KIT - Kalaignarkarunanidhi Institute of Technology

An Autonomous Institution

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' GRADE & NBA (AERO, CSE, ECE, EEE, MECH & MBA)
An ISO 9001 : 2015 Certified Institution, Coimbatore - 641 402.

Regulations, Curriculum & Syllabus - 2023

(For Students admitted from the Academic Year 2023-24 and onwards)

BACHELOR OF ENGINEERING DEGREE IN COMPUTER SCIENCE AND ENGINEERING

Department of Computer Science and Engineering

Vision and Mission of the Department

Vision

◎	To produce intellectual graduates to excel in the field of Computer Science Engineering and Technologies.

Mission

◎	Providing excellent and intellectual inputs to the students through qualified faculty members.
◎	Imparting technical knowledge in latest technologies through the industry institute interaction and thereby making the graduates ready for the industrial environment.
◎	Enriching the student's knowledge for active participation in co-curricular and extracurricular activities.
◎	Promoting research-based projects in contexts to social, legal and technical aspects.

Program Educational Objectives (PEO's)

PEO 1	Graduates will be successful in their profession by taking part actively in the field of software and technology.
PEO 2	Graduates will be proficient in analyzing and facing the challenges in Computer Science and Engineering.
PEO 3	Graduates will engage in lifelong learning activities by adapting to the advanced software technologies for continuous professional development.

Programme Outcomes (PO's)

A graduate of the Computer Science and Engineering will be able to

PO 1	**Engineering Knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex Computer Science Engineering problems.
PO 2	**Problem Analysis :** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and computer engineering sciences.
PO 3	**Design / Development of Solutions :** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations in the field of Computer Science and Engineering.

PO 4	**Conduct Investigations of Complex Problems :** Using research-based knowledge and computer science-oriented research methodologies including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage :** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex computer science engineering activities with an understanding of the limitations.
PO 6	**The Engineer and Society :** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and Sustainability :** Understand the impact of the professional Computer Science Engineering solutions in societal and environmental contexts, and demonstrate the knowledge, and need for the sustainable development.
PO 8	**Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and Team Work :** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings..
PO 10	**Communication :** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project Management and Finance :** Demonstrate knowledge and understanding of the computer science engineering and management principles and apply these to one's own work, as a member and leader in a team and, to manage projects in multidisciplinary environments.
PO 12	**Lifelong Learning :** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO's)	
A graduate of the Computer Science and Engineering will be able to	
PSO 1	Categorize the basic engineering knowledge to solve the problems in Computer Science and Engineering according to the environmental needs.
PSO 2	Apply the modern tools to design and develop the software system ethically to the industrial needs.

BoS Chairman

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Department of Computer Science and Engineering

Conceptual Frame work

(For Students admitted from the Academic Year 2023-24 and onwards)

Semester	Level of Course	Hours / Week	No of Courses	Range of Credits / Courses	Total Credits
PART - I					
A - Foundation Courses					
I to VII	Humanities and Social Sciences (HS)	1-5	6	0-4	10
I to IV	Basic Sciences (BS)	4-5	6	4	24
I to II	Engineering Sciences (ES)	3-5	5	2-4	17
B - Professional Core Courses					
III to VII	Professional Core (PC)	3 – 4	29	2 - 4	86
C - Elective Courses					
V to VIII	Professional Elective (PE)	3 - 5	4	3	12
V to VIII	Open Elective (OE)	3 - 5	2	3	6
D - Project Work					
VI, VII & VIII	Project Work (PW)	4 -16	3	2 - 8	12
E - Mandatory Courses Prescribed by AICTE/UGC (Not to be Included for CGPA)					
V & VI	**Mandatory Course (MC)**	3	3	NC	NC
Total Credit					**167**
PART - II					
F- Career Enhancement Courses (CEC)					
II	Soft Skills	2	1	-	NC
IV	Professional Certificate course	-	1	1	1
V	Summer Internship	-	1	1	1
Total Credit					**02**
Total Credit to be Earned					**169**

Approved By BoS Chairman

Curriculum and Scheme of Assessment

(For Students admitted from the Academic Year 2023-24 and onwards)

Semester - I

Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23IPT101	**Induction Programme**	**HS**	**-**	**-**	**-**	**-**	**NC**	**-**	**-**	**-**
Theory / Theory with Practical										
B23ENT101	Professional English	**HS**	3	3	0	0	2	40	60	100
B23HST101	தமிழர்மரபு / Heritage of Tamils	**HS**	1	1	0	0	1	40	60	100
B23MAT101	Matrices and Differential Calculus	**BS**	4	3	1	0	4	40	60	100
B23PHI101	Engineering Physics	**BS**	5	3	0	2	4	50	50	100
B23MET101	Engineering Graphics	**ES**	5	3	2	0	4	40	60	100
B23CSI101	C Programming	**ES**	6	2	0	4	4	50	50	100
Total credits to be earned							**19**			

Semester - II

Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory / Theory with Practical										
B23ENI201	Professional Communication	**HS**	5	3	0	2	4	50	50	100
B23HST201	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	**HS**	1	1	0	0	1	40	60	100
B23MAT201	Integral Calculus and Complex Analysis	**BS**	4	3	1	0	4	40	60	100
B23CHI101	Engineering Chemistry	**BS**	5	3	0	2	4	50	50	100
B23ECT203	Digital Logic and System Design	**ES**	3	3	0	0	3	40	60	100
B23ADI201	Python Programming	**ES**	6	2	0	4	4	50	50	100
Practical										
B23MEP101	Engineering Practices Laboratory	**ES**	4	0	0	4	2	60	40	100
B23CEP201	Soft Skills	**CEC**	2	0	0	2	NC	100	-	100
B23CEP202	Application Design and Development	**CEC**	2	0	0	2	NC	100	-	100
Total credits to be earned							**22**			

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Semester - III

Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory / Theory with Practical										
B23MAT302	Discrete Mathematics	BS	4	3	1	0	4	40	60	100
B23CST301	Computer Organization and Architecture	PC	3	3	0	0	3	40	60	100
B23CST302	Data Structures	PC	3	3	0	0	3	40	60	100
B23CST303	Computer Networks	PC	3	3	0	0	3	40	60	100
B23CSI301	Operating Systems	PC	5	3	0	2	4	50	50	100
B23CSI302	Object Oriented Programming using C++	PC	5	3	0	2	4	50	50	100
Practical										
B23CSP301	Data Structures Laboratory	PC	4	0	0	4	2	60	40	100
Total credits to be earned							23			

Semester - IV

Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory / Theory with Practical										
B23MAT401	Probability and Queuing Theory	BS	4	3	1	0	4	40	60	100
B23CST401	Database Management Systems	PC	3	3	0	0	3	40	60	100
B23CST402	Design and Analysis of Algorithms	PC	4	3	1	0	4	40	60	100
B23ADT402	Java Programming	PC	3	3	0	0	3	40	60	100
B23CST404	Artificial Intelligence and Machine Learning	PC	3	3	0	0	3	40	60	100
B23CST405	Software Engineering	PC	3	3	0	0	3	40	60	100
Practical										
B23CSP401	Database Management Systems Laboratory	PC	4	0	0	4	2	60	40	100
B23ADP401	Java Programming Laboratory	PC	4	0	0	4	2	60	40	100
B23CEP301	Professional Certificate Course	CEC	-	-	-	-	1	100	-	100
Total credits to be earned							25			

Summer Internship – Three Weeks (Review will be conducted in first week of Semester V and its credit will be included in Semester V) / NPTEL / Product Development / Mini Project / Model Development

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Semester - V

Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory / Theory with Practical										
B23CST501	Computational Theory	**PC**	4	3	1	0	**4**	40	60	100
B23CST502	Modern Web Programming	**PC**	3	3	0	0	**3**	40	60	100
B23CST503	IoT and Smart Technology Integration	**PC**	3	3	0	0	**3**	40	60	100
B23AMT501	Deep Neural Networks	**PC**	3	3	0	0	**3**	40	60	100
	Professional Elective I	**PE**	3	3	0	0	**3**	40	60	100
	Open Elective I	**OE**	3	3	0	0	**3**	40	60	100
B23MCT50X	Mandatory Course I	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT505	Holistic insight into UN SDGs	**MC**	2	2	0	0	**NC**	100	-	100
Practical										
B23CSP501	Modern Web Programming Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23AMP501	Deep Learning Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CEP501	Summer Internship	**CEC**	-	-	-	-	**1**	100	-	100
Total credits to be earned							**24**			

Semester - VI

Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory / Theory with Practical										
B23CST601	Cloud Computing	**PC**	3	3	0	0	**3**	40	60	100
B23CST602	Information and Network Security	**PC**	3	3	0	0	**3**	40	60	100
B23CSI601	Compiler Design	**PC**	5	3	0	2	**4**	50	50	100
B23ECT501	Microprocessors and Microcontrollers	**PC**	3	3	0	0	**3**	40	60	100
	Professional Elective II	**PE**	3	3	0	0	**3**	40	60	100
	Open Elective II	**OE**	3	3	0	0	**3**	40	60	100
B23MCT60X	Mandatory Course II	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT605	Cyber Safety Concepts	**MC**	2	2	0	0	**NC**	100	-	100
Practical										
B23CSP601	Cloud Computing Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23ECP501	Microprocessors and Microcontrollers Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CSP602	Innovative Design Practices	**PW**	4	0	0	4	**2**	40	60	100
Total credits to be earned							**25**			

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Semester – VII

Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory / Theory with Practical										
B23HST701	Universal Human Values	**HS**	3	3	0	0	**2**	40	60	100
B23CST701	Data Engineering and Analytics	**PC**	3	3	0	0	**3**	40	60	100
B23CST702	Mobile App Development	**PC**	3	3	0	0	**3**	40	60	100
B23CST703	LLM and Prompt Engineering	**PC**	3	3	0	0	**3**	40	60	100
	Professional Elective III	**PE**	3	3	0	0	**3**	40	60	100
	Professional Elective IV	**PE**	3	3	0	0	**3**	40	60	100
Practical										
B23CSP701	Data Engineering and Analytics Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CSP702	Project work Phase I	**PW**	6	0	0	6	**4**	40	60	100
Total credits to be earned							**23**			

Semester – VIII

Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Practical										
B23CSP801	Project Work Phase II	**PW**	16	0	0	16	**8**	40	60	100
Total credits to be earned							**8**			

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HUMANITIES AND SOCIAL SCIENCES (HS)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23IPT101	Induction Programme	HS	-	-	-	-	NC	-	-	-
B23ENT101	Professional English	HS	3	3	0	0	2	40	60	100
B23HST101	தமிழர் மரபு / Heritage of Tamils	HS	1	1	0	0	1	40	60	100
B23ENI101	Professional Communication	HS	5	3	0	2	4	50	50	100
B23HST201	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	HS	1	1	0	0	1	40	60	100
B23HST701	Universal Human Values	HS	3	3	0	0	2	40	60	100

BASIC SCIENCES (BS)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23MAT101	Matrices and Differential Calculus	BS	4	3	1	0	4	40	60	100
B23CHI101	Engineering Chemistry	BS	5	3	0	2	4	50	50	100
B23PHI101	Engineering Physics	BS	5	3	0	2	4	50	50	100
B23MAT201	Integral Calculus and Complex Analysis	BS	4	3	1	0	4	40	60	100
B23MAT302	Discrete Mathematics	BS	4	3	1	0	4	40	60	100
B23MAT401	Probability and Queuing Theory	BS	4	3	1	0	4	40	60	100

ENGINEERING SCIENCES (ES)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23MET101	Engineering Graphics	ES	5	3	2	0	4	40	60	100
B23CSI101	C Programming	ES	6	2	0	4	4	50	50	100
B23ADI201	Python Programming	ES	6	2	0	4	4	50	50	100
B23MEP101	Engineering Practices Laboratory	ES	4	0	0	4	2	60	40	100
B23ECT203	Digital Logic and System Design	ES	3	3	0	0	3	40	60	100

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PROFESSIONAL CORE (PC)

Course Code	Course Name	CT	Instructional Hours				Assessment			
			CP	L	T	P	C	CIA	ESE	Total
B23CST301	Computer Organization and Architecture	PC	3	3	0	0	3	40	60	100
B23CST302	Data Structures	PC	3	3	0	0	3	40	60	100
B23CSI301	Operating Systems	PC	5	3	0	2	4	50	50	100
B23CSI302	Object Oriented Programming using C++	PC	5	3	0	2	4	50	50	100
B23CST303	Computer Networks	PC	3	3	0	0	3	40	60	100
B23CSP301	Data Structures Laboratory	PC	4	0	0	4	2	40	60	100
B23CST401	Database Management Systems	PC	3	3	0	0	3	40	60	100
B23CST402	Design and Analysis of Algorithms	PC	3	3	1	0	4	40	60	100
B23ADP402	Java Programming	PC	3	3	0	0	3	40	60	100
B23CST404	Artificial Intelligence and Machine Learning	PC	3	3	0	0	3	40	60	100
B23CST405	Software Engineering	PC	3	3	0	0	3	40	60	100
B23CSP401	Database Management and Systems Laboratory	PC	4	0	0	4	2	40	60	100
B23ADP401	Java Programming Laboratory	PC	4	0	0	4	2	60	40	100
B23CST501	Computational Theory	PC	4	3	1	0	4	40	60	100
B23CST502	Modern Web Programming	PC	3	3	0	0	3	40	60	100
B23CST503	IoT and Smart Technology Integration	PC	3	3	0	0	3	40	60	100
B23AMT501	Deep Neural Networks	PC	3	3	0	0	3	40	60	100
B23CSP501	Modern Web Programming Laboratory	PC	4	0	0	4	2	60	40	100
B23AMP501	Deep Learning Laboratory	PC	4	0	0	4	2	60	40	100
B23CST601	Cloud Computing	PC	3	3	0	0	3	40	60	100
B23CST602	Information and Network Security	PC	3	3	0	0	3	40	60	100
B23CSI601	Compiler Design	PC	5	3	0	2	4	50	50	100
B23ECT501	Microprocessors and Microcontrollers	PC	3	3	0	0	3	40	60	100
B23ECP501	Microprocessors and Microcontrollers Laboratory	PC	4	0	0	4	2	60	40	100
B23CST701	Data Engineering and Analytics	PC	3	3	0	0	3	40	60	100
B23CST702	Mobile App Development	PC	3	3	0	0	3	40	60	100
B23CST703	LLM and Prompt Engineering	PC	3	3	0	0	3	40	60	100

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PROJECT WORK (PW)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23CSP602	Innovative Design Practices	**PW**	4	0	0	4	**2**	40	60	100
B23MEP702	Project work Phase I	**PW**	8	0	0	8	**4**	40	60	100
B23MEP801	Project Work Phase II	**PW**	16	0	0	16	**8**	40	60	100

MANDATORY COURSE (MC)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23MCT501	Environmental Sustainability	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT502	Elements of Literature	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT503	Foundations of Yoga	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT504	Export Import Management	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT505	Holistic insight into UN SDGs	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT601	Education Psychology	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT602	Life style Education	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT603	Start-up and Venture Funding	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT604	Indian Knowledge System	**MC**	2	2	0	0	**NC**	100	-	100
B23MCT605	Cyber Security Concepts	**MC**	2	2	0	0	**NC**	100	-	100

CAREER ENHANCEMENT COURSE (CEC)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23CET201	Soft Skills	**CEC**	2	2	0	0	**NC**	100	-	100
B23CEP202	Application Design and Development	**CEC**	2	0	0	2	**NC**	100	-	100
B23CEP401	Professional Certificate Course	**CEC**	-	-	-	-	**1**	100	-	100
B23CEP501	Summer Internship	**CEC**	-	-	-	-	**1**	100	-	100

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I- Cloud Computing and Security	**Vertical II- Emerging Technologies**	**Vertical III- Intelligent Systems**
Virtualization and Containerization with Kubernetes	Robotic Process Automation	Soft Computing
Serverless Architecture	Game Development	Generative AI
Edge Computing	Expert Systems	Edge AI
Data Privacy in Cloud	Storage Technologies	Reinforcement Learning
Principles of Blockchain and Distributed Technologies	Nature Inspired Computing Techniques	Agent based Intelligent Systems
Federated Computing	Cognitive Science	Quantum Artificial Intelligence
Ethical Hacking Tools and Techniques	Augmented and Virtual Reality	Prompt Engineering
Cybercrime Investigation Techniques	Text and Speech Analysis	Explainable AI
Vertical IV- Network and Communication Systems	**Vertical V- Smart Analytics**	**Vertical VI- Software Engineering**
Data Communication and Transmission Techniques	Information Retrieval Techniques	Agile Methodologies for Software
Network Programming and Socket Development	Pattern Recognition	Software Project Management
IoT Communication Protocols	Healthcare Analytics	Software Quality Assurance
Wireless Communication	Social Media Analytics	Software Testing and Automation
Ad hoc and Sensor Networks	Image and Video Analytics	Modern Software Architectures and Patterns
5G and Next Generation Networks	Computer Vision	Software Dependability
Network Performance Optimization	Knowledge Engineering	Cloud Native Software Engineering
Network Automation using AIML	Ethics for Data Science	Low and No Code Platforms

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PROFESSIONAL ELECTIVES (PE)										
Course	Course Name	CT	Instructional Hours				Assessment			
			CP	L	T	P	C	CIA	ESE	Total
Vertical I- Cloud Computing and Security										
B23CSE909	Virtualization and Containerization with Kubernetes	PE	3	3	0	0	3	40	60	100
B23CSE910	Serverless Architecture	PE	3	3	0	0	3	40	60	100
B23CSE911	Edge Computing	PE	3	3	0	0	3	40	60	100
B23CSE912	Data Privacy in Cloud	PE	3	3	0	0	3	40	60	100
B23CSE913	Principles of Blockchain and Distributed Technologies	PE	3	3	0	0	3	40	60	100
B23CSE914	Federated Computing	PE	3	3	0	0	3	40	60	100
B23CSE915	Ethical Hacking Tools and Techniques	PE	3	3	0	0	3	40	60	100
B23CSE916	Cybercrime Investigation Techniques	PE	3	3	0	0	3	40	60	100
Vertical II- Emerging Technologies										
B23AME901	Robotic Process Automation	PE	3	3	0	0	3	40	60	100
B23AME902	Game Development	PE	3	3	0	0	3	40	60	100
B23AME903	Expert Systems	PE	3	3	0	0	3	40	60	100
B23AME904	Storage Technologies	PE	3	3	0	0	3	40	60	100
B23AME905	Nature Inspired Computing Techniques	PE	3	3	0	0	3	40	60	100
B23AME906	Cognitive Science	PE	3	3	0	0	3	40	60	100
B23AME907	Augmented and Virtual Reality	PE	3	3	0	0	3	40	60	100
B23AME908	Text and Speech Analysis	PE	3	3	0	0	3	40	60	100
Vertical III- Intelligent Systems										
B23ADE901	Soft Computing	PE	3	3	0	0	3	40	60	100
B23ADE902	Generative AI	PE	3	3	0	0	3	40	60	100
B23ADE903	Edge AI	PE	3	3	0	0	3	40	60	100
B23ADE904	Reinforcement Learning	PE	3	3	0	0	3	40	60	100
B23ADE905	Agent based Intelligent Systems	PE	3	3	0	0	3	40	60	100
B23ADE906	Quantum Artificial Intelligence	PE	3	3	0	0	3	40	60	100
B23ADE907	Prompt Engineering	PE	3	3	0	0	3	40	60	100
B23ADE908	Explainable AI	PE	3	3	0	0	3	40	60	100

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PROFESSIONAL ELECTIVES (PE)										
Course	Course Name	CT	Instructional Hours				Assessment			
			CP	L	T	P	C	CIA	ESE	Total
Vertical IV- Network and Communication Systems										
B23CSE917	Data Communication and Transmission Techniques	**PE**	3	3	0	0	**3**	40	60	100
B23CSE918	Network Programming and Socket Development	**PE**	3	3	0	0	**3**	40	60	100
B23CSE919	IoT Communication Protocols	**PE**	3	3	0	0	**3**	40	60	100
B23CSE920	Wireless Communication	**PE**	3	3	0	0	**3**	40	60	100
B23CSE921	Ad hoc and Sensor Networks	**PE**	3	3	0	0	**3**	40	60	100
B23CSE922	5G and Next Generation Networks	**PE**	3	3	0	0	**3**	40	60	100
B23CSE923	Network Performance Optimization	**PE**	3	3	0	0	**3**	40	60	100
B23CSE924	Network Automation using AIML	**PE**	3	3	0	0	**3**	40	60	100
Vertical V- Smart Analytics										
B23ADE909	Information Retrieval Techniques	**PE**	3	3	0	0	**3**	40	60	100
B23ADE910	Pattern Recognition	**PE**	3	3	0	0	**3**	40	60	100
B23ADE911	Healthcare Analysis	**PE**	3	3	0	0	**3**	40	60	100
B23ADE912	Social Media Analytics	**PE**	3	3	0	0	**3**	40	60	100
B23ADE913	Image and Video Analysis	**PE**	3	3	0	0	**3**	40	60	100
B23ADE914	Computer Vision	**PE**	3	3	0	0	**3**	40	60	100
B23ADE915	Knowledge Engineering	**PE**	3	3	0	0	**3**	40	60	100
B23ADE916	Ethics for Data Science	**PE**	3	3	0	0	**3**	40	60	100
Vertical VI- Software Engineering										
B23CSE901	Agile Methodologies for Software	**PE**	3	3	0	0	**3**	40	60	100
B23CSE902	Software Project Management	**PE**	3	3	0	0	3	40	60	100
B23CSE903	Software Quality Assurance	**PE**	3	3	0	0	3	40	60	100
B23CSE904	Software Testing and Automation	**PE**	3	3	0	0	3	40	60	100
B23CSE905	Modern Software Architectures and Patterns	**PE**	3	3	0	0	3	40	60	100
B23CSE906	Software Dependability	**PE**	3	3	0	0	3	40	60	100
B23CSE907	Cloud Native Software Engineering	**PE**	3	3	0	0	3	40	60	100
B23CSE908	Low and No Code Platforms	**PE**	3	3	0	0	3	40	60	100

Approved by BoS Chairman

OPEN ELECTIVES											
Course Code	Course Name	CT	Instructional Hours					Assessment			
			CP	L	T	P	C	CIA	ESE	Total
CSE											
B23AEO501	Principles of Flight	**OE**	3	3	0	0	**3**	40	60	100
B23AEO601	Unmanned Aircraft Systems	**OE**	3	3	0	0	**3**	40	60	100
B23ADO501	Gen AI with Open-Source Framework	**OE**	3	3	0	0	**3**	40	60	100
B23ADO601	Human Computer Communication	**OE**	3	3	0	0	**3**	40	60	100
B23AGO501	Form Automation	**OE**	3	3	0	0	**3**	40	60	100
B23AGO601	Environmental Management in Agriculture	**OE**	3	3	0	0	**3**	40	60	100
B23AMO501	Principles of Machine Learning	**OE**	3	3	0	0	**3**	40	60	100
B23AMO601	AI for Smart Systems	**OE**	3	3	0	0	**3**	40	60	100
B23BMO501	Principles of Biosensors	**OE**	3	3	0	0	**3**	40	60	100
B23BMO601	Medical Instrumentation	**OE**	3	3	0	0	**3**	40	60	100
B23BTO501	Biofertilizer Production and Mushroom Cultivation	**OE**	3	3	0	0	**3**	40	60	100
B23BTO601	Bioinformatics	**OE**	3	3	0	0	**3**	40	60	100
B23CBO501	Front End Technologies	**OE**	3	3	0	0	**3**	40	60	100
B23CBO601	Data Science for Business Analytics	**OE**	3	3	0	0	**3**	40	60	100
B23ECO501	Communication Engineering	**OE**	3	3	0	0	**3**	40	60	100
B23ECO601	Wireless Technology	**OE**	3	3	0	0	**3**	40	60	100
B23EEO501	Electric Vehicle Technology	**OE**	3	3	0	0	**3**	40	60	100
B23EEO601	Green Electronics and sustainable Technologies	**OE**	3	3	0	0	**3**	40	60	100
B23MEO501	Robotics	**OE**	3	3	0	0	**3**	40	60	100
B23MEO601	3D Printing and Tooling	**OE**	3	3	0	0	**3**	40	60	100

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Semester - I

B.E/B.Tech (Except CSBS)	B23ENT101–PROFESSIONAL ENGLISH	L	T	P	C
		2	0	0	2

Course Objectives	
1.	To develop the listening and reading skills of first year engineering and technology students.
2.	To help learners' develop vocabulary through reading skills.
3.	To enhance learners' grammatical knowledge.
4.	To enhance the learners' ability of writing different complex texts.
5.	To develop the competency of learners through LSRW skills.

UNIT-I	6
Listening: Listening to voicemail & messages; Listening and contextualizing. **Speaking:** Replying to polite requests and offers, understanding basic instructions. **Reading:** Short comprehension passages, practice in skimming & scanning **Writing:** Writing Instructions **Language development:** Parts of Speech, Wh - Questions, yes or no questions, Question tags **Vocabulary development:** Prefixes-suffixes	

UNIT-II	6
Listening: Listening commentaries and announcements **Speaking:** Role Play exercises based on workplace contexts. **Reading:** Comprehension questions including dialogues and conversations **Writing:** Writing different types of Paragraph **Language development:** Regular & Irregular Verbs, Tenses **Vocabulary development:** Understanding contextual meaning, Synonyms	

UNIT-III	6
Listening : Listening to a product launch-sensitizing leaners to the nuances of persuasive communication **Speaking :** Debate-discussion on current issues **Reading :** Short texts and longer passages-note making **Writing :** Understanding text structure, use of reference words and discourse markers, jumbled sentences **Language development:** Idioms and Phrases, Degrees of comparison **Vocabulary development:** One word substitutes	

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UNIT-IV	6
Listening : Listening to short academic videos **Speaking :** Making short presentation through short films **Reading :** Intensive and Extensive reading-reading different types of magazines **Writing :** Letter writing- formal and informal **Language development:** Direct/indirect questions **Vocabulary development:** Phrasal verbs	

UNIT-V	6
Listening : Listening to talks/lectures by specialists on specific topics **Speaking :** Discussion on general and current topics **Reading :** Longer texts-cloze reading **Writing :** Writing short essays, developing outline, identifying main and subordinate ideas, Dialogue writing **Language development:** Spelling and Punctuations, Modal verbs **Vocabulary development:** Collocations	
	Total Instructional hours:30

Course Outcomes: Students will be able to	
CO1	Develop listening and reading skills for effective communication
CO2	Develop vocabulary skills
CO3	Build grammatical understanding
CO4	Explain opinions efficiently in writing formal and informal contexts
CO5	Develop knowledge through LSRW skills

Text Books	
1.	Board of Editors Using English, "A Course book for Undergraduate Engineers and Technologists", Orient Black Swan Limited,Hyderabad:2015
2.	Richards,C.Jack," Interchange StudentsBook-2", New Delhi,CUP,2015.

Reference Books	
1.	Bailey, Stephen, "A practical guide for students", New York Rutledge, 2011.
2.	Raman, Meenakshi and Sharma, Sangeetha "Technical Communication Principles and Practice" Oxford University Press: New Delhi, 2014.
3.	Dutt P.Kiranmai and Rajeevan Geeta, "Basic Communication Skills", Foundation Books, 2013.

Approved by BoS Chairman

B.E / B.Tech	B23HST101 - HERITAGE OF TAMILS (Common to all Branches)	L	T	P	C
		1	0	0	1

UNIT I LANGUAGE AND LITERATURE	3
Language Families in India - Dravidian Languages – Tamil as aClassical 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.	

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	3
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.	

UNIT III FOLK AND MARTIAL ARTS	3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.	

UNIT IV THINAI CONCEPT OF TAMILS	3
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.	

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3
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.	
	Total Instructional hours : 15

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TEXT-CUM-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 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 ofArchaeology & Tamil Nadu Text Book 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) – Reference Book.

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		L	T	P	C
B.E/B.TECH	**B23MAT101 MATRICES AND DIFFERENTIAL CALCULUS (Common to all Branches)**	**3**	**1**	**0**	**4**

Course Objectives	
1.	To develop the use of matrices that is needed by engineers for practical applications.
2.	To understand the concept of functions of several variables.
3.	To recognize and classify ordinary differential equations.
4.	To apply the concept of ordinary differential equations in engineering disciplines.
5.	To learn the applications of Laplace transforms in engineering.

UNIT – I MATRICES	**12**
Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigenvectors – Cayley Hamilton theorem – Quadratic form: Nature, Reduction to canonical form by orthogonal transformation.	

UNIT – II FUNCTIONS OF SEVERAL VARIABLES	**12**
Partial differentiation –Total derivative – Jacobians – Taylor‘s series expansion for functions of two variables – Maxima and minima of functions of two variables – Lagrange‘s method of undetermined multipliers.	

UNIT – III ORDINARY DIFFERENTIAL EQUATIONS	**12**
Higher order linear ordinary differential equations with constant coefficients - Method of variation of parameters - Simultaneous differential equations.	

UNIT – IV APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS	**12**
Solution of specified differential equations connected with electric circuits - Law of Natural growth and decay - Simple harmonic motion (Differential equations and associated conditions need to be given).	

UNIT – V LAPLACE TRANSFORM	**12**
Existence conditions - Properties (excluding proofs) - Transform of standard functions -Transforms of derivatives and integrals - Inverse Laplace transform - Applications to solution of linear second order ordinary differential equations with constant coefficients.	
	Total Instructional hours : 60

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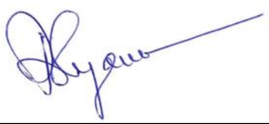
Course Outcomes : Students will be able to	
CO1	Make use of Eigen values and Eigen vectors to reduce the quadratic form into canonical form and to find the powers of a square matrix.
CO2	Construct maxima and minima problems.
CO3	Solve differential equations which existing in different engineering disciplines.
CO4	Develop the applications of differential equations in various engineering field.
CO5	Apply Laplace transform and inverse transform to solve differential equations with constant coefficients.

Text Books	
1.	Grewal B.S.,"Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2015.
2.	Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media -An imprint of Lakshmi Publications Pvt., Ltd., New Delhi, 7th Edition, 2015.
3.	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2015.
4.	George B. Thomas , Joel Hass , Christopher Heil , Maurice D. Weir, "Thomas' Calculus", Pearson,14th Edition, 2018.

Reference Books	
1.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2019.
2.	Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
3.	Ramana B V., "Higher Engineering Mathematics", Tata Mc Graw Hill Publishing Company, New Delhi, 2017.
4.	Veerarajan T., "Engineering Mathematics for Semester I and II", Tata Mc Graw Hill Publishing Company, New Delhi, 2019.
5.	Gean Duffy., "Advanced Engineering Mathematics with MATLAB", A CRC Press Company, Boca Raton London, New York Washington, D.C, 2nd edition 2009. (Free e- book downloaded from www.EasyEngineering.net.pdf).



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B.E / B.Tech	B23MET101 – Engineering Graphics (Common to All)	L	T	P	C
		3	2	0	4

Course Objective:

1. Understand the conventions and method of engineering drawing.
2. Construct and interpret the basic engineering drawings.
3. Improve their visualization skills so that they can apply these skills in new product development.
4. Enhance their technical communication skill in the form of communicative drawings.
5. Comprehend the theory of projection.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) 2

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT-I PLANE CURVES AND FREE HANDSKETCHING 14

Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects.

UNIT-II PROJECTION OF POINTS, LINES AND PLANE SURFACE 14

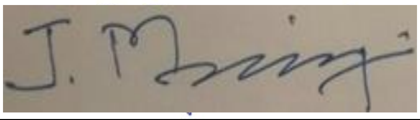
Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT-III PROJECTION OF SOLIDS 14

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

UNIT- IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 14

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of



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section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT-V ISOMETRIC AND PERSPECTIVE PROJECTIONS 14

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING 3

Introduction to drafting packages and demonstration of their use.
Basic Geometrical constructions using AUTOCAD.

Total Instructional Hours: 75

Course Outcome

Student will be able to

CO1: Construct the basic engineering curves and freehand sketching of basic geometrical constructions and multiple views of objects.

CO2: Draw problems related to projections of points, straight lines, planes and solids.

CO3: Build the projection of simple solids.

CO4: Apply the knowledge acquired on practical applications of sectioning and development of solids.

CO5: Construct simple solids and its sections in isometric view and projections and to draw its perspective views.

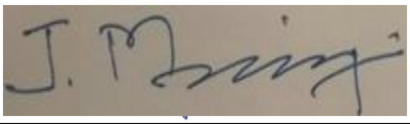
Text Books:

1. K.V.Natarajan, "A text book of Engineering Graphics", 28th Edition, Dhana Lakshmi Publishers, Chennai, 2015.
2. N.D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House,53rd Edition, 2014.

Reference Books:

1. K. Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International Publishers, 2017.
2. K.R.Gopalakrishna., "Engineering Drawing" (Vol. I & II combined) Subhas Publications, Bangalore, 2018.

N.S Parthasarathy and Vela Murali, "Engineering Drawing", O



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B.E / B.Tech	B23PHI101 - ENGINEERING PHYSICS (Common to all Branches)	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To gain knowledge on the basics of properties of matter, its applications and inculcate practical skills in the determination of elastic property of the materials.
2.	To acquire knowledge & experimental skills on the concepts of Photonics and their applications in fiberoptics.
3.	To have adequate knowledge on the concepts of electrical, magnetic properties of materials and enhance the practical skills in determination of electrical properties of the materials.
4.	To get knowledge on advanced physics concepts of quantum theory and its applications in SEM, TEM and induce practical skills in microscope.
5.	To enhance the fundamental knowledge of students in Crystal Physics and its Applications relevant to various streams of Engineering and Technology.

UNIT – I PROPERTIES OF MATTER	14

Elasticity-Modulus, types of modulii of elasticity, Stress-strain diagram and its uses-factors affecting elastic modulus and Twisting couple, torsion pendulum; theory and experiment.

Bending of beams- Bending moment - uniform and non- uniform bending; theory and experiment- I-shaped girders and its applications.

Determination of rigidity modulus – Torsion pendulum- Determination of Young's modulus by non-uniform bending method- Determination of Young's modulus by uniform bending method.

UNIT – II PHOTONICS AND FIBER OPTICS	12

Lasers; properties of laser-spontaneous and stimulated emission-amplification of light by population inversion- Einstein's A and B coefficients - derivation – Types of laser; Nd.-YAG Laser, Semiconductor lasers; homojunction and heterojunction, Industrial and Medical Applications.

Fiber Optics; Principle, Numerical Aperture and Acceptance Angle - Types of optical fibres–-Fiber optic communication System-Block diagram–Medical Applications-Endoscopy.

Determination of wavelength of the Laser using grating- Determination of particle size using Laser- Determination of Numerical aperture and acceptance angle of an optical fiber.

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UNIT – III ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS	12

Classical free electron theory – Relaxation time and collision time - Expression for electrical conductivity – Thermal conductivity – Wiedemann-Franz law –Lorentz number-Drawbacks of classical theory-Quantum theory- Fermi-Dirac statistics – variation of Fermi level with temperature.

Introduction to magnetic materials –Comparision of Dia, Para and Ferro magnetic materials – Domain theory of ferromagnetism- Hysteresis -Soft and Hard magnetic materials **-**Ferrites and its applications.

Determination of specific resistance of the wire using Carey Foster's Bridge.

UNIT – IV QUANTUM PHYSICS	12

Black body radiation; Planck's theory (derivation) - wave particle duality- debroglie's wavelength - concept of wave function and its physical significance.

Wave equation; Schroedinger's time independent and time dependent equations, particle in a one-dimensional rigid box. **Applications;** Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM).

Determination of thickness of a thin wire by using travelling microscope.

UNIT – V CRYSTAL PHYSICS	10

Crystal Structures; Single crystalline, polycrystalline and amorphous materials - unit cell- space lattice-crystal systems- Bravais lattices- Miller indices- inter-planar distances – coordination number and packing factor for SC, BCC, FCC and HCP structures.

Crystal imperfections; Point and Line defects-Burger vector.

Total Theory Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Categorize the basics of properties of matter and its applications, classify the elastic properties of materials by using uniform, non-uniform bending method and torsional pendulum apparatus.
CO2	Explain the basics of Laser, Fiber Optics and their applications, determination of Particle size, Wavelength of laser and acceptance angle, numerical aperture of optical fiber.
CO3	Justify the concepts of electrical, magnetic properties of materials, determination of Specific resistance of the material.
CO4	Interpret the basic knowledge of quantum theory that could be helpful in understanding the wave functions of the particle and determination of thickness of thin sheet by using travelling microscope.

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CO5	Classify and compare the different types of Crystals, their structures and its defects.

Text Books	
1.	Bhattacharya, D.K. & Poonam, T, "Engineering Physics", Oxford University Press,2015.
2.	Gaur, R.K. & Gupta, S.L. "Engineering Physics", Dhanpat Rai Publishers, 2012.
3.	Pandey, B.K. & Chaturvedi, S. "Engineering Physics", Cengage Learning India, 2012.
4.	Rajendran V, "Engineering Physics", Tata McGraw Hill, Publishing Company, NewDelhi, 2011.
5.	Wahab, M.A. —Solid State Physics: Structure and Properties of Materials, Narosa Publishing House, 2009.

Reference Books	
1.	Halliday, D., Resnick, R. & Walker, J. "Principles of Physics"", Wiley, 2015.
2.	Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers", CengageLearning, 2010.
3.	Tipler, P.A. &Mosca, G. "Physics for Scientists and Engineers with Modern Physics", W.H.Freeman, 2007.
4.	Avadhanulu M.N**, "**Engineering Physics - Volume 1", S.Chand & Company Ltd.,NewDelhi, 2010.
5.	Garcia, N. & Damask, A. —Physics for Computer Science Students. Springer-Verlag, 2012.
6.	Senthil Kumar, G. Physics Laboratory I & II, VRB publishers Pvt. Ltd., Chennai (2016).

Equipment Needed for 30 Students

1. Diode Laser (2 mS power) , He –Ne Laser source(2mW), Optical Fibre Kit - 06
2. Travelling Microscope ,Knife edge, Slotted weights - 19
3. Carey Foster Bridge - 06
4. Air Wedge Apparatus with Travelling Microscope - 06
5. Torsional Pendulum - 06

Approved by BoS Chairman

B.E / B.Tech	B23CSI101 – C PROGRAMMING (Common to CSE(AI&ML), AI&DS, BME, ECE, EEE)	L	T	P	C
		2	0	4	4

Course Objectives	
1.	To know the basics of problem-solving techniques.
2.	To provide exposure to problem-solving through programming.
3.	To develop C programming language with conditional statements and loops.
4.	To develop modular applications in C using functions pointers and structures
5.	To do input/output and file handling in C

UNIT - I	INTRODUCTION TO PROBLEM SOLVING & COMPUTER	8

Problem Solving: Problem Solving Techniques - Logical Thinking – Step for Solving the Problems – Compare Problem Solving and Logical Thinking – Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

UNIT - II	BASICS OF C PROGRAMMING	10

Introduction to programming paradigms - Structure of C program - Phases of developing a running computer program in C – Applications of C Language - C programming: Data Types – Storage Class - Constants – Enumeration Constants - Keywords – Operators: Operators – Types of Operators - Expressions - Precedence and Associativity – Input / Output statements – Decision making statements - Looping statements with example of Pattern – Preprocessor directives.

UNIT - III	ARRAYS AND POINTERS	9

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays with example of Matrices Operations – Pointers: Pointer Declaration – Initialization - Pointer operators – Pointer Arithmetic – Dynamic Memory Allocation – Selection sort, Insertion sort, Bubblesort - Searching.

