Passive Footprinting Using OSINT Tools 2. Active Footprinting and Network Mapping 3. Perform System Enumeration on Windows and Linux	**6 Hours** **8 Hours**
SYSTEM HACKING 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. Side-channel Attacks on Cryptographic Hardware: Basic Idea, Current-measurement based Side-channel Attacks. Hardware Trojans **Practical Component** 1. Password guessing and Password Cracking 2. Understanding Data Packet Sniffers 3. Working with Trojans, Backdoors	**6 Hours** **10 Hours**
HACKING WIRELESS NETWORKS Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks **Practical Component** 1. Cracking WEP Encryption 2. Wireless Sniffing and DoS Attack Simulation	**6 Hours** **6 Hours**
Cyber Law and Ethical Frameworks 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). 2. Vivek Sood, Cyber Law Simplified, Tata McGraw-Hill (2017)
Reference books/ Web Links

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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 (3^{rd} 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**

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24CSE011	WEB APPLICATION SECURITY	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	

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Course Content	
FUNDAMENTALS OF WEB APPLICATION SECURITY 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 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 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 Secure website design: Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management, Sensitive Data, Session Management, Cryptography, Parameter Manipulation, Exception Management, Auditing and Logging, Design Guidelines, Forms and validity, technical implementation.	**9 Hours**
HACKING TECHNIQUES AND TOOLS 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

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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.
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. 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/ 2. https://web.stanford.edu/class/cs253/ 3. https://owasp.org/www-project-top-ten/ 4. https://www.hackthebox.com/blog/vulnerability-assessments-vs-pentesting 5. https://developer.mozilla.org/en-US/docs/Learn_web_development/Extensions/Server-side/First_steps/Website_security 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 the BOS Chairman, AI&DS

24CSE012	DATABASE SECURITY	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	

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Course Content	
FOUNDATIONS OF DATABASE SECURITY 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 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 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 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 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).
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.
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).
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)

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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**

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24CSC021	DIGITAL EVIDENCE AND CYBER INVESTIGATION	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

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5					3								2

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

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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

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BLOCKCHAIN

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24CSE023	BLOCKCHAIN TECHNOLOGY	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

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Course Content	
Blockchain Fundamentals and Cryptographic Building Blocks 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 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 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 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 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

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

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24CSE013	CRYPTOCURRENCY AND BITCOINS	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

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2	2	2				3	2						2
3	2	3				2	2						2
4	2	3				2	2						2
5	2					2	3						2

<u>Course Content</u>	
FUNDAMENTALS OF BITCOIN AND CRYPTOGRAPHY 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 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 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 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 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

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

Online Resources
1. https://www.coursera.org/learn/cryptocurrency 2. https://www.edx.org/learn/bitcoin/university-of-california-berkeley-bitcoin-and-cryptocurrencies 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	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 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 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 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 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 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

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24CSC015	SMART CONTRACT DEVELOPMENT	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 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 **Practical Component** Set up Ethereum development environment (Hardhat, MetaMask, testnet faucet) and deploy a basic Solidity contract with state variables, public and payable functions.	**7 Hours** **6 hours**
SMART CONTRACT MODULARITY AND DESIGN PATTERNS 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 **Practical Component** Create modular smart contracts using inheritance, interfaces, and OpenZeppelin (Ownable, Pausable) Implement and test factory and proxy patterns to demonstrate contract modularity and upgradeability.	**7 Hours** **6 hours**
CONTRACT INTERACTIONS AND DECENTRALIZED SYSTEMS Contract communication: delegatecall, call, staticcall - Event-driven architecture using logs - Working with arrays, mappings, structs, storage/memory - Interfacing with oracles, cross-contract coordination. **Practical Component** Simulate contract-to-contract interactions using delegatecall and log relevant events. Develop contracts that use arrays, mappings, structs and demonstrate memory vs storage usage.	**8 Hours** **8 hours**
SMART CONTRACT SECURITY AND REAL-WORLD APPLICATIONS 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 **Practical Component** Detect common vulnerabilities in smart contracts using Slithe rand MythX. Build a simple DAO voting mechanism with role-based control and events. Write and test a basic DeFi lending contract including interest logic and edge case checks. Simulate a flash loan and demonstrate secure logic using mock tokens.	**8 Hours** **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/ 2. https://ethereum.org/en/developers/docs/ 3. https://docs.openzeppelin.com/ 4. https://hardhat.org/getting-started/
Online Resources
1. https://www.coursera.org/learn/smarter-contracts 2. https://www.udemy.com/course/solidity-smart-contracts-build-dapps-in-ethereum-blockchain/ 3. Introduction to Blockchain Technology and Applications 4. https://swayam.gov.in/nd1_noc20_cs01/preview 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	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 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. **Practical Component** Setup Full Development Environment – Node.js, Hardhat, React.js/Next.js, MetaMask	**8 Hours** **4 Hours**
FRONTEND FRAMEWORKS FOR DAPPS 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. **Practical Component** Deploy a Basic Smart Contract Locally – Hardhat, Ethers.js - Integrate Wallet Connection in Frontend – Wagmi, RainbowKit, MetaMask	**8 Hours** **6Hours**
BACKEND AND STORAGE INTEGRATION Using IPFS and Filecoin for decentralized storage – Pinning services – Web3 storage SDKs – GraphQL with The Graph – Data indexing and querying from smart contracts. **Practical Component** Upload and Retrieve Files from IPFS – Web3.Storage, Pinata - Query Blockchain Events via Indexing – The Graph Protocol, GraphQL	**7 Hours** **6 Hours**
FULL-STACK DAPP DEVELOPMENT 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 **Practical Component** 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** **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. 2. Zhang, X. (2022). Build Your First Web3 App: A Developer's Guide. Independently published.
Reference books/ Web Links
Web Links: 1. https://docs.ethers.org/ 2. https://thegraph.com/docs/ 3. https://docs.ipfs.io/ 4. https://developers.ceramic.network/ 5. https://www.rainbowkit.com/docs/introduction

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Online Resources
1. nptel.ac.in/courses/106105184 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	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 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. **Practical Component** Create a Unity project, explore the Unity Editor interface, and organize project assets and scenes. Create and manipulate Game Objects using transformations to design a basic game environment.	**6 Hours** **6 Hours**
C# SCRIPTING FOR GAME OBJECT MOVEMENT 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. **Practical Component** Develop basic C# scripts using variables, functions, conditional statements, and loops, and attach them to Game Objects. Implement keyboard input controls and create player movement functionality with debugging support.	**6 Hours** **6 Hours**
PHYSICS OF MATERIALS AND COLLISION 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. **Practical Component** Apply materials, colors, lighting, and camera settings to create an interactive 2D/3D game scene. Add Rigidbody and Collider components and implement collision detection and object interactions.	**6 Hours** **6 Hours**
AUDIO INTEGRATION AND ANIMATION 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. **Practical Component** Integrate background music and sound effects triggered by gameplay events. Design UI elements such as score, timer, buttons, and implement scene transitions, start screens, and game-over screens.	**6 Hours** **6 Hours**
GAME SCENE MANAGEMENT AND GAME BUILDING 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. **Practical Component** Develop gameplay features using enemies, collectibles, animations, and level progression mechanisms. Build, test, debug, and deploy a complete playable mini-game by integrating scripting, physics, UI, audio, animation, and scene management.	**6 Hours** **6 Hours**
Sample Mini Projects **Coin Collector Adventure** Collect coins, avoid obstacles, and achieve the highest score within a time limit. **Maze Escape Challenge** Navigate through a maze, collect keys, and reach the exit before time runs out. **Endless Runner Game** Control a character that runs continuously while avoiding obstacles and collecting	

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rewards. **Space Shooter** Pilot a spaceship, destroy enemy objects, and survive as long as possible while increasing the score. **Treasure Hunt Quest** 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, Technical Manager – XR Division, ARK Infosolutions Pvt. Ltd		Dr.K.Saranya AP-II, CSE,KCT
Recommended by BoS on	06.06.2026	
Academic Council Approval	No:	**Date:**

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24CSC018	ADVANCED 3D MODELLING	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

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4			3		3								3
5			3		3								3

<u>Course Content</u>	
Blender Fundamentals and Asset Development 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. **Practical Component** Create and organize a Blender project by exploring the interface, viewports, collections, object transformations, and scene management features. Develop basic 3D assets using primitive objects and mesh editing operations such as extrude, inset, bevel, and loop cut.	**6 Hours** **6 Hours**
3D Modeling Techniques and Digital Sculpting 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. **Practical Component** Create low-poly and hard-surface models using modifiers such as Mirror, Subdivision Surface, Solidify, Boolean, and Array. Develop organic models using sculpting tools and apply retopology and optimization techniques for efficient asset creation.	**6 Hours** **6 Hours**
Materials, UV Mapping and Texturing 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. **Practical Component** Apply materials and shaders using the Shader Editor and implement PBR-based workflows for 3D assets. Perform UV mapping, UV unwrapping, texture painting, and apply image or procedural textures to enhance model appearance.	**6 Hours** **6 Hours**
Environment Design, Lighting and Rendering 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. **Practical Component** Design a 3D environment by creating landscapes, placing assets, and composing scenes using appropriate camera settings. Implement lighting techniques using Three-Point Lighting and HDRI environments, and generate optimized renders using Eevee and Cycles.	**6 Hours** **6 Hours**

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Animation, Rigging and Game Asset Pipeline 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.	**6 Hours**
Practical Component Create basic rigging structures using armatures, apply weight painting, and develop object and camera animations using keyframes. Export optimized assets for Unity or Unreal Engine and prepare a professional-quality portfolio presentation showcasing completed 3D work.	**6 Hours**
Project Medieval Village Environment Fantasy Forest Scene Interior Room Visualization Animated Character Showcase 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/ 2. https://docs.blender.org/manual/en/latest/ 3. https://www.blenderguru.com/
Online Resources
1. https://www.udemy.com/course/blendertutorial/ 2. Blender 3D Modeling & Rendering for Games & Animation | Coursera 3. Blender for Beginners | Coursera 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 Senior 3D Environment Artist, Fusion VR Solutions.		Ms.P.Anitha Assitant Professor-I/CSE KCT
Recommended by BoS on	06.06.2026	
Academic Council Approval	No: 30	**Date:** 19.06.2026