UNIT - IV	FUNCTION AND STRINGS	9

Function: definition of function, Declaration of function – Function Call - Prototype Declaration - Pass by value, Pass by reference – Recursion - Linear recursion, Binary Search using recursive functions - C standard functions and libraries - String operations: length, compare, concatenate, copy - String Arrays.

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UNIT - V	STRUCTURES AND FILE HANDLING	9
Introduction: need for structure data type, structure definition, Structure declaration, Structure within a structure – Array Structure - Union – File Handling: File Operations – File Types: Sequential and Random access – Case Study: AI Processing System using C.		

Expt. No.	Description of the Experiments
1.	Experiment with I/O statements, operators, expressions
2.	Develop a C programs for Decision Making Construct. a)if-else b)switch-case c)goto, break-continue
3.	Develop a C programs for Loop Control statements. a)for b) Nested for c) while and do-while
4.	Develop a C programs for Array a)One Dimensional – Sorting and Searching b)Two Dimensional – Matrix Operations c) Traversal
5.	Develop a C program to perform the pointers. Linear Search b) Binary Search c) Pointer Operation
6.	Build a C programs for the recursive function
7.	Implement a C programs for string operations String operations using build in methods
8.	Develop a C program to experiment with Pass by value and Pass by Reference
9.	Develop a c program for structure and union a)Payroll using structure and union.b)Student records using structure and union.
10.	Develop a C program to perform file operations
	Total Instructional hours : (45+30) = 75

Course Outcomes : Students will be able to	
CO1	Demonstrate knowledge on C programming constructs
CO2	Construct C programs using decision making and control statements.
CO3	Experiment with programs in C using an array.
CO4	Build programs in C using strings, pointers, functions.

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CO5	Model the applications in C using Structures, Union and File Operations

Requirements for a Batch of 30 Students		
Sl. No.	**Description of the Equipment**	**Quantity required (Nos.)**
1.	HP Make, Core i5, 11th Generation, 16GB RAM PCs, Operating systems: Windows* 10 or later, macOS, and Linux. Turbo C/C++ 4.5	30

Text Books	
1.	Yashavant P. Kanetkar. “Let Us C”, 19th Edition, BPB Publications, 2022
2.	H. M. Deitel, P. J. Deitel, C: How to program, 9th edition, Pearson Education, 2020.

Reference Books	
1.	Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016
2.	Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2015
3.	Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013
4.	Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013.

Approved by BoS Chairman

Semester - II

B.E/B.Tech (Except CSBS)	B23ENI101–PROFESSIONAL COMMUNICATION	L	T	P	C
		3	0	2	4

Course Objectives	
1	To enhance listening and reading ability of learners to comprehend various forms of speech or conversations.
2	To develop learners' verbal ability through complex texts and speak effectively in real life and **workplace context.**
3	To make use of grammatical knowledge to enhance fluency.
4	To foster learners' ability to write convincing job applications and effective reports.
5	To develop learners language proficiency through LSRW skills

UNIT-I — 9

Listening: Listening for general information-specific details- conversation- Audio /video (formal & informal); Telephone conversation

Speaking: Self-Introduction; Introducing a friend; - politeness strategies- making polite requests & polite offers.

Reading: Introduction to technical texts, scientific texts

Writing: Extended definitions, Writing checklists, Recommendation

Language development: Gerunds, Infinitives

Vocabulary development: Technical vocabulary, abbreviations, British & American spelling

UNIT-II — 9

Listening: Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities

Speaking: Narrating personal experiences / Talking about events and situations

Reading: Reading longer technical texts, Summarizing

Writing: Interpreting graphical representations, Writing dialogues about formal and informal contexts.

Language development: Use of conjunctions and prepositions

Vocabulary development: Numerical adjectives, Transitional device

UNIT-III — 9

Listening: Listen to a classroom lecture; listening to advertisements about products

Speaking: Picture description-describing locations in workplace, Presenting product, describing shape, size and weight- talking about quantities-talking about precautions, discussing advantages and disadvantages-making comparisons

Reading: Cause & effect texts, practice in speed reading

Writing: Process writing, Use of sequence words, Analytical and issue based essays

Language development: Subject verb agreement, Pronoun concord / pronoun antecedent

Vocabulary development: Sequence words, Misspelled words, Content v/s Function words.

UNIT-IV	9

Listening: Listening to TED Talks, Educational videos and completing exercises based on them

Speaking: Short speech (Just A Minute) -Extempore and persuasive speech, discussing and making plans-talking about tasks-talking about progress.

Reading: Reading for details in personal and professional emails

Writing: Drafting personal and professional emails, job application- cover letter, résumé preparation, Internship letter.

Language development: Clauses, if conditionals

Vocabulary development: Finding suitable synonyms, Paraphrasing

UNIT-V	9

Listening: Listening to debates/ discussions and panel discussions, listening to interviews

Speaking: Making predictions- talking about a given topic, giving opinions & facts, describing a process, discussing safety issues (making recommendations)

Reading: Reading and understanding technical articles

Writing: Writing reports, Minutes of meeting, Writing feasibility, survey and industrial reports

Language development: Reported speech, Active and Passive voice, Impersonal passive, Idioms.
Vocabulary development: Verbal analogies, Purpose statements

	Total Theory Instructional hours:45 **Total Lab Instructional hours:30**

Course Outcomes: Students will be able to	
CO1	Develop listening skills to respond appropriately in general and academic purposes
CO2	Develop strategies and skills to enhance their ability to read and comprehend
CO3	Apply vocabulary skills to improve their language skills
CO4	Build the writing skills with specific reference to technical writing
CO5	Demonstrate language proficiency through LSRW skills

Approved By BoS Chairman

Text Books	
1.	Board of Editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016
2.	Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

Reference Books	
1.	Raman, Meenakshi and Sharma, Sangeetha “Technical Communication Principles and Practice” Oxford University Press: New Delhi, 2014.
2.	Kumar, Suresh. E. “Engineering English” Orient Blackswan: Hyderabad, 2015
3.	Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4	Davis, Jason and Rhonda LIss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
5	Communicative English for Engineers and Professionals- Nitin Bhatnagar & Mamta Bhatnagar
6	Skills for Success. Listening and Speaking. Level 4- Margret Brooks
7	Grammar F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011

Exercises for Batch of 30 Students

1. Listening Comprehension
2. Self- introduction
3. Short presentation
4. Group Discussion

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B.E / B.Tech	B23HST201- TAMILS AND TECHNOLOGY (Common to all Branches)	L	T	P	C
		1	0	0	1

UNIT I WEAVING AND CERAMIC TECHNOLOGY	3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.	

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY	3
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.	

UNIT III MANUFACTURING TECHNOLOGY	3
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.	

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY	3
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.	

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UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING		3
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.		
	Total Instructional hours : 15	

TEXT-CUM-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 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 ofArchaeology & Tamil Nadu Text Book 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) – Reference Book.

Approved By BoS Chairman

B.E/B.TECH	B23MAT201 INTEGRAL CALCULUS AND COMPLEX ANALYSIS (Common to all Branches)	L	T	P	C
		3	1	0	4

Course Objectives	
1.	To recognize various techniques of integration.
2.	To apply integration techniques in evaluating area and volume of solids.
3.	To develop the use of Vector calculus in two and three dimensional spaces.
4.	To demonstrate understanding of the basic concepts of complex differentiation.
5.	To understand Cauchy theorem and Cauchy integral formulae and apply these to evaluate complex contour integrals.

UNIT – I INTEGRAL CALCULUS	12
Riemann sum – Definite and Indefinite integrals - Substitution rule (Exponential, logarithmic, Trigonometric functions) – Integration by parts – Integration of Rational functions by Partial fraction.	

UNIT – II MULTIPLE INTEGRALS	12
Double integrals: – Double integrals in Cartesian coordinates - Double integrals in Polar coordinates – Area enclosed by plane curves – Triple integrals: Evaluation of triple integrals - Volume as triple integral (Simple problems).	

UNIT – III VECTOR CALCULUS	12
Gradient and directional derivative - Divergence and curl - Solenoidal and Irrotational vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Verification of theorem and applications (for cubes and rectangular parallellopipeds).	

UNIT – IV COMPLEX DIFFERENTIATION	12
Analytic functions - Cauchy-Riemann equations (excluding proof) – Properties of analytic function – Harmonic conjugate- Construction of analytic function by Milne Thomson method – Bilinear transformation.	

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UNIT – V COMPLEX INTEGRATION	12
Cauchy‘s integral theorem – Cauchy‘s integral formula – residues - Cauchy‘s Residue theorem – Evaluation of real integrals – Stereographic projection – Use of circular contour and semicircular contour (excluding poles on real axis).	
	Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Develop Fundamental Theorem of Calculus, techniques of Integration such as substitution, partial fractions and integration by parts.
CO2	Make use of integration to compute area and volume.
CO3	Apply the line, surface and volume integrals for verification of Green‘s, Gauss and Stokes theorems.
CO4	Develop an understanding of the standard techniques of complex variable theory in particular analytic function
CO5	Identify contour integrations with the help of residue theorem.

Text Books	
1.	Grewal B.S.,”Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2.	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2015.
3.	George B. Thomas , Joel Hass , Christopher Heil , Maurice D. Weir, “Thomas' Calculus”, Pearson, 14th Edition, 2018.

Reference Books	
1.	Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media - An imprint of Lakshmi Publications Pvt., Ltd., New Delhi, 7th Edition, 2015.
2.	Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition 2019.
3.	O‘Neil, P.V.,”Advanced Engineering Mathematics”, Cengage Learning India Pvt. Ltd, New Delhi, 7th Edition 2017.
4.	Sastry, S.S, “Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New

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	Delhi, 2014.
5.	Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics", (Tata McGraw Hill Education Pvt. Ltd), 6th Edition, New Delhi, 2012.
6.	Gean Duffy., "Advanced Engineering Mathematics with MATLAB", A CRC Press Company, Boca Raton London, New York Washington, D.C, 2nd edition 2009. (Free e- book downloaded from www.EasyEngineering.net.pdf)

Approved By BoS Chairman

B.E / B.Tech	B23CHI101 - ENGINEERING CHEMISTRY (Common to all Branches)	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To make the students conversant with boiler feed water requirements, related problems, water treatment and inculcate practical skills in the water quality analysis.
2.	To make the students conversant with basics of polymer chemistry.
3.	To make the students conversant with basic of electrochemical reactions, corrosion and induce experimental skills in the electro-analytical techniques.
4.	To make the student acquire sound knowledge of energy devices.
5.	To develop an understanding of the basic concepts of nano materials.

UNIT – I WATER TECHNOLOGY	17

Hardness of water: Types, expression of hardness and their units, hardness problems, boiler troubles - scale and sludge, caustic embrittlement, boiler corrosion, priming and foaming.
Treatment of Boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning).
External treatment: Ion exchange process, Zeolite process.
Desalination of brackish water: Reverse osmosis - municipal water treatment, break point chlorination.
Determination of alkalinity in water sample, Determination of total, temporary & permanent hardness of water by EDTA method. Estimation of iron content of the water sample using spectrophotometer.

UNIT – II POLYMERS	9

Polymers: Definition, polymerization, types - addition and condensation polymerization, free radical mechanism - tacticity – biodegradable polymer (PHBV) and conducting polymer (poly-aniline).
Plastics: Classification, preparation, properties and uses of PVC, teflon, nylon-6, 6 and epoxy resin.
Rubber: Vulcanization of rubber, synthetic rubbers -n-butyl rubber and SBR.

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Moulding: Ingredients - compression and Injection.	
UNIT – III ELECTROCHEMISTRY AND CORROSION	**16**
Electrochemistry: Redox reaction, electrode potential - oxidation potential, reduction potential, Nernst equation (derivation) - measurement and applications - electrochemical series and its significance. **Corrosion:** causes - types-chemical and electrochemical corrosion (galvanic and differential aeration), corrosion control - electrochemical protection (sacrificial anodic method and impressed current cathodic method). **Estimation of iron content of the given solution using potentiometer, Conductometric titration of strong acid vs strong base, Estimation of copper in brass.**	

UNIT – IV ENERGY DEVICES	**9**
Batteries: Types of batteries – primary (alkaline battery) and secondary battery (lead acid battery, lithium-ion-battery), Fuel Cells (H_2 - O_2 fuel cell). **Super Capacitors:** Principle, construction, working and applications. **Photo voltaic cell:** Solar cells - principle, construction, working and applications.	

UNIT – V NANOCHEMISTRY		**9**
Basics: Distinction between molecules, nanoparticles and bulk materials- surface area to volume ratio. **Synthesis:** Top-down process (ball milling) - Bottom-up process (chemical vapour deposition and sol-gel method). **Properties of nano materials** - Optical, electrical, thermal and mechanical. **Applications of nano materials** – Medicine, Industries, electronics and biomaterials.		
	Total Instructional hours: 60	

Course Outcomes: Students will be able to	
CO1	Determine the characterization of water and quantitative analysis of alkalinity, hardness and Iron. (K5)

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CO2	Develop the basics of polymer chemistry. (K3)
CO3	Interpret the principles of electrochemical reactions, corrosion and estimation of copper in Alloy. (K5)
CO4	Apply the concepts of energy devices and its engineering applications. (K3)
CO5	Organize the basics of Nano chemistry and its applications. (K3)

Text Books	
1.	Dara, S S and Umare, S S, "A Textbook of Engineering Chemistry", Chand S & Company Ltd., New Delhi, 2015.
2.	Jain, P C and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 2015
3.	Vogel's Textbook of Quantitative Chemical Analysis, 8th edition, 2014.
Reference Books	
1.	Friedrich Emich, "Engineering Chemistry", Scientific International Pvt. Ltd., New Delhi, 2014.
2.	Prasanta Rath, "Engineering Chemistry", Cengage Learning India Pvt. Ltd., Delhi, 2015.
3.	Shikha Agarwal, "Engineering Chemistry - Fundamentals and Applications", Cambridge University Press, Delhi, 2015.
4.	Charles P. Poole and Frank J. Owens, "Introduction to nanotechnology", John Wiley Sons, New Jersey, 2003.

Equipment Needed for 30 Students

1. Conductivity Meter-10
2. Potentiometer-10
3. Spectrophotometer-02
4. Electronic Balance-01

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B.E/B.Tech	B23ECT203-DIGITAL LOGIC AND SYSTEM DESIGN	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce basic postulates of Boolean Algebra and to simplify the Boolean expressions using K-map
2.	To impart the knowledge on combinational logic circuits
3.	To analyze and design synchronous and asynchronous sequential circuits
4.	To learn about various memory devices & PLDs
5.	To introduce the concept of very high speed integrated circuits Hardware description language.

UNIT-I	BOOLEAN ALGEBRA AND LOGIC GATES	9
Number Systems, Arithmetic Operations, Binary Codes, Boolean Algebra and Logic Gates, Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Simplification of Boolean Functions using Karnaugh Map, Logic Gates, NAND and NOR Implementations.		
UNIT-II	**COMBINATIONAL LOGIC**	**9**
Combinational Circuits–Analysis and Design Procedures- Binary Adder-Subtractor-Decimal Adder-Binary Multiplier-Magnitude Comparator-Decoders–Encoders–Multiplexers.		
UNIT-III	**SYNCHRONOUS SEQUENTIAL LOGIC**	**9**
SequentialCircuits-StorageElements:Latches,Flip-Flops-AnalysisofClockedSequential Circuits - State Reduction and Assignment - Design Procedure - Registers and Counters.		
UNIT-IV	**ASYNCHRONOUS SEQUENTIAL LOGIC**	**9**
Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and FlowTables–Race-free State Assignment–Hazards.		
UNIT-V	**MEMORY AND PROGRAMMABLE LOGIC**	**9**
RAM – Memory Decoding – Error Detection and Correction - ROM - Programmable Logic Array–Programmable Array Logic–Sequential Programmable Devices. Introduction to Verilog HDL–HDL Models of Combinational circuits, Sequential Circuits.		
	Total Instructional hours:45	

Approved by BoS Chairman

Text Books	
1.	M.MorrisMano, Michael D.Ciletti, “Digital Design:With an Introduction to the Verilog HDL, VHDL and System Verilog”,6th Edition, Pearson Education, 2017.

Reference Books	
1.	G.K.Kharate, “Digital Electronics”, Oxford University Press, 2 010.
2.	John F.Wakerly, “Digital Design Principles and Practices”, Fifth Edition, Pearson Education, 2017.
3.	Charles H.RothJr,LarryL.Kinney, “Fundamentals of Logic Design”, Sixth Edition,Cengage Learning, 2013.
4.	Donald D.Givone,“Digital Principles and Design”,Tata McGraw Hill, 2003.
5.	ZainalabedinNavabi,“ Verilog Digital System Design”, McGraw Hill Education; 2nd edition , July 2017.
6	https://archieve.nptel.ac.in/courses/108/106/108106177 https://archieve.nptel.ac.in/courses/117/106/117106114 https://archieve.nptel.ac.in/courses/117/106/117106086

Course Outcomes: Students will be able to	
CO1	Simplify Boolean expressions using Boolean functions and K-Map
CO2	Analyze and design of combinational circuits with optimized inputs
CO3	Analyze and design of Synchronous sequential circuits
CO4	Analyze and design of Asynchronous sequential circuits
CO5	Apply HDL for simulation of combinational & sequential logic circuits

Approved by BoS Chairman

B.E / B.Tech	B23ADI201 – PYHTON PROGRAMMING (Common to AI&DS, CSE, CSE(AI&ML)) (Lab Integrated)	L	T	P	C
		2	0	4	4

Course Objectives	
1.	To create simple python and object oriented programs using data types and control statements
2.	To develop a python programs using Strings and functions
3.	To use Python data structures such as lists, tuples, and Dictionaries
4.	To define python modules and packages
5.	To develop an applications using Numerical Python

UNIT - I	OVERVIEW OF OOPS CONCEPTS AND PYTHON BASICS	6

Object oriented programming overview - Python programming: Introduction – data types- Operators – Values and types – Variables – expressions – Statements – Functions - conditionals and Recursion – Iteration.

UNIT - II	STRINGS & FUNCTIONS	6

Accessing characters and substrings in strings - Data Encryption - Strings and Number System – String methods. Functions: Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.

UNIT - III	LISTS, TUPLES & DICTIONARIES	6

Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods. Dictionaries:

UNIT - IV	MODULES & PACKAGES	6

Modules: Importing module, Math module, Random module. Python packages: Simple programs using the built-in functions of packages packages matplotlib, Numpy, pandas.

UNIT - V	DATA MANIPULATION WITH PYTHON	6

Jupyter and Colab Notebook System- Python Demonstration: Reading and Writing CSV files- Advanced Python Lambda and List Comprehensions- Numerical Python Library (NumPy) - NumPy array creation- reading arrays from disk- I/O with NumPy.

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List of Experiments:

Expt. No.	Description of the Experiments
1.	Write a program to demonstrate different basic data types in python.
2.	Create a menu driven program for reading the input from console and to perform different arithmetic operations on numbers in python..
3.	Write a Programs using Decision statements and looping statements.
4.	Write a Python program to demonstrate various built-in string handling function
5.	Construct a Python program to implement various string operations Without using built-in function
6.	Create Python Programs using user-defined functions with different types of function arguments. a) Create a simple calculator that can add, subtract, multiply and divide using functions. b) Implement the above concept by using pass by value and pass by reference.
7.	a) Implement linear search and binary search using list. b) Matrix operations using Nested List.
8.	Create a tuple and perform the following methods 1) Add items 2) len() 3) check for item in tuple 4)Access items
9.	Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len()
10.	Write a python program to create a package (college), sub - package (all dept), modules (AI&DS, CSE) and create admin and cabin function to module.
11.	Simulate bouncing ball using Pygame and elliptical orbits in Pygame
12.	Write a Python program to perform read and write operations in a file, and find the occurrence of a given word in the text file using Jupyter / Lamda notebook
13.	Write a Python program to perform various array operations using Jupyter or Lamda note Book
13.	Write a Python program sorting numbers and strings using Jupyter perform various array operations using Jupyter or Lamda note Book
14.	Write a Python program for sorting numbers and Strings using Jupiter or Lamda notebook
	Total Instructional hours : (30+30)=60

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Course Outcomes : Students will be able to	
CO1	Make use of basic elements of Python programming to develop an application
CO2	Experiment with the various Strings and functions in Python
CO3	Develop Python programs to implement the operations in Lists, Tuples & Dictionaries..
CO4	Construct a simple application by using modules and packages.
CO5	Build an application using Jupyter or Colab notebook in Python

Text Books	
1.	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd edition, O Reilly Publishers, 2016.
2.	Reema Thareja, “Python Programming using Problem Solving Approach”, 4th Impression , Oxford University Press, 2019.

Reference Books	
1.	John V Guttag, “Introduction to Computation and Programming Using Python”, 3rd illustrated edition, MIT Press, 2021.
2.	Guido Van Rossum and Fred L. Drake Jr, “An Introduction to Python”, Network Theory Ltd., 2011.
3.	Robert Sedgewick, Kevin Wayne and Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd, 2015.

List of Equipment Required:

S.NO.	Description of the Equipment	Quantity required (Nos.)
1	Python 3 interpreter for Windows/Linux	30

Approved by BoS Chairman

B.E. / B.Tech	B23MEP101 – ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1.	Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work, sawing, planning, making joints in wood materials used in common household wood work.
2.	Welding various joints in steel plates using arc welding work; machining various simple processes like turning, drilling, tapping in parts; assembling simple mechanical assembly of common household equipments, making a tray out of metal sheet using sheet metal work.
3.	To provide exposure to the students with hands on experience on various basic Engineering practices in Electrical Engineering.
4.	To provide exposure to the students with hands on experience on various basic Engineering practices in Electronics Engineering.

GROUP – A (CIVIL & MECHANICAL)

I	Civil Engineering Practices	12

Plumbing Works

Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings

Carpentry

Preparation of wooden joints by sawing, planning and cutting

1.	Planning & Polishing operation
2.	Half lap joint
3.	Cross lap joint

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II	**Mechanical Engineering Practices**	**18**
Welding Workshop Study of welding tools and equipment's - Study of various welding methods - Instruction of BI standards and reading of welding drawings.		
Exercise in arc welding for making		
1.	Lap joint	
2.	Butt joint	
3.	Demonstration of gas welding and cutting.	
Machine Shop		
1.	Drilling and Tapping	
2.	Lathe Exercise – Facing operation	
3.	Lathe Exercise – Straight turning and Chamfering	
Sheet metal		
Making of small parts using sheet metal		
1.	Making of Square Tray	

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GROUP – B (ELECTRICAL & ELECTRONICS)	30

Expt. No.	Description of the Experiments
1.	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2.	Fluorescent lamp and Stair case wiring.
3.	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
4.	Measurement of energy using single phase energy meter.
5.	Measurement of resistance to earth of an electrical equipment.
6.	Study of Electronic components and equipment's – Resistor color coding
7.	Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
8.	Study of logic gates AND, OR, EX-OR and NOT.
9.	Soldering & desoldering practices.
10.	Study of Fan, Iron Box, Emergency Lamp, Telephone and FM Radio.
	Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Explain the pipe connections and identify the various components used in plumbing.
CO2	Develop simple wooden joints using wood working tools and simple components using lathe and drilling machine.
CO3	Construct simple lap, butt and tee joints using arc welding equipment and simple parts using sheet metal.
CO4	Construct Residential house wiring, Fluorescent lamp wiring and Stair case wiring.
CO5	Measure electrical quantities such as voltage, current, power & power factor in RLC Circuit, resistance to earth, AC signal parameter (peak-peak, RMS period, frequency) and ripple factor.
CO6	Examine logic gates (AND, OR, EX-OR and NOT), Electronic components and equipment's.

J.P. [signature]

Approved by BoS Chairman

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
GROUP – A (CIVIL & MECHANICAL)		
Sl. No.	**Description of Equipment**	**Quantity required**
1.	Assorted components for plumbing, Consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15
2.	Carpentry vice (fitted to work bench)	15
3.	Standard woodworking tools	15
4.	Models of industrial trusses, door joints, furniture joints	5
5.	Power Tools:	
	(a) Rotary Hammer	2
	(b) Demolition Hammer	2
	(c) Circular Saw	2
	(d) Planer	2
	(e) Hand Drilling Machine	2
	(f) Jigsaw	2
6.	Arc welding transformer with cables and holders	5
7.	Welding booth with exhaust facility	5
8.	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5
9.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2
10.	Centre lathe	2
11.	Hearth furnace, anvil and smithy tools	2
12.	Moulding table, foundry tools	2
13.	Power Tool: Angle Grinder	2
14.	Study-purpose items: Centrifugal pump, Airconditioner	1

Approved by BoS Chairman

GROUP – B (ELECTRICAL & ELECTRONICS)		
Sl. No.	Description of Equipment	Quantity required
1.	Assorted Electrical Components for House Wiring	15 sets
2.	Electrical Measuring Instruments	10 sets
3.	Iron Box	1
4.	Fan and Regulator	1
5.	Emergency Lamp	1
6.	Megger	1
7.	Digital Live Wire Detector	2
8.	Soldering Guns	10
9.	Assorted Electronic Components for Making Circuits	50
10.	Multipurpose PCBs	10
11.	Multi Meters	10
12.	Telephone	2
13.	FM radio	2
14.	Regulated Power Supply	2
15.	CRO (30MHz)	2
16.	Bread board	10
17.	Digital IC types (IC 7432, IC 7408, IC 7400, IC 7404, IC 7402, IC 7486)	Each 10

Approved by BoS Chairman

B.E / B.Tech	B23CET201 – SOFT SKILLS (Common to all Branches)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To identify personality using evaluation method.
2.	To encourage creative thinking by practice.
3.	To enrich interpersonal skills through integrated activities.
4.	To develop social and professional etiquette.
5.	To identify and apply employability skills for professional success.

UNIT – I SELF EVALUATION	6
Introduction to soft skills, Familiarize oneself, Self-understanding, SWOT analysis, Goal Setting.	

UNIT – II INNOVATIVE THINKING	6
Divergent thinking, Encourage curiosity, Writing a story, Poster making.	

UNIT – III INTERPERSONAL SKILLS	6
Interpersonal skills - Need & Components – Understanding Intercultural Competence - Team Work- Problem Solving Skills - Conflict Management & Resolutions in Workplace, Leadership skills, Managerial skills.	

UNIT – IV BUSINESS ETIQUETTE	6
Define Etiquette -Types and Importance of Workplace Etiquette - Basic Corporate Etiquette - Telephone Etiquette - Meeting & E- mail Etiquette - Customer Service Etiquette.	

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UNIT – V CORPORATE SKILLS	6
Work Ethics- Adaptability-Analytical Reasoning- Lateral Thinking-Stress & Time Management.	
	Total Instructional hours : 30

Course Outcomes : Students will be able to	
CO1	Identify different personalities.
CO2	Show creative skill in different aspects.
CO3	Utilize leadership skills with ability to work in a team.
CO4	Analyze work place etiquette.
CO5	Develop adequate soft skills required for the workplace.

Reference Books	
1.	Butterfield, Jeff "Soft Skills for Everyone" Cengage Learning, New Delhi, 2015.
2.	S.Hariharanetal "Soft Skills" MJP Publishers: Chennai, 2010.
3.	Peter, Francis "Soft Skills and Professional Communication" New Delhi: Tata McGraw Hill. 2012. Print.
4.	Meenakshi Raman, Shalini Upadhyay, 'Soft Skills', Cengage Learning India Pvt. Ltd, Delhi, 2018.
5.	M.S.Rao, 'Soft Skills Enhancing Employability', I. K. International Publishing House Pvt. Ltd, New Delhi, 2010
6	Sabina Pillai, Agna Fernandez, 'Soft Skills and Employability Skills', Cambridge University Press, 2018.
7	John Peter.A, 'Self – Development and Professional Excellence', Cengage Learning India Pvt. Ltd, Delhi, 2019.

Approved by BoS Chairman

B.E./ B.Tech	B23CEP202 - APPLICATION DESIGN AND DEVELOPMENT (Common to All UG Branches)	L	T	P	C
		2	0	0	NC

Course Objectives	
1.	To understand the basics concepts of SDLC and web development basics.
2.	To introduce the concepts of styling with CSS
3.	To understand the fundaments concepts of JavaScript
4.	To acquire the skills to manipulate the Document Object Model (DOM)
5.	To introduce version control concepts using Git and GitHub.

UNIT - I	SDLC and Web Development Basics	3

Introduction to Software Development Lifecycle (SDLC): Waterfall Model – Phases, Methods - Best Practices.

HTML Fundamentals: Introduction – Versions - HTML5 Standards - Tags - Semantic Elements – Forms - Media(Images, Audio, Video) – Tables - Lists

UNIT - II	Styling with CSS & Frameworks	3

CSS : Introduction – Selectors - Box Model (Margins, Padding, Borders) – Colors - Backgrounds – Frameworks: Introduction to Bootstrap - Tailwind CSS

UNIT - III	JavaScript Programming Essentials	3

JavaScript Basics - Variables - Data Types - Operators - Conditional Statements – Loops - Functions and events - Function Declarations - Event Handling.

UNIT - IV	DOM, Form Handling & Error Management	3

Document Object Model (DOM) Manipulation - Form Handling - Validation - Page Redirection - Error Handling – Exception handling in JavaScript.

UNIT - V	Version Control & Shell Scripting	3

Git & GitHub - Repositories - Branching – Merging – Remote Repositories - Advanced Git actions – Advanced Git Actions: Pull Requests- Issues - Contribution to Open Source

Approved by BoS Chairman

- Developer Communities: Google Developer – Group - Stack Overflow - Kaggle - Shell Scripting: Process Management - File Handling - User & Group Management.
Total Instructional hours: 15

Course Outcomes: Students will be able to	
CO1	Understand the phases and best practices of the Software Development Life Cycle (SDLC), and apply HTML5 features to structure web page
CO2	Construct visually appealing web pages by applying CSS styling techniques
CO3	Apply the use of JavaScript programming constructs
CO4	Build a JavaScript application by make use of client-side form validation, manage redirection, and handle exceptions and manipulate DOM.
CO5	Utilize version control systems like Git and GitHub for collaborative development.
Text Books	
1.	Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley & Sons, Inc, 2011.
2.	Marijn, Haverbeke, "Eloquent JavaScript: A Modern Introduction to Programming", 3rd Edition, William Pollock Publisher, 2019.
3.	Scott Chacon and Ben Straub, "Pro Git", 2 nd Edition, APress Publication, 2024

Reference Books	
1.	Jennifer Robbins, "Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics", O'Reilly Media, Inc., 2012.
2.	Douglas Crockford, "JavaScript: The Good Parts", O'Reilly Publications, 2008
3.	Cameron Newham, "Learning the Bash Shell", 3rd Edition, O'Reilly Media, Inc,
4	https://www.freecodecamp.org/
5	https://developer.mozilla.org/en-US/docs/Web/JavaScript
6	https://www.codecademy.com/catalog/subject/web-development

Approved by BoS Chairman

Semester - III

B.E / B.TECH	B23MAT302 - DISCRETE MATHEMATICS (Common to CSE, AI&ML, AI&DS & CSBS)	L	T	P	C
		3	1	0	4

Course Objectives	
1.	To extend student‘s logical and mathematical maturity and ability to deal with abstraction.
2.	To solve counting problems involving the Combinatorics.
3.	To understand the basic concepts of graph theory.
4.	To familiarize the applications of algebraic structures.
5.	To understand the concepts of lattices and boolean algebra.

UNIT – I LOGIC AND PROOFS	12
Propositional logic - Propositional equivalences - Predicates and quantifiers – Nested quantifiers - Rules of inference - Introduction to proofs - Proof methods and strategy.	

UNIT – II COMBINATORICS	12
Mathematical induction - Strong induction and well ordering - The basics of counting - Permutations and combinations - Generating functions - Inclusion and exclusion principle and its applications.	

UNIT – III GRAPHS	12
Graphs and graph models - Graph terminology and special types of graphs - Matrix representation of graphs and graph isomorphism - Euler and Hamilton Paths - Graph coloring.	

UNIT – IV ALGEBRAIC STRUCTURES	12
Algebraic systems - Groups - Subgroups - Homomorphisms - Normal subgroup and cosets - Lagrange‘s theorem - Definition and examples of rings and fields.	

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UNIT – V LATTICES AND BOOLEAN ALGEBRA	**12**
Partial ordering - Posets - Lattices as posets - Properties of lattices - Lattices as algebraic systems - Sub lattices - Boolean algebra - Basic postulates of Boolean algebra.	
	Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Construct the Propositional and Predicate Calculus.
CO2	Solve the Mathematical Induction and recurrence relation.
CO3	Make use of Graph models and special types of graphs.
CO4	Develop the concepts of groups.
CO5	Identify the Lattice and Boolean algebra.

Text Books	
1.	Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
2.	Rosen, K.H., "Discrete Mathematics and its Applications", 8th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2018.
3.	Narsingh Deo, “Graph Theory with Applications to Engineering and Computer Science”, Prentice Hall of India, 2016.

Reference Books	
1.	Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2007.
2.	Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum‘s Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

Approved by BoS Chairman

B.E.	B23CST301 COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the basic structure and operation of computer.
2.	To familiarize with the implementation of fixed point and floating-point arithmetic operations.
3.	To study the design of data path unit, control unit for processor and to familiarize with the hazards.
4.	To understand parallelism and multi-core processors, memory hierarchies, cache memories and virtual memories.
5.	To understand the concept of various memories and I/O interfacing.

UNIT - I	BASIC ARCHITECTURE	9

Functional Units - Basic Operational Concepts - Performance -Software- Instructions: Instruction Cycle - Memory reference instructions - Input / Output Instructions - Quantitative Principles of computer design.

UNIT - II	ARITHMETIC OPERATIONS	9

Hardware for Addition and Subtraction -Addition and subtraction of signed numbers - Design of fast adders - Multiplication of positive numbers - Signed operand multiplication and fast multiplication- Integer division - Integer division-Floating point numbers and operations.

UNIT - III	PROCESSOR AND CONTROL UNIT	9

ALU Operation-Instruction Execution – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Data path and control consideration -Pipelining – Data Hazard – Control Hazards.

UNIT - IV	PARALLELISIM AND MULTIPROCESSOR SYSTEMS	9

Parallel processing challenges - Flynn‘s classification - SISD, MIMD, SIMD, SPMD, and Vector Architectures -Multi-core processors and other Shared Memory Multiprocessors- Instruction Level Parallelism – Dependencies- Symmetric and Distributed shared memory architectures -Cache Coherence - Snooping protocol

UNIT - V	MEMORY AND I/O	9

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Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB 3.x, SATA and PATA.

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Outline the basics structure of computers, operations and instructions.
CO2	Illustrate arithmetic and logic unit.
CO3	Identify pipelined execution and design control unit.
CO4	Analyze how parallel processing and memory system can have significant impact on performance of a digital
CO5	Examine the characteristics of various memory systems and I/O communication

Text Books	
1.	David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Sixth Edition, Morgan Kaufmann/Elsevier, 2020.
2.	William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.

Reference Books	
1.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.
2.	Andrew S Tanenbaum and Todd Austin, Structured Computer Organization, Sixth edition, Pearson, 2013.
3.	Barry B.Brey, The Intel Microprocessors Architecture Programming and Interfacing, Eighth edition, Pearson Prentice Hall, 2009
4.	John L. Hennessey and David A. Patterson, Computer Architecture - A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012
5.	Morris Mano,"Computer System Architecture", 3rd Edition, Prentice Hall of India, New Delhi, 2014

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K2**	3	2	1	-	-	-	-	-	-	-	-	1	1	2
CO2	**K2**	3	2	1	-	-	-	-	-	-	-	-	1	2	3
CO3	**K3**	3	2	1	-	-	-	-	-	-	-	-	1	1	1
CO4	**K4**	2	2	1	-	-	-	-	-	-	-	-	1	1	1
CO5	**K4**	2	2	1	-	-	-	-	-	-	-	-	1	1	1
Weighted Average		3	2	1	-	-	-	-	-	-	-	-	1	1	1

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

B.E.	B23CST302 DATA STRUCTURES Common to AI&DS, CSE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the basic concepts of data structures.
2.	To understand the ADT models.
3.	To understand the tree structures and its operations.
4.	To understand graphs and its usage.
5.	To understand the application of data structures in pattern matching.

UNIT - I	INTRODUCTION	9

Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Operations, array and linked representations of stacks, stack applications, Queues- operations, array and linked representations.

UNIT - II	ABSTRACT DATA STRUCTURES	9

Dictionaries: linear list representation, skip list representation, operations - insertion, deletion and searching. Hash Table Representation: hash functions, collision resolution-separate chaining, open addressing- linear probing, quadratic probing, double hashing, rehashing, extendible hashing

UNIT - III	TREES	9

Search Trees: Binary Search Trees, Definition, Implementation, Operations- Searching, Insertion and Deletion, B- Trees, B+ Trees, AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion and Searching, Red –Black, Splay Trees.

UNIT - IV	GRAPHS	9

Graphs: Graph Implementation Methods. Graph Traversal Methods. Sorting: Quick Sort, Heap Sort, External Sorting- Model for external sorting, Merge Sort.

UNIT - V	PATTERN MATCHING	9

Pattern Matching and Tries: Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Outline the data structures that efficiently model the information in a problem
CO2	Utilize various searching and hashing algorithms.
CO3	Develop programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and AVL-trees
CO4	Classify efficiency trade-offs among graphs and trees implementation or combinations in various applications
CO5	Examine the application of algorithms for sorting and pattern matching.

Text Books	
1.	Data Structures using C – A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education, 2017.
2.	Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press, 2008.

Reference Books	
1.	Data Structures: A Pseudocode Approach with C, 2nd Edition, R. F. Gilberg and B.A. Forouzan, Cengage Learning, 2016.
2.	Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles, Career monk, 2016.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K2**	3	2	1	-	-	-	-	-	-	-	-	1	3	1
CO2	**K3**	3	3	2	-	-	-	-	-	-	-	-	1	3	1
CO3	**K3**	3	3	2	-	-	-	-	-	-	-	-	2	3	2
CO4	**K4**	3	3	2	-	-	-	-	-	-	-	-	2	3	2
CO5	**K4**	3	3	2	-	-	-	-	-	-	-	-	2	3	2
Weighted Average		3	3	2	-	-	-	-	-	-	-	-	2	3	2

3 – Substantial **2- Moderate** **1- Low** **‘-‘ – No Correlation**

Approved by BoS Chairman

B.E.	B23CST303 - COMPUTER NETWORKS Common to AI&DS, CSE(AIML) & CSE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamental principles of computer networks including important layers and protocols.
2.	To study the most important layers including transport layer and link layer along with their functionalities.
3.	To analyze network access protocols and error handling codes to design Local Area Network.
4.	To understand the application layer services and their protocols.
5.	To analyse the working process of data link and physical layers.

UNIT - I	INTRODUCTION	10
Data Communications - Data Flow - The Internet - Network Protocols - Network Models: Layered Tasks - The OSI Model - Introduction to Sockets - Application Layer protocols: HTTP – FTP – Email protocols (SMTP - POP3 - IMAP - MIME) – DNS – SNMP.		

UNIT - II	TRANSPORT LAYER	8
Introduction - Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control - Congestion Control - Congestion avoidance (DECbit, RED) – SCTP – Quality of Service.		

UNIT - III	NETWORK LAYER	8
Switching: Packet Switching - Internet protocol - IPV4 – IP Addressing – Sub netting - IPV6, ARP, RARP, ICMP, DHCP.SDN: Network Virtualization – Open SDN – SDN by API – Hybrid SDN		

UNIT - IV	ROUTING	8
Routing and protocols: Unicast routing - Distance Vector Routing - RIP - Link State Routing – OSPF – Path-vector routing - BGP - Multicast Routing: DVMRP – PIM.		

UNIT - V	DATA LINK AND PHYSICAL LAYERS	11
Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC – PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) - Physical Layer: Data and Signals - Performance – Transmission media- Switching – Circuit Switching.		