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24CSC019	AUGMENTED REALITY APPLICATION DEVELOPMENT	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 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. **Practical Component** Create and configure a Unity3D project for AR development using AR Foundation or Vuforia, and explore Game Objects, Scenes, and Prefabs. Develop basic C# scripts to perform simple AR interactions and manage virtual objects within an AR scene.	**6 Hours** **6 Hours**
Building First AR Experiences 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. **Practical Component** Configure AR Session and AR Camera, and implement marker-based AR by detecting image targets and displaying 3D content. Implement marker-less AR using plane detection and anchors, and develop a simple AR application integrating virtual objects into the real environment.	**6 Hours** **6 Hours**
Interaction Design in AR 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. **Practical Component** Develop touch-based AR interactions for placing virtual objects on detected surfaces. Implement object manipulation techniques such as move, rotate, and scale, and design world-space user interface elements with visual feedback.	**6 Hours** **6 Hours**
Advanced AR Features and Enhancements 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 **Practical Component** Integrate environmental understanding features including light estimation, audio effects, particle systems, and basic face-tracking functionality. Develop an AR mini-application incorporating navigation, object recognition concepts, or interactive AR gameplay features.	**6 Hours** **6 Hours**
AR Project Development and Deployment 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. **Practical Component** Design and prototype an AR application by applying user experience principles, testing methodologies, and performance optimization techniques. Build, debug, optimize, and deploy a complete AR application to a mobile device and demonstrate its functionality.	**6 Hours** **6 Hours**
Project • AR Museum Guide • AR Educational Learning App • AR Solar System Visualization	

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• AR Furniture Placement Application • AR Treasure Hunt Game	

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 Assitant Professor-I/CSE 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	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 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. **Practical Component** Create and configure a Unity3D VR project using XR Plugin Management, and explore Game Objects, Scenes, Prefabs, and immersive environment setup. Develop basic C# scripts for VR interactions and create simple immersive environments with interactive virtual objects.	**5 Hours** **6 Hours**
VR Hardware, Input Systems, and Player Setup 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. **Practical Component** Configure XR Rig, VR camera, and controller setup using XR Interaction Toolkit for VR application development. Implement gaze-based and controller-based interactions to enable user interaction with virtual objects in a VR scene.	**7 Hours** **6 Hours**
Creating VR Interactions and User Interfaces 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. **Practical Component** Develop teleportation-based navigation systems using teleportation areas and anchors within a virtual environment. Implement object grabbing, manipulation, haptic feedback, and world-space user interface elements for immersive interaction.	**6 Hours** **6 Hours**
VR Environment Building and Optimization 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. **Practical Component** Design immersive VR environments using lighting, spatial audio, textures, particle effects, animations, and 360-degree media. Apply optimization techniques and develop intelligent VR interactions to improve performance and user experience.	**6 Hours** **6 Hours**
VR Application Development and Deployment 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	**6 Hours**

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simulation, or a mini VR game. **Practical Component** Design and prototype a VR application by integrating navigation, interaction, environment design, and user experience considerations. Test, debug, optimize, build, and deploy a complete VR application for standalone or PC-based VR platforms.	**6 Hours**
Sample Mini Project Virtual Art Gallery Virtual Museum Tour VR Training Simulator VR Forest Exploration 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 Assitant Professor-I/CSE KCT
Recommended by BoS on	06.06.2026	

Signature of the BOS Chairman, AI&DS

Academic Council Approval	No: 30	Date: 19.06.2026

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24CSC022	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FOR GAMES	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

Course Content	
Introduction to AI and Machine Learning in Games 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. **Practical Component** Exploring AI Applications in Popular Video Games Implementing a basic finite state machine or pathfinding algorithm	**6 Hours** **4 Hours**
Pathfinding,Navigation and Decision Making 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. **Practical Component** Implementing A* pathfinding for NPC navigation in a simple game environment Building Behavior Trees for NPC Actions Implementing Utility-Based AI Decision Systems	**6 Hours** **6 Hours**
Machine Learning for Game Intelligence 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. **Practical Component** Training a Supervised Learning Model for Player Prediction Implementing a Reinforcement Learning Agent AI-Based Procedural Content Generation Experiment.	**6 Hours** **6 Hours**
AI for NPCs, Dynamic Worlds, and Intelligent Interactions 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. **Practical Component** Developing an AI-driven NPC Interaction System Procedural Level or Quest Generation Experimenting with AI-Based Adaptive Behaviors	**6 Hours** **6 Hours**

AI/ML for Game Testing, Optimization, and Analytics 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 Developing AI-Based Automated Testing Agents Implementing Gameplay Optimization Techniques 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 Assitant Professor-I/CSE KCT
Recommended by BoS on	06.06.2026	
Academic Council Approval	No: 30	**Date:** 19.06.2026

NETWORKING AND IOT

24ITC010	IOT SYSTEM DESIGN (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