Total Instructional hours : 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Summarize the basic layers and its functions in computer networks.
CO2	Interpret the flows of data from one node to another node.
CO3	Make use of protocols for various functions in the network.
CO4	Analyse the routing algorithms.
CO5	Dissect the working of various application layer protocols.

Text Books	
1.	Behrouz A. Forouzan, "Data Communication Networking with TCP/IP Protocol Suite ", 6th Edition, Tata McGraw Hill, 2022.
2.	Larry L.Peterson and Bruce S.Davie, "Computer Networks", Elsevier, 2009.

Reference Books	
1.	James F.Kurose and Keith W.Ross, "Computer Networking : A Top-Down Approach Featuring the Internet", Pearson Education, 2005
2.	Andrew S.Tanenbaum, "Computer Networks", Pearson Education, 2008
3.	William Stallings, "Data and Computer Communication", Pearson Education, 2007
4.	Douglas E. Comer and M.S. Narayanan, "Computer Networks and Internets", Pearson Education, 2008

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2	2	2	1	-	-	-	-	-	-	-	-	1	2	1
CO2	K2	2	2	1	-	-	-	-	-	-	-	-	1	2	1
CO3	K3	3	3	1	-	-	-	-	-	-	-	-	1	3	2
CO4	K4	3	3	2	-	-	-	-	-	-	-	-	1	3	2
CO5	K4	3	3	2	-	-	-	-	-	-	-	-	1	3	2
Weighted Average		3	3	2	-	-	-	-	-	-	-	-	1	3	2

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

B.E.	B23CSI301- OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To understand the basics and functions of operating systems, processes and threads
2.	To analyze scheduling algorithms and process synchronization, deadlocks.
3.	To analyze various memory management schemes.
4.	To be familiar with I/O management and file systems.
5.	To understand the basics of virtual machines and Mobile OS like iOS and Android.

UNIT - I	INTRODUCTION	9

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services-User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.

UNIT - II	PROCESS MANAGEMENT	9

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-Process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT - III	MEMORY MANAGEMENT	9

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

UNIT - IV	STORAGE MANAGEMENT	9

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management;

UNIT - V	VIRTUAL MACHINES AND MOBILE OS	9

Approved by BoS Chairman

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

LIST OF EXPERIMENTS:

Expt. No.	Description of the Experiments
1.	Installation of windows operating system and any guest system Linux using VMWare, implement the UNIX commands and Shell Programming.
2.	Implementation of Process Management using System Calls : fork(), exit(), getpid(), wait(), close()
3.	Write C programs to implement the various CPU Scheduling Algorithms
4.	Illustrate the inter process communication strategy
5.	Implement mutual exclusion by Semaphore
6.	Write C programs to avoid Deadlock using Banker's Algorithm
7.	Write C programs to implement the following Memory Allocation Methods a. First Fit b. Worst Fit c. Best Fit
8.	Write C programs to implement the various Page Replacement Algorithms
9.	Implement the following File Allocation Strategies using C programs a. Sequential b. Indexed c. Linked
10.	Write C programs for the implementation of various disk scheduling algorithms

Total Instructional hours : (45 + 15) = 60

Course Outcomes : Students will be able to	
CO1	Utilize various scheduling algorithms and process synchronization.
CO2	Experiment with deadlock prevention and avoidance algorithms.
CO3	Compare and contrast various memory management schemes.
CO4	Examine the functionality of file systems, I/O systems, and Virtualization
CO5	Assess iOS and Android Operating Systems.

Approved by BoS Chairman

Text Books	
1.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”‖, 10th Edition, John Wiley and Sons Inc., 2018
2.	Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:	
1.	Ramez Elmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2.	William Stallings, "Operating Systems: Internals and Design Principles", 7 th Edition, Prentice Hall, 2018.
3.	Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.
4.	Lab Manual for the experiments.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K3	3	3	2	-	-	-	-	-	1	-	-	2	3	2
CO2	K3	3	3	2	-	-	-	-	-	1	-	-	1	2	2
CO3	K4	3	3	2	-	-	-	-	-	1	-	-	2	3	2
CO4	K4	3	3	2	-	-	-	-	-	1	-	-	2	3	2
CO5	K5	3	3	2	-	2	-	-	-	1	-	-	2	3	2
Weighted Average		3	3	2	-	2	-	-	-	1	-	-	2	3	2

3 – Substantial **2- Moderate** **1- Low** **‘-‘ – No Correlation**

Approved by BoS Chairman

B.E	B23CSI302- OBJECT ORIENTED PROGRAMMING USING C++	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To study the basics of Object-oriented programming and OOP concepts through C++.
2.	To learn the concepts such as objects, classes and member functions in C++.
3.	To understand the concepts of object creation and deletion through constructors and destructors.
4.	To study the concepts of inheritance, pointer to classes, virtual and pure virtual functions.
5.	To have a knowledge on file processing operations and exception handing.

UNIT - I	INTRODUCTION TO OOP	9

Principles of OOP- Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures, switch statement with enumeration in C++.

UNIT - II	OBJECTS, CLASSES AND FUNCTIONS	9

Functions, Inline function, function overloading, friend and virtual functions, specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions, template classes, exception handling in classes.

UNIT - III	CONSTRUCTORS, DESTRUCTORS AND OPERATOR OVERLOADING	9

Constructors, Multiple constructors in a class, copy constructor, Dynamic constructor, move semantics and move constructors, Destructors, Operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators, lambda expressions.

UNIT - IV	INHERITANCE, POINTERS AND VIRTUAL FUNCTIONS	9

Derived Classes, Single, multilevel, multiple inheritance, Virtual inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions.

UNIT - V	FILE OPERATIONS AND EXCEPTION HANDLING	9

C++ streams and stream classes, formatted and unformatted I/O operations, Exception handling in File operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF.

LIST OF EXPERIMENTS:

Expt. No.	Description of the Experiments
1.	a) Write a C++ program to find the sum of individual digits of a positive integer. b) Write a C++ program to generate the first n terms of the sequence.
2.	a) Write a C++ program to generate all the prime numbers between 1 and n, where n is a value supplied by the user. b) b) Write a C++ program to find both the largest and smallest number in a list of integers.
3.	Create a C++ program with a class named “Student” to store student’s details a) Implement an array of objects of the class to store details of multiple students. b) Write functions to input data for each student and display details of all students.
4.	Develop a C++ program with class named "Shape" with member variables representing geometric shapes and member functions to calculate area and perimeter. a) Use pointers to members to access and modify member variables dynamically. b) Implement member functions to perform various operations on shapes, such as scaling or rotating.
5.	Create a C++ program to implement a class named "MyString" to represent strings with basic string manipulation functionalities. a) Overload operators such as + (concatenation), == (comparison), += (append), and << (output) to perform string manipulation operations. b) Implement lambda expressions to define custom comparison functions for sorting strings. c) Demonstrate the usage of overloaded operators and lambda expressions for string manipulation within the main program.
6.	Define a class named "Complex" to represent complex numbers with real and imaginary parts. a) Overload binary operators such as addition, subtraction, multiplication, and division to perform arithmetic operations on complex numbers. b) Overload unary operators such as negation and increment to perform specific operations on complex numbers. c) Implement operator overloading functions as member functions or friend functions as appropriate.
7.	Write a C++ program to create a base class named "Shape" with a virtual function named calculateArea(). a) Derive classes like "Rectangle" and "Circle" from the Shape class. b) Implement the calculateArea() function in each derived class to calculate the area of the respective shape. c) Demonstrate polymorphic behaviour by creating an array of Shape pointers and assigning derived class objects to them. d) Define a pure virtual function in the base class "Shape" called draw(), which has no implementation.
8.	Create a class named "Point" to represent 2D points with attributes x and y. in C++ to A) Implement member functions to set and display the coordinates of a point. B) Utilize this pointer to access the member variables within member functions.

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	C) Demonstrate the usage of the this pointer to differentiate between local variables and member variables.
9.	Write a C++ program that randomly generates complex numbers (use previouslydesigned Complex class) and writes them two per line in a file along with an operator (+,-, *, or /). The numbers are written to file in the format (a + ib). Write another program to read one line at a time from this file, perform the corresponding operation on the two complex numbers read, and write the result to another file (one per line)
10.	Write a C++ program to implement exception handling for file operations.

Total Instructional hours: (45 + 15) = 60

Course Outcomes: Students will be able to	
CO1	Summarize the basics of Object-Oriented Programming concepts.
CO2	Make use objects, classes and functions in applications.
CO3	Apply the concepts of constructors and destructors for object creation and deletion.
CO4	Analyse the use of inheritance, polymorphism through virtual, overriding function and abstract class in programs.
CO5	Examine the concept of I/O operations and file streams using C++ programming.

Text Books	
1.	Herbert Schildt, “C++ The Complete Reference”, 5th Edition, McGraw-Hill education, 2017.
2.	Object Oriented Programming with C++, E. Balaguruswamy, TMH, 6th Edition, 2013

Reference Books	
1.	Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010
2.	The C++ programming Language, Bjarnestroustrup, Addison Wesley, 4th Edition, 2013
3.	C++ primer, 5th Edition, Stanley B Lippman, Josee Lajoie, Barbara E, Moo, Addison Wesly 2012.
4.	C++ How to Program, 7th Edition, Harvey M. Deitel and Paul J. Deitel, Prentice Hall, 2010.

Approved by BoS Chairman

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K2**	3	3	2	-	-	-	-	-	1	1	-	2	3	2
CO2	**K3**	3	3	1	-	-	-	-	-	1	1	-	1	2	2
CO3	**K3**	3	3	2	-	-	-	-	-	1	1	-	2	3	2
CO4	**K4**	3	3	2	-	-	-	-	-	1	1	-	2	3	2
CO5	**K4**	3	3	2	-	1	-	-	-	1	1	-	2	3	2
Weighted Average		3	3	2	-	1	-	-	-	1	1	-	2	3	2

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

B.E.	B23CSP301- DATA STRUCTURES LABORATORY Common to AI&DS, CSE	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To understand ADTs and its applications.
2.	To learn the concept of expression evaluation.
3.	To understand search and sort operations using data structures
4.	To be familiar tree traversal techniques
5.	To understand the design aspects of hash.

Expt. No.	Description of the Experiments
1	Array implementation of Stack and Queue
2	Array implementation of List
3	Linked list implementation of Stack and Queue
4	Implementation of Doubly Linked List using pointers
5	Applications of List in polynomial addition and subtraction
6	Implementation of Infix to postfix Conversion using Stack ADT
7	Implementation of Linear and Binary Search
8	Implementation of AVL Tree
9	Graph Representation and traversal using DFS and BFS
10	Implementation of Insertion, Bubble, Merge and Quick sort techniques
11	Implementation of Heap using priority Queue
12	Implementation of Hash functions and Collision Resolution Technique
	Total Instructional hours = 45

Course Outcomes : Students will be able to	
CO1	Categorize basic ADTs.
CO2	Examine the applications of ADTs.
CO3	Develop algorithms to perform search and sort operations.
CO4	Analyze the functioning of various types of tree and graph structures.
CO5	Assess different types of Hashing techniques and collision avoidance strategies

Approved by BoS Chairman

Requirements for a Batch of 30 Students		
Sl. No.	**Description of the Equipment**	**Quantity required (Nos.)**
1.	Dell Optiplex 390 PCs Operating systems: Windows* 10 or later, macOS, and Linux. Software Required: Turbo C 4/4.5.	30

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K4**	3	3	2	-	-	-	-	-	-	-	-	2	3	2
CO2	**K4**	3	3	2	-	-	-	-	-	-	-	-	2	3	2
CO3	**K3**	3	3	1	-	-	-	-	-	-	-	-	2	3	2
CO4	**K4**	3	3	2	-	1	-	-	-	-	-	-	2	3	2
CO5	**K5**	3	3	2	-	1	-	-	-	-	-	-	2	3	2
Weighted Average		3	3	2	-	1	-	-	-	-	-	-	2	3	2

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

Semester - IV

B.E.	B23MAT401 - PROBABILITY AND QUEUEING THEORY (CSE)	L	T	P	C
		3	1	0	4

Course Objectives	
1.	To introduce the basic concepts of probability and random variables.
2.	To understand the basic concepts of two dimensional random variables.
3.	To introduce the basic probability tools and concepts useful in modeling, such as Markov models.
4.	To develop the fundamental knowledge of basic characteristic features of a queuing system and acquire skills in analyzing queueing models.
5.	To provide the significance of advanced queueing models.

UNIT – I ONE DIMENSIONAL RANDOM VARIABLES	12
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.	

UNIT – II TWO DIMENSIONAL RANDOM VARIABLES	12
Definition – Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression.	

UNIT – III RANDOM PROCESSES	12
Classification – Stationary process – Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.	

UNIT – IV QUEUEING MODELS	12
Markovian queues – Birth and death processes – Single and multiple server queueing models - Little‘s formula – Queues with finite waiting rooms – Queues with impatient customers: Balkingand reneging.	

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UNIT – V ADVANCED QUEUEING MODELS	12
Finite source models – M/G/1 queue – Pollaczek Khinchin formula (including proof) – M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.	
	Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Interpret the concepts of probability and standard distributions.
CO2	Develop the concepts of one and two dimensional random variables and apply in engineering domain.
CO3	Identify the concept of random processes in engineering disciplines.
CO4	Apply the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.
CO5	Construct the network of queues with Poisson external arrivals, exponential service R requirements and Jackson networks.

Text Books	
1.	Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., “Fundamentals of Queueing Theory”, Wiley Student 4th Edition, 2014.
2.	Ibe, O.C., “Fundamentals of Applied Probability and Random Processes”, Elsevier, 2nd Indian Reprint, 2014.

Reference Books	
1.	Hwei Hsu, “Schaum‘s Outline of Theory and Problems of Probability, Random Variables and Random Processes”, Tata McGraw Hill Edition, New Delhi, 2011.
2.	Taha, H.A., “Operations Research”, 9th Edition, Pearson India Education Services, Delhi, 2016.
3.	Trivedi, K.S., “Probability and Statistics with Reliability, Queueing and Computer Science Applications”, 2nd Edition, John Wiley and Sons, 2016.
4.	Yates, R.D. and Goodman. D. J., “Probability and Stochastic Processes”, 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
5.	Kanti Swarup, Gupta P K., Man Mohan., “Operations Research”, Sultan Chand & Sons Publications, 20th Edition, 2022.

Approved by BoS Chairman

B.E	B23CST401- DATABASE MANAGEMENT SYSTEMS Common to CSE, AI&DS, CSE(AIML) & CSBS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the basic concepts of Database Management Systems.
2.	To know different normalization techniques
3.	To learn about the Structured Query Language (SQL)
4.	To provide knowledge in PL/SQL
5.	To provide knowledge of transaction, locks and recovery strategies of DBMS.

UNIT - I	INTRODUCTION TO DATABASE	9
Introduction: Overview of DBMS fundamentals -Databases and Database Users - Relational Databases - Advantages of Using the DBMS Approach; Database System Architecture – Data Models, Schemas, and Instances - Database Languages.		

UNIT - II	DATA MODELING AND DATABASE DESIGN	9
Entity-Relationship model - Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets and Structural Constraints - Functional dependencies - 2NF, 3NF, BCNF.		

UNIT - III	UNDERSTANDING SQL	9
SQL Data Definition and Data Types - SQL – Constraints: Key and Referential Integrity Constraints - Basic Retrieval Queries in SQL- Joins –Sub queries –Nested subquery - Single row subquery – Multiple row sub query – Correlated sub query – Views.		

UNIT - IV	ADVANCED SQL	9
Basics of PL/SQL variables – Constants – Procedures parameters – Procedures – Functions – Triggers – Embedded SQL – Kafka - Cassandra and Mongo DB - Case study for NOSQL databases.		

UNIT - V	TRANSACTION PROCESSING	9
Transaction processing: Introduction – ACID Properties - Need for concurrency control – Desirable properties of transaction – Schedule and recoverability - Types of locks – Two phase locking – Deadlock – Timestamp based concurrency control – Recovery techniques.		

Total Instructional hours : 45

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Course Outcomes : Students will be able to	
CO1	Outline the basics of database management systems.
CO2	Develop the ER model to Relational model to perform database design effectively.
CO3	Apply various normalization techniques on database table.
CO4	Examine the SQL for DB creation and updation.
CO5	Classify transaction and locking protocols.

Text Books	
1.	Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, 7th Edition, Pearson Education, 2021.
2.	Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, 7th Edition, McGraw Hill, 2021.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K2**	3	2	1	-	-	-	-	-	-	-	-	1	2	1
CO2	**K3**	3	2	1	-	-	-	-	-	-	-	-	1	2	1
CO3	**K3**	3	3	1	-	-	-	-	-	-	-	-	2	3	2
CO4	**K4**	3	3	2	-	1	-	-	-	-	-	-	2	3	2
CO5	**K4**	3	3	2	-	1	-	-	-	-	-	-	2	3	2
Weighted Average		3	3	1	-	1	-	-	-	-	-	-	2	3	2

3 – Substantial **2- Moderate** **1- Low** **‘-‘ – No Correlation**

Approved by BoS Chairman

B.E.	B23CST402- DESIGN AND ANALYSIS OF ALGORITHMS Common to AI&DS & CSE	L	T	P	C
		3	1	0	4

Course Objectives	
1.	To analyze the asymptotic performance of algorithms.
2.	To critically analyze the efficiency of alternative algorithmic solutions for the same problem.
3.	To apply various graph-based algorithms and understand the classes of complexity
4.	To apply appropriate method to solve a given problem.
5.	To describe various algorithmic strategies, analysis and their implementation

UNIT - I	INTRODUCTION TO ALGORITHMIC ANALYSIS	12

Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behaviour; Performance Measurements of Algorithm, Time and Space Trade-Offs, Performance Analysis: Space complexity, Time complexity. Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Important Problem Types, Mathematical analysis of Non-Recursive and recursive Algorithms.

UNIT - II	DIVIDE AND CONQUER METHOD	12

Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum, Merge sort, Quick sort, Strassen's matrix multiplication, Advantages and Disadvantages of divide and conquer. Decrease and Conquer Approach: Topological Sort.

UNIT - III	GREEDY METHOD, GRAPH AND TREE ALGORITHMS	12

Greedy Method: General method, Knapsack Problem, Job sequencing with deadlines. Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm. Single source shortest paths: Dijkstra's Algorithm. Optimal Tree problem: Huffman Trees and Codes, Traversal algorithms: Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

UNIT - IV	DYNAMIC PROGRAMMING	12

Dynamic Programming - Elements of Dynamic Programming, Rod Cutting, Matrix chain multiplication, Longest Common Subsequence; Greedy Algorithms - Activity Selection Problem, Elements of greedy strategy, Knapsack problem, Huffman Coding; Fibonacci Heaps, transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees.

Approved by BoS Chairman

UNIT - V	BACKTRACKING, APPROXIMATION AND RANDOMIZED ALGORITHMS	12
Computability of Algorithms and classes, P, NP, NP-Complete, and NP-Hard Problems, Backtracking: N-Queens problem, Sum of subsets problem, Graph colouring, Hamiltonian cycles. Branch and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem, Performance ratios for approximation algorithms, approximation scheme, APPROX-VERTEX-COVER, APPROX-TSP Tour, GREEDY-SET-COVER, Randomized algorithms.		

Total Instructional hours : 60

Course Outcomes: Students will be able to	
CO1	Classify the computational complexity of different algorithms.
CO2	Identify computational solution to problems like searching, sorting etc
CO3	Apply various problem-solving techniques for greedy problems and understand the classes of complexity
CO4	Develop an algorithm using appropriate design strategies for a given problem.
CO5	Examine all the possible solutions for a given problem using Backtracking and Branch & Bound and describe various algorithmic strategies, analysis and their implementation

Text Books	
1.	Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd Ed, Pearson Education, New Delhi, 2017.
2.	Horowitz, E., Sahni, S., & Rajasekaran, S. “Fundamentals of computer algorithms”, Hyderabad, Universities Press, 2nd edition, 2019.
3.	Kleinberg J, Tardos E. “Algorithm design”, Pearson Education India; 2006

Reference Books	
1.	Knuth Donald E, “Art of Computer Programming: Fundamental Algorithms Volume 1 - Fundamental Algorithms”, Third Edition, Pearson Publishers, 2011.
2.	Pat Morin, “Open Data Structures: An Introduction (Open Paths to Enriched Learning)”, 31st ed. Edition, UBC Press, 2013.1974.
3.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, Galgotia publications, New Delhi, 2013.
4.	Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, “Introduction to Algorithms”, MIT Press, New Delhi, 2010

Approved by BoS Chairman

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2	2	3	1	-	-	-	-	-	-	-	-	1	2	2
CO2	K3	3	3	1	-	-	-	-	-	-	-	-	1	1	1
CO3	K3	3	3	1	-	-	-	-	-	-	-	-	1	1	1
CO4	K3	3	3	1	-	-	-	-	-	-	-	-	1	2	1
CO5	K4	3	3	2	-	-	-	-	-	-	-	-	1	2	2
Weighted Average		3	3	1	-	-	-	-	-	-	-	-	1	2	1

3 – Substantial **2- Moderate** **1- Low** **‘-‘ – No Correlation**

Approved by BoS Chairman

B.E.	B23ADT403- JAVA PROGRAMMING Common to AI&DS & CSE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the OOPs concepts and basics of Java
2.	To know the principles of inheritance and interfaces
3.	To develop a java application with threads
4.	To define exceptions and use I/O streams
5.	To design and build Graphical User Interface Application using JAVAFX

UNIT - I	INTRODUCTION TO JAVA	9

Overview of OOP – Object oriented programming paradigms –Characteristics of Java – Java Environment- Structure – Compilation - Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Class and object – Constructors- Methods - Static members- strings- Java Doc comments

UNIT - II	INHERITANCE AND INTERFACE	9

Inheritance: Basics– Types of Inheritance -Super classes and sub classess - Access modifiers – Method Overloading and overriding – Objects class – abstract class and methods Interfaces: Defining an interface- implementing an interface – extending interfaces

UNIT - III	EXCEPTIN HANDLING AND MULTI THREADING	9

Exceptions: Exception hierarchy- throwing and catching the exceptions – checked and unchecked exceptions – Built-in-Exceptions – User defined exceptions – Chained Exceptions – stack trace elements-Multithreaded Programming: Java Thread Model–Creating Multiple Threads Priorities – Synchronization and Inter Thread Communication

UNIT - IV	PACKAGES AND I/O BASICS	9

Interfaces - defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes. Introduction - Establishing Connection - Creation of Data Tables - Entering Data into the Tables - Table Updating.

UNIT - V	COLLECTIONS AND JDBC	9

Approved by BoS Chairman

Collection: Overview – Framework: Iterable, Collection, List, Set, Queue, Map- Components: ArrayList, Linked List, HashSet, TreeSet, PriorityQueue, HashMap, TreeMap,- Hashcode and equals

JDBC: Basics of JDBC, Java program and MYSQL Connectivity- Simple Applications

Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply the concepts of classes and objects to solve simple Problems.
CO2	Develop programs using inheritance and interfaces
CO3	Make use of exception handling mechanisms
CO4	Build Java applications with I/O packages, string classes
CO5	Developing GUI based applications

Text Books	
1.	Herbert Schildt, The Complete Reference - Java, Tata McGraw-Hill Education, 12th edition, December 2021.
2.	Cay S. Horstmann, “Core Java Fundamentals”, Volume 1, 11 th Edition, Prentice Hall, 2018.
3.	Paul J. Deitel, Harvey Deitel, Java SE8 for Programmers (Deitel Developer Series) 3rdEd, 2014.

Reference Books	
1.	E. Balagurusamy, “Programming with Java “,Tata McGraw-Hill Education, 7th edition
2.	K. Santosh Kumar “JDBC, Servlets, And JSP Black Book,” Dreamtech Press, 2008
3.	Paul Deitel Harvey Deitel ,Java, How to Program, Prentice Hall; 9th edition, 2011.
4.	Nicholas S. Williams, Professional Java for Web Applications, Wrox Press, 2014.

CO Mapping with PO & PSO

Approved by BoS Chairman

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K2**	3	3	2	2	3	2	-	-	-	-	-	3	2	3
CO2	**K3**	3	3	2	2	3	2	-	-	-	-	-	3	2	3
CO3	**K3**	3	3	2	3	3	2	-	-	-	-	-	3	3	3
CO4	**K4**	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO5	**K4**	3	3	3	3	3	2	-	-	-	-	-	3	3	3
Weighted Average		3	3	2	3	3	2	-	-	-	-	-	3	3	3

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

B.E	B23CST404 - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand about the search algorithm.
2.	To understand about reasoning under uncertainty.
3.	To understand the Machine Learning and supervised learning algorithms.
4.	To understand the basics of ensemble and unsupervised learning algorithms.
5.	To understand the basics of deep learning using neural networks.

UNIT - I	PROBLEM SOLVING	9
Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)		

UNIT - II	PROBABILISTIC REASONING	9
Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian Networks – exact inference in BN – approximate inference in BN – causal networks.		

UNIT - III	SUPERVISED LEARNING	9
Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests.		

UNIT - IV	ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	9
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization, Semi-supervised learning & Reinforcement Learning.		

UNIT - V	NEURAL NETWORKS	9
Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks – Unit saturation – ReLU, hyper parameter tuning, batch normalization, regularization, dropout.		

Total Instructional hours : 45

Approved by BoS Chairman

Course Outcomes : Students will be able to	
CO1	Apply the search algorithms for problem solving.
CO2	Utilize the reasoning under uncertainty.
CO3	Develop supervised learning models.
CO4	Build ensemble and unsupervised models.
CO5	Make use of neural network models in simple applications.

Text Books	
1.	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, 4th Edition, Pearson Education, 2021.
2.	Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, 4th Edition, 2020.

Reference Books	
1.	Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education,2007.
2.	Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3.	Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006.
4.	Tom Mitchell, “Machine Learning”, McGraw Hill, 3rd Edition,1997.
5.	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K3**	3	2	1	-	-	-	-	-	-	-	-	2	2	-
CO2	**K3**	3	2	1	-	-	-	-	-	-	-	-	2	2	-
CO3	**K3**	3	2	1	-	-	-	-	-	-	-	-	1	2	-
CO4	**K3**	3	2	1	-	-	-	-	-	-	-	-	1	2	-
CO5	**K3**	3	2	1	-	-	-	-	-	-	-	-	1	2	-
Weighted Average		3	2	1	-	-		-	-	-	-	-	2	2	-

3 – Substantial **2- Moderate** **1- Low** **‘-‘ – No Correlation**

Approved by BoS Chairman

B.E.	B23CST405 – SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the basic knowledge of software Engineering and Agile development.
2.	To Understand the systematic approach related to the design, development and maintenance of a software system.
3.	To understand the Quality of code and code tuning techniques.
4.	To Analyze the limitations of manual testing process and provide a succinct summary of those limitations with the help of automated testing tools.
5.	To Understand the Enterprise Architecture (EA) framework that provides the building blocks for successful digital business transformation

UNIT - I	SOFTWARE DEVELOPMENT PROCESS	9

Phases in Software Development – Traditional Software Development Models – Agile Methodologies – Agile Scaling Frameworks – Lean Software Development – Software Requirements Specification (SRS) – Project Scheduling and Estimation.

UNIT - II	TOOLS AND TECHNIQUES FOR SOFTWARE DEVELOPMENT	9

DevOps – Version control with Git – Containerization Using Docker and Kubernetes – Application Performance Monitoring (APM) – Continuous Integration Continuous deployment (CICD) – Clean Room build.

UNIT - III	CODE QUALITY	9

Software Metaphors – Upstream Prerequisites – Key Construction Decisions – Defensive Programming – Code Tuning Strategies and Techniques.

UNIT - IV	TESTING	9

Writing good test cases – Test driven development – Test Automation – Testing using Selenium tool – Continuous Testing – Exploratory Testing – Testing in Agile and DevOps Environments.

UNIT - V	ENTERPRISE ARCHITECTURE AND MODELING	9

Enterprise Architecture (EA) in Digital Transformation – Agility in Digital Business – Measuring EA: Metrics, KPIs and Risks.

Total Instructional hours : 45

Course Outcomes : Students will be able to

Approved by BoS Chairman

CO1	Identify the software development methodologies to various real-life scenarios
CO2	Apply modern tools and techniques to develop scalable, maintainable, and reliable software systems.
CO3	Examine the coding strategies and techniques to write well-structured, efficient, and error-free code
CO4	Analyze specific modern testing tools to ensure the quality and reliability of software products
CO5	Analyze the elements, structure, and positioning of an Enterprise Architecture framework used for successful digital business transformation

Text Books	
1.	Roger S.Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill International edition, 8th edition, 2019.

Reference Books	
1.	David D. Riley, Kennya. Hunt, Computational thinking for the modern problem solver, CRC Press Taylor & Francis Group, 2014
2.	Andrew Eliaz, Little Man Computer Programming: For the Perplexed from The Ground Up, The Internet Technical Bookshop; 1st edition, 2016.
3.	Ian Sommerville, "Software Engineering", 10th Edition, Pearson Education, Asia, 2016. Reference.
4.	B. B. Agarwal, S. P. Tayal, Mahesh Gupta, "Software Engineering and Testing", Jones and Bartlett Publisher, 2010.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K3**	3	3	2	-	-	-	2	-	2	-	-	2	1	2
CO2	**K3**	3	3	2	-	-	-	2	-	2	-	-	2	1	2
CO3	**K4**	2	2	2	-	-	-	2	-	2	-	-	2	1	-
CO4	**K4**	2	2	2	-	-	-	2	-	2	-	-	2	-	2
CO5	**K4**	2	2	2	-	-	-	2	-	2	-	-	-	1	-
Weighted Average		2	2	2	-	-	-	2	-	2	-	-	2	1	2

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

B.E	B23CSP401- DATABASE MANAGEMENT SYSTEMS LABORATORY Common to AI&DS, CSE(AIML) & CSE	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To understand data definitions and data manipulation commands
2.	To learn the use of nested and join queries
3.	To understand functions, procedures and procedural extensions of data bases
4.	To be familiar with the use of a front-end tool
5.	To understand design and implementation of typical database applications

Expt. No.	Description of the Experiments
1.	Create a database table, , add foreign key constraints and incorporate referential integrity and add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2.	Implementation of Database Querying – Simple queries, Nested queries, Sub queries.
3.	Query the database tables and explore sub queries, simple join operations, natural, equi and outer joins.
4.	Create View, Sequences and index for database tables with a large number of records.
5.	Implementation of Database Programming: Implicit and Explicit Cursors.
6.	Implementation of Procedures and Functions.
7.	Implementation of Triggers.
8.	Implementation of Exception Handling.
9.	Implementation of Database Design using ER modelling, normalization and Implementation for any application.
10.	Create Document, column and graph based data using NOSQL database tools.

Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Categorize typical data definitions and manipulation commands.
CO2	Examine the applications to test Nested and Join Queries
CO3	Take part in simple applications that use Views

Approved by BoS Chairman

CO4	Evaluate PL/SQL blocks using Cursors
CO5	Assess the use of Tables, Views, Triggers, Functions, Procedures, Front-end Tool in Database applications

Requirements for a Batch of 30 Students		
Sl. No.	**Description of the Equipment**	**Quantity required (Nos.)**
1.	Dell Optiplex 390 PCs Operating systems: Windows* 7 or later, macOS, and Linux. Software Required: Oracle 10g, XAMPP Server 7.	30

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K4**	3	3	2	-	-	-	1	-	1	-	-	2	2	1
CO2	**K4**	3	3	2	-	-	-	1	-	1	-	-	2	2	1
CO3	**K4**	3	2	2	-	-	-	1	-	1	-	-	2	2	1
CO4	**K5**	3	2	3	-	-	-	1	-	1	-	-	2	1	1
CO5	**K5**	3	2	3	-	-	-	1	-	1	-	-	-	1	1
Weighted Average		3	2	2	-	-	-	1	-	1	-	-	2	2	1

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

B.E	B23ADP401 – JAVA PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To understand the fundamentals of object oriented programming in Java.
2.	To understand concepts of inheritance and interfaces in JAVA.
3.	To familiarize Java environment to create, debug and run simple programs with exception handling and thread method.
4.	To demonstrate java compiler and learn how to use swing functionalities to create Java Application.
5.	To implement the java Programs with real time applications

Expt. No.	Description of the Experiments
1.	Build of Java programs using conditional statements
2.	Implement Java program using Method overloading and Constructor overloading
3.	Construct the Java program for the employee details using Scanner class
4	Build the Java Program using String Operations
5	Implement the Java program using Abstract class
6	Build a Java Program using Inheritance
7	Construct the Java program using Interfaces

Approved by BoS Chairman

8	Build a Java Program using Exception handling & Threads
9	Implement the concept of File operations using Java program
10	Build a Java Program for any type of applications using JDBC with MYSQL database

Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply the concepts of classes and objects to solve simple problems
CO2	Develop programs using inheritance and interfaces
CO3	Make use of exception handling mechanisms
CO4	Build Java applications with I/O packages, string classes
CO5	Applying the concept of Collections and JDBC

Requirements for a Batch of 30 Students		
Sl. No.	**Description of the Equipment**	**Quantity required (Nos.)**
1.	Dell Optiplex 380 PCs, Operating systems: Windows* 7 or later, macOS, and Linux. Software Required: Java 21 and above, Apache Tomcat, NetBeans/Eclipse IDE	30

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K3**	3	3	2	2	3	2	-	-	3	3	-	3	2	3
CO2	**K4**	3	3	2	2	3	2	-	-	3	3	-	3	2	3
CO3	**K5**	3	3	2	3	3	2	-	-	3	3	-	3	3	3
CO4	**K5**	3	3	3	3	3	2	-	-	3	3	-	3	3	3
CO5	**K6**	3	3	3	3	3	2	-	-	3	3	-	3	3	3
Weighted Average		3	3	2	3	3	2	-	-	3	3	-	3	3	3

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

Semester - V

B.E / B.Tech	B23CST501 COMPUTATIONAL THEORY	L	T	P	C
		3	1	0	4

Course Objectives	
1.	To understand the overview of the theoretical foundations of computer science from the perspective of formal languages.
2.	To illustrate finite state machines to solve problems in computing.
3.	To outline the hierarchy of problems arising in the context free grammar and languages.
4.	To study about computation theory through PDA and TM, focusing on models, language acceptance, and equivalences.
5.	To Understand RE languages and complexity classes P and NP.

UNIT - I	AUTOMATA FUNDAMENTALS	12
Introduction to formal proof— Additional forms of Proof — Inductive Proofs – Finite Automata — Deterministic Finite Automata — Non-deterministic Finite Automata - Finite Automata with Epsilon Transitions.		

UNIT - II	REGULAR EXPRESSIONS AND LANGUAGES	12
Regular Expressions-FA and Regular Expressions — Proving Languages not to be regular — Closure Properties of Regular Languages—Equivalence and Minimization of Automata. Regular Grammars: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA.		

UNIT - III	CONTEXT FREE GRAMMAR AND LANGUAGES	12
CFG — Parse Trees — Ambiguity in Grammars and Languages — Definition of the Pushdown Automata — Languages of a Pushdown Automata — Pushdown Automata: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA -DPDA		

UNIT - IV	TURING MACHINES	12
Turing Machines(TM): Formal definition and behaviour, Languages of a TM, TM as accepters, and TM as a computer of integer functions, Types of TMs – UTM – Halting Problem – Programming Techniques of TM		

UNIT - V	UNDECIDABILITY	12
Non Recursive Enumerable (RE) Language — Undecidable Problem with RE — Undecidable Problems about TM — Rice's Theorem, Post's Correspondence Problem, The Class P and NP.		

Total Instructional hours: 60

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Recall key concepts of formal languages, automata theory, and computational models.
CO2	Explain the fundamentals differences of DFA, NFA, PDA and TM.
CO3	Apply formal methods to prove the properties of regular and context-free languages using finite automata, regular expressions, and context-free grammars.
CO4	Analyze and differentiate decidable and undecidable problems
CO5	Evaluate the equivalence of computational models and assess the minimization of FA

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2														
CO2	K2														
CO3	K3														
CO4	K4														
CO5	K5														
Weighted Average															

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Text Books	
1.	K.R. Chowdry "Theory of Computation: Automata, Formal Languages, Computation and Complexity", April 13,2025.
2.	Wladyslaw Homenda, Witold Pedrycz, "Automata Theory and Formal Languages" January 31,2022.

Reference Books	
1.	Mishra K L P and Chandrasekaran N, "Theory of Computer Science – Automata Languages and Computation", Third Edition, Prentice Hall of India, 2004.
2.	Hopcroft J.E., Motwani R, and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2008.
3.	John C Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGraw Hill Publishing Company, New Delhi, 2007.
4.	Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education 2009.

Approved by BoS Chairman

B.E / B.Tech	B23CST502 – MODERN WEB PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To explore the fundamentals and evolution of modern web architecture including SPA and JAM stack.
2.	To develop skills in client-side development using HTML5, CSS3, and modern JavaScript
3.	To build server-side web applications using Node.js and integrate with RESTful APIs and databases.
4.	To introduce front-end frameworks like React and tools such as Webpack and Vite.
5.	To address deployment, security, performance optimization, and accessibility in web development.

UNIT - I	Web Architecture and Fundamentals	9
Web architecture: Client-Server Model, HTTP/2 and HTTP/3, DNS, CDN - Evolution of Web: Static vs. Dynamic Web, SPA vs. MPA, JAMstack - HTML5 Semantic Elements - CSS3: Grid, Flexbox, Media Queries - JavaScript (ES6+): Variables, Arrow functions, Destructuring, Promises		

UNIT - II	Modern JavaScript and Client-Side Scripting	9
DOM Manipulation, Events, Fetch API, Async/Await - Modular JavaScript (ES Modules, CommonJS) - Introduction to TypeScript - Tooling: Babel, ESLint, Prettier, npm/yarn - Hands-on: Build a dynamic responsive form with validation		

UNIT - III	Front-End Framework – React	9
Introduction to React and JSX - Functional Components, Hooks (useState, useEffect), Props, State - Routing with React Router - Component Lifecycle and Custom Hooks - React + API Integration, Forms Handling		

UNIT - IV	Server-Side Programming and Full Stack Integration	9
Node.js & Express.js Basics - RESTful API Design and Implementation - MongoDB (or PostgreSQL): CRUD Operations - JWT Authentication & Authorization - Environment variables and error handling		

UNIT - V	Web Performance, Security & Deployment	9
Web Accessibility (WCAG), SEO Basics - Web Security: HTTPS, CORS, XSS, CSRF, Helmet - Deployment: Netlify, Vercel, GitHub Pages, Render, Railway - CI/CD Pipelines Basics (GitHub Actions) - Web Optimization: Lazy Loading, Code Splitting, Lighthouse Audits		

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Explain modern web architecture and utilize standard markup and styling techniques.
CO2	Develop interactive client-side applications using modern JavaScript and DOM APIs.
CO3	Build dynamic user interfaces using React and manage state effectively.
CO4	Construct full-stack web applications with RESTful APIs and secure user authentication.
CO5	Analyze and implement web deployment, accessibility using various tools.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2														
CO2	K3														
CO3	K3														
CO4	K3														
CO5	K4														
Weighted Average															

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Text Books	
1.	Robin Nixon, Learning PHP, MySQL, JavaScript, CSS & HTML5, 5th Edition, O'Reilly Media, 2021.
2.	Ethan Brown, Web Development with Node and Express, 2nd Edition, O'Reilly Media, 2019.
3.	Alex Banks & Eve Porcello, Learning React, 2nd Edition, O'Reilly Media, 2020.

Reference Books	
1.	David Flanagan, JavaScript: The Definitive Guide, 7th Edition, O'Reilly Media, 2020.
2.	Eric Elliott, Programming JavaScript Applications, O'Reilly Media, 2014.
3.	Kyle Simpson, You Don't Know JS (book series), O'Reilly Media, 2020
4.	Val Head, Designing Interface Animation, Rosenfeld Media, 2016.