Course Content	
Fundamentals of IoT and Challenges Introduction to IOTs - Improving Quality of Life. Challenges to solve in IOTs - Energy / Power, Data Explosion, Security **AI Tools:** IBM Watson IoT, Google Cloud IoT, Microsoft Azure IoT, ThingSpeak, AWS IoT Core, MATLAB	**6 Hours**
IoT System Architecture and Design 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. **AI Tools:** Arduino IDE, Raspberry Pi OS, Proteus Design Suite, Node-RED, Cisco Packet Tracer, Fritzing	**6 Hours**
Power Management and Energy Harvesting 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. **AI Tools:** MATLAB Simulink, ANSYS, LTspice, PLECS, COMSOL Multiphysics, LabVIEW	**6 Hours**
Communication Protocols for IoT IOT Protocols - loT MAC, REST based COAP, Publish subscribe- MQTT, AMQP, MDNS, Building an IOT System - Application based Microcontroller selection. **AI Tools:** Postman, Eclipse Mosquitto, Wireshark, Eclipse Paho, Node-RED, OMNeT++	**6 Hours**
IoT Case Studies and Applications Joule Jotter, Cloud Based Systems **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 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. 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. 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, ASP / CSE
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	**Date**	19.06.2026

24ITC011	AI-DRIVEN INTELLIGENT IoT SYSTEMS (Common to CSE, IT, AI&DS)	L	T	P	J	C
PE		1	0	0	4	3
		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

Course Content

CLOUD IoT PLATFORMS AND DEVICE CONNECTIVITY 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 **Project components** • Configure IoT cloud accounts on AWS IoT Core, Google Cloud IoT, and IBM Watson IoT. • Connect Raspberry Pi / NodeMCU to AWS IoT Core using MQTT over TLS. • Publish and subscribe sensor data • Create dashboards for real-time monitoring using Node-RED and cloud visualization tools. **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** **12 Hours**
AI-ENABLED IOT DATA ANALYTICS 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 **Project components** • Collect time-series IoT data (temperature, humidity, light) and store it in cloud databases (Firebase / DynamoDB). • Use Google Cloud AutoML or Azure ML Studio to build predictive models • Deploy a trained ML model on cloud to classify real-time data from IoT devices. • Integrate TensorFlow Lite on edge devices for on-device inference. • Build a Python dashboard to compare edge vs. cloud inference results. **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** **12 Hours**
CLOUD APIs AND IoT APPLICATION DEVELOPMENT 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 **Project components** • Access IoT data via RESTful APIs • Build mobile dashboards for IoT monitoring and control. • Implement remote device control through APIs. • Deploy IoT applications on cloud platforms. **AI Tool - GitHub Copilot -** Used to generate API code, develop Flask/Node.js applications, and assist in IoT dashboard	**3 Hours** **12 Hours**
IoT SECURITY AND PRIVACY IMPLEMENTATION Security challenges in IoT systems - Authentication and access control mechanisms - TLS/SSL, AES, RSA Fundamentals - Replay and spoofing attack prevention **Project components** • Configure TLS/SSL certificates for device authentication. • Implement role-based access control for IoT devices in IBM Watson IoT. • Encrypt sensor data using AES/RSA before transmission. • Detect and prevent replay or spoofing attacks using secure timestamps and tokens. **AI Tool - Microsoft Security Copilot -** Used to analyze security threats, identify vulnerabilities, and suggest secure authentication and encryption methods	**3 Hours** **12 Hours**

EDGE–CLOUD INTEGRATION Edge and Fog Computing concepts - AWS Greengrass and Azure IoT Edge – Edge analytics and bandwidth optimization, and real-time edge inference **Project components** • Set up an edge gateway using Raspberry Pi for pre-processing and local decision-making. • Deploy edge computing services using AWS Greengrass or Azure IoT Edge. • Compare latency, bandwidth usage, and energy consumption of edge vs. direct cloud upload. • Integrate edge analytics with cloud dashboards and alerts. **AI Tool - TensorFlow Lite -** Used to deploy AI models on edge devices for local processing, real-time analytics, and reduced cloud dependency	**3 Hours** **12 Hours**
Development of a mini-project integrating Cloud IoT, AI Analytics, Edge Computing, and Security concepts. **Example:** • Smart Energy Management System with Cloud AI Prediction • Intelligent Waste Segregation System with Cloud Analytics Dashboard • Secure Smart Agriculture System using IoT Edge and Blockchain • Cloud-Based Air Quality Monitoring with ML-Driven Alerts • 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)

Course Curated by

<table>
<tr><th>Expert(s) from Industry</th><th colspan="2">Expert(s) from Higher Education Institution</th><th colspan="2">Internal Expert</th></tr>
<tr><td></td><td colspan="2"></td><td colspan="2">Dr. V. Sujitha,
AP / IT</td></tr>
<tr><td>Recommended by BoS on</td><td colspan="4">06.06.2026</td></tr>
<tr><td>Academic Council Approval</td><td>No: 30</td><td colspan="2">Date</td><td>19.06.2026</td></tr>
</table>

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

Course Content

Fundamentals of Wireless and Mobile Networks 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 **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 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 **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) SDN architecture and components – OpenFlow – SDN Controllers: Floodlight, NFV: virtualization of routers, firewalls, load balancers – Programmable Networks (P4), SmartNICs, Ansible/Terraform for network automation **AI Tools:** Mininet, Python API (SDN topology simulation, Ansible + AI (automate NFV deployment & orchestration)	**6 Hours**
Edge Computing and IoT - Integrated Networks 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 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 **AI Tools:** Perplexity AI (research 6G whitepapers & satellite tech), ChatGPT/Claude AI (analyze future networking scenarios)	**6 Hours**
Project Component • Select a wireless networking scenario (e.g., campus, IoT, vehicular) and simulate topology and routing feasibility using tools like Cisco Packet Tracer or GNS3. • 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. • 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. • 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. • 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. • Prepare a feasibility report or a prototype on emerging networking technologies such as AI-native 6G, blockchain-based secure networking, or quantum communication. **Sample Projects Examples:** • Simulation and Performance Analysis of a Campus-Based Wireless Network Using GNS3 • Design and Routing Feasibility Study of an IoT-Enabled Smart City Network • 4G vs. 5G: A Comparative Study with Use Case Prototype for Smart Traffic Management	**30 Hours**

• Building and Simulating a Basic SDN Topology with OpenFlow Protocol in Mininet • Developing an SDN-Based Firewall Using Northbound APIs and Python • Latency-Aware Sensor Data Communication in Smart Agriculture Using MQTT and Raspberry Pi • 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

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

Course Content	
Fundamentals of Industry 4.0 and Industrial Communication 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. **AI tools:** Cisco Packet Tracer, MATLAB Simulink, Siemens Tecnomatix, ThingSpeak, Node-RED	**9 Hours**
Industry 4.0 Technologies and Cyber Physical Systems 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. **AI tools:** TensorFlow, OpenCV, Unity, IBM Watson IoT, Google Collab, Wireshark	**9 Hours**
Industrial IoT Architecture and Layers 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. **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 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. **AI tools:** Apache Hadoop, R Project, Julia, Tableau, Microsoft Azure IoT, Mininet, Snort	**9 Hours**
Industrial IoT Applications and Case Studies 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. **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. 2. Mahmood, Z. (2019). The Internet of Things in the Industrial Sector. Springer International Publishing. 3. Rawat, D. B., Brecher, C., Song, H., & Jeschke, S. (2017). Industrial Internet of Things: Cyber manufacturing Systems. Cham, Switzerland: Springer. 4. Butun, I. (2020). Industrial IoT. Springer International Publishing.
Reference books/ Web Links
Book References: 1. Mahmood, N. H., Marchenko, N., Gidlund, M., & Popovski, P. (Eds.). (2020). Wireless Networks and Industrial IoT: Applications, Challenges and Enablers. Springer Nature. 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. 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

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

Course Content	
INTRODUCTION 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 **AI Tool:** Tinker cad Circuits (Design IoT hardware Circuits), Edge Impulse (AI capabilities to sensors, microcontrollers, and embedded system)	**6 Hours**
IOT COMMUNICATION 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 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. **AI tool:** Chatgpt, Claude (design system architecture, generate embedded code (Arduino/Python), and integrate communication)	**6 Hours**
DEPLOYING IOT IN CLOUD 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 **AI Tool/ Platform:** Google Cloud / Think speak	**6 Hours**
DEVELOPING SECURE IOT APPLICATION 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 **AI Tool/ Platform:** Google Cloud and firebase **LAB COMPONENT** 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. **Sample Experiments:** • Interface and programming IoT hardware and circuits • Implement communication and MAC techniques • Configure wired and wireless IoT networks • Deploy IoT workloads using Google Cloud SDK and APIs • Apply secure design, authentication, and firmware security practices (e.g., Smart Home Control, smart framing)	**6 Hours** **30 Hours**

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. 2. "IOT Deployment Handbook: A practical Guide to Implementing Successful IOT Projects" By Richard G. Brown, 2022 3. "Internet of Things: A Hands-On Approach",Arshdeep Bahga, Vijay Madisetti,Publisher Universities Press, 2016 4. "The Internet of Things: Key Applications and Protocols",Olivier Hersent, David Boswarthick, Omar Elloumi,Wiley Publication, 2012 5. "Computer Networking: A Top-Down Approach", James F. Kurose, Keith W. Ross: Pearson Publication, 2021 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 2. Hands-on Internet of Things | Coursera 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

CLOUD COMPUTING

24ITC001	CLOUD APPLICATION DEVELOPMENT	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

Course Content	
Introduction to Application Design 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 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 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 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: 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. 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 2. https://www.udemy.com/course/cloud-computing-development-essentials/ 3. https://www.coursera.org/learn/cloud-native-devops-agile-nosql?specialization =ibm-cloud-application-development-foundations 4. https://www.edx.org/certificates/professional-certificate/ibm-cloud-and-application-development-foundations

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. L. Dhanabal, MCA	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	**Date**	19.06.2026

24ITC002	INFRASTRUCTURE FOR PRIVATE CLOUD	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

Course Content

Introduction to Cloud Infrastructure 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. **Practical Component** Single node private cloud setup using Devstack/Packstack	**7 Hours** **6 Hours**
Cloud Compute Architecture 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. **Practical Component** Configure NOVA compute Node - Build a horizon node – Monitor node	**7 Hours** **9 Hours**
Cloud Storage Architecture 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, 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. **Practical Component** Configure Swift object storage - Construct a cinder block node	**8 Hours** **7 Hours**
Cloud Network Architecture 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. **Practical Component** Launching an instance- Register an account at openstack, Create SSH Key, validate network - Sharing project environment among multiple users.	**8 Hours** **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?