Approved by BoS Chairman

B.E / B.Tech	B23CST503 – IoT AND SMART TECHNOLOGY INTEGRATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the fundamentals of IoT architecture and its components.
2.	To develop an understanding of IoT communication protocols and standards.
3.	To understand about IoT sensors, actuators, and embedded systems.
4.	To explore IoT data management, cloud integration, and security.
5.	To know real-world IoT applications and system design.

UNIT - I	INTRODUCTION TO IoT	9

Overview of IoT: Definition, Characteristics, and Applications - IoT Architecture: Three-Layer and Five-Layer Models - IoT Ecosystem: Devices, Connectivity, Data Processing, and Applications - IoT Enabling Technologies: RFID, WSN, and M2M Communication - Case Study: Real-World IoT Applications.

UNIT - II	IoT COMMUNICATION PROTOCOLS	9

IoT Communication Protocols: MQTT, CoAP, HTTP, and WebSocket - Wireless Communication Technologies: Wi-Fi, Bluetooth, Zigbee, LoRaWAN, and 5G - IoT Network Topologies: Star, Mesh, and Hybrid - IoT Gateways: Role and Functionality - Case Study: IoT Protocol Implementations.

UNIT - III	IoT SENSORS AND ACTUATORS	9

IoT Sensors: Types, Characteristics, and Applications - Actuators: Types and Working Principles - Embedded Systems for IoT: Microcontrollers (e.g., Arduino, ESP8266) and Microprocessors (e.g., Raspberry Pi) - Interfacing Sensors and Actuators with Embedded Systems - Case Study: Sensor-Based IoT Applications.

UNIT - IV	IoT DATA MANAGEMENT AND CLOUD INTEGRATION	9

IoT Data Acquisition and Processing - IoT Data Storage: Edge Computing vs. Cloud Computing - Cloud Platforms for IoT: AWS IoT, Google Cloud IoT, and Microsoft Azure IoT - Big Data and Analytics in IoT - Case Study: IoT Data Management Solutions.

UNIT - V	IoT SECURITY AND APPLICATIONS	9

IoT Security Challenges: Device, Network, and Data Security - IoT Security Protocols: DTLS, TLS, and IPSec - IoT Privacy and Ethical Considerations - IoT Applications: Smart Homes, Smart Cities, Industrial IoT (IIoT), and Healthcare - Case Study: IoT Security Breaches and Mitigation Strategies.

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Define IoT concepts, architecture, and enabling technologies.
CO2	Demonstrate the use of IoT communication protocols and network topologies.
CO3	Build IoT applications by integrating sensors, actuators, and embedded systems.
CO4	Analyze cloud-based IoT data management and processing techniques.
CO5	Design secure and scalable IoT solutions for smart applications.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K1														
CO2	K2														
CO3	K3														
CO4	K4														
CO5	K6														
Weighted Average															

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Text Books	
1.	David Hanes, Gonzalo Salgueiro, and Patrick Grossetete, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 2nd Ed, Cisco Press,2020.
2.	Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-On Approach", 2nd Ed, VPT, 2021.
3	S. Vijayalakshmi and S. Muruganand, "IoT Security Fundamentals", 1st Ed, CRC Press, 2021.

Reference Books	
1.	Perry Lea, "IoT and Edge Computing for Architects", Second Edition, Packt, 2020.
2.	Jan Holler, Vlasios Tsiatsis, and Catherine Mulligan, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Second Edition, Academic Press, 2020.

Approved by BoS Chairman

B.E / B.Tech	B23AMT501 - DEEP NEURAL NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the concepts Neural Networks.
2.	To study the Deep learning concepts and frameworks.
3.	To analyse deep convolutional learning networks and Architecture Models.
4.	To identify implementations of RNN learning and Encoder-Decoder Sequence Architecture.
5.	To learn the deep unsupervised learning with applications.

UNIT - I	INTRODUCTION	9

Neural Networks basics – Functions in Neural Networks – Activation function, Loss function for classification and clustering problems – Deep networks basics – Shallow neural networks – Bias – Variance – Tradeoffs : Under-fitting vs over-fitting - Early stopping conditions.

UNIT - II	DEEP LEARNING	9

Introduction to Deep neural networks – Forward and Back Propagation – Parameters – Hyperparameters – Softmax Regression – Softmax Classifier – Introduction to Optimization Techniques – Classical Optimization Techniques – Linear Programming - Deep Learning Frameworks

UNIT - III	DEEP CONVOLUTIONAL NETWORKS	9

CNN Operations – CNN Architecture – Simple Convolution Network – Deep Convolutional Models - Pretrained Models : (YOLO, Faster R-CNN) – Transfer learning and Fine-tuning of CNNs – Recent advances in CNNs (Efficient Attention, Sparsity) – Open problems and challenges in CNNs (Robustness, Fairness).

UNIT - IV	SEQUENTIAL MODELLING	9

Recurrent Neural Networks (RNN) – Unfolding Computational Graphs – RNN Design Patterns – Back Propagation through time – Bidirectional RNN – Encoder Decoder Sequence-to-Sequence Architectures – Deep Recurrent Networks – Recursive Neural Networks – LSTM and GRU – Attention and the Transformers.

UNIT - V	DEEP UNSUPERVISED LEARNING	9

Boltzmann Machine – Auto Encoders – Standard – Denoising – Contractive – Variational Auto Encoders – Generative Adversarial Networks – Applications : Image Compression, Cartoon Character Generation.

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes : Students will be able to	
CO1	Recall the fundamental concepts of neural Networks.
CO2	Explain the architecture and functioning of deep learning frameworks.
CO3	Apply convolutional neural networks.
CO4	Analyze the sequential deep learning models.
CO5	Evaluate and compare deep unsupervised learning techniques.

Text Books	
1.	Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Pres, USA, 2016.
2.	Charu C. Aggarwal, “Neural Networks and Deep Learning”, Springer, 1st Edition, 2018.

Reference Books	
1.	N D Lewis, “Deep Learning Step by Step with Python”, 2016.
2.	Adam Gibson and Josh Patterson, “Deep Learning A Practitioner’s Approach”, O’Reilly, USA, 2016.
3.	Umberto Michelucci, “Applied Deep Learning : A Case-based Approach to Understanding Deep Neural Networks”, Apress, 2018.
4.	Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy, “Deep Learning with TensorFlow : Explore Neural Networks with Python”, Packt Publisher, 2017.

Approved by BoS Chairman

B.E / B.Tech	B23MCT505- Holistic Insight into UN SDGs (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand the origin, purpose, and significance of the UN Sustainable Development Goals (SDGs).
2.	To explore the 17 SDGs, their interconnections, and challenges in achieving them.
3.	To analyze global and local case studies of SDG implementation.
4.	To evaluate the role of governments, businesses, and individuals in sustainable development.
5.	To develop practical solutions and action plans for achieving SDGs at community and policy levels

SYLLABUS:

UNIT - I	INTRODUCTION TO SUSTAINABLE DEVELOPMENT & SDGS	6

Concept of **sustainability** and its evolution.

UN Millennium Development Goals (MDGs) vs. Sustainable Development Goals (SDGs). Overview of the **17 SDGs**, their targets, and indicators.

Importance of **global collaboration** for sustainable development.

UNIT - II	PEOPLE-CENTERED SDGS (SDG 1–6)	6

SDG 1: No Poverty – Causes, measures & policies.

SDG 2: Zero Hunger – Food security & sustainable agriculture.

SDG 3: Good Health & Well-being – Universal healthcare & disease prevention.

SDG 4: Quality Education – Inclusive and equitable education.

SDG 5: Gender Equality – Women's empowerment & equal opportunities.

SDG 6: Clean Water & Sanitation – Water conservation & access to sanitation.

Approved by BoS Chairman

UNIT - III	ECONOMIC & INFRASTRUCTURE SDGS (SDG 7–12)	6
SDG 7: Affordable & Clean Energy – Renewable energy solutions. **SDG 8:** Decent Work & Economic Growth – Inclusive economic policies. **SDG 9:** Industry, Innovation & Infrastructure – Sustainable development & digital transformation. **SDG 10:** Reduced Inequalities – Social inclusion & global justice. **SDG 11:** Sustainable Cities & Communities – Smart urban planning & resilience. **SDG 12:** Responsible Consumption & Production – Circular economy & waste management.		

UNIT - IV	ENVIRONMENTAL SDGS (SDG 13–15)	6
SDG 13: Climate Action – Climate change impacts & mitigation strategies. **SDG 14:** Life Below Water – Ocean conservation & marine biodiversity. **SDG 15:** Life on Land – Forest preservation & biodiversity protection.		

UNIT - V	Governance & Global Partnerships (SDG 16–17)	6
SDG 16: Peace, Justice & Strong Institutions – Human rights & good governance. **SDG 17:** Partnerships for the Goals – Role of international cooperation, businesses & individuals.		

Course Outcomes: Students will be able to	
CO1	Explain the origin, purpose, and significance of the UN Sustainable Development Goals.
CO2	Summarize the 17 SDGs, their interconnections, and challenges in achieving them.
CO3	Interpret global and local case studies of SDG implementation.
CO4	Describe the roles of governments, businesses, and individuals in sustainable development.
CO5	Illustrate practical solutions and action plans for achieving SDGs at community and policy levels.

Approved by BoS Chairman

Text Books	
1.	Sachs, J. D. (2015). The Age of Sustainable Development. Columbia University Press.
2.	United Nations (2015). Transforming Our World: The 2030 Agenda for Sustainable Development.
3.	Griggs, D., Stafford-Smith, M., Gaffney, O., & Rockström, J. (2017). Sustainable Development Goals: Harnessing Business to Achieve the SDGs Through Finance, Technology and Innovation. Routledge.
4.	Mebratu, D., & Swilling, M**. (2019).** Transformational Infrastructure for Development of a Wellbeing Economy. Springer.

Reference Books	
1.	Leal Filho, W. (Ed.). (2020). Encyclopedia of the UN Sustainable Development Goals. Springer.
2.	Sachs, J. D. (2021). The Decade of Action: Mobilizing the World to Achieve the SDGs. Columbia University Press.

Approved by BoS Chairman

B.E.	B23CSP501- MODERN WEB PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To build responsive and accessible web pages using modern frontend technologies.
2.	To apply client-side scripting and DOM manipulation for dynamic user interfaces.
3.	To develop single-page applications (SPA) using React and state management techniques.
4.	To construct full-stack applications using Node.js, Express, and MongoDB.
5.	To implement secure authentication, deploy applications, and assess performance metrics.

Expt. No.	Description of the Experiments
1	Build a Personal Portfolio Website using HTML5, CSS3 (Flexbox/Grid) and Media Queries
2	JavaScript DOM Manipulation and Event Handling – Create a dynamic to-do list
3	Client-side Form Validation with JavaScript and Regex
4	Single Page Application (SPA) using React – Navigation and Component Management
5	Use React Hooks to build a Weather Dashboard (API call to Open Weather Map)
6	Build a RESTful API using Node.js and Express (e.g., Book or Task Manager API)
7	Connect Frontend and Backend – React frontend with Express + MongoDB backend
8	Implement User Authentication using JWT and form-based login
9	Deploy Web Application using Netlify (Frontend) and Render/Heroku (Backend)
10	Web Performance & Security Audit using Lighthouse – Optimize and secure an existing site
	Total Instructional hours = 45

Course Outcomes : Students will be able to	
CO1	Build and deploy responsive and dynamic web interfaces.
CO2	Identify APIs to integrate frontend and backend.
CO3	Apply state management and routing in React apps.
CO4	Examine web applications using authentication and HTTPS.
CO5	Evaluate web apps using performance and accessibility tools.

Requirements for a Batch of 30 Students

Sl. No.	Description of the Equipment	Quantity required (Nos.)
1.	Dell Optiplex 390 PCs Operating systems: Windows* 10 or later, macOS, and Linux. Software Required: Bootstrap / Tailwind CSS, MongoDB, JWT,Node.js, MongoDB, VS Code	30

Approved by BoS Chairman

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K3														
CO2	K3														
CO3	K3														
CO4	K4														
CO5	K5														
Weighted Average															

3 – Substantial **2- Moderate** **1- Low** **‘-‘ – No Correlation**

Approved by BoS Chairman

B.E. / B.Tech	B23AMP501 – DEEP NEURAL NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To learn deep neural networks and apply for simple problems.
2.	To Learn and apply Convolution Neural Network for image processing.
3.	To understand the Deep Neural Networks with CNN.
4.	To Learn and apply Recurrent Neural Network and its variants for text.
5.	Develop a real-world application using suitable deep neural networks.

Expt. No.	Description of the Experiments
1	Implement character and Digit Recognition using ANN.
2	Implement an Overfitting in Neural Networks for Time Series Prediction (Stock Market or Weather Data)
3	Build a code for Smart Health Monitor – Predict Activity from Sensor Data by using Softmax Classifier.
4	Implement Speech Recognition using NLP.
5	Develop a code to design object detection and classification for traffic analysis using DNN.
6	Implement Plant Disease Detection Using CNN from Leaf Images.
7	Implement online fraud detection of share market data using sequential modelling (LSTM/GRU).
8	Build a Real-Time Email Spam Detector Using GRU.
9	Implement Sentiment Analysis using LSTM.
10	Generate Cartoon Characters Using GANs.
11	Implement an autoencoder to denoise an audio signal in real time.
12	Mini Project: Number plate recognition of traffic video analysis.
	Total Instructional Hours = 45

Approved by BoS Chairman

Course Outcomes : Students will be able to	
CO1	Apply deep neural network for simple problems
CO2	Examine Convolution Neural Network for image processing
CO3	Develop Recurrent Neural Network and its variants for text analysis
CO4	Analyze the generative models for data augmentation
CO5	Develop a real-world application using suitable deep neural networks

Requirements for a Batch of 30 Students		
Sl. No.	**Description of the Equipment**	**Quantity required (Nos.)**
1.	Dell Optiplex 390 PCs Operating systems: Windows 10 or later, macOS, and Linux. Software Required: Python, TensorFlow, Keras, PyTorch, OpenCV, Jupyter Notebook, and other ML libraries.	66

B.E / B.Tech	B23CEP501 – SUMMER INTERNSHIP	L	T	P	C
		0	0	0	1

Course Objectives	
1.	Provide students with hands-on exposure to real-world IT industry environments.
2.	Enhance technical skills, critical thinking, and effective teamwork abilities.
3.	Familiarize students with software development cycles, tools, and methodologies.
4.	Encourage practical application of theoretical concepts to real-world challenges.
5.	Prepare students for professional roles in software development, data science, and cybersecurity.

ELIGIBILITY CRITERIA

- Students should have completed **Semester IV** before applying.
- The internship should be conducted at **recognized IT companies, research institutions, or certified online platforms (e.g., Google, IBM, Microsoft, Altair, Intel AWS, Coursera, NPTEL, etc.).**
- Students should obtain prior approval from the **Internship Coordinator/Faculty Advisor.**

INTERNSHIP DURATION & STRUCTURE

- **Minimum Duration: 3 Weeks (Full-Time) or Equivalent Part-Time (120+ Hours)**
- **Location: Industry, R&D Lab, or Online Virtual Internship**
- **Internship Modes:**
  - **On-site Internship:** Work in a company/research lab.
  - **Remote Internship:** Work on projects assigned by companies/start-ups.

Online Certified Internship: (Only if industry-based options are unavailable

Assessment & Evaluation (Total: 100 Marks)		
Component	**Weightage**	**Evaluation Method**
Internship Report (Technical & Learning Summary)	30 Marks	Submitted after completion
Internship Diary/Logbook	20 Marks	Daily/Weekly progress record
Project Demonstration (if applicable)	30 Marks	Presentation + Code/Prototype
Supervisor Feedback (Industry Mentor/Guide)	20 Marks	Evaluation from company/institution

Approved by BoS Chairman

Submission Requirements

• **Internship Completion Certificate** from the company/institution.
• **Internship Report (10-15 pages)** including:
  ○ Introduction to the company/organization.
  ○ Technologies & tools used.
  ○ Work experience, learning outcomes, challenges, and solutions.
  ○ Conclusion & future scope.
• **Internship Diary/Logbook** with daily/weekly progress.
• **Presentation (5-10 slides)** summarizing key takeaways.

Semester - VI

B.E.	B23CST601 CLOUD COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the fundamental concepts and architecture of cloud computing.
2.	To understand different cloud service models and deployment strategies.
3.	To explore virtualization, containerization, and data storage in the cloud.
4.	To study cloud security, management, and performance metrics.
5.	To gain insights into cloud platforms like AWS, Azure, and Google Cloud.

UNIT - I	INTRODUCTION	9
Definition and Characteristics of Cloud Computing - Cloud Architecture and Service Models (IaaS, PaaS, SaaS) - Deployment Models: Public, Private, Hybrid, Community - Advantages, Limitations, and Challenges - NIST Reference Architecture		

UNIT - II	VIRTUALIZATION AND CONTAINERIZATION	9
Basics of Virtualization: Hypervisors (Type I, Type II) - VM provisioning and orchestration - Containerization: Docker Architecture and Commands - Difference between VMs and Containers - Kubernetes Basics and Clusters		

UNIT - III	CLOUD STORAGE AND NETWORKING	9
Data Storage Models: Object, Block, and File Storage - Cloud Storage Services: S3, Blob, EBS - Cloud Networking: Virtual Private Cloud (VPC), Subnets, Load Balancers - CDN and Edge Computing - Data Consistency, Availability, and Redundancy		

UNIT - IV	CLOUD PLATFORMS AND DEVOPS INTEGRATION	9
Overview of AWS, Azure, GCP Core Services - Auto-scaling and Load Balancing - Serverless Computing: AWS Lambda, Azure Functions - DevOps on Cloud: CI/CD pipelines, Infrastructure as Code (IaC) using Terraform - Case Studies: Multi-cloud and Hybrid Environments		

UNIT - V	SECURITY, GOVERNANCE AND FUTURE TRENDS	9
Security Challenges: Authentication, Authorization, Data Protection - Identity and Access Management (IAM) - Regulatory and Legal Issues (GDPR, HIPAA, etc.) - Billing and Cost Optimization - Future of Cloud: AI in Cloud, Edge + Cloud, Quantum Cloud Computing		
		Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Relate cloud computing models, architecture, and applications.
CO2	Compare virtualization and containerization technologies.
CO3	Utilize cloud services for storage, networking, and application deployment.
CO4	Develop cloud-based DevOps and automation pipelines.
CO5	Analyze cloud security issues and strategies for cost and resource optimization

Text Books	
1.	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing: Foundations and Applications Programming”, Second Edition, McGraw-Hill Education, 2024.
2.	Arshdeep Bahga, Vijay Madisetti, “Cloud Computing: A Hands-On Approach”, First Edition, Universities Press, 2014.

Reference Books	
1.	Dan C. Marinescu, “Cloud Computing: Theory and Practice”, Third Edition, Morgan Kaufmann, 2022.
2.	Thomas Erl, Zaigham Mahmood, Ricardo Puttini, “Cloud Computing: Concepts, Technology & Architecture”, First Edition, Pearson Education, 2013.
3.	Gautam Shroff, “Enterprise Cloud Computing: Technology, Architecture, Applications”, First Edition (South Asian Edition), Cambridge University Press, 2010.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K1														
CO2	K2														
CO3	K3														
CO4	K3														
CO5	K4														
Weighted Average															

3 – Strong **2- Moderate** **1- Weak** **‘-‘ – No Correlation**

Approved by BoS Chairman

B.E.	B23CST602 INFORMATION AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the principles and practices of information security.
2.	To study cryptographic techniques and their applications.
3.	To explore the concepts of secure network communication.
4.	To examine security threats, vulnerabilities, and mitigation techniques.
5.	To gain knowledge of security protocols, firewalls, IDS/IPS, and modern trends.

UNIT - I	INTRODUCTION	9

Security Goals – CIA Triad – Threats, Vulnerabilities, and Attacks – Security Policies – Access Control Models – Security Mechanisms – Cybersecurity Frameworks (ISO 27001, NIST) – Security in Software Development Lifecycle.

UNIT - II	CRYPTO GRAPHY AND PKI	9

Symmetric Encryption: AES, DES – Asymmetric Encryption: RSA, ECC – Key Management – Hash Functions (SHA, MD5) – Digital Signatures and Certificates – Public Key Infrastructure (PKI) – Cryptanalysis Basics.

UNIT - III	SECURE N/W PROTOCOLS AND THREAT MITIGATION	9

TCP/IP Security Overview – Network Attacks: Sniffing, Spoofing, DoS, DDoS – Secure Communication Protocols: SSL/TLS, HTTPS, IPsec – Firewalls and VPNs – Intrusion Detection and Prevention Systems (IDS/IPS).

UNIT - IV	APPLICATION ENDPOINT SECURITY	9

Web Security: OWASP Top 10 – Secure Coding Practices – Email Security: PGP, S/MIME – Endpoint Security – Malware Types and Detection – Authentication Mechanisms (MFA, Biometrics) – Access Control Systems.

UNIT - V	SECURITY, GOVERNANCE AND FUTURE TRENDS	9

Security Auditing and Risk Assessment – Incident Response and Recovery – Digital Forensics Basics – Cloud Security Principles – Zero Trust Architecture – IoT Security Challenges – AI in Security and Ethical Hacking.

Approved by BoS Chairman

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Outline key concepts and goals of information and network security.
CO2	Apply cryptographic algorithms and secure key management techniques.
CO3	Analyze network vulnerabilities and implement protection mechanisms.
CO4	Examine application and system-level security requirements.
CO5	Choose emerging trends and technologies in cybersecurity.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2														
CO2	K3														
CO3	K4														
CO4	K4														
CO5	K3														
Weighted Average															

3 – Strong **2- Moderate** **1- Weak** **‘-‘ – No Correlation**

Text Books	
1.	William Stallings, “Cryptography and Network Security: Principles and Practice”, Eighth Edition, Pearson Education, 2023.
2.	Behrouz A. Forouzan, Debdeep Mukhopadhyay, “Cryptography and Network Security”, Third Edition, McGraw-Hill Education, 2015.

Reference Books	
1.	Charles P. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Fifth Edition, Pearson Education, 2015.
2.	Mark Stamp, “Information Security: Principles and Practice”, Second Edition, Wiley, 2011.
3.	Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.

Approved by BoS Chairman

B.E / B.Tech	B23CSI601 – COMPILER DESIGN	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To learn fundamentals concepts of compiler and its components
2.	To learn various parsing techniques for source program analysis.
3.	To understand intermediate code generation and optimization
4.	To learn about code generators for target machines.
5.	To know recent advancements in complier technologies.

UNIT - I	INTRODUCTION TO COMPILERS	9

Overview of Compiler Design - Phases of a Compiler- Structure of a Compiler - Lexical Analysis: Role of the Lexical Analyzer, Regular Expressions, Tokens, NFA, DFA, and Minimization- Lexical Analysis Tools: Lex & Flex-Tools for Compiler Construction: YACC, Bison - Machine Learning in Compilers - Compilation for New Architectures: GPUs, TPUs and Cloud/Serverless environments.

UNIT - II	SYNTAX ANALYSIS	9

Syntax Analysis: Role and importance of parsers-Context-Free Grammars and Syntax Trees - Top-Down Parsing: Recursive Descent Parsing, LL Parsing, and Backtracking - Bottom-Up Parsing: Shift-Reduce Parsing, LR Parsing, SLR, LALR, and Canonical LR Parsing - Predictive Parsing - Parsing Techniques: Operator Precedence Parsing, Left-Recursive Grammar Handling, Left Factoring-Parsing Tools: YACC, ANTLR

UNIT - III	INTERMEDIATE CODE GENERATION	9

Introduction to Intermediate Languages - Three-Address Code: Generation and Representation - Syntax Trees and Intermediate Representation - Code Generation: Generation of Quadruples, Triples, and Indirect Triples - Backpatching and its Use in Intermediate Code - Data Flow Analysis and Optimization during Intermediate Code Generation - Symbol Table Construction and Management - Type Checking and Type Conversion during Intermediate Code Generation

UNIT - IV	CODE OPTIMIZATION	9

Introduction to Optimization Techniques-Basic Block Optimization and Flow Graphs-Loop Optimization Techniques: Loop Unrolling, Loop Inversion-Global Data Flow Analysis and its Role in Optimization-Register Allocation and Instruction Scheduling- Peephole Optimization and its Types - Just-In-Time (JIT) Compilation - Compilation, Loop Distribution, Vectorization, SSE (Streaming SIMD Extensions), and GPU optimizations.

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UNIT - V	CODE GENERATION	9
Code Generation Process: Target Machine, Runtime Storage Management-Instruction Selection: Design of a Simple Code Generator-Register Allocation and Mapping to Machine Registers - DAG (Directed Acyclic Graph) Representation of Basic Blocks -Next-use Information and its Role in Code Generation- Code Optimization: Peephole Optimization, Loop Optimization in Code Generation-Runtime Environments and Memory Management - Issues in Generating Code for Different Platforms (e.g., x86, ARM)		

Expt. No.	Description of the Experiments
1	Lexical Analysis using LEX/FLEX
2	Syntax Analysis using YACC/Bison
3	Recursive Descent Parser Implementation
4	Implementation of a Predictive Parser
5	Intermediate Code Generation (Three-Address Code)
6	Back patching for Boolean Expressions & Control Flow
7	Symbol Table Construction
8	Code Optimization using Peephole Techniques
9	Code Generation for x86/ARM using DAG Representation
10	Register Allocation & Instruction Scheduling
	Total Instructional hours : (45+30) = 75

Course Outcomes: Students will be able to	
CO1	Explain the core principles of compiler construction, including lexical and syntax analysis.
CO2	Design and implement different types of parsers, such as top-down and bottom-up.
CO3	Develop and apply intermediate code generation techniques in compilers.
CO4	Utilize optimization methods to improve the performance of compiled code.
CO5	Analyse a basic code generator for a simple programming language.

Requirements for a Batch of 30 Students		
Sl. No.	**Description of the Equipment**	**Quantity required (Nos.)**
1.	HP Make, Core i5, 11th Generation, 16GB RAM PCs, Operating systems: Windows* 10 or later, macOS, and Linux. Software Required: Flex for Windows 2.5 (LEX and YACC)	30

Approved by BoS Chairman

CO Mapping with PO & PSO															
CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2														
CO2	K3														
CO3	K3														
CO4	K3														
CO5	K4														
Weighted Average															
3 – Strong			2- Moderate				1- Weak		'-' – No Correlation						

Text Books	
1.	Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D." Compilers: Principles, Techniques, and Tools", Second Edition, Pearson India 2023.
2.	S. Godfrey Winster, S. Aruna Devi, R. Sujatha,"Compiler Design", Esdee Publishing Pvt.Ltd, Second Edition 2020

Reference Books	
1.	K. Muneeswaran," Compiler Design", Oxford Higher Education, Fourth edition 2015
2.	David Galles, "Modern Compiler Design", Pearson Education, Reprint 2012.
3.	V. Raghavan, Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010

Approved by BoS Chairman

B.E / B. TECH	B23ECT501 MICROPROCESSORS AND MICROCONTROLLERS (Common To ECE & CSE)	L	T	P	C
		3	0	0	3

Course Objectives

1.	To Study the Architecture Of 8085 & 8086.
2.	To Explore the Need and Use of Peripherals and Interfacing.
3.	To Study the Architecture of 8051.
4.	To Develop Skill to Explore System Design Technique of Microcontroller.
5.	To Study the ARM Architecture.

UNIT I 8 BIT and 16 BIT MICROPROCESSOR	9
Introduction to 8085 Architecture, Instruction set, addressing modes, Interrupts, 8086 Architecture, Instruction set and programming, Addressing modes, Minimum and Maximum mode configurations, Coprocessor, Multiprocessor.	

UNIT II PERIPHERALS AND INTERFACING	9
Programmable Peripheral Interface (8255), Keyboard display controller (8279), ADC0808 and DAC0808 Interface, Programmable Timer Controller (8254), Programmable interrupt controller (8259), Serial Communication Interface (8251), DMA controller (8257)	

UNIT III MICROCONTROLLER	9
8051 – Architecture, Special Function Registers (SFRs), Instruction set, Addressing modes, Assembly language programming, I/O Ports, Timers / counters, Interrupts and serial communication.	

UNIT IV MICROCONTROLLER BASED SYSTEM DESIGN	9
Interfacing to: matrix display, (16 x 2) LCD, high power devices, optical motor shaft encoder, Stepper Motor, DC Motor speed Control using PWM, RTC and EEPROM interface using I2C protocol.	

UNIT V 32- BIT ARM PROCESSOR	9
RISC Vs CISC Architecture, ARM Processor Architecture, ARM Core data flow model, Barrel Shifter, ARM processor modes and families, pipelining, ARM instruction Set and its Programming, ARM Cortex Processors.	
	Total Instructional hours: 45

Course Outcomes: Students will be able to

CO1	Outline the architectures of 8085 and 8086

Approved by BOS Chairman

CO2	Build and verify applications using peripheral interfacing with8085/8086
CO3	Construct the 8051 microcontroller-based systems
CO4	Apply the 8051 microcontroller programs in various interfacing circuits
CO5	Categorize among different processor organization

Text Books	
1.	Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085". Penram International Publishing reprint, 6th Edition, 2017.
2.	Douglas V. Hall, "Microprocessor and Interfacing, Programming and Hardware", Tata McGraw Hill, revised 2 nd Edition 2006, 11th reprint, 2015.

Reference Books	
1.	Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinley, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education 2008. 12th impression, 2018
2.	Krishna Kant, “Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096’’, PHI, 2007, 7th Reprint, 2015.
3.	Kenneth J. Ayala., “The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning’’, 2012.
4.	A.K. Ray, K.M. Bhurchandi, “Advanced Microprocessor and Peripherals’’, Tata McGraw-Hill, 2 nd Edition, 2010.
5.	Barry B. Brey, “The Intel Microprocessors Architecture, Programming and Interfacing’’, Pearson Education, 2007, 2 nd impression, 2010.

Approved by BOS Chairman

B.Tech CSBS	B23MCT605 CYBER SAFETY CONCEPTS	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand various types of cyber-attacks and cyber-crimes
2.	To learn threats and risks within context of the cyber security
3.	To have an overview of the cyber laws & concepts of cyber forensics
4.	To study the defensive techniques against these attacks
5.	To understand various cyber security privacy issues

UNIT- I	Introduction to Cyber Security	9
Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.		

UNIT- II	Cyberspace and the Law & Cyber Forensics	9
Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics		

UNIT- III	Cybercrime: Mobile and Wireless Devices	9
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in Mobile Computing Era, Laptops.		

Approved by BoS Chairman

UNIT- IV	Cyber Security	9
Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations		

UNIT- V	Privacy Issues	9
Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains medical, financial, etc.		
		Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Analyze and evaluate the cyber security needs of an organization.
CO2	Understand Cyber Security Regulations and Roles of International Law.
CO3	Design and develop a security architecture for an organization.
CO4	Understand fundamental concepts of data privacy attacks.
CO5	Explain fundamental concepts of data privacy and analyze the role of privacy policies and privacy- preserving techniques.

Text Books	
1.	Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2.	B.B. Gupta, D.P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.
Reference Books	
1.	Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2.	Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

Approved by BoS Chairman

B.E.	B23CSP601- CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To provide hands-on experience in deploying cloud services.
2.	To experiment with virtualization, containers, and serverless platforms.
3.	To manage cloud resources using scripting and automation tools.
4.	To perform cloud-based DevOps tasks using CI/CD tools.
5.	To monitor, secure, and optimize cloud applications.

Expt. No.	Description of the Experiments
1	Launch and configure a Virtual Machine using AWS EC2 / GCP Compute Engine
2	Deploy a static website on AWS S3 or Azure Blob Storage
3	Set up and deploy a containerized app using Docker
4	Manage Kubernetes cluster and deploy microservices using kubectl
5	Implement serverless function (e.g., AWS Lambda / GCP Cloud Function)
6	Connect a web application to cloud database (RDS / Firebase / Cosmos DB)
7	Configure Load Balancer and Auto-scaling Group
8	Build and deploy a CI/CD pipeline using GitHub Actions or Jenkins
9	Create Infrastructure using Terraform (basic IaC setup)
10	Implement cloud monitoring and alerting using CloudWatch / Azure Monitor
	Total Instructional hours = 45

Course Outcomes : Students will be able to	
CO1	Outline cloud-based compute and storage resources.
CO2	Model applications using containers and orchestrate with Kubernetes.
CO3	Identify serverless services for dynamic scaling.
CO4	Plan deployment and integrate CI/CD workflows.
CO5	Analyze and troubleshoot issues and optimize cloud services.

Approved by BoS Chairman

Requirements for a Batch of 30 Students		
Sl. No.	**Description of the Equipment**	**Quantity required (Nos.)**
1.	HP Make, Core i5, 11th Generation, 16GB RAM PCs, Operating systems: Windows* 10 or later, macOS, and Linux. Software Required: VirtualBox or KVM (for local virtualization), Ubuntu Server ISO (for VM OS), MinIO, Nginx, Docker, Docker Compose, Minikube / K3s Kubectl, Helm, OpenFaaS, faas-cli, PostgreSQL / MySQL, MongoDB / CouchDB, Adminer or pgAdmin, HAProxy, KEDA, Jenkins or GitLab CI, Git, Terraform, Localstack, VS Code with Terraform plugin, Prometheus, Grafana, Alertmanager, Node Exporter / cAdvisor	30

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2														
CO2	K3														
CO3	K3														
CO4	K3														
CO5	K4														
Weighted Average															

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

B.E / B. TECH	B23ECP501 - MICROPROCESSORS AND MICROCONTROLLERS LABORATORY (Common To ECE & CSE)	L	T	P	C
		0	0	4	2

Course Objectives:

1. To study the Architecture of 8085 & 8086 microprocessor.
2. To learn the design aspects of I/O and Memory Interfacing circuits.
3. To study the Architecture of 8051 microcontroller.

List of Experiments:

Expt. No.	Description of the Experiments
PROGRAMMING WITH 8085 and 8086 MICROPROCESSORS	
1.	Arithmetic and Logical operations
2.	Code conversion
3.	Sorting
4.	Searching
5.	Stepper Motor Control
6.	Serial interface / Parallel interface
7.	A/D and D/A interface
8.	Keyboard & Display interface (Added)
9.	Digital clock interfacing board (Added)
PROGRAMMING WITH 8051	
10.	Arithmetic and Logical operations
11.	Square and Cube program, Find 2's complement of a number
12.	Unpacked BCD to ASCII

Total Instructional hours: 60

Approved by BOS Chairman

Course Outcomes:

Students will be able to

CO1: Inspect and implement the programs on the 8085 and 8086 microprocessors, along with interfacing circuits for the 8086.

CO2: Examine the implementation of 8051 microcontroller-based systems and the concepts related to I/O and memory interfacing.

CO3: Demonstrate and outline the technical details of all the experiments conduction with result obtained.

List of Equipment Required:

Requirements for a Batch of 30 Students

Sl. No.	Description of the Equipment	Quantity required (Nos.)
1.	8086 Microprocessor trainer kit with power supply	15
2.	8051 Microcontroller trainer kit	15
3.	Traffic light control interfacing card compatible with 8086 & 8051kits	5
4.	Stepper motor control interfacing compatible with8086&8051kits	5
5.	Digital clock interfacing board compatible with 8086&8051kits	5
6.	Keyboard & Display interface board compatible with8086&8051kits	5
7.	Printer interfacing card compatible with 8086 & 8051 kits	5
8.	A/D and D/A interfacing card compatible with 8086 & 8051kits	5
9.	Serial and Parallel interfacing card compatible with8086&8051kits	5

Approved by BOS Chairman

Text Books	
1.	Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085". Penram International Publishing reprint, 6th Edition, 2017.
2.	Douglas V. Hall, "Microprocessor and Interfacing, Programming and Hardware", Tata McGraw Hill, revised 2 nd Edition 2006, 11th reprint, 2015.
Reference Books	
1.	Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinley, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education 2008. 12th impression, 2018
2.	Krishna Kant, “Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096’’, PHI, 2007, 7th Reprint, 2015.
3.	Kenneth J. Ayala., “The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning’’, 2012.
4.	A.K. Ray, K.M. Bhurchandi, “Advanced Microprocessor and Peripherals’’, Tata McGraw-Hill, 2 nd Edition, 2010.
5.	Barry B. Brey, “The Intel Microprocessors Architecture, Programming and Interfacing’’, Pearson Education, 2007, 2 nd impression, 2010.

Approved by BOS Chairman

B.E / B.Tech	B23CSP602 – INNOVATIVE DESIGN PRACTICES	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To develop creativity and critical thinking through structured design thinking methodologies.
2.	To provide practical exposure to rapid prototyping using relevant hardware and software tools.
3.	To integrate computer science with emerging technologies like AI, IoT, and electronics in innovative solutions.
4.	To enable students to identify real-world problems and design effective proof-of-concept models.
5.	To foster teamwork, communication, and presentation skills through collaborative project development.

MODULE-I	INTRODUCTION TO INNOVATIVE THINKING (WEEK 1-2)	6
Design Thinking Methodology - Human-Centered Design Approach - Problem Identification & Idea Generation		

MODULE-II	PROTOTYPING & DESIGN TOOLS (WEEK 3-5)	6
Rapid Prototyping Techniques - Hardware & Software Integration (Arduino, Raspberry Pi, etc.) - UX/UI Design and Wireframing		

MODULE-III	EMERGING TECHNOLOGIES IN INNOVATION (WEEK 6-8)	6
AI & ML for Innovation - IoT and Embedded Systems in Design - Cloud and Edge Computing for Smart Solutions		

MODULE-IV	PROJECT DEVELOPMENT & IMPLEMENTATION (WEEK 9-12)	6
Design Validation and Testing - Industry Use Cases & Case Studies - Team-Based Mini Project Development		

MODULE-V	PRESENTATION & EVALUATION (WEEK 13-14)	6
Project Demonstration & Peer Reviews - Business & Market Viability Analysis - Final Report Submission & Presentation		

Total Instructional hours: 30

Approved by BoS Chairman

Assessment & Evaluation (Total: 100 Marks)		
Component	**Weightage**	**Evaluation Method**
Problem Identification & Ideation	20 Marks	Initial Proposal & Concept Presentation
Prototype Development	30 Marks	Working Prototype Demonstration
Innovation & Feasibility	20 Marks	Novelty, Impact, and Real-World Application
Final Project Report	20 Marks	Documentation & Technical Report
Presentation & Review	10 Marks	Peer & Faculty Evaluation

Submission Requirements
Final Report (8-12 pages) including: Problem Statement & Innovation Idea Technology Stack & Architecture Development Process & Prototyping Testing & Validation Results Future Enhancements & Market Feasibility **Project Demonstration (5-7 min video)** showcasing the working prototype. **Presentation Slides (5-10 slides)** summarizing the innovation process and outcomes.

Approved by BoS Chairman

Professional Electives

Vertical – I
Cloud Computing and Security

B.E / B.Tech	B23CSE909-VIRTUALIZATION AND CONTAINERIZATION WITH KUBERNETES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the core principles of virtualization and its role in modern infrastructure.
2.	To learn containerization using Docker for efficient application deployment.
3.	To acquire knowledge of Kubernetes architecture and container orchestration techniques.
4.	To build and deploy cloud-native applications using container orchestration tools.
5.	To explore advanced Kubernetes capabilities including security, scaling, and multi-cloud operations.

UNIT - I	FUNDAMENTALS OF VIRTUALIZATION	8

Evolution of Computing Infrastructure and Virtualization - Types of Virtualization: Full, Para, and Hardware Assisted Virtualization - Hypervisors: Type 1 and Type 2 Hypervisors - Virtual Machine Management and Migration - Virtualization Platforms: VMware, KVM, Hyper V, XenNetwork Virtualization and Software-Defined Networking - Storage Virtualization and Virtual Storage Area Networks - Performance Considerations and Resource Management.