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

24ITC003	CLOUD STORAGE MANAGEMENT	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

Course Content	
Introduction to Cloud Storage and Infrastructure 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 **Practical Component** Set up AWS S3 and upload/download objects using console and CLI - Create and configure block storage (EBS) and attach to EC2	**6 Hours** **6 Hours**
Cloud Storage Access and Protocols 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 **Practical Component** Create and deploy storage bucket policies and lifecycle rules (S3/Azure Blob)	**10 Hours** **4 Hours**
Data Lifecycle Management, Backup, and Compliance 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 **Practical Component** 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** **10 Hours**
Security, Monitoring, and Emerging Trends 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. **Practical Component** 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** **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).

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	
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. S.Kanagaraj, IT	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	**Date**	19.06.2026

24ITC004	VIRTUALIZATION AND RESOURCE MANAGEMENT	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

Course Content

Introduction 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. **Practical Component** 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** **6 Hours**
CPU Virtualization Hardware assisted virtualization: Libvirt and QEMU/KVM - QEMU architecture - QEMU/KVM operation - VMX mode - VM control structure (VMCS) – VMX Mode Execution. Full virtualization: Full virtualization VMM architecture - Host and VMM - Binary translation - Dynamic binary translation - Use of segmentation for protection. 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. **Practical Component** 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** **8 Hours**
Memory virtualization techniques 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. **Practical Component** 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** **6 Hours**
Network Virtualization 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. **Practical Component** 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** **6 Hours**
Resource Management 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 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	**5 Hours**

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. **Practical Component** 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	
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

24ITC005	CLOUD SECURITY	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

Introduction to Cloud Security 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. **Practical Component:** Securing free tier account in cloud platform - Securing Free Tier Account with IAM Users and Roles	**6 Hours** **6 Hours**
Cloud Security Architecture and Data Protection 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. **Practical Component:** 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** **8 Hours**
Compliance, Governance, and Risk management 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. **Practical Component:** Configuring networking firewall for an application - Securing and restricting access to storage	**6 Hours** **6 Hours**
Secure Development and DevSecOps 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. **Practical Component:** Securing code with automated vulnerability scanning in CI/CD pipeline.	**6 Hours** **4 Hours**
Emerging Trends and Future of Cloud Security Edge Computing Security, Zero Trust Architecture, Serverless Security, AI/ML for Threat Detection, Quantum Computing and Cloud Security, Future Research Directions, Open Challenges. **Practical Component:** Securing an ERP or Healthcare App in the Cloud - Simulating a Cloud Security Threat Detection Model Using ML	**6 Hours** **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. 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. 2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing," 2010. 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	
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 Asmithashree, CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	**Date**	19.06.2026

24ITC006	CLOUD AUTOMATION	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	

Course Content	
Introduction to Cloud Automation	**7 Hours**

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.	
Cloud Resource Scaling and Storage Automation 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 DuploCloud - Puppet - Heroku -HashiCorp, Monitoring and Logging Tools – Prometheus, Grafana, Docker, Raygun, Splunk, Git, Ansible, Jenkins, Bamboo.	**7 Hours**
Cloud Deployment Automation 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). 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). 2. Turnbull, James. *The Terraform Book.* Turnbull Press, San Francisco (2022). 3. Huttermann, Michael. *DevOps for Developers.* Apress, New York (2012).
Online Resources 1. https://www.coursera.org/learn/gcp-fundamentals/home/module/1 2. https://www.coursera.org/learn/information-technology-and-aws/home/week/1 3. https://www.coursera.org/learn/devops-capstone-project/home/welcome

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)**	
[Name, Organization]	[Name, Institution]	[S.Kanagaraj, IT]	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	**Date**	19.06.2026

24ITC007	CLOUD ADMINISTRATION AND SOLUTION ARCHITECTURE	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		

Course Content	
AWS CLOUD TECHNICAL ESSENTIALS LAB AWS Overview and Security, Compute and Networking, Storage and databases on AWS, Monitoring & Optimization. **Project Component:** 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 15 Hours
ARCHITECTING SOLUTIONS ON AWS LAB 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 **Project Component:** 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 15 Hours
BUILDING DATA LAKES ON AWS LAB 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. 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. **Project Component:** 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 15 Hours
EXAM PREP: AWS CERTIFIED SOLUTIONS ARCHITECT – ASSOCIATE LAB Designing Resilient Architectures, Designing High-performing Architectures, Designing Secure Applications and Designing Cost-optimized Architectures. **Project Component:** 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 15 Hours

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

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. 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. 3. Greyson Chesterfield, Serverless Architectures with AWS: Build Scalable Backends Without Managing Servers, 2025 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. 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

24ITC008	SECURE COMPUTING AND NETWORKING	L	T	P	J	C
PE		1	0	0	4	3
		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

Course Content

INTRODUCTION TO COMPUTERS & SECURE NETWORKING LAB Introduction to computers and operating systems, Enterprise systems and security, Business systems Applications. **Project Component:** 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 15 Hours
INTRODUCTION TO SECURE NETWORKING LAB Computer Networking, Network Devices and protocols , Network Security, Cloud Computing and Networking **Project Component:** 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 15 Hours
ESSENTIAL ASPECTS OF SOFTWARE, HARDWARE, AND DATA BACKUP LAB Secure Software Configurations, Secure Hardware Configuration, Robust data backup and Recovery, Project - Developing a data strategy **Project Component:** 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 15 Hours
CYBERSECURITY AND PRIVACY Advanced password management and privacy measures, Cyber Security Concepts, Computing Environments, Project - Developing a secure data transmission **Project Component**: 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 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.