UNIT - II	CONTAINERIZATION ESSENTIALS	10

Introduction to Containers and Container Architecture - Containers vs. Virtual Machines: Benefits and Trade-offs - Linux Namespaces, Cgroups, and Container Fundamentals - Docker Architecture and Components - Building and Managing Docker Images - Docker Container Lifecycle Management - Dockerfile Best Practices and Multi-stage Builds - Container Registries and Distribution - Docker Compose for Multi-container Applications - Container Networking and Storage Options

UNIT - III	KUBERNETES ARCHITECTURE AND FUNDAMENTALS	9

Introduction to Container Orchestration - Kubernetes Architecture and Components - Kubernetes API and Object Model - Kubernetes Cluster Setup and Management - Pods, ReplicaSets, and Deployments - Services, Endpoints, and Service Discovery - ConfigMaps and Secrets for Configuration Management - Persistent Volumes and Storage Classes - Resource Requests and Limits - Namespaces, Labels, and Annotations

UNIT - IV	ADVANCED KUBERNETES CONCEPTS	9

Kubernetes Networking Models and CNI Plugins - Ingress Controllers and API Gateway Patterns - StatefulSets for Stateful Applications - DaemonSets and Jobs for Specialized Workloads - Horizontal and Vertical Pod Autoscaling - Kubernetes Operators and Custom Resources - Helm for Kubernetes Package Management - Rolling Updates, Canary Deployments, and Blue-Green Deployments - Service Mesh Architectures with Istio/Linkerd - Monitoring, Logging, and Observability in Kubernetes

Approved by BoS Chairman

UNIT - V	ENTERPRISE KUBERNETES AND CLOUD-NATIVE APPLICATIONS	9

Kubernetes Security Best Practices and RBAC - Multi-tenant Kubernetes Clusters - Multi-cluster Management and Federation - CI/CD Pipelines for Kubernetes Deployments - Kubernetes in Public Cloud: AWS EKS, Azure AKS, Google GKE - Edge Computing with Kubernetes (K3s, MicroK8s) - Serverless on Kubernetes: Knative and OpenFaaS - Disaster Recovery and High Availability Strategies - Performance Tuning and Optimization - Case Studies and Enterprise Deployment Patterns

Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Configure and manage virtualized environments.
CO2	Examine containerized applications using Docker.
CO3	Deploy and manage applications in Kubernetes.
CO4	Design cloud-native architectures for scalability.
CO5	Make use of secured and optimized Kubernetes deployments.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K3	3	2	2	2	3	2	1	1	2	2	2	3	3	3
CO2	K4	3	3	3	3	3	2	1	1	2	2	2	3	3	3
CO3	K3	3	3	3	3	3	2	2	1	2	2	2	3	3	3
CO4	K4	3	3	3	3	3	3	2	2	2	2	2	3	3	3
CO5	K3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
Weighted Average		3	3	3	3	3	2	2	2	2	2	2	3	3	3

3 – Substantial **2- Moderate** **1- Low** **‘-‘ – No Correlation**

Text Books	
1.	Kelsey Hightower, Brendan Burns, Joe Beda, "Kubernetes: Up and Running," O'Reilly Media, 2nd Edition, 2021.
2.	Nigel Poulton, "Docker Deep Dive," Independently published, 2020.
	Brendan Gregg, "Systems Performance: Enterprise and the Cloud," Addison-Wesley,2nd Ed, 2020.

Reference Books	
1.	Marko Lukša, "Kubernetes in Action," Manning Publications, 2nd Edition, 2021
2.	Sam Newman, "Building Microservices," O'Reilly Media, 2nd Edition, 2021

Approved by BoS Chairman

B.E / B.Tech	B23CSE910-SERVERLESS ARCHITECTURE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals and evolution of serverless computing in cloud architecture.
2.	To learn design patterns for building scalable and cost-effective serverless applications.
3.	To gain proficiency in implementing serverless solutions using leading cloud platforms and tools.
4.	To acquire practical skills in developing, testing, deploying, and managing serverless applications.
5.	To explore advanced serverless concepts like event-driven design, security, and cloud integration.

UNIT - I	INTRODUCTION TO SERVERLESS COMPUTING	9

Evolution of Cloud Computing and Serverless Paradigm - Serverless Architecture Principles and Concepts - Comparison with Traditional Architectures: Monolithic, SOA, Microservices - Function-as-a-Service (FaaS) and Backend-as-a-Service (BaaS) - Benefits and Challenges of Serverless Computing - Pay-per-use Model and Cost Optimization - Stateless Architecture and Cold/Warm Starts - Event-driven Programming Models - Serverless Ecosystem and Market Overview

UNIT - II	SERVERLESS ON MAJOR CLOUD PLATFORMS	9

AWS Lambda and AWS Serverless Ecosystem - Azure Functions and Azure Serverless Services - Google Cloud Functions and Google Cloud Run - IBM Cloud Functions and OpenWhisk - Serverless Framework for Cross platform Development - Function Deployment Models and Management - Triggers and Event Sources - Function Configuration and Runtime Environments - Cloud specific Limitations and Considerations - Serverless API Gateway Implementation

UNIT - III	SERVERLESS APPLICATION DESIGN PATTERNS	9

Event-Driven Architectures with Serverless - Asynchronous Processing Patterns - Choreography vs. Orchestration in Serverless - Fan-out/Fan-in Patterns for Parallel Processing - Circuit Breaker and Retry Patterns - Serverless Microservices Design - Saga Pattern for Distributed Transactions - CQRS and Event Sourcing with Serverless - API Composition and Aggregation Patterns - Strangler Pattern for Legacy Migration to Serverless

Approved by BoS Chairman

UNIT - IV	SERVERLESS DATA MANAGEMENT AND INTEGRATION	9
Data Persistence Options in Serverless Architectures - NoSQL Database Integration: DynamoDB, Cosmos DB, Firestore - Relational Database Access Patterns in Serverless - Object Storage Integration: S3, Azure Blob, Google Cloud Storage - Message Queues and Event Buses: SQS, SNS, Event Grid, Pub/Sub - Stream Processing with Serverless: Kinesis, Event Hubs, Dataflow - API Management and Service Mesh Integration - Serverless ETL and Data Processing Pipelines - Caching Strategies in Serverless Applications - Serverless Integration with Big Data and ML Services		

UNIT - V	ADVANCED SERVERLESS ARCHITECTURE	9
Serverless Security: Authentication, Authorization, and Data Protection - Monitoring, Logging, and Observability in Serverless Applications - Serverless Testing Strategies and Tools - CI/CD for Serverless Applications - Debugging and Troubleshooting Serverless Functions - Performance Optimization Techniques - Cost Management and Optimization Strategies - Multi region Deployment and Disaster Recovery - Hybrid Serverless Architectures with Containers.		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Apply serverless architecture concepts to build cloud-based applications.
CO2	Develop serverless applications using cloud platforms like AWS, Azure, and Google Cloud.
CO3	Analyze event-driven serverless architectures for better performance.
CO4	Evaluate serverless deployment, monitoring, and security strategies.
CO5	Assess cost, performance, and hybrid serverless solutions for enterprises.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K3**	3	2	2	2	3	2	1	1	2	2	2	3	3	3
CO2	**K3**	3	3	3	3	3	2	1	1	2	2	2	3	3	3
CO3	**K4**	3	3	3	3	3	2	2	1	2	2	2	3	3	3
CO4	**K4**	3	3	3	3	3	3	2	2	2	2	2	3	3	3
CO5	**K4**	3	3	3	3	3	3	3	2	3	3	3	3	3	3
Weighted Average		3	3	3	3	3	3	2	2	2	2	2	3	3	3

Approved by BoS Chairman

3 – Substantial **2- Moderate** **1- Low** **‘-‘ – No Correlation**

Text Books	
1.	John Chapin and Mike Roberts, "What Is Serverless?", O'Reilly Media, 2020
2.	Peter Sbarski, "Serverless Architectures on AWS", Manning Publications, 2nd Edition, 2021
3.	Jason Katzer, "Programming AWS Lambda: Build and Deploy Serverless Applications with Java", O'Reilly Media, 2020

Reference Books	
1.	Paolo Mainardi, "Serverless: A Complete Guide", Independently published, 2021
2.	Yan Cui, "Production-Ready Serverless", Manning Publications, 2021

Approved by BoS Chairman

B.E / B.Tech	B23CSE911- EDGE COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of edge computing and its differences from cloud computing.
2.	To study the architecture, platforms, and technologies that enable edge computing.
3.	To explore data processing models and analytics at the edge.
4.	To analyze resource management, security, and privacy challenges in edge environments.
5.	To evaluate real-world applications and use cases of edge computing.

UNIT - I	INTRODUCTION TO EDGE COMPUTING	9
Definition, Need for Edge Computing – Cloud vs. Edge – Edge and Fog Computing – Benefits and Limitations – Use Cases: Industrial IoT, Smart Cities, Autonomous Vehicles – Edge Computing Architecture – Components and Layers.		

UNIT - II	ENABLING TECHNOLOGIES AND INFRASTRUCTURE	9
Edge Devices, Gateways, and Sensors – Edge Data Centers – Role of 5G – Communication Protocols (MQTT, CoAP, AMQP) – Containerization (Docker, Kubernetes) at the Edge – Lightweight Virtualization – Real-time Constraints.		

UNIT - III	EDGE COMPUTING FRAMEWORKS AND PLATFORMS	9
EdgeX Foundry – AWS Greengrass – Microsoft Azure IoT Edge – Google Edge TPU – OpenFog Reference Architecture – Apache NiFi – Edge-Oriented Middleware – Edge Analytics Platforms.		

UNIT - IV	DATA PROCESSING AND MANAGEMENT AT THE EDGE	9
Data Acquisition and Filtering – In-situ Data Processing – Stream Processing at the Edge – AI/ML on Edge Devices – Data Aggregation and Summarization – Data Offloading – Federated Learning – Caching and Storage.		

UNIT - V	SECURITY, PRIVACY AND APPLICATIONS	9
Security Requirements at the Edge – Authentication and Access Control – Secure Data Transmission – Privacy-preserving Mechanisms – Blockchain for Edge – Case Studies: Smart Grid, Healthcare, Intelligent Transportation Systems, AR/VR.		

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Understand the principles, architecture, and use cases of edge computing.
CO2	Identify and deploy key technologies and platforms used in edge environments..
CO3	Apply data processing models and analytics techniques at the edge.
CO4	Evaluate security and privacy challenges and solutions in edge computing.
CO5	Analyze and propose edge-based solutions for real-world application scenarios.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2	3	2	1	1	2	1	1	1	1	2	1	2	2	1
CO2	K2	3	3	2	2	2	1	1	2	2	2	1	2	2	1
CO3	K2	3	3	3	2	3	2	2	2	3	2	2	2	2	1
CO4	K3	3	3	3	3	3	2	2	3	2	2	2	2	2	1
CO5	K3	3	3	3	3	3	3	3	3	3	3	3	3	2	1
Weighted Average		3	3	3	2	3	2	2	2	2	2	1	2	2	1

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Text Books	
1.	Rajkumar Buyya, Satish Narayana Srirama, "Fog and Edge Computing: Principles and Paradigms", Wiley, 2019.
2.	Perry Lea, "Edge Computing: A Primer", O'Reilly Media, 2020.

Reference Books	
1.	Amir Vahid Dastjerdi, Rajkumar Buyya, "Internet of Things: Principles and Paradigms", Morgan Kaufmann, 2016.
2.	Xiaofei Wang, Min Chen, "Edge AI: Convergence of Edge Computing and Artificial Intelligence", Springer, 2020.

Approved by BoS Chairman

B.E / B.Tech	B23CSE912-DATA PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals, significance, and challenges of data privacy in cloud environments.
2.	To learn various data protection techniques and security mechanisms used in cloud computing.
3.	To study legal and regulatory frameworks related to cloud data privacy.
4.	To explore tools and methodologies for maintaining privacy and confidentiality in cloud-based systems.
5.	To explore cloud service models (IaaS, PaaS, SaaS) and their specific privacy concerns.

UNIT - I	INTRODUCTION TO DATA PRIVACY IN CLOUD	9
Fundamentals of Data Privacy - Importance of Data Privacy in the Cloud - Data Privacy Challenges in Cloud Computing - Overview of Cloud Computing and Cloud Service Models (IaaS, PaaS, SaaS) - Cloud Security and Privacy Landscape - Cloud Computing Benefits vs. Data Privacy Risks - Cloud Data Breaches and Privacy Concerns - Risk Management in Cloud Data Privacy.		

UNIT - II	DATA PROTECTION TECHNIQUES IN CLOUD	9
Data Encryption Techniques in the Cloud - Data Masking and Tokenization - Privacy-Preserving Data Mining - Identity and Access Management in Cloud - Secure Multi-Party Computation in the Cloud - Data Loss Prevention (DLP) Solutions - Privacy by Design and Data Minimization Principles.		

UNIT - III	LEGAL, ETHICAL, AND REGULATORY ISSUES	9
Privacy Laws and Regulations (GDPR, CCPA, HIPAA) - Data Protection and the Cloud: Compliance Challenges - Legal Frameworks for Cloud Data Privacy - Ethics of Data Privacy in the Cloud - Cross-border Data Transfers and Jurisdictional Concerns - Legal Implications of Data Breaches in Cloud Services.		

UNIT - IV	CLOUD DATA PRIVACY MANAGEMENT	9
Data Ownership and Control in the Cloud - Data Integrity and Availability in Cloud Environments - Techniques for Auditing Cloud Services for Data Privacy - Risk Management Strategies for Cloud Privacy - Privacy Threats and Vulnerabilities in Cloud Environments - Incident Response for Data Breaches in the Cloud..- Global Privacy Regulations and Their Impact on Cloud Services.		

Approved by BoS Chairman

UNIT - V	ADVANCED TOPICS IN CLOUD DATA PRIVACY	9
Privacy Challenges in Hybrid and Multi-Cloud Environments - Cloud Privacy and Blockchain Technology - Privacy in Cloud-Based IoT Systems - Privacy-Enhanced Technologies for Cloud Security - Case Studies on Cloud Data Privacy Breaches - Future Trends in Cloud Privacy Protection - Serverless Computing and Data Privacy - Cloud-Native Security Tools and Privacy Enhancements.		

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Outline the fundamentals and challenges of data privacy in cloud computing.
CO2	Identify and apply data protection techniques in cloud environments.
CO3	Classify legal, ethical, and regulatory requirements for data privacy in the cloud.
CO4	Apply cloud data privacy, including data ownership, control, and compliance.
CO5	Analyze and apply advanced data privacy strategies for complex cloud environments.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2	1	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	K3	2	3	-	-	-	2	1	1	-	-	-	-	3	2
CO3	K3	2	3	-	2	-	1	1	1	2	1	-	-	3	2
CO4	K3	2	3	3	2	3	2	1	1	-	-	-	3	2	-
CO5	K3	2	3	3	2	3	1	1	-	-	-	-	3	2	-
Weighted Average		2	3	3	2	3	2	1	1	2	1	-	3	3	2

3 – Substantial **2- Moderate** **1- Low** **‘-‘ – No Correlation**

Approved by BoS Chairman

Text Books	
1.	Harrison, L., "Data Privacy in the Cloud: A Hands-On Guide," Wiley, 2019.
2.	Kennes, W., & Rees, M., "Cloud Security and Privacy: A Practical Guide," O'Reilly Media, 2020.

Reference Books	
1.	Chander, A., & Lior, T., "Cloud Computing and Data Privacy," Cambridge University Press, 2018.
2.	Mell, P., & Grance, T., "The NIST Cloud Computing Security Reference Architecture," NIST Special Publication 500-292, 2019.
3.	Sill, E., "Data Privacy in Cloud Computing: Regulation and Compliance," CRC Press, 2021.
4.	Weston, P., & Zhang, D., "Securing Data in the Cloud: Privacy, Compliance, and Risk Management," Springer, 2017.

B.E / B.Tech	B23CSE913-PRINCIPLES OF BLOCKCHAIN AND DISTRIBUTED TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To provide a fundamental understanding of blockchain and distributed ledger technologies.
2.	To introduce the cryptographic principles and consensus mechanisms in blockchain networks.
3.	To explore a smart contract development and blockchain frameworks.
4.	To explain different blockchain models and their security challenges.
5.	To analyze the real-world applications of blockchain in various industries.

UNIT - I	INTRODUCTION	9
Basics of Distributed Ledger Technology (DLT), Centralized vs. Decentralized vs. Distributed Systems, Blockchain Structure, Blocks, Transactions, Nodes, Types of Blockchains: Public, Private, Consortium, Overview of Web3 and Decentralization, Case Study: Bitcoin & Ethereum.		

UNIT - II	CRYPTOGRAPHY AND CONSENSUS MECHANISMS	9
Cryptographic Hash Functions: SHA-256, Keccak-256, Public and Private Key Cryptography: RSA, ECC, Digital Signatures and Merkle Trees, Consensus Mechanisms: Proof of Work (PoW), Proof of Stake (PoS), Delegated PoS (DPoS), Proof of Authority (PoA), Byzantine Fault Tolerance (BFT).		

UNIT - III	SMART CONTRACTS AND SOLIDITY PROGRAMMING	9
Smart Contracts: Definition, Features, and Execution, Ethereum Virtual Machine (EVM) and Gas Fees, Solidity Basics: Variables, Functions, Events, Developing and Deploying Smart Contracts using Remix IDE, Token Standards: ERC-20 (Fungible), ERC-721 (NFTs), ERC-1155 (Multi-Token), Introduction to Decentralized Applications (DApps)		

UNIT - IV	BLOCKCHAIN FRAMEWORKS AND TECHNOLOGIES	9
Blockchain Platforms: Ethereum, Hyperledger Fabric, Corda, Binance Smart Chain, Permissioned vs. Permissionless Blockchains, Consensus Mechanisms Used in Frameworks (PBFT, PoS, PoA), Smart Contract Development in Different Frameworks, Tokenization and Digital Assets, Challenges in Blockchain Adoption: Scalability, Security, Governance, Energy Consumption.		

UNIT - V	APPLICATIONS OF BLOCKCHAIN	9
Blockchain in Finance, Blockchain in Supply Chain Management, Blockchain in Healthcare, Blockchain in Voting Systems, Blockchain in Digital Identity, Blockchain in Entertainment & Media, Blockchain in IoT.		

Approved by BoS Chairman

Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Explain Blockchain Basics & Distributed Ledger Technology
CO2	Apply Cryptography and Consensus Mechanisms
CO3	Develop and Deploy Smart Contracts
CO4	Analyze Blockchain Frameworks and Technologies
CO5	Examine the Blockchain Applications in Industries

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2	3	3	3	2	2	2	-	-	1	1	-	3	2	3
CO2	K3	3	3	3	2	2	2	-	-	1	1	-	3	2	3
CO3	K3	3	3	3	3	2	2	-	-	1	1	-	3	3	3
CO4	K4	3	3	3	3	2	2	-	-	1	1	-	3	3	3
CO5	K4	3	3	3	3	2	2	-	-	1	1	-	3	3	3
Weighted Average		3	3	3	3	2	2	-	-	1	1	-	3	3	3

– Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Text Books	
1.	"Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications" Imran Bashir, 4th Edition, 2023
2.	"Blockchain Security and Privacy: Threats and Countermeasures" by Feng Hao, Dylan Yaga, Artech House, 2020.

Reference Books	
1.	"Cryptography and Network Security: Principles and Practice" by William Stallings, Pearson Education, 8th Edition (2022)
2.	"Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher, Apress, 2017
3.	"Mastering Ethereum: Building Smart Contracts and DApps" by Andreas M. Antonopoulos, Gavin Wood, O'Reilly Media, 1st Edition (2018)

Approved by BoS Chairman

B.E / B.Tech	B23CSE914-FEDERATED COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamental concepts of federated computing and its role in distributed systems and privacy-preserving machine learning.
2.	To master the architectural principles and algorithmic foundations of federated learning and computing frameworks.
3.	To develop proficiency in implementing federated learning models across heterogeneous devices and networks.
4.	To gain practical skills in addressing security, privacy, and communication challenges in federated computing environments.
5.	To explore advanced applications of federated computing in IoT, edge computing, healthcare, and enterprise systems.

UNIT - I	INTRODUCTION TO FEDERATED COMPUTING	9

Evolution of Distributed Computing and Emergence of Federated Computing - Federated Computing Paradigm and Core Principles - Comparison with Centralized, Distributed, and Decentralized Computing - Privacy-Preserving Machine Learning Fundamentals - Federated Learning Architecture and Ecosystem – Cross Device vs. Cross-Silo Federated Learning - Benefits and Challenges of Federated Computing - Industry Applications and Use Cases - Key Players and Research Directions in Federated Computing

UNIT – II	FEDERATED LEARNING ALGORITHMS AND MODELS	9

Federated Averaging (FedAvg) and Its Variants - Model Aggregation Techniques and Weighted Averaging - Optimization Algorithms for Federated Learning - Stochastic Gradient Descent in Federated Settings - Handling Non-IID Data and System Heterogeneity - Model Personalization in Federated Learning - Transfer Learning and Knowledge Distillation in Federated Systems - Convergence Analysis and Performance Metrics - Federated Neural Network Architectures - Federated Reinforcement Learning

UNIT – III	PRIVACY AND SECURITY IN FEDERATED COMPUTING	9

Differential Privacy in Federated Learning - Secure Multi-party Computation Techniques - Homomorphic Encryption for Federated Applications - Secure Aggregation Protocols - Adversarial Attacks on Federated Systems - Poisoning and Model Inversion Attacks - Byzantine-Robust Federated Learning - Trusted Execution Environments - Secure Hardware for Federated Computing – Privacy Preserving Techniques and Trade-offs

UNIT – IV	SYSTEMS AND INFRASTRUCTURE FOR FEDERATED COMPUTING	9

Communication Efficiency in Federated Computing - Resource Allocation and Scheduling - Edge Computing Integration with Federated Learning - Federated Computing for IoT and Mobile Devices - Client Selection Strategies and Participation Models - Heterogeneous Device Management - Fault Tolerance and Recovery Mechanisms - Synchronous vs. Asynchronous Federated Computing - Federated Computing Frameworks and Platforms - Deployment Patterns and Architectural Considerations

UNIT – V	ADVANCED APPLICATIONS AND FUTURE DIRECTIONS	9

Federated Computing in Healthcare and Medical Applications - Financial Services and Federated Analytics - Smart Cities and Intelligent Transportation Systems - Federated Natural Language Processing - Federated Computer Vision Applications - Vertical Federated Learning for Cross-Organization Collaboration - Federated Reinforcement Learning for Autonomous Systems - Regulatory Considerations and Compliance - Federated Computing Business Models - Emerging Trends and Research Challenges

Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Recall federated computing concepts to develop privacy-sensitive applications.
CO2	Classify federated learning models in distributed environments.
CO3	Analyze security and privacy challenges in federated systems.
CO4	Optimize communication and resource allocation in federated computing.
CO5	Evaluate federated computing applications in healthcare, finance, and IoT.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K3	3	2	2	2	3	2	1	1	2	2	2	3	3	3
CO2	K3	3	3	3	3	3	2	1	1	2	2	2	3	3	3
CO3	K4	3	3	3	3	3	2	2	1	2	2	2	3	3	3
CO4	K4	3	3	3	3	3	3	2	2	2	2	2	3	3	3
CO5	K4	3	3	3	3	3	3	3	2	3	3	3	3	3	3
Weighted Average		3	3	3	3	3	3	2	2	2	2	2	3	3	3

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

Text Books	
1.	Qiang Yang, Yang Liu, Tianjian Chen, and Yongxin Tong, "Federated Machine Learning: Concept and Applications," ACM Transactions on Intelligent Systems and Technology, 2019
2.	Liang Xiong and Mehryar Mohri, "Privacy-Preserving Deep Learning," O'Reilly Media, 2022

Reference Books	
1.	Peter Kairouz et al., "Advances and Open Problems in Federated Learning," Foundations and Trends in Machine Learning, 2021
2.	Virginia Smith and Aurélien Bellet, "Federated Learning: Challenges, Methods, and Future Directions," Morgan & Claypool Publishers, 2022

B.E / B.Tech	B23CSE915-ETHICAL HACKING: TOOLS AND TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the fundamentals of ethical hacking and its role in cybersecurity.
2.	To develop skills in penetration testing and vulnerability assessment.
3.	To familiarize students with ethical hacking tools and techniques.
4.	To explore advanced topics such as network security, web application security, and wireless
5.	To prepare students for real-world ethical hacking challenges and certifications.

UNIT - I	INTRODUCTION TO ETHICAL HACKING	9
Overview of Ethical Hacking: Definition, Importance, and Legal Aspects - Types of Hackers: White Hat, Black Hat, and Grey Hat - Phases of Ethical Hacking: Reconnaissance, Scanning, Gaining Access, Maintaining Access, and Covering Tracks - Cybersecurity Laws and Ethics - Case Studies: Real-World Ethical Hacking Scenarios		

UNIT - II	PENETRATION TESTING AND VULNERABILITY ASSESSMENT	9
Introduction to Penetration Testing: Types and Methodologies - Vulnerability Assessment: Tools and Techniques - Common Vulnerabilities and Exposures (CVEs) - Exploitation Techniques: Buffer Overflow, SQL Injection, and Cross-Site Scripting (XSS)		

UNIT - III	NETWORK SECURITY AND HACKING	9
Network Scanning and Enumeration - Sniffing and Spoofing: Tools and Techniques - Man-in-the-Middle (MITM) Attacks - Firewall and IDS Evasion Techniques		

UNIT - IV	WEB APPLICATION SECURITY	9
Web Application Vulnerabilities: OWASP Top 10 - Web Application Penetration Testing: Tools and Techniques - Session Hijacking and Cookie Stealing - Secure Coding Practices		

UNIT - V	WIRELESS SECURITY AND ADVANCED TOPICS	9
Wireless Network Security: WEP, WPA, and WPA2 - Wireless Hacking Techniques: Rogue Access Points and Evil Twin Attacks - Social Engineering and Phishing Attacks - Incident Response and Forensics		

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Demonstrate knowledge of ethical hacking fundamentals and methodologies.
CO2	Make use of penetration testing and vulnerability assessments using industry-standard tools.
CO3	Analyze and secure network infrastructure against common attacks.
CO4	Identify and mitigate web application vulnerabilities.
CO5	Classify wireless security challenges and implement incident response strategies.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO 2 (K4)	PO3 (K5)	PO 4 (K5)	PO 5 (K6)	PO6 (K3) (A3)	PO 7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K2**	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO2	**K3**	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO3	**K4**	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO4	**K3**	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO5	**K2**	3	2	2	-	1	-	-	-	-	-	1	1	2	2
Weighted Average		3	2	2	-	1		-	-	-	-	1	1	2	2

3 – Strong 2- Moderate 1- Weak ‘-‘ – No Correlation

Text Books	
1.	EC-Council, “CEH v11: Certified Ethical Hacker Study Guide”, Wiley, 2021.
2.	Patrick Engebretson, “The Basics of Hacking and Penetration Testing”, Third Edition, Syngress, 2018.
3.	Peter Kim, “The Hacker Playbook 3: Practical Guide To Penetration Testing”, Third Edition, Secure Planet, 2018.

Reference Books	
2.	Georgia Weidman, “Penetration Testing: A Hands-On Introduction to Hacking”, No Starch Press, 2014.
3.	Jon Erickson, “Hacking: The Art of Exploitation”, Second Edition, No Starch Press, 2008.

Approved by BoS Chairman

B.E / B.Tech	B23CSE916-CYBERCRIME INVESTIGATION TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the fundamentals of cybercrime and its impact on society.
2.	To develop skills in digital forensics and evidence collection.
3.	To familiarize students with cybercrime investigation tools and techniques.
4.	To explore advanced topics such as network forensics, malware analysis, and incident response.
5.	To prepare students for real-world cybercrime investigation challenges and legal compliance.

UNIT - I	INTRODUCTION TO CYBERCRIME	9

Overview of Cybercrime: Definition, Types, and Trends - Cybercrime Laws and Regulations: IT Act, GDPR, and Cybercrime Conventions - Cybercrime Investigation Process: Identification, Preservation, Analysis, and Reporting - Roles and Responsibilities of Cybercrime Investigators - Case Studies: Real-World Cybercrime Scenarios

UNIT - II	DIGITAL FORENSICS FUNDAMENTALS	9

Introduction to Digital Forensics: Principles and Methodologies - Types of Digital Evidence: Volatile and Non-Volatile - Data Acquisition and Preservation: Imaging and Hashing - Forensic Tools: FTK, EnCase, and Autopsy - Case Studies: Digital Forensics in Cybercrime Investigations

UNIT - III	NETWORK FORENSICS AND INCIDENT RESPONSE	9

Network Forensics: Capturing and Analyzing Network Traffic - Intrusion Detection and Prevention Systems (IDS/IPS) - Incident Response: Preparation, Identification, Containment, Eradication, and Recovery - Log Analysis and Timeline Reconstruction

UNIT - IV	MALWARE ANALYSIS AND CYBERCRIME TOOLS	9

Introduction to Malware: Types and Behavior - Static and Dynamic Malware Analysis - Reverse Engineering and Debugging - Cybercrime Investigation Tools: Volatility, Cuckoo Sandbox, and Ghidra - Case Studies: Malware Analysis in Cybercrime Investigations

UNIT - V	LEGAL AND ETHICAL ASPECTS OF CYBERCRIME INVESTIGATION	9

Legal Frameworks for Cybercrime Investigations - Chain of Custody and Admissibility of Digital Evidence - Ethical Considerations in Cybercrime Investigations - Reporting and Documentation: Writing Forensic Reports - Case Studies: Legal Challenges in Cybercrime Investigations

Approved by BoS Chairman

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Demonstrate knowledge of cybercrime fundamentals and legal frameworks.
CO2	Perform digital forensics and evidence collection using industry-standard tools.
CO3	Analyze network traffic and respond to cybersecurity incidents.
CO4	Conduct malware analysis and reverse engineering.
CO5	Address legal and ethical challenges in cybercrime investigations.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K2**	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO2	**K3**	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO3	**K3**	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO4	**K3**	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO5	**K3**	3	2	2	-	1	-	-	-	-	-	1	1	2	2
Weighted Average		3	2	2	-	1		-	-	-	-	1	1	2	2

3 – Strong **2- Moderate** **1- Weak** **‘-‘ – No Correlation**

Text Books

1.	Thomas J. Holt, Adam M. Bossler, and Kathryn C. Seigfried-Spellar, “Cybercrime and Digital Forensics: An Introduction”, Second Edition, Routledge, 2020.
2.	Cory Altheide and Harlan Carvey, “Digital Forensics with Open Source Tools”, Second Edition, Syngress, 2019.

Reference Books

1.	Michael Sikorski and Andrew Honig, “Practical Malware Analysis”, Second Edition, No Starch Press, 2020.
2.	John Bandler and Antonia Merzon, “Cybercrime Investigations: A Comprehensive Resource for Everyone”, First Edition, CRC Press, 2020.

Approved by BoS Chairman

Vertical–II
Emerging Technologies

B.E / B.Tech	B23AME901 - ROBOTIC PROCESS AND AUTOMATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand fundamental concepts and principles of Robotic Process Automation (RPA).
2.	To install and activate UiPath, and demonstrate debugging techniques and the utilization of UiPath Orchestrator.
3.	To apply advanced data manipulation techniques using collections and data tables in RPA and analyze elements using RPA Techniques.
4.	To implement exception handling techniques in RPA, utilize logging, debugging, and error reporting methods to evaluate bot performance.
5.	To understand the concept of RPA bots, their configuration, management, security, and functionality of an Orchestration Server.

UNIT - I	RPA METHODOLOGIES	9
Introduction to RPA - Definition - Importance and Benefits of RPA - RPA Skills - RPA Application. Comparision of RPA with BPO- BPM- BPA and Traditional Automation. Components and Architecture of RPA. Agile Methodology and its importance in RPA.		

UNIT - II	RPA ENVIROMENT	9
Introduction to UiPath: Installation and activation-UiPath Activities: Flowcharts - Sequences and Data Manipulation - UiPath Variables and Data Types-Debugging techniques in UiPath-Overview of UiPath Orchestrator: BOT Development and Management-UiPath Automation Best Practices, RPA Tools and Interface.		

UNIT - III	ADVANCED RPA	9
Data Manipulation: Collections and Data Table Usage-File Operations: CSV/Excel to data table and vice versa-Working with UiExplorer and Desktop Automation-Web Automation: Basic and Desktop Recording-Advanced Screen Scraping Techniques-Data Scraping and Extraction from Websites. Case study : UI Automation, work with API and Database in RPA		

UNIT - IV	FILE AND EVENTS HANDLING IN RPA	9
Exception Handling Techniques and Tools: Try-Catch - Re-throwing Exceptions and Custom Exception Handling Logging – Debugging - Error Reporting Techniques and RPA Tools used in Error Handling-Handling User Events: Assistant bots - System Event Triggers and Image and Element Triggers-Monitoring Techniques in RPA - Launching an Assistant bot on a Keyboard Event. Case Study: Real world example in API Handling, Deploy RPA bot in an application.		

UNIT - V	DEPLOYMENT AND MAINTENANCE OF BOT	9
What is BOT?, Configuration and Management of BOT - Security in BOT. Overview of Orchestration Server and its functionalities - Orchestrator to Control Bots and Deploy Bots Uploading Packages - Managing Packages and Deleting Packages- Case Study : Cloud In BOT, RPA Bot In Different Industry, Future Bot In RPA.		

Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Define RPA, its importance, benefits in automation, RPA architecture and components.
CO2	Infer UiPath, including installation and activation, UiPath Orchestrator for bot management and deployment.
CO3	Make use of practical knowledge of UI automation and integrating APIs and databases in RPA scenarios.
CO4	Develop a hands-on experience in handling API integrations and deploying RPA bots into production environments.
CO5	Understand the bot configuration, management, and deploy bots securely.

Approved by BoS Chairman

Text Books	
1.	Tom Taulli, “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Monrovia, CA, USA, A Press, 2020.
2.	Christian Czarnecki, Peter Fettke, “Robotic Process Automation: Management, Technology, Applications”, 2021.

Reference Books	
1.	"Learning Robotic Process Automation" by Alok Mani Tripathi
2.	"Robotic Process Automation and Cognitive Automation: The Next Phase" by Mary C. Lacity and Leslie Willcocks

Approved by BoS Chairman

B.E / B.Tech	B23AME902 – GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To Understand game genres and their visual requirements.
2.	To create engaging game narratives and balanced mechanics across all production phases.
3.	To optimize game performance and dynamics through efficient rendering, algorithms, collision
4.	To Learn Pygame, Unity, mobile games, scripting, multiplayer, 2D/3D games, and avatar design.
5.	To the integration of graphics, sound, assets, physics, and device handling in isometric, tile-based, and puzzle game design.

UNIT - I	3D MODELING AND ANIMATION FOR GAMES	9
Game Frameworks, Core Concepts of 2D and 3D Game Character Design, Game Components – 2D and 3D Transformations – Projections – Color Models – Camera and Projections, Culling and Clipping – Animation - Scene Graphs.		

UNIT - II	GAME DESIGN AND PRINCIPALS	9
Character Crafting, Game Plot Development – Script Design – Script Narration, Game Balancing, Finite State Machines (FSMs) for AI behaviour modelling – Proposals – Writing for Preproduction, AI-driven enemy behaviour and NPC interactions.		

UNIT - III	ML IN GAME DEVELOPMENT	9
Introduction to machine learning in games - Reinforcement learning in gaming -Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms -Algorithms for Game Engine-Crash Detection – Gameplay Dynamics – Game AI – Path finding.		

UNIT - IV	ML APPLICATIONS AND GAMING PLATFORM	9
Mobile Gaming Introduction- Unity -Unity scripts, Unity ML Agents -Single and Multiplayer games-game studio -Use cases (Non-player character- Anti cheating measure- Procedural context generation)		

Approved by BoS Chairman

UNIT - V	GAME DEVELOPMENT USING PYGAME	9
To architect immersive 2D and 3D interactive experiences using Pygame- emphasizing avatar design- advanced graphics programming, seamless audio integration- asset creation, physics algorithm development- and proficient device handling- while delving into isometric.		

Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Understand the Proficiency in tailoring visual designs to suit various game genres.
CO2	Develop the cohesive narratives and balanced mechanics throughout development.
CO3	Identify the game performance through efficient rendering, algorithms, and collisions.
CO4	Make use of Expert in 2D/3D game development with Pygame, Unity, and mobile.
CO5	Plan the integrating graphics, sound, and physics for various game types.

Text Books	
1.	Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig
2.	Mike Mc Shaffrfy and David Graham, “Game Coding Complete”, Fourth Edition, Cengage Learning, PTR, 2012.

Reference Books	
1.	Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison Wesley, 2013.
2	Paul Craven, “Python Arcade games”, Apress Publishers, 2016.
3	Machine Learning for Game Developers by Darrin P. O'Neill.

Approved by BoS Chairman

B.E / B.Tech	B23AME903 - EXPERT SYSTEM	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To Introduce the fundamental concepts of Machine Learning (ML) and Expert Systems (ES).
2.	To Understand the key techniques like regression and classification.
3.	To Explore the concept of unsupervised learning and its applications.
4.	To Gain an understanding of the principles of knowledge representation in expert systems.
5.	To Study the principles of reinforcement learning and its real-world applications.

UNIT - I	INTRODUCTION TO ML&ES	9
Introduction to Expert Systems- Rule-based Expert Systems- Case-Based Expert Systems-Overview of AI, ML, and Expert Systems- Components of an Expert System- Knowledge Base, Inference Engine, Knowledge Acquisition.		

UNIT - II	SUPERVISED LEARNING	9
Introduction to Supervised Learning- ML Algorithms and Expert Systems Integration -State space search – Production Systems –Structures and phase of an expert system.		

UNIT - III	ML SYSTEM DESIGN	9
Pattern Recognition System & Machine Learning (ML)- Vision System Architecture & ML-Rule based system Architecture- Knowledge Acquisition - Validation in AI and ML- Knowledge System Building Tools in AI&ML- Use of AI, ES, and ML in Manufacturing and Design-Comparison between AI, ES,ML.		

UNIT - IV	GEN-AI	9
Genetic Algorithm in AI, Fundamental of Gen AI, Combining Genetic Algorithm with Expert System, Application Of Genetic AI, Advantages and Disadvantages of GEN AI.		

UNIT - V	APPLICATIONS AND CASE STUDIES	9
Expert system and Applications: Introduction, phases in building expert systems, expert system architecture, expert system versus traditional systems.		

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes : Students will be able to	
CO1	Outline the foundational understanding of both ML and ES.
CO2	Demonstrate the implementation of production systems using rule-based approaches.
CO3	Outline the structure of rule-based systems in expert systems.
CO4	Explain how Genetic Algorithms are applied to solve optimization and search problems in AI.
CO5	Compare expert systems with traditional systems in terms of problem-solving capabilities and design.

Text Books	
1.	Principles and Programming" by Joseph C. Giarratano and Gary D. Riley.
2.	Expert Systems: A Practical Introduction by B. G. Buchanan and E. H. Shortliffe.

Reference Books	
1.	Stuart Russell & Peter Norvig , "Artificial Intelligence A Modern Approach", Perason, 2 nd Edition.
2.	George F Luger , "Artificial Intelligence", Pearson 2002, 4th Edition
3.	V S Janaki Raman, K Sarukesi, P Gopalakrishnan, "Foundations of Artificial Intelligent and Expert Systems", MacMillan India limited.

Approved by BoS Chairman

B.E / B.Tech	B23AME904 - STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of storage systems and their components.
2.	To explore different storage architectures, including block, file, object storage and Virtualization.
3.	To learn about advanced Intelligent Storage System and RAID.
4.	To understand data management, security, and backup/recovery methods in storage technologies.
5.	Understand the security challenges associated with different types of storage infrastructure.

UNIT - I	SYSTEM STORAGE	9

Introduction to Storage system: types of Storage device, Storage System Architecture. Information storage and its types, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure. Data Center Environment: Building blocks of a datacenter, Compute systems and compute virtualization and Software-defined data center.

UNIT - II	STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION	9

Storage architecture- Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: FC SAN components and architecture - FC SAN topologies, SAN Configuration and Maintenance Tools. Storage Virtualization – Concepts, Technologies and Tools. Internet Protocol in SAN.

UNIT - III	INTELLIGENT STORAGE SYSTEMS AND RAID	9

Introduction to Intelligent Storage System and its types- Components of an intelligent storage system, Scale-up and scale-out storage Architecture, RAID – RAID Technology, Data Caching and Tiering and Performance Tuning.

Approved by BoS Chairman

UNIT - IV	BACKUP, ARCHIVE AND REPLICATION	9
Introduction to Backup, Backup architecture, Backup targets and methods, Data Integrity and Error Recovery, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS). Case Study: Business Continuity to Backup Process, Cloud Based Mobile Backup.		

UNIT - V	STORAGE INFRASTRUCTURE AND SECURITY	9
Overview of Storage Infrastructure, Threats to a storage infrastructure, Key principal of Storage Security, Security controls to protect a storage infrastructure, Cloud based Storage Security, Storage infrastructure management functions, Storage infrastructure management processes. Case Study: Future Trends In AI Security		

Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Demonstrate the fundamentals of storage management system and various models of Cloud infrastructure services and deployment.
CO2	Interpret various storage networking architectures - SAN, and virtualization.
CO3	Illustrate the usage of advanced intelligent storage systems and RAID.
CO4	Examine the different role in providing disaster recovery and remote replication technologies.
CO5	Infer the security needs and security measures to be employed in information storage management.

Approved by BoS Chairman

Reference Books	
1.	"Storage Networking Protocols: The Complete Guide to Fibre Channel, iSCSI, and FCoE" by Ulf Troppens, Rainer Erkens, and Wolfgang Mueller-Friedt (2020).
2.	"Data Center Virtualization Fundamentals: Understanding Techniques and Designs for Scalable Data Centers with VMware" by Gustavo A. A. Santana (2020).
3.	"Storage Networks: The Complete Reference" by Robert Spalding (2020).

Text Books	
1.	EMC Corporation, Information Storage and Management, Wiley, India.
2.	Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017.

Approved by BoS Chairman

Approved by BoS Chairman

B.E. - CSE(AI&ML)	B23AME905 - NATURE INSPIRED COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand parallelism, distributive, adaptation, and self-organization in nature-inspired computing
2.	To develop an understanding of how nature-inspired algorithms can be applied to real-world problems in various domains.
3.	To examine swarm intelligence techniques, such as ant colony optimization (ACO) and particle swarm optimization (PSO), and their applications models.
4.	To analyze the working principles of the immune system and its role in developing immune-inspired computational models
5.	To explore DNA computing, its fundamental concepts, and its application in solving complex computational problems.

UNIT- I	FOUNDATIONS OF NATURAL COMPUTING SYSTEMS	9

From Nature to Nature Computing , Philosophy , Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity Interactivity, Adaptation Feedback-Self-Organization - Complexity, Emergence and ,Bottom-up Vs Top-Down- Determination, Chaos and Fractals.

UNIT - II	NATURE-INSPIRED COMPUTING	9

Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms , Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming

UNIT - III	EMERGENT BEHAVIOR IN COLLECTIVE SYSTEMS	9

Particle Swarm Optimization Algorithm, Hybrid PSO algorithms, Ant Colony Optimization, Artificial Bee Colony, Firefly Algorithm

UNIT - IV	COMPUTATIONAL MODELS AND IMMUNE SYSTEM	9
Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding , Immune Network Theory- Danger Theory, Evaluation Interaction Immune Algorithms , Introduction – Genetic algorithms , Bone Marrow Models , Forest's Algorithm, Artificial Immune Networks		

UNIT - V	NEXT-GENERATION COMPUTING WITH NATURAL MATERIALS	9
DNA Computing: Motivation, DNA Molecule , Adleman's experiment , Test tube programming language, Universal DNA Computers , PAM Model , Splicing Systems , Lipton's Solution to SAT Problem , Scope of DNA Computing , From Classical to DNA Computing		

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Recall fundamental concepts of natural computing, parallelism, distributivity, and complexity.
CO2	Build the principles of evolutionary computing, genetic algorithms, and simulated annealing.
CO3	Develop the working mechanisms of swarm intelligence techniques, including ant colony optimization and particle swarm optimization
CO4	Identify key components of immune computing models, such as immune system mechanisms and artificial immune networks.
CO5	Choose the concepts of DNA computing, Adleman's experiment, and test tube programming.

Text Books	
1.	Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007.

Reference Books	
1.	Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
2.	Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
3.	Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI,2005

B.E. - CSE(AI&ML)	B23AME906 - COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the nature of cognitive science and artificial intelligence and machine learning
2.	To know the theoretical background of cognition
3.	To learn basic cognitive science research methods
4.	To understand the link between cognition and computational intelligence
5.	To outline the neuroscience models of cognitive science and applications

UNIT- I	INTRODUCTION	9

Introduction to cognitive science – The Cognitive view – Some Fundamental concepts Computers in Cognitive Science - Applied Cognitive science - The interdisciplinary Nature of Cognitive Science - Artificial Intelligence and Machine Learning - Knowledge representation - The Nature of Artificial Intelligence and Machine Learning - Search - Control and Learning - Cognitive psychology.

UNIT - II	COGNITIVE SCIENCE AND ARTIFICIAL INTELLIGENCE	9

Definition of AI – History - Practical World of Artificial Intelligence - Approaches to the Design of Intelligent Agents - Machine Representation of Knowledge - Machine Reasoning - Logical Reasoning - Inductive Reasoning - Expert Systems

UNIT - III	VISUALIZING THE ACTIVE BRAIN	9

Imaging the living brain - Brain recording: more and less direct measurements - The time-space tradeoff - Measuring electric and magnetic signals - Functional neuroimaging: a bold new world - New ways to measure brain connectivity: diffusion tensor imaging - Conscious versus unconscious brain events - Correlation and causation.

UNIT - IV	COMPUTATIONAL APPROACHES TO COGNITION	9

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.

Approved by BoS Chairman

UNIT - V	EMERGING TRENDS AND INNOVATIONS	9
Introduction: need for structure data type, structure definition, Structure declaration, Structure within a structure – Array Structure - Union – File Handling: File Operations – File Types: Sequential and Random access – Case Study: AI Processing System using C.		

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Infer the major concepts philosophical and theoretical perspectives in cognitive science.
CO2	Demonstrate the domains of cognitive neuroscience and Nervous system.
CO3	Interpret the methodologies and theories used by psychologists and cognitive neuroscientists.
CO4	Develop applications using cognitive computational intelligence.
CO5	Apply the cognitive science research methods to dynamic and real time applications.

Text Books	
1.	Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
2.	Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
3.	Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences",The MIT Press, 1999.
4.	Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020

Reference Books	
1.	Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of Probabilistic Programming Languages", Electronic version of book, https://dippl.org/.
2.	Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.org/.

Approved by BoS Chairman

B.E / B.Tech	B23AME907- AUGMENTED REALITY AND VIRTUAL REALITY	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To impart the fundamental aspects and principles of AR/VR technologies
2.	To comprehend the architecture of AR and VR
3.	To explore and understand the concept of 3D modeling and positioning of objects.
4.	To understand the basic knowledge of augmented reality
5.	To gain knowledge about AR/VR application development.

UNIT - I	INTRODUCTION	9

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT - II	AR/VR COMPUTING ARCHITECTURE	9

Computing Architectures of VR – Rendering Principle – Graphics and Haptics Rendering –PC Graphics Architecture – Graphics Accelerators – Graphics Benchmarks – Workstation Based Architectures – SGI Infinite Reality Architecture – Distributed VR Architectures –Multi-pipeline Synchronization – Collocated Rendering Pipelines – Distributed Virtual Environments – AR Architecture.

UNIT - III	3D MODELING	9

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants – Object Hierarchies – Viewing The 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT - IV	AUGMENTED REALITY	9
Introduction to Augmented Reality,Taxonomy,Technology and Features of Augmented Reality ,AR Vs VR, Challenges with AR,AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, Enhancing interactivity in AR Environments, Evaluating AR systems.		

UNIT - V	APPLICATIONS	9
Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.		
Total Instructional hours: 45		

Course Outcomes: Students will be able to	
CO1	Understand how AR/VR systems work and list its applications.
CO2	Outline the concept of AR and VR architecture..
CO3	Apply the 3D modeling techniques and graphics.
CO4	Make use of basic concept of AR visualize the simple application
CO5	Make use of the VR techniques can able to visualize simple applications.
Text Books	
1.	Erin Pangilinan, Steve Lukas, and Vasanth Mohan, “Creating Augmented and Virtual Realities Theory & Practice for Next-Generation Spatial Computing” ,O‘Reilly 2019
2.	Alan B. Craig, ”Understanding Augmented Reality, Concepts and Applications” ,Morgan Kaufmann, 2013.
Reference Books	
1.	Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create Compelling VRExperiences for Mobile”, Packt , 2018.
2.	Steve Aukstakalnis, “Practical Augmented Reality - A Guide to the Technologies, Applications, and Human Factors for AR and VR”, Addison-Wesley Professional, 2016.

Approved by BoS Chairman

B.E. - CSE(AI&ML)	B23AME908 - TEXT AND SPEECH ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the concept of Text analysis
2.	To apply classification algorithms to text documents
3.	To build question-answering and dialogue systems
4.	To develop a speech recognition system
5.	Develop a speech synthesizer

UNIT- I	FUNDAMENTALS OF TEXT AND SPEECH ANALYSIS	9
Overview of Text and Speech Analysis-Applications of NLP and Speech Processing-Basic Concepts in Text Analysis and Speech Recognition.		

UNIT - II	CATEGORIZING AND ANALYZING TEXT	9
Vector Semantics and Embeddings -Word Embeddings – Word2Vec model – Glove model -Fast Text model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models		

UNIT - III	INSIGHTS FROM TEXT ANALYSIS	9
Text Classification: Naive Bayes, Support Vector Machines, and Neural Networks-Word Embeddings: Word2Vec, GloVe, BERT		

UNIT - IV	GENERATING SPEECH FROM TEXT	9
Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.		

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UNIT - V	SPEECH RECOGNITION AND ACOUSTIC MODELING	9
Speech recognition: Acoustic modelling – Feature Extraction - HMM - DNN systems - Hidden Markov Models: Markov Processes – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.		

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Recall the fundamental concepts of Natural Language Processing (NLP), including language syntax, structure, and text Preprocessing techniques
CO2	Demonstrate the role of deep learning models such as RNNs and Transformers in text. Classification and summarization.
CO3	Develop a simple chat bot or QA system using basic NLP techniques.
CO4	Apply basic TTS techniques to generate synthetic speech from text input
CO5	Identify basic speech recognition techniques using feature extraction and HMM-based modeling.

Text Books	
1.	Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

Reference Books	
1.	Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress, 2018.
2.	Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3.	Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009. 4. Steven Bird

Approved by BoS Chairman

Vertical – III
Intelligent Systems

B.TECH	B23ADE901 - SOFT COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To Understand the basic knowledge of soft computing
2.	To learn about the fuzzy set theory.
3.	To gain the knowledge in fuzzy relations and fuzzy inference.
4.	To study the basics of neural networks and their algorithms.
5.	To gain the knowledge of genetic algorithms for optimization problems.

UNIT - I	INTRODUCTION TO NEURAL NETWORKS AND PERCEPTRONS	9

Biological Neurons vs. Artificial Neurons – McCulloch-Pitts Neuron – Perceptron Model – Limitations – Activation Functions – Learning Rules – Supervised and Unsupervised Learning – Single Layer Neural Networks – Applications of Neural Networks.

UNIT - II	MULTILAYER NEURAL NETWORKS AND LEARNING ALGORITHMS	9

Multilayer Perceptron – Backpropagation Algorithm – Gradient Descent – Learning Rate and Momentum – Overfitting and Regularization – Convolutional Neural Networks (CNNs) – Recurrent Neural Networks (RNNs) – Case Studies using TensorFlow/PyTorch.

UNIT - III	FUZZY LOGIC AND SYSTEMS	9

Introduction to Fuzzy Sets – Membership Functions – Fuzzy Set Operations – Fuzzy Rules and Reasoning – Fuzzy Inference Systems – Mamdani and Sugeno Models – Applications in Control Systems and Decision-Making.

UNIT - IV	GENETIC ALGORITHMS	9

Introduction to Evolutionary Computation – Genetic Algorithm Basics – Encoding Schemes – Selection, Crossover, Mutation – Fitness Function – Convergence Issues – Hybrid Approaches – Applications in Optimization Problems.

UNIT - V	EVALUATION METRICS AND MODEL PERFORMANCE	9

Confusion Matrix – Accuracy, Precision, Recall, F1 Score – ROC Curve and AUC – Cross Validation – Bias-Variance Tradeoff – Performance Evaluation for Classification and Regression – Metrics for Clustering and Optimization.

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	Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the architecture and functioning of artificial neurons, perceptrons, learning rules, and identify applications of single-layer neural networks.
CO2	Apply multilayer neural networks and training algorithms such as backpropagation, CNNs, and RNNs to solve real-time problems using TensorFlow/PyTorch
CO3	Analyze fuzzy set theory, fuzzy logic operations, and inference systems for implementing control and decision-making applications.
CO4	Implement genetic algorithm techniques including encoding, selection, crossover, and mutation for solving optimization problems and explore hybrid methods
CO5	Evaluate machine learning and optimization models using metrics such as accuracy, precision, recall, F1 score, ROC-AUC, and assess model performance for classification, regression, and clustering tasks.
Text Books	
1.	S.N.Sivanandam and S.N.Deepa, Principles of Soft Computing, Wiley India, 2nd Edition, 2011.
2.	Himanshu Singh and Yunis Ahmad Lone, “Deep Neuro-Fuzzy Systems with Python 3. With Case Studies and Applications from the Industry”, Apress, 2020
Reference Books	
1.	Lewis Tunstall, Leandro von Werra, and Thomas Wolf, “Natural Language Processing with Transformers: Building Language Applications with Hugging Face”, Revised Colour Edition. Shroff/O'Reilly, First Edition, 2022
2.	Snehashish Chakraverty. "Concepts of Soft Computing: Fuzzy and ANN with Programming", Springer, first edition 2019,

Approved By BoS Chairman

B.TECH	B23ADE902- GENERATIVE AI	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the foundation model of Gen AI.
2.	To outline various Models of Gen AI.
3.	To Extend the basics of Text Generation and videos.
4.	To Apply Gen AI tools.
5.	To analyze different use cases of opensource.

UNIT - I	FOUNDATIONS OF GENERATIVE AI	9

Introduction of Gen Ai- benefits and applications of generative AI - Applications of Generative AI- Sub Sets of Gen Ai- Importance of generative models in AI and Machine Learning - Model Creation -Foundation Model of Gen Ai- Types of Generative Ai Models- Future of Gen AI – Ethical Aspects of AI – Responsible AI – Use Cases.

UNIT - II	GENERATIVE MODELS	9

Introduction to Generative AI Models: Generative Adversarial Networks (GANs), Introduction to VAEs- VAE architecture: Encoder, Decoder, and Latent space- Applications of VAEs - autoregressive models and Vector quantized Diffusion models - Understanding if probabilistic modeling and generative process - Challenges of Generative Modeling.

UNIT - III	GENERATION OF TEXT AND IMAGES	9

Language Models Basics – Building blocks of Language models - Transformer Architecture - Generation of Text – Models like BERT and GPT models – Generation of Text – Regression Models – Exploring ChatGPT- Issues of LLM like hallucination. Introduction to Generative Adversarial Networks – Adversarial Training Process – Nash Equilibrium - CLIP – Visual Transformers ViT - Issues of Image Generation models like Mode Collapse and Stability.

UNIT - IV	OPEN SOURCE MODELS	9

Open Source Models - Training and Fine tuning of Generative models – GPT4All - Transfer learning and Pretrained models - Training vision models – Google Copilot - Programming LLM – LangChain - Programming for TimeSformer.

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UNIT - V	OPEN SOURCE MODELS	9
Generative ai use cases in open source- visual content- audio generation- Text generation- Code generation- Collaboration Generative AI use cases and applications across industries- Manufacturing- Supply chain and logistics- Retail & e-commerce- Automotive.		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the subsets and model of AI.
CO2	Demonstrate the techniques into real world problem.
CO3	Analyse Gen AI for Generating Texts and generating video.
CO4	Apply Open Source Tools for solving problems using Gen AI.
CO5	Examine the open-source Gen AI use cases.
	Text Books
1.	"Introduction to Generative AI", Numa Dhamani, Kindle Edition, 2024.
Reference Books	
1.	Altaf Rehmani, "Generative AI for Everyone", BlueRose One, 2024.
2.	David Foster, "Generative Deep Learning", O'Reily Books, 2024.
3.	David Foster, "Generative Deep Learning: Teaching Machines to Paint, Write,Compose, and Play", O'Reilly Media, 2019.
4.	Chollet, F. "Deep Learning with Python", Manning Publications, 2017.

Approved By BoS Chairman

B.TECH	B23ADE903 - EDGE AI	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To learn the techniques and components of Edge Computing.
2.	To Apply AI knowledge to develop Edge Artificial Intelligent Systems.
3.	To Apply Training at Edge AI
4.	To Find optimized solutions for given problems
5.	To Learn Real-time applications on Edge

UNIT - I	Introduction to Edge Computing	9

Fundamentals of Edge Computing: Introduction, Key Techniques, Benefits, Systems Paradigms of Edge computing, Frameworks, Value Scenarios - Edge computing system architectures. Industrial Applications of Edge Computing, Intelligent Edge and Edge Intelligence, Challenges and opportunities in Edge Computing.

UNIT - II	Inference in Edge AI	9

Artificial Intelligence Inference in Edge: Optimizing AI models in Edge: General method, Edge device, Overview of TensorFlow Lite (TFLite) format and its benefits, Understanding NVIDIA TensorRT format and its optimizations for inference Segmentation of AI Model, Segmentation of AI Model, Early Exit of Inference (EEoI), Sharing of AI Computation.

UNIT - III	Training in Edge AI	9

Artificial Intelligence Training at Edge: Distributed Training at Edge, Federated Learning (FL) at Edge, Communication-Efficient FL, Resource-Optimized FL, Security-Enhanced FL

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UNIT - IV	AI for Optimizing Edge and Mobile Edge	9
AI for Adaptive Edge Caching: use cases DNNs and DRL, Optimizing Edge Task Offloading, Edge Management and Maintenance: Communication, security, joint Edge optimization. Mobile Edge inference: On-device inference, Computation offloading, Server-based edge inference, Device-edge joint inference, Edge training: Data partition-based, Coded computing		

UNIT - V	AI Applications on Edge	9
Real-time Video Analytic, Autonomous Internet of Vehicles(IoVs), Intelligent Manufacturing, Smart Home and City, Urban Healthcare, Urban Energy Management, Manufacturing, Transportation and traffic.		

Course Outcomes : Students will be able to	
CO1	Understand the relation of AI and Edge Computing.
CO2	Apply knowledge of AI for optimizing Edge application
CO3	Analyse the knowledge of AI for Training Edge application
CO4	Understand and apply concepts of Mobile Edge AI
CO5	Design and Develop edge application.

Text Books	
1.	Yuanming Shi, Kai Yang, Zhanpeng Yang and Yong Zhou , “Mobile Edge Artificial Intelligence Opportunities and Challenges”, Elsevier, 2021
2.	Jie Cao, Quan Zhang, and Weisong Shi, “Edge Computing: A Primer”, Springer, 2018.

Reference Books	
1.	Javid Taheri; Javid Shuiguang Deng, “Edge Computing- Models, Technologies and Application”, IET, 2020.
2.	Xiaofei Wang , Yiwen Han , Victor C. M. Leung , Dusit Niyato , Xueqiang Yan and Xu Chen , “Edge AI - Convergence of Edge Computing and Artificial Intelligence”, Springer, 2020.

Approved by BoS Chairman

Approved by BoS Chairman

B.TECH	B23ADE904- REINFORCEMENT LEARNING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	Understand the Fundamentals of Reinforcement Learning such as agents, environments, states, actions, rewards, and the process of maximizing cumulative reward
2.	Understand how RL problems are formalized using MDPs
3.	Explore various RL techniques, including Dynamic Programming, Monte Carlo Methods, and Temporal-Difference Learning, to solve RL problems in practical scenarios.
4.	Dive into more advanced topics such as eligibility traces, n-step prediction, and the forward and backward views of TD(λ) to refine RL algorithms
5.	Analyze the trade-offs between model-based and model-free reinforcement learning approaches, and explore their applications in real-world problems

UNIT – I INTRODUCTION TO REINFORCEMENT LEARNING	9
Definition and Fundamentals of Reinforcement Learning, Key Characteristics of RL, Applications of Reinforcement Learning, Elements of Reinforcement Learning (Agent, Environment, States, Actions, Rewards), Maximizing Cumulative Reward, Trial-and-Error Search and Delayed Rewards, Limitations and Scope of RL, Case Study: Solving Tic-Tac-Toe with RL, History of Reinforcement Learning, Formal Framework: Agent-Environment Interaction, Cause and Effect, Uncertainty, and Goal-Directed Behavior	
UNIT – II MARKOV DECISION PROCESSES (MDPS)	**9**
Introduction to MDPs, Formalization of RL Problems with MDPs, The Markov Property Value Functions and Optimal Value Functions, Bellman Equations, Unified Notation for Episodic and Continuing Tasks	
UNIT – III TABULAR SOLUTION METHODS	**9**
Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Monte Carlo Methods: Action Value Estimation, Monte Carlo Control, Temporal-Difference Learning: TD(0), Q-Learning	

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UNIT – IV ELIGIBILITY TRACES	**9**
N-step Prediction, Forward View and Backward View of TD(λ), Implementing TD(λ) Replacing and Accumulating Traces, Sarsa(λ) and Q(λ)	
UNIT – V PLANNING AND LEARNING	**9**
Model-Based vs. Model-Free RL, Integrating Planning, Acting, and Learning, Dimensions of Reinforcement Learning Methods	
	Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the fundamentals of reinforcement learning, its components, characteristics, and applications, including agent-environment interactions.
CO2	Describe the Markov Decision Process (MDP) framework and illustrate the role of value functions and Bellman equations in reinforcement learning tasks.
CO3	Apply tabular methods such as dynamic programming, Monte Carlo methods, and temporal-difference learning to solve reinforcement learning problems.
CO4	Implement eligibility traces, n-step prediction, and TD(λ) techniques to enhance learning in RL algorithms.
CO5	Analyze the differences between model-based and model-free reinforcement learning approaches and determine appropriate methods for specific learning scenarios

Text Books	
1.	Sutton, Richard S., and Andrew G. Barto**.** *Reinforcement Learning: An Introduction (2nd Edition).* MIT Press, 2018
2.	Phil Winder. *Reinforcement Learning: Industrial Applications of Intelligent Agents.* O'Reilly Media, 2020.

Reference Books

Approved by BoS Chairman

1.	Sudharsan Ravichandiran, Deep Reinforcement Learning with Python, Second Edition, Packet Publishing, Birmingham, 2020.
2.	Laura Graesser and Wah Loon Keng, Foundations of Deep Reinforcement learning: theory and Practice in Python, Pearson India, New Delhi, 2022.

B.TECH	B23ADE905 - AGENT BASED INTELLIGENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To analyze intelligent agent programs and systems of varying Complexities.
2.	To design and implement intelligent agent programs
3.	To Demonstrate good knowledge of basic foundations of intelligent systems methodologies.
4.	To Determine which type of intelligent system methodology would be suitable for application problem.
5.	To analyze for high level planning and application of agent-based systems.

UNIT - I	INTRODUCTION	9
Introduction: Definitions – Distributed AI – Agent Application areas - Foundations – History – Intelligent Agents – Multi agent systems - Problem Solving –Searching – Heuristics – Constraint satisfaction Problems – Game Playing.		

UNIT - II	KNOWLEDGE REPRESENTATION AND REASONING	9
Knowledge representation and reasoning: Logical agents – multi-agent epistemic logic, action logics, deliberation. Logical Agents - First order logic – First Order Inference – Unification – Chaining – Resolution Strategies – Knowledge Representation – Objects – Actions – Events.		

UNIT - III	PLANNING AGENTS	9
Planning Agents: Planning Problem – State Space Search – Partial Order Planning _Graphs – No deterministic Domains – Conditional Planning – continuous Planning – Multiagent Planning.		

UNIT - IV	AGENTS AND UNCERTAINTY	9
Agents And Uncertainty: Acting under uncertainty – Probability Notation – Bayes Rule and use – Bayesian Networks – Other approaches – Time and Uncertainty – Temporal Models – Utility Theory – Decision Network – Complex Decisions.		

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UNIT - V	HIGHER LEVEL AGENTS	9
Higher Level Agents: Knowledge in Learning – Relevance information –Statistical Learning Methods – Reinforcement Learning – Communication – Formal Grammar – Augmented Grammars-Future of AI.		

Course Outcomes : Students will be able to	
CO1	Understand the fundamental concepts of intelligent agents
CO2	Understand the basic concepts, methods, knowledge representation and reasoning.
CO3	Make use of the types of planning problems, and apply in agent based intelligent systems.
CO4	Apply statistics to design intelligent agents.
CO5	Analyze for high level planning and application of agent-based systems.

Text Books	
1.	Michae l Wooldridge, “An Introduction to MultiAgent Systems “,CreateSpace Independent Publishing Platform, 2017.
2.	Stuart Russell and Peter Norvig, "Artificial Intelligence - A Modern Approach", Pearson, 2016

Reference Books	
1.	Zili Zhang and Chengqi Zhang, “ Agent Based Inteligent systems”, Springer, 2017

Approved by BoS Chairman

B.TECH	B23ADE906 - QUANTUM ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To know the background of classical computing and quantum computing.
2.	To study the details of quantum mechanics
3.	To understand entangled quantum subsystems and properties of entangled states
4.	To analyse the quantum information processing
5.	To explore the applications of quantum computing

UNIT - I	QUANTUM COMPUTING BASIC CONCEPTS	9
Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Superpositions.		

UNIT - II	QUANTUM ALGORITHMS	9
Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm		

UNIT - III	STATE TRANSFORMATIONS AND ENTANGLED SUBSYSTEMS	9
Unitary Transformations, Quantum Gates, Language for Quantum Implementations. Quantum Subsystems, Properties of Entangled States, Quantum Error Correction, Graph states and codes, CSS Codes, Stabilizer Codes, Fault Tolerance and Robust Quantum Computing.		

Approved by BoS Chairman

UNIT - IV	QUANTUM INFORMATION PROCESSING	9
Limitations of Quantum Computing, Alternatives to the Circuit Model of Quantum Computation, Quantum Protocols, Building Quantum, Computers, Simulating Quantum Systems, Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.		

UNIT - V	QUANTUM AI APPLICATIONS	9
Quantum parallelism - Optimization problems - Drug discovery - Materials science - Financial modeling – Cyber security		

Course Outcomes : Students will be able to	
CO1	Understand the basics of quantum computing.
CO2	Extend the computation models.
CO3	Outline the problems that can be expected to be solved well by quantum computers
CO4	Simulate and analyze the characteristics of Quantum Computing Systems
CO5	Utilize the application areas

Text Books	
1.	Parag K Lala, Mc Graw Hill Education, “Quantum Computing, A Beginners Introduction”, First edition (1 November 2020).
2.	Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), “Quantum Computing for Everyone”.

Reference Books	
1.	Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, Tenth Edition, Cambridge University Press, 2010.
2.	Scott Aaronson, “Quantum Computing Since Democritus”, Cambridge University Press, 2013

Approved by BoS Chairman

B.TECH	B23ADE907 PROMPT ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the principles and techniques of prompt engineering, including the designs of effective prompts
2.	To understand and explore the capabilities of large language models for text
3.	To utilize Image generation techniques and to leverage the creation of engaging content
4.	To develop practical skills in crafting prompts
5.	To Generate text and images using AI tools and platforms

UNIT - I	UNDERSTANDING PROMPTING AND PROMPT TECHNIQUES	9

Five Principles of Prompting - Introducing LLM Prompts - How LLM Prompts Work - Types of Prompts - Components of an Prompt - Defining Personality in Prompts - Mix and Match Strategic Combination for Enhanced Prompts - Challenges and Limitations of Using Prompts

UNIT - II	THE ART OF TEXT DATA GENERATION WITH GENAI	9

Standard Practices for Text Generation Generating Lists - Universal Translation Through LLMs - Ask For Context - Text Style Unbundling - Identifying the Desired Textual Features - Role Prompting - Analyzing Existing Prompts for Strengths and Weaknesses

UNIT - III	PROMPT OPTIMIZATION TECHNIQUES	9

Zero-shot Prompting - Few-shot Prompting - Chain-of-Thought Prompting - Prompt Refinement Techniques - Dynamic Prompt Engineering - Using AI for Copywriting - Creating Social Media Posts. Writing Video Scripts - Using AI for Personalized Messaging

UNIT - IV	DIFFUSION MODELS FOR IMAGE GENERATION	9

Introduction to Image Generation with AI - Principles of Designing Prompts for Image Generation, Available Models - OpenAI DALL-E – Midjourney - Stable Diffusion - Google Gemini - Text to Video - Model Comparison - Reverse Engineering Prompts - Negative Prompts - Prompt Re-Writing - Prompt Analysis.

UNIT - V	BUILDING AI POWERED APPLICATIONS	9
AI Blog Writing - Topic Research - Expert Interview - Generate Outline - Text Generation - Writing Style - Title Optimization - AI Blog Images - User Interface - Ethical Considerations of Using AI for Text and Image Generation		
Total Instructional hours: 45		

Course Outcomes: Students will be able to	
CO1	Understand the relevant prompts by the standard principles of prompt engineering
CO2	Make use of LLM for Text data generation.
CO3	Utilize AI for automating and refining content generation processes.
CO4	Make use of existing prompts and make strategic combinations for enhanced prompts
CO5	Design relevant prompts by the standard principles of prompt engineering
Text Books	
1.	John Berryman, Albert Ziegler, "Prompt Engineering for LLMs", O'Reilly Media, 2024
2.	Yaswanth Sai Palaghat, "Prompt Engineering : The Art of Asking "Master Generative AI Tools Like ChatGPT & MidJourne Notion press, 2023
Reference Links	
1.	James Phoenix, Mike Taylor, "Prompt Engineering for Generative AI", O'Reilly, 2024
2.	Gilbert Mizrahi, "Unlocking the Secrets of Prompt Engineering: Master the Art of Creative Language Generation to Accelerate Your Journey from Novice to Pro", PACKT 2024

Approved By BoS Chairman

B.Tech	B23ADE908 - EXPLAINABLE AI	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the foundations of explainable AI
2.	To explore post hoc explanation techniques
3.	To investigate attention and concept-based explanations
4.	To assess Explainability in fair machine learning
5.	To apply explainable AI in real-world scenarios

UNIT- I	FOUNDATIONS OF EXPLAINABLE AI	9

Science of Interpretable Machine Learning - Motivation - Challenges and Mythos of Model Interpretability - Human Factors in Explainability - Interpreting Interpretability.

UNIT - II	RETROSPECTIVE INTERPRETABILITY IN AI	9

Explaining the Predictions of Any Classifier - Pitfalls - Challenges and Evaluation of Feature Attributions - LIME and SHAP - OpenXAI - The Disagreement Problem in Explainable Machine Learning - Counterfactual Explanations - Agnostic Counterfactual Explanations for Tabular Data

UNIT - III	CONCEPT BASED EXPLANATIONS	9

Quantifying Interpretability of Deep Visual Representations - Interpretability Beyond Feature Attribution - Data Attribution and Interactive Explanation - Equitable Valuation of Data - Explainable Active Learning (XAL) - Theory of Explainability and Interpreting Generative Models

UNIT - IV	ENHANCING FAIRNESS THROUGH EXPLAINABLE AI	9

Connections with Robustness - Privacy - Fairness and Unlearning - Right to Explanation and the Right to be Forgotten - Fairness via Explanation Quality - Mechanistic Interpretability and Compiled Transformers - Understanding and Reasoning in Large Language Models

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UNIT - V	APPLICATIONS AND FUTURE DIRECTIONS IN EXPLAINABLE AI	9
Real-world Applications of Explainable AI – Healthcare, Finance, Autonomous Systems, Legal and Policy Implications - Explainability in Reinforcement Learning - Future Directions and Open Research Challenges.		

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Recall the fundamental concepts of interpretable machine learning, including challenges, myths, and human factors in explainability.
CO2	Demonstrate the challenges and pitfalls of feature attribution techniques in model explainability.
CO3	Illustrate the role of interactive explanations, data attribution, and equitable data valuation.
CO4	Extend mechanistic interpretability approaches in compiled transformers and large language models.
CO5	Apply explainability techniques to enhance transparency in AI-based decision-making systems.

Text Books	
1.	Christoph Molnar, “Interpretable Machine Learning: A Guide for Making Black Box Models Explainable,” 2nd Edition, 2022.

Reference Books	
1.	Wojciech Samek, Gregoire Montavon, Andrea Vedaldi, Lars Kai Hansen, and Klaus-Robert Müller (Editors), “Explainable AI: Interpreting, Explaining and Visualizing Deep Learning,” Springer, 2019.
2.	Mayuri Mehta, Nilanjan Dey, and Amir H. Gandomi (Editors), “Explainable AI: Foundations, Methodologies, and Applications,” Springer, 2022.
3.	Jenny Benois-Pineau and Akka Zemmari, “Explainable AI: Interpreting, Explaining and Visualizing Deep Learning,” Springer, 2021.
4.	Sebastian Palacio, Adriano Lucieri, Mohsin Munir, Jörn Hees, Sheraz Ahmed, and Andreas Dengel, “XAI Handbook: Towards a Unified Framework for Explainable AI,” arXiv preprint, 2021.

Approved by BoS Chairman

Vertical – IV
Network and Communication Systems

B.E / B.Tech	B23CSE917-DATA COMMUNICATION AND TRANSMISSION TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamental concepts and components of data communication systems.
2.	To explore various transmission media and techniques used in data communication.
3.	To study encoding, modulation, and multiplexing techniques.
4.	To analyze error detection, correction, and flow control mechanisms.
5.	To examine real-world communication standards and protocols.

UNIT - I	INTRODUCTION TO DATA COMMUNICATION	9
Components of a Data Communication System – Data Flow: Simplex, Half-Duplex, Full-Duplex – Types of Networks – Network Topologies – Protocols and Standards – OSI and TCP/IP Models – Layered Communication.		

UNIT - II	TRANSMISSION MEDIA AND SIGNALS	9
Transmission Modes – Analog and Digital Signals – Characteristics of Signals – Transmission Impairments – Guided Media: Twisted Pair, Coaxial, Fiber Optics – Unguided Media: Radio Waves, Microwaves, Infrared – Bandwidth and Data Rate.		

UNIT - III	ENCODING, MODULATION AND MULTIPLEXING	9
Digital Data – Digital Signals: Line Coding Techniques – Analog Data – Digital Signals: Pulse Code Modulation (PCM) – Digital Data – Analog Signal: ASK, FSK, PSK, QAM – Multiplexing: FDM, TDM, WDM – Spread Spectrum Techniques.		

UNIT - IV	ERROR CONTROL AND FLOW CONTROL	9
Types of Errors – Error Detection Techniques: Parity Check, CRC, Checksum – Error Correction: Hamming Code – Flow Control: Stop-and-Wait, Sliding Window Protocols – Media Access Control: ALOHA, CSMA/CD, CSMA/CA.		

Approved by BoS Chairman

UNIT - V	COMMUNICATION STANDARDS AND PROTOCOLS	9
RS-232, Ethernet, HDLC, PPP – Switching Techniques: Circuit, Packet, and Message Switching – Data Link and Physical Layer Standards – Wireless Transmission Techniques – Emerging Trends in Communication: 5G, IoT, and Satellite Communication.		

Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Explain the fundamentals of data communication systems and layered architectures.
CO2	Identify and compare various transmission media and signal characteristics.
CO3	Apply encoding, modulation, and multiplexing techniques for efficient communication.
CO4	Implement error detection, correction, and flow control mechanisms.
CO5	Analyze communication standards and apply appropriate protocols for network communication.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO 12 (A3)	PS O1 (K4) (A3)	PS O2 (K3) (A3)
CO1	K2	3	3	2	2	3	2	-	-	1	1	-	3	2	3
CO2	K3	3	3	2	2	3	2	-	-	1	1	-	3	2	3
CO3	K3	3	3	2	3	3	2	-	-	1	1	-	3	3	3
CO4	K3	3	3	3	3	3	2	-	-	1	1	-	3	3	3
CO5	K3	3	3	3	3	3	2	-	-	1	1	-	3	3	3
Weighted Average		3	3	3	3	3	2	-	-	1	1	-	3	3	3

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

Text Books	
1.	Behrouz A. Forouzan, “Data Communications and Networking”, Fifth Edition, McGraw Hill Education, 2017.
2.	William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2013.

Reference Books	
1.	Fred Halsall, “Computer Networking and the Internet”, Fifth Edition, Pearson Education, 2006.
2.	Tomasi Wayne, “Advanced Electronic Communications Systems”, Sixth Edition, Pearson Education, 2009.
3.	Alberto Leon-Garcia, Indra Widjaja, “Communication Networks: Fundamental Concepts and Key Architectures”, Second Edition, McGraw Hill, 2004.

Approved by BoS Chairman

B.E / B.Tech	B23CSE918- NETWORK PROGRAMMING AND SOCKET DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the principles and layers of computer networks related to programming interfaces.
2.	To introduce socket programming concepts using TCP and UDP.
3.	To develop client-server applications using low-level networking APIs.
4.	To explore advanced topics such as multiplexing, multithreading, and secure communication.
5.	To integrate network programming in real-world applications such as chat servers, file transfer, and web communication.

UNIT - I	INTRODUCTION TO NETWORK PROGRAMMING	9
Overview of Computer Networks – OSI and TCP/IP Stack – Role of Transport Layer – TCP vs UDP – Ports and Addressing – Sockets and APIs – Network Programming Model – Berkeley Sockets API (BSD) Overview.		

UNIT - II	SOCKET INTERFACES AND PROGRAMMING WITH TCP	9
Socket System Calls: socket(), bind(), listen(), accept(), connect(), send(), recv() – TCP Client-Server Programming in C/Python – Handling Multiple Clients – Connection Termination – Common Issues (Blocking/Non-blocking Modes).		

UNIT - III	UDP SOCKET PROGRAMMING AND MULTICAST	9
UDP Socket Functions – Datagram Sockets – Connectionless Communication – Broadcast and Multicast Programming – Implementing Time Server, DNS Query Client – Comparison with TCP.		

UNIT - IV	ADVANCED CONCEPTS: MULTIPLEXING AND THREADING	9
select(), poll(), epoll() APIs – Non-blocking Sockets – Multithreaded Server Implementation – Signal Handling – Thread Safety and Synchronization – Performance Tuning.		

UNIT - V	SECURE AND HIGH-LEVEL NETWORK COMMUNICATION	9
Socket Options – Secure Communication using TLS/SSL (OpenSSL Library) – HTTP Communication – Building Chat Application, File Transfer, Remote Command Execution – Introduction to WebSockets and REST APIs.		