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

24ITC009	**SECURE CLOUD INFRASTRUCTURE MANAGEMENT**	**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 Introduction to cloud Computing, Exploring Core Azure services, Azure management and Governance, Project - Cloud computing essentials with Azure Management	3 Hours
Project Component: Design and implement a secure Azure cloud solution by configuring Azure Storage services, virtual networks, and Role-Based Access Control (RBAC), monitoring cloud resources using Azure Monitor and Alerts, and integrating compute, storage, and	12 Hours

networking services to deploy and manage an end-to-end application with performance monitoring and cost governance.	
AZURE CLOUD SERVICES LAB Azure Compute, Azure Networking, Azure Security, Project - Implement a secure, scalable Azure environment incorporating virtual infrastructure. **Project Component**: 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 12 Hours
AZURE IDENTITY AND NETWORKING ESSENTIALS LAB Configuring Microsoft Entra ID, Configuring Resources, Configuring virtual networks for advanced security and performance. **Project Component**: 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 12 Hours
AZURE NETWORK CONFIGURATION Configuring Lad Balancer, Configuring Storage Accounts, Configuring Azure storage security, Project - Azure Infrastructure: Design, deploy, optimize **Project Component**: 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 12 Hours
AZURE MONITORING AND ANALYTICS FUNDAMENTALS Introduction to Azure monitor, Configuring Alerts in Azure, Advanced monitoring Techniques, Azure monitoring Implementation **Project Component** 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 12 Hours
AZURE BACKUP, SECURITY, AND COMPLIANCE ADMINISTRATION LAB 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 **Project Component** 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 12 Hours

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

Learning Resources*
Textbooks

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

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

24ADC001	BUSINESS INTELLIGENCE	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

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 Analytics and Data Science – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration. **Practical Component:** 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** **6 Hours**
BUSINESS INTELLIGENCE Data Warehouses and Data Mart – Knowledge Management – Types of Decisions – Decision Making Process – Decision Support Systems – Business Intelligence – OLAP – Analytic Functions. **Practical Component:** 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** **6 Hours**
BUSINESS FORECASTING AND COMPETITIVE ANALYSIS 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. **Practical Component:** 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** **6 Hours**
ANALYTICS – HR AND SUPPLY CHAIN 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. **Practical Component:** 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. 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	**6 Hours** **6 Hours**

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.	
MARKETING AND SALES ANALYTICS 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. **Practical Component:** 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** **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. 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. 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. 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 2. Business Intelligence and Analytics, IIT Madras – NPTEL/SWAYAM (2025): https://onlinecourses.nptel.ac.in/noc25_cs09/preview 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

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
Mr. Karthick K	Dr. Antony Seba P Assistant Professor Grade I,	Ms. Preethi G

<table>
<tr><td>Operations Manager, Fractal Analytics, Chennai</td><td colspan="2">School of Computer Science and Engineering
Computational Intelligence
VIT, Vellore</td><td colspan="2">AP/ Department of Artificial Intelligence and Data Science</td></tr>
<tr><td>Recommended by BoS on</td><td colspan="4">06.06.2026</td></tr>
<tr><td>Academic Council Approval</td><td>No: 30</td><td colspan="2">Date</td><td>19.06.2026</td></tr>
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24ADC002	DEEP LEARNING APPLICATIONS	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
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 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 **Practical Component** 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** **6 Hours**
CONVOLUTIONAL NEURAL NETWORKS 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 **Practical Component** 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** **6 Hours**
SEQUENTIAL MODELING 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 **Practical Component** 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** **6 Hours**
GENERATIVE AND UNSUPERVISED DEEP LEARNING MODELS Introduction to Representation Learning - Unsupervised Deep Learning - Energy-Based Models - Boltzmann Machines - Deep Belief Networks - Autoencoders and Variants - Generative Adversarial Networks (GANs) **Practical Component** Train a simple Autoencoder for dimensionality reduction and feature learning - Generate synthetic images using a Generative Adversarial Network (GAN)	**9 Hours** **6 Hours**
TRANSFORMERS & ADVANCED DEEP LEARNIG TECHNIQUES 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 **Practical Component** 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	**9 hours** **6 Hours**

Theory Hours:30	Tutorial Hours:0	Practical Hours:30	Project Hours:0	Total 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
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	**Date**	19.06.2026

24ADE003	RESPONSIBLE AI	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

Course Content

INTRODUCTION TO RESPONSIBLE AI 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 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 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 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 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.
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 2. https://www.coursera.org/learn/principles-ethical-considerations-responsible-ai 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 Senior specialist, HPE Nonstop Database Products, Hewlett-Packard Enterprise R&D Division, Mahadevapura, Bangalore.	Dr. Sangeetha S ASP/ Department of Artificial Intelligence and Data Science, PSG Institute of Technology and Applied Research, Coimbatore.	Ms Shriaarthy E AP/Department of Artificial Intelligence and Data Science.