Approved by BoS Chairman

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the foundational concepts of network programming and socket APIs.
CO2	Develop and debug TCP-based client-server applications.
CO3	Implement UDP and multicast communication programs.
CO4	Apply advanced socket techniques such as multiplexing and multithreading.
CO5	Integrate security and high-level communication protocols in real-world applications.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K2**	3	3	2	1	2	-	-	-	1	1	-	2	2	1
CO2	**K2**	3	3	3	2	2	-	-	-	2	1	-	2	2	1
CO3	**K3**	3	3	3	3	2	-	-	-	2	1	-	2	2	1
CO4	**K3**	3	3	3	3	3	1	-	-	2	2	1	2	2	1
CO5	**K3**	3	3	3	3	3	1	1	-	3	2	1	3	2	1
Weighted Average		3	3	3	3	2	1	1	-	2	1	1	2	2	1

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Text Books	
1.	W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, "Unix Network Programming, Volume 1: The Sockets Networking API", Third Edition, Pearson Education, 2004.
2.	Michael J. Donahoo, Kenneth L. Calvert, "TCP/IP Sockets in C: Practical Guide for Programmers", Second Edition, Morgan Kaufmann, 2009.

Reference Books	
1.	james F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", Seventh Edition, Pearson Education, 2017.
2.	Brian "Beej" Hall, "Beej's Guide to Network Programming", Open Access

Approved by BoS Chairman

B.E / B.Tech	B23CSE919 – WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals and evolution of wireless and mobile communication systems.
2.	To explore the concepts of mobile radio propagation and fading.
3.	To study wireless networking standards including 3G, 4G, 5G, Wi-Fi, and Bluetooth.
4.	To analyze multiple access techniques, channel allocation, and handoff strategies.
5.	To learn about mobile IP, transport protocols, and mobile application layer services.

UNIT - I	INTRODUCTION TO WIRELESS COMMUNICATION	9

Evolution of Mobile Communication – 1G to 5G – Cellular Concept – Frequency Reuse – Wireless Communication Channels – Applications and Services – Overview of Mobile Devices and Architectures.

UNIT - II	MOBILE RADIO PROPAGATION AND FADING	9

Large Scale Path Loss – Free Space and Two-Ray Models – Link Budget Design – Small Scale Fading – Fading Models (Rayleigh, Rician) – Doppler Effect – Delay Spread – Coherence Time and Bandwidth.

UNIT - III	WIRELESS NETWORKING STANDARDS	9

GSM Architecture and Protocol Stack – Call Setup and Handoff – GPRS – UMTS and LTE Basics – 4G/5G Architectures – Wi-Fi (IEEE 802.11 a/b/g/n/ac/ax) – Bluetooth and ZigBee – WiMAX Overview.

UNIT - IV	MULTIPLE ACCESS AND MOBILITY MANAGEMENT	9

FDMA, TDMA, CDMA, OFDMA – Channel Allocation – Power Control – Handoff Types and Strategies – Roaming – Location Management – Mobile QoS – Call Admission Control – Load Balancing.

Approved by BoS Chairman

UNIT - V	MOBILE NETWORK AND APPLICATION LAYER PROTOCOLS	9
Mobile IP – IPv6 and Mobility – Transport Layer Protocols for Wireless (TCP Variants) – Mobile Web, HTTP, and Web Services – Context-aware Computing – Overview of Mobile Apps and Cloud Integration.		

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Explain the evolution, architecture, and services of wireless communication systems.
CO2	Analyze radio propagation models and fading characteristics.
CO3	Compare wireless networking standards and their implementations.
CO4	Evaluate multiple access techniques and mobility management strategies.
CO5	Apply network and application layer protocols to mobile environments.

CO Mapping with PO & PSO

CO/PO & PSO	PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO2	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO3	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO4	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO5	3	2	2	-	1	-	-	-	-	-	1	1	2	2
Weighted Average	3	2	2	-	1		-	-	-	-	1	1	2	2

3 – Strong **2- Moderate** **1- Weak** **‘-‘ – No Correlation**

Approved by BoS Chairman

Text Books	
1.	Theodore S. Rappaport, “Wireless Communications: Principles and Practice”, Second Edition, Pearson Education, 2010.
2.	Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2008.

Reference Books	
1.	Kaveh Pahlavan and Prashant Krishnamurthy, “Principles of Wireless Networks: A Unified Approach”, First Edition, Pearson Education, 2009.
2.	Andreas F. Molisch, “Wireless Communications”, Second Edition, Wiley India, 2011.
3.	William Stallings, “Wireless Communications and Networks”, Second Edition, Pearson Education, 2007.

Approved by BoS Chairman

B.E / B.Tech	B23CSE920 – IoT COMMUNICATION PROTOCOLS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the fundamental concepts of IoT communication architectures and protocol stacks.
2.	To explore key IoT network layer and transport protocols.
3.	To understand lightweight protocols designed for constrained environments.
4.	To study wireless technologies and standards for IoT communication.
5.	To apply IoT protocols in real-time applications and smart systems.

UNIT - I	INTRODUCTION TO IoT AND COMMUNICATION ARCHITECTURE	9

Overview of IoT – IoT Protocol Stack – OSI Model vs IoT Stack – Sensing, Networking, and Application Layers – Communication Requirements – Characteristics of IoT Communication – IoT vs Traditional Internet Protocols.

UNIT – II	NETWORK AND INTERNET PROTOCOLS FOR IoT	9

IPv4/IPv6 for IoT – 6LoWPAN: Header Compression and Fragmentation – Routing Protocol for Low Power and Lossy Networks (RPL) – Neighbor Discovery Optimization – ICMPv6, UDP, TCP for IoT.

UNIT – III	LIGHTWEIGHT APPLICATION PROTOCOLS	9

MQTT: Architecture, QoS Levels, Brokers – CoAP: REST Architecture, Message Types – AMQP, XMPP – HTTP vs MQTT vs CoAP – Use Cases – Security and Reliability Features.

UNIT – IV	WIRELESS IoT COMMUNICATION STANDARDS	9

ZigBee – Bluetooth Low Energy (BLE) – LoRa and LoRaWAN – Wi-Fi (802.11ah) – Thread – NB-IoT and LTE-M – IEEE 802.15.4 – Comparative Analysis and Applications.

UNIT - V	IoT COMMUNICATION IN PRACTICE	9

Edge and Fog Computing Communication – Smart Home and Smart City Use Cases – Industrial IoT (IIoT) Protocol Requirements – Real-Time Communication – Protocol Stack Selection Based on Application Scenarios.

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Understand the architecture and requirements of IoT communication systems.
CO2	Apply IP-based protocols (IPv6, 6LoWPAN, RPL) in IoT network layers.
CO3	Analyze lightweight messaging protocols (MQTT, CoAP, AMQP) for constrained devices.
CO4	Evaluate wireless standards (BLE, ZigBee, LoRa) for various IoT scenarios.
CO5	Design communication stacks for real-world IoT applications.

CO Mapping with PO & PSO

CO/PO & PSO	PO1 (K3)	PO 2 (K4)	PO3 (K5)	PO 4 (K5)	PO 5 (K6)	PO6 (K3) (A3)	PO 7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO2	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO3	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO4	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO5	3	2	2	-	1	-	-	-	-	-	1	1	2	2
Weighted Average	3	2	2	-	1		-	-	-	-	1	1	2	2

3 – Strong **2- Moderate** **1- Weak** **‘-‘ – No Correlation**

Text Books	
1.	Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, First Edition, Universities Press, 2015.
2.	Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Second Edition, Wiley, 2016.

Reference Books	
1.	Yasser Ismail, IoT Protocols and Applications, First Edition, CRC Press, 2022.
2.	Pethuru Raj, Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press, 2017.

Approved by BoS Chairman

B.E / B.Tech	B23CSE921 – ADHOC AND SENSOR NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the fundamentals, characteristics, and applications of Ad Hoc and Sensor Networks.
2.	To understand routing, MAC protocols, and transport protocols for Ad Hoc networks.
3.	To explore architecture, topology control, and energy management in wireless sensor networks.
4.	To study data-centric routing, localization, and aggregation in sensor networks.
5.	To gain insights into security issues and emerging trends in Ad Hoc and sensor networks.

UNIT - I	INTRODUCTION TO AD HOC NETWORKS	9

Ad Hoc Network Fundamentals – Features, Challenges, and Applications – Comparison with Infrastructure Networks – Wireless Standards – Issues in Designing a Protocol Stack – IEEE 802.11, Bluetooth, Wi-Fi Direct.

UNIT – II	ROUTING AND MAC IN AD HOC NETWORKS	9

Proactive Routing: DSDV – Reactive Routing: DSR, AODV – Hybrid Routing: ZRP – Multicast Routing – MAC Protocols: IEEE 802.11 MAC, MACA, MACAW, CSMA/CA – QoS in Ad Hoc Networks.

UNIT – III	INTRODUCTION TO WIRELESS SENSOR NETWORKS	9

Sensor Network Architecture – Characteristics and Requirements – Sensor Deployment Strategies – Energy-Efficient Communication – WSN Topologies – Node Discovery and Configuration – Transmission Power Management.

UNIT – IV	ROUTING AND DATA MANAGEMENT IN WSNs	9

Data-Centric Routing: SPIN, Directed Diffusion – Geographic Routing – Hierarchical Routing: LEACH, PEGASIS – Data Aggregation – Time Synchronization – Localization and Positioning Techniques – Mobile WSNs.

UNIT – V	SECURITY AND EMERGING TRENDS	9

Security Requirements and Challenges – Attacks in Ad Hoc and Sensor Networks – Secure Routing – Key Management – Recent Trends: IoT Integration, Mobile Sensing, Delay Tolerant Networks – Case Studies and Applications in Smart Cities, Health, and Industry.

Approved by BoS Chairman

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the architecture, features, and challenges of Ad Hoc and sensor networks.
CO2	Analyze different routing and MAC protocols for Ad Hoc wireless networks.
CO3	Apply knowledge of energy-efficient techniques in WSNs.
CO4	Evaluate data-centric protocols and localization mechanisms in WSNs.
CO5	Examine security threats and explore emerging applications in Ad Hoc and sensor networks.

CO Mapping with PO & PSO

CO/PO & PSO	PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO2	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO3	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO4	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO5	3	2	2	-	1	-	-	-	-	-	1	1	2	2
Weighted Average	3	2	2	-	1	-	-	-	-	-	1	1	2	2

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Text Books	
1.	C. Siva Ram Murthy, B.S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, Second Edition, Pearson Education, 2011.
2.	Holger Karl, Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, First Edition, Wiley, 2005.

Reference Books	
1.	Carlos de Morais Cordeiro, Dharma Prakash Agrawal, Ad Hoc and Sensor Networks: Theory and Applications, Second Edition, World Scientific, 2011.
2.	Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications, First Edition, Wiley-Interscience, 2007.
3.	Adrian Perrig, J.D. Tygar, Secure Wireless Sensor Networks, First Edition, Springer, 2006.

Approved by BoS Chairman

B.E / B.Tech	B23CSE922-NETWORK AUTOMATION USING AIML	L	T	P	C
		3	0	0	3

Course Objectives	
1.	Understand the fundamentals of network automation and its relevance to AI and machine learning.
2.	Explore ML techniques for network traffic prediction, fault detection, and resource optimization.
3.	Analyze use cases in self-configuring, self-healing, and intelligent networks.
4.	Study automation frameworks, tools, and platforms such as Ansible, Netmiko, and Python libraries.
5.	Design intelligent, policy-driven, and scalable network management systems.

UNIT - I	INTRODUCTION TO NETWORK AUTOMATION	9
Evolution of network automation – Traditional vs. programmable networks – Overview of SDN, NFV – Role of automation in modern networks – Tools for automation: Ansible, Netmiko, NAPALM – Configuration management and provisioning.		

UNIT - II	FUNDAMENTALS OF AI/ML IN NETWORKING	9
Overview of AI/ML – Supervised, Unsupervised, and Reinforcement Learning – ML pipelines – Feature extraction from network data – Introduction to data sources in networks – Log parsing and pre-processing.		

UNIT - III	NETWORK MONITORING AND TRAFFIC PREDICTION	9
Traffic classification and prediction – Time series forecasting models (ARIMA, LSTM) – Anomaly detection using ML – QoS prediction – Case study: AI/ML-based bandwidth estimation.		

UNIT - IV	AI/ML-DRIVEN NETWORK SECURITY AUTOMATION	9
Intrusion Detection Systems using ML – Threat modeling – Malware detection – Network behavior analysis – Automating firewall rules – Ethical issues and bias in automated decision-making.		

UNIT - V	IMPLEMENTATION FRAMEWORKS	9
Open-source tools: PyATS, Genie, Scapy, Wireshark + Python – Model deployment: Flask, Docker – Integration with cloud-native networks – AI/ML for 5G and edge networks – Real-world applications and case studies.		

Approved by BoS Chairman

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Explain the role and importance of automation in networking.
CO2	Apply AI/ML models to network data for traffic prediction and anomaly detection.
CO3	Use open-source tools to automate and monitor network operations.
CO4	Evaluate the security implications of AI-based network systems.
CO5	Design and deploy intelligent network automation workflows.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2	3	2	1	1	3	-	-	-	1	1	-	2	2	1
CO2	K2	3	3	2	2	3	-	1	-	2	1	1	2	2	1
CO3	K3	3	3	2	3	3	1	1	-	2	2	1	2	2	1
CO4	K3	3	3	3	3	3	1	1	-	2	2	2	3	2	1
CO5	K3	3	3	3	3	3	2	2	1	3	3	2	3	2	1
Weighted Average		3	3	3	3	3	1	1	1	2	2	2	2	2	1

3 – Substantial **2- Moderate** **1- Low** **‘-‘ – No Correlation**

Text Books	
1.	Adrian Cantrill, “Automating Networks with Ansible: From Basics to Advanced”, First Edition, Leanpub, 2023.
2.	Kumar Saurabh, “Machine Learning for Network Automation”, First Edition, BPB Publications, 2022.

Reference Books	
1.	Timothy Winters et al., “Network Programmability and Automation”, First Edition, O'Reilly Media, 2018.
2.	Jason Edelman, Scott Lowe, Matt Oswalt, “Network Programmability and Automation: Skills for

Approved by BoS Chairman

B.E / B.Tech	B23CSE923 – NETWORK PERFORMANCE OPTIMIZATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand key metrics and techniques used in evaluating and improving network performance.
2.	To analyze bottlenecks and latency issues in different network layers.
3.	To explore QoS mechanisms and traffic engineering techniques.
4.	To learn about network simulation, performance modeling, and optimization strategies.
5.	To gain practical exposure to performance monitoring and tuning tools.

UNIT - I	INTRODUCTION TO NETWORK PERFORMANCE	9

Network performance metrics – Latency, throughput, jitter, packet loss – Network models (OSI, TCP/IP) – Performance benchmarks and SLAs – Common network bottlenecks – Need for optimization.

UNIT - II	LAYER-WISE PERFORMANCE ANALYSIS	9

Physical and Data Link layer factors – Errors, collisions, retransmissions – Transport layer optimization (TCP tuning, congestion control) – Application layer performance (DNS, HTTP/3) – Role of MTU, buffer size, and window scaling.

UNIT - III	TRAFFIC MANAGEMENT AND QoS	9

Traffic shaping and policing – QoS models: IntServ and DiffServ – Queuing disciplines (FIFO, WFQ, RED) – MPLS and traffic engineering – Load balancing strategies – Policy-based routing.

UNIT - IV	PERFORMANCE MONITORING AND DIAGNOSTICS	9

SNMP, NetFlow, sFlow, IPFIX – Packet capture and analysis tools: Wireshark, tcpdump – Real-time monitoring with tools (Nagios, Zabbix, Grafana) – Performance tuning on routers, switches, and firewalls – Network baselining and reporting.

UNIT - V	ADVANCED OPTIMIZATION	9

WAN optimization – CDN strategies – SD-WAN and Cloud-based optimization – AI/ML for predictive performance tuning – Optimization in wireless and mobile networks – Case studies on enterprise network performance tuning.

Approved by BoS Chairman

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Identify key network performance issues and relevant metrics.
CO2	Analyze and optimize different layers of network protocols.
CO3	Implement traffic management techniques and QoS policies.
CO4	Use network monitoring tools for performance diagnostics.
CO5	Apply optimization techniques in real-world networking scenarios.

CO Mapping with PO & PSO

CO/PO & PSO	PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO2	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO3	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO4	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO5	3	2	2	-	1	-	-	-	-	-	1	1	2	2
Weighted Average	3	2	2	-	1		-	-	-	-	1	1	2	2

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Text Books	
1.	James F. Kurose, Keith W. Ross, *"Computer Networking: A Top-Down Approach"*, 8th Edition, Pearson, 2021.
2.	Narbik Kocharians, Terry Vinson, *"Network Performance and Optimization Guide"*, Cisco Press, 2023.

Reference Books	
1.	William Stallings, "High-Performance Communication Networks", 2nd Edition, Pearson, 2020.
2.	Kevin Wallace, "Cisco QoS Exam Certification Guide", Cisco Press, 2018.
3.	D. Medhi and K. Ramasamy, "Network Routing: Algorithms, Protocols, and Architectures", Morgan Kaufmann, 2017.

Approved by BoS Chairman

B.E / B.Tech	B23CSE924 - 5G AND NEXT GENERATION NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the evolution of mobile networks and the architecture of 5G.
2.	To explore key enabling technologies and standards for 5G networks.
3.	To analyze network slicing, edge computing, and virtualization in 5G.
4.	To examine radio access technologies, spectrum management, and massive MIMO.
5.	To study future trends including 6G, AI-driven networks, and IoT integration.

UNIT - I	INTRODUCTION TO MOBILE NETWORK EVOLUTION	9

Overview of 1G to 4G – Limitations of LTE – 5G vision and requirements – ITU IMT-2020 – Use cases: eMBB, URLLC, mMTC – 5G architecture: Core and RAN – Key design principles.

UNIT - II	5G NETWORK ARCHITECTURE AND TECHNOLOGIES	9

5G NR (New Radio) – 5G Core (5GC) – Control and user plane separation (CUPS) – Network Function Virtualization (NFV) – Software Defined Networking (SDN) – MEC (Multi-access Edge Computing).

UNIT - III	RADIO TECHNOLOGIES AND PHYSICAL LAYER DESIGN	9

Millimeter Wave Communication – Beamforming – Massive MIMO – Spectrum Allocation – Channel models and modulation – Antenna design for 5G – 5G NR PHY layer features.

UNIT - IV	NETWORK SLICING AND QOS MANAGEMENT	9

Concept of Network Slicing – Slice lifecycle and orchestration – 5G QoS framework – Mobility management – RAN slicing – Integration with cloud-native architecture – Security challenges in sliced networks.

UNIT - V	BEYOND 5G AND FUTURE TRENDS	9

Towards 6G: Key drivers and vision – THz Communication – AI/ML in network optimization – Internet of Everything (IoE) – Non-terrestrial networks (NTN) – Smart city and IoT applications using 5G.

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Describe the evolution and key concepts of 5G and its applications.
CO2	Explain the architecture and enabling technologies of 5G networks.
CO3	Analyze physical layer advancements and radio access innovations.
CO4	Apply concepts of network slicing and QoS in 5G deployments.
CO5	Evaluate future network trends including AI-driven and 6G technologies.

CO Mapping with PO & PSO

CO/PO & PSO	PO1 (K3)	PO 2 (K4)	PO3 (K5)	PO 4 (K5)	PO 5 (K6)	PO6 (K3) (A3)	PO 7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO2	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO3	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO4	3	2	2	-	1	-	-	-	-	-	1	1	2	2
CO5	3	2	2	-	1	-	-	-	-	-	1	1	2	2
Weighted Average	3	2	2	-	1		-	-	-	-	1	1	2	2

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Text Books	
1.	Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.
2.	Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 2015.

Reference Books	
1.	Amitabha Ghosh, Rapeepat Ratasuk, "Essentials of 5G: Everything You Need to Know", Cambridge University Press, 2023.
2.	Saro Velrajan, "5G NR: Architecture, Technology, Implementation, and Operation of 3GPP New Radio Standards", Wiley, 2022.
3.	Mischa Dohler and Gerhard Fettweis, "6G Wireless: The Communication Paradigm Beyond 2030", Wiley-IEEE Press, 2024.

Approved by BoS Chairman

Vertical – V
Smart Analytics

B.TECH	B23ADE909- INFORMATION RETRIEVAL	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of Information retrieval.
2.	To study the metrics and evaluation of the retrieval system.
3.	To analyse machine learning techniques for text classification and clustering.
4.	To identify various search engine system operations.
5.	To learn different techniques of recommender system.

UNIT - I	INTRODUCTION	9

Information Retrieval – Early Developments – The IR Problem – The Users Task – Information versus Data Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes – The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today.

UNIT - II	MODELING AND RETRIEVAL EVALUATION	9

Basic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Reference Collection – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

UNIT - III	TEXT CLASSIFICATION AND CLUSTERING	9

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching.

UNIT - IV	WEB RETRIEVAL AND WEB CRAWLING	9
The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations — Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler.		

UNIT - V	RECOMMENDER SYSTEM	9
Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content based Filtering – Collaborative Filtering.		
Total Instructional hours: 45		

Course Outcomes: Students will be able to	
CO1	Understand and explore the information and developments of the system.
CO2	Interpret the modelling and retrieval evaluations.
CO3	Make use of appropriate method of classification or clustering.
CO4	Utilize the innovative features in a search engine.
CO5	Identify and implement a recommender system.
Text Books	
1.	Ricardo Baeza-Yates and Berthier Ribeiro-Neto, ―Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2.	Ricci, F, Rokach, L. Shapira, B.Kantor, ―Recommender Systems Handbook, First Edition, 2011.
Reference Links	
1.	C. Manning, P. Raghavan, and H. Schütze, ―Introduction to Information Retrieval, Cambridge University Press, 2008.
2.	Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

Approved By BoS Chairman

B.TECH	B23ADE910 - PATTERN RECOGNITION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To learn the fundamentals of Pattern Recognition techniques
2.	To Study the various Statistical Pattern recognition techniques
3.	To Analyse the linear discriminant functions and unsupervised learning and clustering.
4.	To learn the various syntactical pattern recognition techniques.
5.	To learn the Neural Pattern recognition techniques.

UNIT - I	PATTERN RECOGNITION OVERVIEW	9
Pattern recognition, classification ad description – Patterns and feature Extraction with Examples – Training and Learning in PR systems – Pattern recognition Approaches.		

UNIT - II	STASTISTICAL PATTERN RECOGNITION	9
Introduction to statistical Pattern Recognition-supervised Learning using Parametric and Non-Parametric Approaches.		

UNIT - III	LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING	9
Introduction-Discrete and binary classification problems-Techniques to directly obtaining linear classifiers – Formulation of Unsupervised Learning problems-Clustering for unsupervised learning and classification.		

UNIT - IV	SYNTACTIC PATTERN RECOGNITION	9
Overview of Syntactic Pattern Recognition Syntactic recognition via parsing and other grammars – Graphical Approaches to syntactic pattern recognition – Learning via grammatical inference.		

UNIT - V	NEURAL PATTERN RECOGNITION	9
Introduction to Neural Networks – Feedforward Networks and training by Back Propagation – Content Addressable memory Approaches and Unsupervised Learning in Neural PR.		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the concepts, importance, application and the process developing Pattern recognition over view
CO2	Classify about parametric and non-parametric related concepts.
CO3	Relate the framework of frames and bit images to animations.
CO4	Develop the multimedia projects and stages of requirement in phases of project.
CO5	Build the concept of cost involved in multimedia planning, designing, and producing
Text Books	
1.	Braga-Neto, "Fundamentals of Pattern Recognition and Machine Learning", Springer, 2020.
2.	M. Narasimha Murty and V. Susheela Devi, "Pattern Recognition: An Algorithmic Approach", Springer; Reprint, 2019.
Reference Links	
1.	Robert Schalkoff, "Pattern Recognition: Statistical Structural and Neural Approaches", John wiley& sons.2020
2.	Earl Gose, Richard johnsonbaugh, Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall of India, Pvt Ltd, New Delhi., 2021

Approved By BoS Chairman

B.TECH	B23ADE911- HEALTH CARE ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To Understand the various forms of electronic healthcare information.
2.	To Learn the use of machine learning in healthcare.
3.	To Understand the importance of predictive model.
4.	To learn the techniques adopted to analyse healthcare data.
5.	To study about the Temporal data Analytics

UNIT - I	FOUNDATION OF HEALTHCARE ANALYTICS	9
Introduction to Healthcare Data Analytics - Need for Healthcare Analytics – Examples of Healthcare Analytics -Electronic Health Records–Components of EHR- Coding Systems-Benefits of EHR- Barrier - Challenges- Phenotyping Algorithms.		

UNIT - II	ANALYTICS ON MACHINE LEARNING	9
Machine learning pipeline: Pre – processing – Visualization – Feature Selection – Training model parameter – Evaluation model: Sensitivity, Specificity, PPV, NPV, FPR, Accuracy, ROC, Precision Recall Curves - Natural Language Processing and Data Mining for Clinical Text– Social Media Analytics for Healthcare		

UNIT - III	MEASURING HEALTHCARE QUALITY	9
Introduction to healthcare measures, Medicare value-based programs: The Hospital Value Based Purchasing (HVBP) program, The Hospital Readmission Reduction (HRR) program, The Hospital-Acquired Conditions (HAC) program, The End-Stage Renal Disease (ESRD) quality incentive program, The Skilled Nursing Facility Value-Based Program (SNFVBP), The Home Health Value-Based Program (HHVBP), The Merit-Based Incentive Payment System (MIPS).		

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UNIT - IV	PREDICTIVE MODELS	9
Introduction to Predictive Analytics – Obtaining and Importing the NHAMCS Dataset – Making the Response Variable - Splitting the Data into Train and Test Sets - Preprocessing the Predictor Variables – Building the Models – Using the Models to Make Predictions – Improving our Models.		

UNIT - V	ADVANCED DATA ANALYTICS	9
Advanced Data Analytics for healthcare – Review of Clinical Prediction Models-Temporal data mining for healthcare data – Visual Analytics for healthcare - Predictive models for Integrating Clinical and Genomic Data – Information Retrieval for Healthcare – Privacy – Preserving Data Publishing Methods in Healthcare		
Total Instructional hours: 45		

Course Outcomes: Students will be able to	
CO1	Outline the concepts of healthcare foundations.
CO2	Extend machine learning for healthcare data analysis.
CO3	Analyze the quality of health-care systems.
CO4	Develop models for effective predictions in healthcare applications.
CO5	Organize temporal data mining for healthcare data.
Text Books	
1.	Kumar, Vikas Vik. Healthcare Analytics Made Simple: Techniques in healthcare computing using machine learning and Python. Packt Publishing Ltd, 2018.
2.	Yang, Hui, and Eva K. Lee, eds. Healthcare analytics: from data to knowledge to healthcar improvement. John Wiley & Sons, 2016.
Reference Links	
1.	El Morr, Christo, and Hossam Ali-Hassan. Analytics in healthcare: a practical introduction. Springer, 2019.
2.	Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, “Health Care Data Analysis and management, Academic Press, 2018.

Approved By BoS Chairman

B.TECH	B23ADE912 SOCIAL MEDIA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To Understand the basic concepts of social media analytics and its significance
2.	To familiarize learners with the concept of social media analytics and understand its significance.
3.	To Demonstrate learners with the tools of social media analytics.
4.	To Extend the concepts used for studying the effectiveness of social media for business purposes.
5.	To familiarize with different social media analytics tools.

UNIT - I	INTRODUCTION TO SOCIAL MEDIA ANALYSIS	9

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas. Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization

UNIT - II	COMMUNITY BUILDING AND MANAGEMENT	9

History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages- Linking Social Media Accounts-The Viral Impact of Social Media.

UNIT - III	SOCIAL MEDIA POLICIES AND MEASUREMENTS	9

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The road ahead in social media- The Basics of Tracking Social Media.

UNIT - IV	DATA COLLECTION AND VISUALIZATION	9

Processing and Visualizing Data - Influence Maximization - Link Prediction - Collective Classification - Applications in Advertising and Game Analytics - Collecting and analyzing social media data using python - visualization and exploration of data using python

UNIT - V	SOCIAL MEDIA ANALYTICS TOOLS	9
Face book analytics: introduction, parameters, demographics - analyzing page audience – Reach and Engagement analysis - Social campaigns –Measuring and analyzing social campaigns - defining goals and evaluating outcomes –Network Analysis - Twitter analytics tools – Whatsapp analytics: Whatsanalyzer, Whatsapp Business Analyzer - YouTube analytics: Overview of channel analytics – Overview of video analytics - Tracking links with Bit.ly - Google analytics		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Infer knowledge about basic concepts of social media analytics
CO2	Develop a mass communication strategy and guide campaigns
CO3	Build an idea of social media policies.
CO4	Model the how social media data is visualized.
CO5	Apply different tools for studying and processing social media data.
Text Books	
1.	Matthew Ganis, Avinash Kohirkar , Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Pearson, 2021
2.	K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers PrivateLimited, 2020
Reference Links	
1.	Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 7th Edition, Wiley, 2021.
2.	Bittu Kumar, Social Networking, V & S Publishers, 2020.

Approved By BoS Chairman

B.TECH	B23ADE913 IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of image processing techniques for computer vision.
2.	To learn the techniques used for image processing.
3.	To understand the various Object recognition mechanisms.
4.	To discuss about various face and gesture recognition techniques.
5.	To understand the video analytics techniques.

UNIT - I	INTRODUCTION	9
Computer Vision – Image representation and image analysis tasks – Image representations – digitization – properties – color images – Data structures for Image Analysis – Levels of image data representation – Traditional and Hierarchical image data structures.		

UNIT - II	IMAGE PROCESSING TECHNIQUES	9
Image Enhancement: Spatial Domain methods: Histogram Processing - Fundamentals of Spatial Filtering - Smoothing Spatial filters - Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain - image smoothing - image sharpening - selective filtering Image Segmentation: Segmentation concepts - point, line and Edge detection – Thresholding - region based segmentation.		

UNIT - III	OBJECT DETECTION AND RECOGNITION IN IMAGE AND VIDEO	9
Texture models image – Video Classification models – Video Classification examples – Object tracking in video – Applications and Case Studies – Industrial remote sensing – Retail remote sensing – Transportation and Travel remote sensing – Video Analytics in WSN – IoT Video Analytics Architectures		

UNIT - IV	FACE RECOGNITION AND GESTURE RECOGNITION	9
Face Recognition - Introduction-Applications of Face Recognition - Process of Face Recognition Deep Face solution by Facebook - FaceNet for Face Recognition- Implementationusing FaceNetGesture Recognition.		

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UNIT - V	VIDEO ANALYTICS	9
Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3.		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Explain the basics of image representation.
CO2	Outline the techniques used for image processing.
CO3	Develop various object detection techniques to solve real world problems.
CO4	Identify the various face and gesture recognition mechanisms.
CO5	Apply the various video analytics techniques.
Text Books	
1.	Vaibhav Verdhan,"Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras" ,Apress, 2021.
2.	Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Thomson Learning, 2020.
Reference Links	
1.	Jean-Yves Dufour "Intelligent Video Surveillance Systems" Wiley,2020
2.	W.Härdle, M.Müller,S.Sperlich , A.Werwatz 3rd Edition Springer "Non parametric and Semi parametric Models", Pearson, 2020.

B.TECH	B23ADE914- COMPUTER VISION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To Understand the standard computer vision concepts
2.	To study the standard image processing tasks
3.	To apply the Clustering concept for Image Classification
4.	To introduce practical constraints in computer vision application
5.	To study with an existing computer vision pipeline based on deep learning models

UNIT - I	COMPUTER VISION	9

About Computer Vision. Components of an Image Processing System. Image Resolution. Image Formats. Colour Spaces. Fundamental of Image Processing. Visual Inspection System. Biomedical Imaging Methods. Image Thresholding. Based Image Retrieval. Human Visual Inception. Image Formation. Geometric Properties. 3D Imaging. Stereo Images.

UNIT - II	PIXEL-BASED MANIPULATIONS & TRANSFORMATION	9

Visual properties-Pixel colour manipulation-Randomness-Drawing with existing images-Blending multiple images-Image transformation-Image orientation-Image resizing-Affine transform-Affine Transformations-Perspective transform-Linear vs. polar coordinates-Three-dimensional space-General pixel mapping.

UNIT - III	STRUCTURE IDENTIFICATION	9

Image preparation-Conversion to grayscale-Conversion to a black-and-white image-Morphological operations (erode, dilate)-Blur operations (smoothing)Edge detection-Line detection-Circle detection-Contours processing-Shape detection.

UNIT - IV	CLUSTERING IMAGES & IMAGE RETRIEVAL	9

About Transfer Learning. Extract features. SciPy Clustering Package. K-Means Clustering. Clustering Images. Principal Components. Clustering Pixels. Hierarchical Clustering. Spectral Clustering. Fast Fourier Transforms. -Based Image Retrieval. Indexing Images. Searching the Database for Images. Querying with an Image. Benchmarking and Plotting the Results. Ranking Results Using Geometry.

Approved By BoS Chairman

UNIT - V	IMAGE CLASSIFICATION USING DEEP LEARNING	9
Working with Image Datasets. k-NN: A Simple Classifier. k-NN Hyperparameters. Gradient Descent. Loss Functions. Stochastic Gradient Descent (SGD). Regularisation. The Perceptron Algorithm. Backpropagation and Multi-layer Networks. Weight Initialization. Constant Initialization. Uniform and Normal Distributions. CNN Building Blocks. Image Classification.		
Total Instructional hours: 45		

Course Outcomes: Students will be able to	
CO1	Understand the basic knowledge, theories and methods of computer vision.
CO2	Illustrate the essentials of image processing concepts through mathematical interpretation.
CO3	Demonstrate a knowledge of a broad range of fundamental image processing and image analysis techniques
CO4	Apply Clustering algorithms for clustering.
CO5	Make use of cognitive tasks including image classification, recognition and detection
Text Books	
1.	Pro Processing for Images and Computer Vision with OpenCV, Bryan WC Chung, Apress, 2017.
Reference Books	
1.	Practical Computer Vision Applications Using Deep Learning with CNNs: With Detailed Examples in Python Using TensorFlow and Kivy, Ahmed Fawzy Gad, Apress. 2018
2.	Computer Vision Principles, Algorithms, Applications, Learning E.R. Davies, Academic Press, 5th edition, 2017

Approved By BoS Chairman

B.TECH	B23ADE915 KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	1	3

Course Objectives	
1.	To understand the basics of knowledge engineering.
2.	To study the methodologies and modelling for Agent Design and Development.
3.	To identify the development methodologies and ontologies
4.	To interpret the reasoning with ontologies.
5.	To Apply different rule concepts and rule learnings.

UNIT - I	REASONING UNDER UNCERTAINITY	9
Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.		

UNIT - II	METHODOLOGY AND MODELING	9
Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis.		

UNIT - III	ONTOLOGIES – DESIGN AND DEVELOPMENT	9
Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching - Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation		

UNIT - IV	REASONING WITH ONTOLOGIES AND RULES	9
Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.		

Approved By BoS Chairman

UNIT - V	LEARNING AND RULE LEARNING	9
Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization - Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the basics of Knowledge Engineering.
CO2	Apply methodologies and modelling for Agent Design and Development.
CO3	Design and develop ontologies.
CO4	Utilize reasoning with ontologies and rules.
CO5	Make use of the learning and rule learning.
Text Books	
1.	Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, “Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning”, Cambridge University Press, 2021.
2.	Ricci, F, Rokach, L. Shapira, B.Kantor, “Recommender Systems Handbook”, First Edition, 2020.
Reference Links	
1.	Ela Kumar, “Knowledge Engineering”, 1 K International Publisher House, 2020.
2.	King, “Knowledge Management and Organizational Learning”, Springer, 2019

Approved By BoS Chairman

B.TECH	B23ADE916 ETHICS FOR DATA SCIENCE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To Understand the importance, principles, benefits, and challenges of data ethics.
2.	To identify the insights of ethical philosophies, applied ethics and guiding principles for ethical action.
3.	To study about ethical data gathering and its presprocessing .
4.	To apply the privacy-preserving data mining and ethical considerations in AI applications.
5.	To interpret the skills for ethical measurement and handling unintended consequences

UNIT - I	INTRODUCTION TO DATA SCIENCE ETHICS	9

Data Ethics- Importance of Data Ethics – Principles of Data Ethics - Benefits and challenges of data ethics - The Rise of Data Science (Ethics)- Care-Right and Wrong –Data Science- Data Science Ethics Equilibrium - The FAT Flow Framework for Data Science Ethics

UNIT - II	PRINCIPLES OF ETHICS	9

Doing Good Data Science - Oaths and Checklists - Data's Day of Reckoning - Philosophy of ethics- Applied Ethics - Implementing the Five C's-Causality and ethics- Some settings for Professional Ethics – Principles to guide Ethical action - Case Studies.

UNIT - III	ETHICAL DATA GATHERING AND PRE-PROCESSING	9

Privacy as a Human Right – Regulations - Privacy Mechanisms - Cautionary Tales: Backdoors and Messaging Encryption- Bias - Human Experimentation - Defining and Measuring Privacy - Cautionary Tales: Re-identification - Selecting Variables - Fair Relabeling

UNIT - IV	ETHICAL MODELLING	9

Privacy-Preserving Data Mining - Discrimination-Aware Modelling - Predicting Recidivism and Redlining - Comprehensible Models and Explainable AI- Explaining Webpage Classifications - Including Ethical Preferences: Self-Driving Cars

Approved By BoS Chairman

UNIT - V	ETHICAL EVALUATION AND DEPLOYMENT	9
Ethical Measurement - Ethical Interpretation of the Results - Ethical Reporting - Access to the System - Different Treatments for Different Predictions - Censoring Search and Face Recognition - Honesty and DeepFake – Governance - Unintended Consequences.		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the importance and challenges of data ethics in the modern data-driven world.
CO2	Infer about Ethical Awareness in Data Science.
CO3	Demonstrate Ethical Data Collection and Processing.
CO4	Apply Ethical Principles to Data Modeling.
CO5	Analyze Ethical Implications in Data Deployment
Text Books	
1.	Mike Loukides, Hilary Mason and DJ Patil,"Ethics and Data Science", O'Reilly Media,2018.
2.	David Martens, "Data Science Ethics Concepts, Techniques, and Cautionary Tales" Oxford University Press, 2022.
Reference Links	
1.	https://joshualoftus.com/ms4ds/ethical-data-science.html#ethical-guidelines-for statistical-practice.
2.	https://joshualoftus.com/ms4ds/ethical-data-science.html#causality-and-ethics.

Approved By BoS Chairman

Vertical – VI
Software Engineering

B.E / B.Tech	B23CSE901-AGILE METHODOLOGIES FOR SOFTWARE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamental principles and values of Agile methodologies.
2.	To provide exposure to Agile software development processes and frameworks such as Scrum, Kanban, and Extreme Programming (XP).
3.	To develop skills in Agile project management, including sprint planning, backlog grooming, and iterative development.
4.	To implement Agile software development practices using continuous integration, test-driven development (TDD), and automated testing.
5.	To apply Agile methodologies in real-world projects, including large-scale and distributed teams.

UNIT - I	INTRODUCTION TO AGILE METHODOLOGIES	9
Traditional vs Agile Software Development- The Agile Manifesto: Principles and Values Benefits and Challenges of Agile-Agile vs. Waterfall Methodologies-Introduction to Scrum, Kanban, XP, Lean, SAFe- Hybrid Agile Approaches- Agile in Cyber-Physical Systems and IoT.		

UNIT - II	AGILE PROCESSES	9
Lean Production – SCRUM, Crystal, Feature Driven Development- Adaptive Software Development – Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices- introducing CI/CD, Automation, Agile Testing).		