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

24ADC004	GENERATIVE AI	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
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 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. **Practical Component:** 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** **6 Hours**
LARGE LANGUAGE MODELS 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. **Practical Component:** 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** **6 Hours**
GENERATING IMAGES AND CODE Vision models - Vision Transformer – Diffusion models – Multimodal models - Editing and enhancing images using Stable Diffusion - Code generation - Code explanation - Generate tests. **Practical Component:** 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** **6 Hours**
GENERATING VIDEO 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. **Practical Component:** 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** **6 Hours**
AGENTIC AI AND GENERATIVE AI APPLICATIONS 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. **Practical Component:** 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	**6 Hours** **6 Hours**

– Analyze the AI's role, output quality, limitations, and ethical considerations and present findings. Designing an Autonomous Agent using LangGraph Framework – Case Study on Real-World Application of Generative AI with Ethical and Societal Impact Analysis.	

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 Senior Principal Engineer, Oracle, Bengaluru, Karnataka, India.	Dr. S. Sangeetha Associate Professor Department of Artificial intelligence and data science PSG Institute of Technology and Applied Research, Neelambur	Ms. Preethi G AP/ Department of Artificial Intelligence and Data Science

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

24ADC005	SOCIAL NETWORK ANALYTICS	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
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 SNA Definition & Applications-Graph Basics: Nodes, Edges, Weights-Network Representation: Matrices, Edge Lists-Data Collection: APIs & Web Scraping-Intro to NetworkX & Basic Properties. **Practical Component** 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** **6 Hours**
NETWORK METRICS: CONNECTION AND CENTRALITY Connection Metrics: Density & Degree Dist.-Distance Metrics: Geodesics, Diameter Node Centrality: Degree, Closeness, Betweenness-Eigenvector Centrality & PageRank Identifying 'Brokers' & Key Players. **Practical Component** 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** **6 Hours**
NETWORK STRUCTURE: COHESION AND COMMUNITIES Cohesion: Connected Components-Clustering Coefficients: Global vs Local-Community Detection Algorithms (Louvain)-Modularity Optimization & Graph Partitioning-Introduction to Gephi Visualization. **Practical Component** 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** **6 Hours**
NETWORK DYNAMICS AND POSITIONS Topology: Small-World & Scale-Free-Homophily & Assortativity Measurement-Structural Holes & Brokerage Theory (Burt)-Information Diffusion (SI/SIR Models)-Link Prediction & Contagion Concepts. **Practical Component** 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** **6 Hours**
VISUALIZATION, APPLICATIONS AND EVALUATION 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. **Practical Component** 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. Map and analyze a social subgroup to predict influential communication bridges using graph intelligence and AI-driven simulation.	**6 Hours** **6 Hours**

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 Senior Consultant EY	Dr. Vishnuvarthan R Assistant Professor- School of Computing- Amrita Vishwa Vidyapeetham- Coimbatore		Ms. Rupashini P R, AP/Department of Artificial Intelligence and Data Science
Recommended by BoS on	06.06.2026		
Academic Council Approval	No:30	**Date**	19.06.2026

24ADC006	DIGITAL TWIN ANALYTICS	L	T	P	J	C
		2	0	2	0	3
PE		SDG	9-12			

Pre-requisite courses	24ADI017 Machine Learning Techniques 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

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 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. **Practical Component** 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** **6 Hours**
MACHINE LEARNING FOR DT DATA STREAMS 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. **Practical Component** 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** **6 Hours**
DIGITAL TWIN ARCHITECTURE AND INTEGRATION ANALYSIS 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. **Practical Component** 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** **6 Hours**

MODELING APPROACHES AND ANALYSIS 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. **Practical Component** 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** **6 Hours**
PLATFORM DESIGN AND IMPLEMENTATION Commercial Platforms: TwinMaker- Azure Digital Twins-Evaluating Effectiveness: KPIs & Predictive Accuracy-ROI Measurement & Implementation Challenges-Security- Privacy- & Ethical Considerations-Visualisation: 3D Dashboards & Reality Comparison **Practical Component** 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** **6 Hours**

Theory Hours:30	**Tutorial Hours:0**	**Practical Hours:30**	**Project Hours:0**	**Total 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 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 AP/Department of Artificial Intelligence and Data Science

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

24ADC007	AGENTIC AI	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

Course Contents	
FOUNDATIONS OF GENERATIVE AI & RAG 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 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 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 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 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 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. **Final Deliverables (Presentation & Report)** • GitHub repository with source code, sample datasets/documents, and README. • Functional Agentic AI application with RAG, agents, and workflow orchestration. • 10-minute project presentation demonstrating architecture, workflow, and results. • Final report summarizing problem statement, methodology, tools/frameworks used, implementation, evaluation results, and future enhancements.	**60 Hours**

Theory Hours:15	**Tutorial Hours: 0**	**Practical Hours: 0**	**Project Hours: 60**	**Total 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.

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 AP/Department of Artificial Intelligence and Data Science

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

24ADC008	AI AND ML INFRASTRUCTURE ENGINEERING	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

	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 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 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 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 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 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 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. **Final Deliverables (Presentation & Report)** • GitHub repository with source code, datasets, configuration files, and README • Functional MLOps pipeline with model training, deployment, monitoring, and automation • Fine-tuned AI/LLM-based application demonstrating practical use of ML, DL, or NLP techniques • 10-minute project presentation showcasing architecture, implementation, evaluation, and deployment workflow • Final report summarizing problem statement, methodology, tools and frameworks used, experimental results, responsible AI considerations, and future enhancements.	**60 Hours**

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 AP/Department of Artificial Intelligence and Data Science

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