UNIT - III	AGILITY AND KNOWLEDGE MANAGEMENT	9
Agile Information Systems – Agile Decision Making – EarlS Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).- AI-driven Scrum Assistants.		

UNIT - IV	AGILE IN INDUSTRY AND EMERGING APPLICATIONS	9
Case Studies of Agile in Industry (Software, Finance, Healthcare, IoT)-Agile in Cyber-Physical Systems & IoT Development-Agile for Hardware and Embedded Systems-Agile and Cloud Computing Agile in Large-Scale Distributed Teams (Global Agile Development).		

Approved by BoS Chairman

UNIT - V	AGILE QUALITY ASSURANCE AND SECURITY	9
Agile Product Development Strategies-Agile Metrics and Performance Measurement: Burn-Down and Burn-Up Charts-Velocity, Cycle Time, Lead Time-Feature-Driven Development (FDD) Metrics: Financial and Production Metrics in FDD, Test-Driven Development (TDD) and Behavior-Driven Development (BDD)-Agile Testing Strategies: Continuous Testing-Automated Testing in Agile-DevSecOps – Security in Agile Development.		

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Apply knowledge of Agile principles and methodologies by understanding Agile values, iterative development, and adaptability in software engineering.
CO2	Apply Agile frameworks and Extreme Programming (XP) in software project management.
CO3	Develop Agile project management strategies and daily scrum to enhance team collaboration
CO4	Utilize Agile development practices and automated testing for software quality assurance
CO5	Analyze real-world software applications using Agile methodologies for distributed teams.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K3**	3	2	2	1	1	-	-	-	-	1	-	1	3	3
CO2	**K3**	3	3	3	1	1	-	-	-	-	1	-	1	3	3
CO3	**K3**	3	3	3	1	1	-	-	-	-	1	-	1	3	3
CO4	**K3**	3	3	3	2	2	-	-	-	-	1	-	1	3	3
CO5	**K4**	3	3	3	2	2	-	-	-	-	1	-	1	3	3
Weighted Average		3	3	3	2	2	-	-	-	-	1	-	1	3	3

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Approved by BoS Chairman

Text Books	
1.	"Agile Project Management: Creating Innovative Products" by Jim Highsmith, 2004.
2.	"Agile and Iterative Development: A Manager's Guide" by Craig Larman, 2003.

Reference Books	
1.	Adaptive Software Development: A Collaborative Approach to Managing Complex Systems" by Jim Highsmith, 2000.
2.	Scaling Lean & Agile Development: Thinking and Organizational Tools for Large-Scale Scrum" by Craig Larman and Bas Vodde, 2008.
3.	"The Art of Agile Development" by James Shore and Shane Warden, 2008.
4.	"Agile Analytics: A Value-Driven Approach to Business Intelligence and Data Warehousing" by Ken W. Collier, 2011.

B.E / B.Tech	B23CSE902-SOFTWARE PROJECT MANAGMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of software project management and life cycle models.
2.	To learn project planning, estimation, scheduling, and risk management.
3.	To study resource allocation, project tracking, and configuration management.
4.	To explore quality assurance, testing strategies, and maintenance planning.
5.	To examine agile, DevOps, and emerging methodologies in project execution.

UNIT - I	INTRODUCTION	9

Project Definition – Characteristics of Software Projects – Project Life Cycle – Software Development Life Cycle Models – Role of Project Manager – Project Stakeholders – Overview of PMBOK and CMMI – Contract Management – Metrics and KPIs.

UNIT - II	PROJECT PLANNING AND ESTIMATION	9

Project Planning Process – Scope Management – Work Breakdown Structure (WBS) – Software Size and Cost Estimation Techniques: Function Point Analysis, COCOMO I & II – Resource Planning – Project Scheduling: Gantt Charts, PERT, CPM.

UNIT - III	RISK MANAGEMENT AND RESOURCE ALLOCATION	9

Risk Identification – Risk Assessment and Mitigation – Risk Register – Resource Allocation Models – Critical Chain Scheduling – Project Staffing and Team Structures – Communication and Stakeholder Management.

UNIT - IV	PROJECT EXECUTION AND CONTROL	9

Project Monitoring and Control – Earned Value Management (EVM) – Change Control and Version Management – Software Configuration Management (SCM) – Project Status Reporting – Project Closure and Post-mortem Analysis.

UNIT - V	QUALITY, MAINTENANCE AND MODERN APPROACHES	9

Software Quality Assurance – Reviews and Audits – Testing Strategies – Defect Management – Maintenance and Re-engineering – Agile Project Management – Scrum, Kanban – DevOps Integration – Tools: Jira, Trello, MS Project.

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Describe the key concepts and practices of software project management.
CO2	Plan, estimate, and schedule software projects effectively.
CO3	Identify, assess, and manage risks and resources in a project.
CO4	Monitor, control, and report on software project progress.
CO5	Apply modern project management tools and agile methods to software development.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO 2 (K4)	PO3 (K5)	PO 4 (K5)	PO 5 (K6)	PO6 (K3) (A3)	PO 7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1															
CO2															
CO3															
CO4															
CO5															
Weighted Average															

3 – Strong **2- Moderate** **1- Weak** **‘-‘ – No Correlation**

Text Books	
1.	Bob Hughes, Mike Cotterell, Rajib Mall, “Software Project Management”, 6th Edition, McGraw-Hill Education, 2017.
2.	Walker Royce, “Software Project Management: A Unified Framework”, 1st Edition, Pearson Education, 2009.

Reference Books	
1.	Jalote, Pankaj, “Software Project Management in Practice”, 1st Edition, Pearson Education, 2005.
2.	Harold Kerzner, “Project Management: A Systems Approach to Planning, Scheduling, and Controlling”, 12th Edition, Wiley, 2022.

Approved by BoS Chairman

B.E / B.Tech	B23CSE903-SOFTWARE QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of software quality and key quality models.
2.	To learn various software testing strategies and techniques.
3.	To implement software quality assurance processes, defect management, and risk
4.	To get hands-on experience in test automation tools and frameworks.
5.	To explore quality assurance practices in Agile and DevOps environments.

UNIT - I	INTRODUCTION TO SOFTWARE QUALITY ASSURANCE	9

Software Quality - Software Quality Attributes - Software Development Life Cycle and Role of Quality - SQA principles and processes – McCall's and Boehm Software Quality Models - Quality Standards: ISO 9001, CMMI, Six Sigma, TQM.

UNIT - II	SOFTWARE TESTING STRATEGIES AND TECHNIQUES	9

Software Testing Principles - Types of testing - Functional and Non-functional testing - Levels of testing - Unit, integration, system, acceptance testing, Regression testing - Test case design - boundary value analysis- equivalence partitioning.

UNIT - III	SOFTWARE QUALITY ASSURANCE PROCESS	9

Software Reviews: Peer Review, Walkthroughs, and Inspections- SQA Plan: Components and Implementation - Risk Management in SQA - Defect Management Process: Defect Lifecycle, Defect Tracking Tools - SQA Metrics: Reliability Metrics and Maintainability Metrics.

UNIT - IV	TEST AUTOMATION TOOLS	9

Introduction to automated testing - Selenium, JUnit, TestNG, and other test automation tools - Writing and executing test scripts - Continuous Integration and Continuous Testing.

UNIT - V	QUALITY ASSURANCE IN AGILE AND DEVOPS	9

Agile testing principles - Test-driven development (TDD) and behavior-driven development (BDD) - QA practices in DevOps - CI/CD for Quality Assurance - Industry Best Practices & Future Trends in Software Quality

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Recall fundamental concepts of Software Quality Assurance, quality attributes, and models.
CO2	Analyse different software testing strategies, techniques, and test case design methodologies.
CO3	Apply software quality assurance processes, risk management, and defect tracking methods.
CO4	Utilize modern test automation tools for writing, executing, and managing test scripts.
CO5	Develop Agile and DevOps-based quality assurance practices, including TDD, BDD, and CI/CD.

CO Mapping with PO & PSO

CO/PO & PSO		**PO1 (K3)**	**PO2 (K4)**	**PO3 (K5)**	**PO4 (K5)**	**PO5 (K6)**	**PO6 (K3) (A3)**	**PO7 (K2) (A3)**	**PO8 (K3) (A3)**	**PO9 (A3)**	**PO10 (A3)**	**PO11 (K3) (A3)**	**PO12 (A3)**	**PSO1 (K4) (A3)**	**PSO2 (K3) (A3)**
CO1	**K2**	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	**K4**	3	3	2	2	-	-	-	-	-	-	-	-	3	2
CO3	**K3**	-	2	3	3	2	2	-	-	-	-	-	-	3	3
CO4	**K3**	-	-	3	3	3	-	-	-	-	-	-	-	3	3
CO5	**K3**	-	-	2	3	3	2	2	-	-	-	-	3	3	3
Weighted Average		1	1	2	2	2	1	-	-	-	-	-	1	3	3

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Text Books	
1.	G. J. Myers, T. Badgett, T. M. Thomas, and C. Sandler "The Art of Software Testing" , 3rd Edition, Wiley, 2011.
2.	Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson, 2018.

Reference Books	
1.	Roger S. Pressman and Bruce R. Maxim **"**Software Engineering: A Practitioner's Approach**",**
2.	Kshirasagar Naik and Priyadarshi Tripathy "Software Testing and Quality Assurance: Theory
3.	Stephen H. Kan, "Metrics and Models in Software Quality Engineering", 2nd Edition, Pearson,

Approved by BoS Chairman

B.E / B.Tech	B23CSE904-SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To explain the fundamental principles, concepts, and importance of software testing.
2.	To identify key test design techniques and their applications in software testing.
3.	To define the key concepts, processes, and best practices in test management and
4.	To explain the fundamental concepts of software quality assurance and testing methodologies
5.	To **d**evelop test scripts using industry-standard automation tools and best practice

UNIT - I	FUNDAMENTALS OF SOFTWARE TESTING	9

Introduction to software testing: goals, principles, and limitations- Software development life cycle and testing process- Testing levels: unit, integration, system, and acceptance testing- Testing types: functional, non-functional, structural, and change-related testing- Static and dynamic testing techniques- Software quality attributes and metrics.

UNIT - II	TEST DESIGN TECHNIQUES	9

Black-box testing techniques: equivalence partitioning, boundary value analysis- White-box testing techniques: statement, branch, and path coverage- Experience-based testing: error guessing, exploratory testing- Combinatorial testing methods- State transition testing and decision tables- Risk-

UNIT - III	TEST MANAGEMENT AND PLANNING	9

Test planning and strategy development- Test estimation and scheduling- Test case design, execution, and reporting- Defect management process and tools- Test documentation and standards (IEEE 829)- Review and inspection processes-Test management tools and dashboards

UNIT - IV	QUALITY ASSURANCE AND TESTING TOOLS	9

Software quality assurance frameworks- Test management tools and their application- Performance, security, and usability testing tools- Mobile application testing tools and techniques- Web application testing approaches- API testing methodologies and tools- Test environment setup and configuration management

UNIT - V	TEST AUTOMATION AND CONTINUOUS INTEGRATION	9

Test automation frameworks and architectures- Test script development and maintenance- Data-driven and keyword-driven testing- Behavior-driven development (BDD) and test automation- Continuous integration and continuous delivery pipelines- DevOps practices and testing- Advanced topics: AI in testing, chaos engineering, and service virtualization.

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Explain fundamental concepts, principles, and methodologies of software testing.
CO2	Apply various testing techniques to design effective test cases for different types of software applications.
CO3	Identify software requirements to develop comprehensive test plans and strategies.
CO4	Apply the effectiveness of testing processes and tools in improving software quality.
CO5	Build automated test frameworks and implement continuous integration/continuous delivery pipelines.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K1	3	2	1	1	1	1	-	1	1	2	1	2	2	1
CO2	K3	3	3	3	2	2	1	-	1	2	2	1	2	2	1
CO3	K3	3	3	3	3	2	1	-	2	3	3	2	2	2	1
CO4	K3	2	3	3	3	3	2	1	2	2	3	3	2	2	1
CO5	K3	3	3	3	3	3	2	1	2	3	3	3	3	2	1
Weighted Average		3	3	3	3	2	1	1	2	2	3	1	2	2	1

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Text Books	
1.	"Software Testing Automation: Testability Evaluation, Refactoring, Test Data Generation, and Fault Localization", Saeed Parsa, Springer , March 25, 2023
2.	"Software Testing: Second Edition", Ron Patton, Sams Publishing,2005

Reference Books	
1.	"Software Testing", Rex Black, Wiley, April 2009 (Third Edition)
2.	"Software Test Automation: Effective Use of Test Execution Tools", Mark Fewster and Dorothy Graham,Addison-Wesley, June 28, 1999
3.	"Lessons Learned in Software Testing: A Context-Driven Approach",Cem Kaner, James Bach, and Bret Pettichord,Wiley, December 15, 2001
4.	"Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing", Rex Black, Wiley, April 2009 (Third Edition)

Approved by BoS Chairman

B.E / B.Tech	B23CSE905-MODERN SOFTWARE ARCHITECTURES AND PATTERNS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the principles, characteristics, and design considerations of modern software architectures.
2.	To learn various architectural styles, patterns, and their applications in software design.
3.	To explore microservices, cloud-native architectures, and distributed systems.
4.	To analyze software design patterns and best practices to improve maintainability and scalability.
5.	To Investigate emerging trends in software architecture, including AI-driven and event-driven architectures.

UNIT - I	FUNDAMENTALS OF SOFTWARE ARCHITECTURE	9

Introduction to Software Architecture - Architectural Styles (Monolithic, Layered, Client-Server, Microservices) - Quality Attributes (Scalability, Maintainability, Performance, Security), Architectural Decision Making - Role of Software Architects.

UNIT - II	ARCHITECTURAL PATTERNS AND DESIGN PRINCIPLES	9

Introduction to Software Design Patterns - Creational Patterns (Singleton, Factory, Builder) - Structural Patterns (Adapter, Composite, Proxy) - Behavioral Patterns (Observer, Strategy, Command) - SOLID Principles, Domain-Driven Design (DDD).

UNIT - III	MICROSERVICES AND CLOUD-NATIVE ARCHITECTURE	9

Principles of Microservices - Service-Oriented Architecture (SOA) vs. Microservices - API Gateway - Service Discovery, Load Balancing - Cloud-Native Applications - Containerization (Docker, Kubernetes) - Serverless Computing.

UNIT - IV	DISTRIBUTED SYSTEMS AND EVENT-DRIVEN ARCHITECTURE	9

Introduction to Distributed Systems - CAP Theorem - Event-Driven Architecture (EDA) - Message Queues and Event Streaming (Kafka, RabbitMQ - CQRS and Event Sourcing - Scalable Data Processing Architectures.

UNIT - V	EMERGING TRENDS AND CASE STUDIES	9

AI-Driven Software Architecture - Edge Computing, Blockchain-Based Architectures - Observability and Monitoring - Case Studies on Modern Architectural Implementations - Future Trends in Software Architecture.

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes:	
CO1	Explain the principles, characteristics, and importance of modern software architectures.
CO2	Apply architectural and design patterns to develop scalable and maintainable software.
CO3	Identify microservices and cloud-native principles for modern software applications
CO4	Design distributed systems and event-driven architectures for high-performance applications.
CO5	Analyze emerging trends and real-world case studies in modern software architecture.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2	3	2	2	2	3	-	-	-	-	-	-	2	3	2
CO2	K3	3	3	3	2	3	-	-	-	-	-	-	2	3	3
CO3	K3	3	2	3	3	3	2	2	-	-	-	-	2	3	3
CO4	K6	3	3	3	3	3	2	2	2	-	-	-	2	3	3
CO5	K4	3	3	3	3	3	2	2	2	-	-	-	2	3	3
Weighted Average		3	3	3	2	3	1	1	1	-	-	-	2	3	3

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Text Books	
1.	Mark Richards, Neal Ford, "Fundamentals of Software Architecture: An Engineering Approach," O'Reilly Media, 2020.
2.	Eberhard Wolff, "Microservices: Flexible Software Architecture," Addison-Wesley, 2017.

Reference Books	
1.	Martin Fowler, "Patterns of Enterprise Application Architecture," Addison-Wesley, 2002.
2.	Sam Newman, "Building Microservices: Designing Fine-Grained Systems," 2nd Edition, O'Reilly Media, 2021.
3.	Vaughn Vernon, "Implementing Domain-Driven Design," Addison-Wesley, 2013.

Approved by BoS Chairman

B.E / B.Tech	B23CSE906-SOFTWARE DEPENDABILITY	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of software dependability and its significance in critical systems.
2.	To identify fault tolerance, reliability, and safety in software systems.
3.	To apply verification, validation, and testing techniques for dependable software.
4.	To discover software failure analysis and strategies for improving system resilience.
5.	To analyze security aspects related to dependable and fault-tolerant software.

UNIT - I	INTRODUCTION TO SOFTWARE DEPENDABILITY	9

Definition and Importance of Dependable Software - Key Attributes: Reliability, Availability, Maintainability, Safety, and Security - Failure Types and Their Impact on Software Systems - Dependability vs. Traditional Software Quality - Case Studies of Software Failures and Their Consequences

UNIT - II	FAULT TOLERANCE AND ERROR RECOVERY	9

Fault Tolerance: Definition and Techniques - Types of Faults: Transient, Intermittent, and Permanent - Error Detection and Recovery Mechanisms - Redundancy Techniques: Hardware, Software, and Information Redundancy - Exception Handling and Check pointing Strategies.

UNIT - III	VERIFICATION, VALIDATION, AND TESTING FOR DEPENDABILITY	9

Software Verification & Validation (V&V) Techniques - Dependability-Oriented Software Testing - Formal Methods for Software Verification - Software Debugging and Fault Injection - Automated Testing Tools and Static/Dynamic Analysis.

UNIT - IV	DEPENDABILITY IN SAFETY-CRITICAL AND SECURE SYSTEMS	9

Safety-Critical Systems: Standards and Regulations (DO-178C, IEC 61508, ISO 26262) - Risk Analysis and Hazard Identification (FMEA, Fault Trees) - Secure Software Engineering Principles - Security vs. Dependability: Trade-offs and Challenges - Case Studies: Dependability in Medical, Automotive, and Aerospace Software.

UNIT - V	SOFTWARE FAILURE ANALYSIS AND RESILIENT SYSTEM DESIGN	9

Root Cause Analysis of Software Failures - Self-Healing and Self-Adaptive Systems - Dependable Software Architecture Patterns - Resilience Engineering and Recovery Strategies - Future Trends in Software Dependability.

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Explain the principles and challenges of software dependability and its impact on real-world systems
CO2	Apply fault tolerance techniques to enhance system reliability.
CO3	Make use of verification, validation, and testing strategies to ensure dependable software.
CO4	Examine safety-critical and secure systems to ensure compliance with industry standards.
CO5	Analyze software failures and propose strategies to enhance resilience and fault recovery.

CO Mapping with PO & PSO

CO/PO & PSO		**PO1 (K3)**	**PO2 (K4)**	**PO3 (K5)**	**PO4 (K5)**	**PO5 (K6)**	**PO6 (K3) (A3)**	**PO7 (K2) (A3)**	**PO8 (K3) (A3)**	**PO9 (A3)**	**PO10 (A3)**	**PO11 (K3) (A3)**	**PO 12 (A3)**	**PS O1 (K4) (A3)**	**PS O2 (K3) (A3)**
CO1	**K2**	3	2	2	2	2	2	-	2	2	2	2	3	3	2
CO2	**K3**	3	3	3	3	3	2	-	2	2	2	2	3	3	3
CO3	**K3**	3	3	3	3	2	2	-	2	2	1	2	3	3	3
CO4	**K4**	3	3	3	2	2	3	-	3	3	2	2	3	3	3
CO5	**K4**	3	3	3	3	3	2	-	3	3	1	2	3	3	3
Weighted Average		3	3	3	3	2	2	-	2	2	2	2	3	3	3

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Text Books	
1.	John D. Musa , "Software Reliability Engineering: More Reliable Software, Faster Development, and Testing", McGraw-Hill Education, 2nd Edition, 2004.
2.	Anderson Avizienis, Jean-Claude Laprie, Brian Randell , "Fundamental Concepts of Dependability", Springer, 2004.

Reference Books	
1.	Eric Bauer, Randee Adams, Douglas W. Eustace, "*Reliable Design of Digital Systems*", Springer, 2011.
2.	Daniel P. Siewiorek, Robert S. Swarz, "Reliable Computer Systems: Design and Evaluation",
3.	Anderson Avizienis, Laprie & Randell , "Dependable Computing: Concepts, Techniques, and

Approved by BoS Chairman

B.E / B.Tech	B23CSE907-CLOUD NATIVE SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the principles and best practices of Cloud Native Software Development.
2.	To understand the design, development, and deployment of containerized applications using Kubernetes and Docker.
3.	To explore Microservices Architecture, API development, and service orchestration.
4.	To familiarize with DevOps tools such as CI/CD pipelines, Infrastructure as Code (IaC),
5.	To learn cloud security, scalability, and fault-tolerance techniques for cloud-native applications.

UNIT - I	INTRODUCTION	9
Cloud Computing Overview - Cloud Native vs. Traditional Application Development - 12-Factor Applications- Containers vs. Virtual Machines- Introduction to Docker: Installation – Images – Containers – Dockerfile - Docker Compose and Multi-Container Applications.		

UNIT - II	KUBERNETES AND SERVICE ORCHESTRATION	9
Kubernetes Architecture and Components - Pods, Deployments, Services, and Ingress - Stateful vs. Stateless Applications – Config Maps, Secrets, and Persistent Volumes - Kubernetes Networking and Security Policies - Helm Charts for Kubernetes Package Management.		

UNIT - III	MICROSERVICES ARCHITECTURE AND API DEVELOPMENT	9
Introduction to Microservices: Characteristics and Benefits - RESTful APIs and GraphQL Basics - API Gateway and Service Mesh (Istio, Linkerd) - Event-Driven Microservices with Kafka - Distributed Data Management and Database Patterns - Fault Tolerance and Circuit Breaker Patterns.		

UNIT - IV	DEVOPS AND CI/CD PIPELINES	9
Introduction to DevOps in Cloud-Native Applications - CI/CD Pipeline Implementation (Jenkins, GitHub Actions, GitLab CI) - Infrastructure as Code (Terraform, Ansible) - Observability and Logging (Prometheus, Grafana, ELK Stack) - Cloud-Native Security: IAM, Role-Based Access Control (RBAC) - Performance Testing and Scaling Strategies.		

UNIT - V	CLOUD-NATIVE DEPLOYMENT AND CASE STUDIES	9
Serverless Computing: AWS Lambda, Google Cloud Functions - Cloud-Native Deployment Strategies (Blue-Green, Canary, Rolling) - Edge Computing and Cloud-Native AI/ML Workloads - Case Study: Netflix, Uber, or Google Cloud Native Architecture - Future Trends in Cloud-Native Engineering.		

Approved by BoS Chairman

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the fundamental concepts of Cloud Native Development and containerization.
CO2	Design and deploy cloud-native applications using Docker and Kubernetes.
CO3	Develop and manage microservices-based architectures with APIs and service meshes.
CO4	Identify DevOps pipelines for automation, monitoring, and CI/CD in cloud environments.
CO5	Apply cloud security, scalability, and deployment best practices for high availability.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2	3	2	3	3	3	2	1	1	1	1	2	3	3	2
CO2	K6	3	3	3	3	3	2	2	1	2	2	2	3	3	3
CO3	K3	3	3	3	2	3	2	2	1	2	2	2	3	3	3
CO4	K3	3	3	3	3	3	2	2	1	2	3	3	3	3	3
CO5	K3	3	3	3	3	3	3	3	2	2	3	3	3	3	3
Weighted Average		3	3	3	3	3	2	2	1	2	2	2	3	3	3

3 – Strong 2- Moderate 1- Weak '-' – No Correlation

Text Books	
1.	Matt Stine, “Migrating to Cloud-Native Application Architectures”, O'Reilly, 2015.
2.	Brendan Burns, “Designing Distributed Systems: Patterns and Paradigms for Scalable Cloud Applications”, O'Reilly, 2018.

Reference Books	
1.	Pini Reznik, Jamie Dobson, Michelle Gienow, “Cloud Native Transformation: Practical Patterns for Innovation”, O'Reilly, 2019.
2.	Bilgin Ibryam, Roland Huß, “Kubernetes Patterns: Reusable Elements for Designing Cloud-Native Applications”, O'Reilly, 2019.
3.	Kief Morris, “Infrastructure as Code: Dynamic Systems for the Cloud Age”, O'Reilly, 2020.

Approved by BoS Chairman

B.E / B.Tech	B23CSE908- LOW AND NO CODE PLATFORMS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals, advantages, and use cases of low-code and no-code platforms.
2.	To learn how to build and customize applications using visual development tools and workflow automation.
3.	To explore advanced customization techniques, security best practices, and optimization
4.	To understand DevOps practices, automate deployments, and manage the lifecycle of LCNC applications.
5.	To understand emerging trends, AI integration, and real-world case studies to understand the impact of LCNC platforms on software development.

UNIT - I	INTRODUCTION	9
Definition and Evolution of LCNC Platforms - Difference Between Low-Code and No-Code Development - Benefits and Limitations of LCNC Platforms - Popular Low-Code & No-Code Platforms (Mendix, OutSystems, Appian, Bubble, Zapier) - Industry Use Cases of LCNC Development.		

UNIT - II	LOW-CODE AND NO-CODE APPLICATION DEVELOPMENT	9
User Interface (UI) and User Experience (UX) Design in LCNC - Drag-and-Drop Development and Visual Programming - Database Management in LCNC Platforms - Workflow Automation and Business Logic Implementation - Integration with APIs and Third-Party Services.		

UNIT - III	ADVANCED FEATURES AND CUSTOMIZATION	9
Extending LCNC Platforms with Custom Code (JavaScript, Python, SQL) - Security and Compliance in LCNC Applications - Role-Based Access Control and Authentication - Performance Optimization and Scalability Considerations - Mobile and Web Application Development in LCNC.		

UNIT - IV	DEVOPS, DEPLOYMENT, AND MAINTENANCE IN LCNC	9
DevOps Principles in Low-Code Development - Continuous Integration & Continuous Deployment CI/CD) in LCNC - Cloud Deployment and Hosting Options (AWS, Azure, Google Cloud) - Version		

UNIT - V	FUTURE TRENDS AND REAL-WORLD APPLICATIONS	9
AI and Automation in Low-Code and No-Code Platforms - Citizen Development and Democratization of Software Development - LCNC in Business Process Automation and Enterprise Solutions - Challenges and Future Trends in LCNC Development.		

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Explain the fundamentals, evolution, benefits, limitations, and industry use cases of low-code and no-code platforms
CO2	Develop applications using visual development tools, workflow automation, and database integration
CO3	Illustrate advanced customization, security best practices, authentication, and performance optimization in LCNC applications.
CO4	Apply DevOps principles to automate deployment and manage the lifecycle of LCNC applications.
CO5	Evaluate emerging trends, AI integration, and real-world case studies to assess the impact of LCNC platforms on modern software development

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	**K2**	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO2	**K3**	3	3	3	2	3	-	-	-	-	-	2	3	3	3
CO3	**K2**	3	2	3	3	3	2	2	-	-	-	-	2	3	3
CO4	**K3**	3	3	3	3	3	2	2	2	-	-	-	2	3	3
CO5	**K5**	3	3	3	3	3	2	2	2	-	-	-	2	3	3
Weighted Average		3	3	3	3	2	1	1	1	-	-	1	2	3	3

3 – Strong **2- Moderate** **1- Weak** **'-' – No Correlation**

Text Books

1.	Pradeep Venkata Reddy," Low-Code No-Code: Jumpstart Your Software Development Journey", BPB Publications, 2023.
2.	Job Verhagen, Mark Manning, "Mendix for Dummies", Wiley, 2020.

Reference Books

1.	Bindu Reddy, "No-Code AI and Machine Learning: Building AI Solutions without Programming, Manning Publications, 2021.
2.	Johan den Haan, "The Rise of the Citizen Developer: Low-Code and No-Code Application Development ", Springer, 2022.

Approved by BoS Chairman

OPEN ELECTIVE

Open Elective - I

B.E.	B23AEO501- PRINCIPLES OF FLIGHT (Common to all Except AERO)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To study the different component systems and functions.
2.	To understand the basic properties and principles behind the flight.
3.	To study the basic concepts of Aerodynamics.
4.	To study the different structures & construction.
5.	To study the various types of power plants used in aircrafts.

UNIT - I	AIRCRAFT CONFIGURATIONS	9

Brief History-Components of an airplane and their functions. Different types of flight vehicles, classifications. Basic instruments for flying.

UNIT - II	INTRODUCTION TO PRINCIPLES OF FLIGHT	9

Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Evolution of lift, drag and moment. Different types of drag.

UNIT - III	INTRODUCTION TO AERODYNAMICS	9

Aerodynamic forces on aircraft – classification of NACA aerofoils, aspect ratio, wing loading, Mach number, centre of pressure and aerodynamic centre-aerofoil characteristics lift, drag curves.

UNIT - IV	INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS	9

General types of construction, Monocoque, semi-monocoque. Typical wing and fuselage structure. Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials.

UNIT - V	POWER PLANTS USED IN AIRPLANES	9
Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production., Principles of operation of rocket, types of rockets		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Identify the types and classification of components and control system.
CO2	Identify the properties and principles to analyze lift, drag (including types), moment, and their variation with altitude.
CO3	Identify the aerodynamics forces and NACA Airfoils.
CO4	Identify different type of fuselage and constructions.
CO5	Categorize the different types of engines and principles of rocket.

	Text Books
1.	Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition, 2015
2.	E Rathakrishnan, "Introduction to Aerospace Engineering: Basic Principles of Flight", John Wiley, NJ, 2021

	Reference Books
1.	Kermode, A.C., "Flight without Formulae", McGraw-Hill, 1997.
2.	Sadhu Singh, "Internal Combustion Engines and Gas Turbine", SS Kataraia & Sons, 2015.
3.	Stephen.A. Brandt, Introduction to aeronautics: A design perspective, 2nd edition, AIAA Education Series, 2004.

Programme Coordinator

BoS Chairman

B.Tech.	B23AGO501 - Farm Automation	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals and scope of farm automation systems.
2.	To study various types of sensors and their role in smart farming.
3.	To analyze the working of automation systems in field operations.
4.	To explore greenhouse automation and resource management.
5.	To examine the role of advanced technologies like AI, drones, and robotics in agriculture.

UNIT I	INTRODUCTION TO FARM AUTOMATION	9
Definition and scope – Historical development – Classification of automation systems: manual, semi-automated and fully automated – Benefits of automation – Limitations and challenges – Status of automation in Indian agriculture – Automation in small and large farms – Farm automation value chain – Socio-economic implications.		

UNIT II	SENSORS AND SMART FARMING COMPONENTS	9
Types of sensors: soil moisture, pH, temperature, humidity, light, nutrient sensors – Actuators – Microcontrollers and microprocessors (Arduino, Raspberry Pi) – IoT architecture for agriculture – Wireless sensor networks – Communication protocols – Data acquisition and cloud connectivity – Mobile apps and remote monitoring systems.		

UNIT III	AUTOMATION IN FIELD OPERATIONS	9
Automatic steering and GPS-guided tractors – Variable Rate Technology (VRT) – Autonomous planters and seeders – Spraying automation – Robotic weeders – Harvesting automation – Drones for crop health monitoring – Field mapping – Automation kits – Safety aspects in field automation.		

UNIT IV	GREENHOUSE AND RESOURCE MANAGEMENT AUTOMATION	9
Greenhouse control systems: Temperature, humidity, light, CO_2 , irrigation and nutrient management – Automation of fertigation and irrigation (drip, sprinkler) – Scheduling using weather data – Software tools and apps for DSS – Renewable energy-based automation – Case studies of protected cultivation systems.		

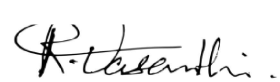
UNIT V	ADVANCED TECHNOLOGIES IN AUTOMATION	9
Artificial Intelligence (AI) and Machine Learning (ML) in farming decisions – Robotics in seeding, pruning, sorting and packaging – Machine vision systems – Drones and UAVs in agriculture – Automation for post-harvest management – Success stories from India and abroad – Future prospects and trends.		
		Total Instructional Hours: 45

Approved by BoS Chairman

COURSE OUTCOMES: Students will be able to	
CO1	Explain the concept and scope of farm automation.
CO2	Identify and interpret various sensors and smart devices in agriculture.
CO3	Apply automation techniques in field operations.
CO4	Demonstrate the application of automation in greenhouse and resource management.
CO5	Evaluate advanced automation technologies and their integration into smart farming systems.

Text Books	
1.	Nageshwar Rao, *Precision Farming and Agricultural Automation*, Kalyani Publishers, 2020.
2.	Manjunatha K.S., *Farm Machinery and Automation*, Jain Brothers, New Delhi, 2018.
3.	Rajvir Yadav, *Agricultural Automation*, Biotech Books, New Delhi, 2021.

References	
1.	CIGR Handbook of Agricultural Engineering Volume VI – Information Technology, ASABE, USA.
2.	Mehta M.L., Verma S.R., and Sharma V.K., *Farm Machinery and Power Engineering*, Jain Brothers.
3.	Internet of Things: https://nptel.ac.in/courses/106105166
4.	Articles and Case Studies from ICAR, IARI, and SmartFarm India



Approved by BoS Chairman

B.E/ B.TECH	B23ADO501– GEN AI WITH OPEN SOURCE FRAMEWORK	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To Understand the Core Concepts of Artificial Intelligence
2.	To explain the Fundamentals of Generative AI and Its Architectures
3.	To Outline Open-Source GenAI Tools and Frameworks
4.	To identify the Prompt Engineering Techniques and Build Chatbots
5.	To study the Real-World Applications of Generative AI in Open-Source Domains

UNIT-I	BASICS OF AI	9
Introduction to AI - Future of AI – Applications of AI – History of AI- Types of AI- Intelligent Agent: Types of Agents- Characteristics of Intelligent Agents - Structure of Agents – Agents and Environments- Examples of AI.		

UNIT-II	GEN AI MODELS	9
Introduction of Gen Ai- Sub Sets of Gen Ai- Model Creation - Types of Generative Ai transformer Based Architecture -LLM- GAN architecture - Training GANs and challenges) - Variants of GANs- VAE : Encoder, Decoder, and Latent space- Applications of VAEs		

UNIT-III	OPEN SOURCE GEN AI	9
Gen AI in open source - Benefits of Open source AI -Open source tools for generative AI - Deep learning frameworks for generative AI- Advantages and Disadvantages of these frameworks		

UNIT-IV	PROMPT ENGINEERING & CHATBOT DEVELOPMENT	9
Basics of Prompt Engineering- Few-shot - Zero-shot prompting - Prompt tuning vs Fine-tuning - Building a chatbot using: Lang Chain -RAG (Retrieval-Augmented Generation)		

UNIT-V	USE CASES OF GEN AI IN OPEN SOURCE	9
Open-Source Generative AI Models-generative ai use cases in open source- visual content- audio generation- Text generation- Manufacturing- Supply chain and logistics- Retail & e-commerce- Automotive.		

Approved By BoS Chairman

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Explain Intelligent agents, and their interaction with environments.
CO2	Identify the structure and working principles of various Generative AI models
CO3	Apply open-source tools, frameworks, and platforms
CO4	Discover prompt engineering techniques
CO5	Examine use cases of Generative AI across various domains
TextBooks	
1.	Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson, 2021.
2.	Goodfellow I, Bengio Y and Courville, "A Deep Learning", MIT Press. Foster, D, 2022
Reference Books	
1.	Chollet, F. "Deep Learning with Python", Manning Publications, 2018
2.	Martin Musiol, "Generative Ai: Navigating the Course to the Artificial General Intelligence Future", John Wiley Sons, 2024

Approved By BoS Chairman

B.E / B.Tech	B23AMO501 – PRINCIPLES OF MACHINE LEARNING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the concepts of Machine Learning.
2.	To study the Supervised Learning with Classifications.
3.	To analyse Random Forest methods and Backpropagation.
4.	To identify the Clustering Techniques for Data Analysis.
5.	To infer the applications of Machine Learning and Dimensionality Analysis.

UNIT - I	INTRODUCTION	9
Introduction to Machine Learning – Need of Machine Learning – Machine Learning Applications – Types of Machine Learning Systems – Challenges – Machine Learning Process – Data Collection – Exploration – Preparation – Training – Optimization – Performance Measures.		

UNIT - II	SUPERVISED LEARNING	9
Classification and Regression Technique – Linear Regression – Polynomial Regression – Logistic Regression – Generalization – Overfitting – Underfitting – Support Vector Machine – Kernels – KNN – Naïve Bayes Classifiers – Decision Tree.		

UNIT - III	ENSEMBLE LEARNING TECHNIQUES	9
Random Forest – Ensemble Learning – Bagging – Boosting – Ada Boost – Gradient Boosting – Neural Networks – ANN Perceptron – MLP's and Backpropagation – Hyperparameter Optimization – Dimensionality Reduction.		

UNIT - IV	UNSUPERVISED LEARNING	9
Clustering – Techniques – K-Means Clustering – AGNES – DIANA – Density Based Clustering (DBSCAN) – Grid Based Clustering – Gaussian Mixtures – Clustering High Dimensionality Data – Outlier Analysis.		

UNIT - V	APPLICATIONS OF ENSEMBLE LEARNING	9
Dimensionality Reduction Applications – Factor Analysis – Model Selection & Evaluation – Visualization of Results – Applications of ML : Medical Science, Fraud Detection, Traffic Prediction, Personal Assist, Stock Prediction.		

Total Instructional hours: 45

Approved by BoS Chairman

Text Books	
1.	Muller, Andreas C., and Sarah Guido. “Introduction to Machine Learning with Python : A Guide for Data Scientists.” 3rd Edition, “O’Reilly Media, Inc.”, 2016.
2.	Geron, Aurelien. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow : Concepts, Tools, and Techniques to build intelligent systems. 1st Edition, “O’Reilly Media, Inc.”,

Reference Books	
1.	Himanshu Singh, Yunis Ahmed Lone, Deep Neuro-Fuzzy Systems with Python : With Case Studies and Applications from the Industry, 3rd Edition, 2019.
2	Leonardo De Marchi, Hands-On Neural Networks : Learn how to Build and Train Your First Neural Network Model using Python Book, 1st Edition, 2019.
3	James Loy, Neural Network Projects with Python : The Ultimate Guide to using Python to explore the true power of neural networks through six projects. 1st Edition, Kindle Edition,

Course Outcomes : Students will be able to	
CO1	Recall the basics of Machine Learning
CO2	Illustrate the Classification and Regressions
CO3	Identify the Concepts of Neural Networks and Ensemble Learning
CO4	Analyze the features of unsupervised Learning
CO5	Explain the applications of Machine Learning

		L	T	P	C
B.E / B.Tech	**BM23BMO501- PRINCIPLES OF BIOSENSORS**	**3**	**0**	**0**	**3**

Course Objectives	
1.	To study the basic structural ,functional elements, the gaseous exchange and fluid maintenance of the human body.
2.	To learn the organs and structures involved in system formation and functions.
3.	To understand the functions of physiological system
4.	To Know the activity of sensory and motor nerves
5.	To analyse Different Physiological Conditions in the Human Body.

UNIT - I	**INTRODUCTION TO BIOSENSOR**	**9**
Biosensors- Advantages and limitations, various components of biosensors, Classification of Biosensors Based on Type of Transduction - Electrochemical, Optical, Acoustic, Calorimetric. Classification of Biosensors Based on Biological Element - Enzyme Sensor, Immunosensors, Cell-based Sensors		

UNIT - II	**DESIGN OF BIOSENSOR**	**9**
Introduction, Assay format, Immobilisation-Ligand Activity, Regeneration, Analysis of regeneration data, Signal correction, Buffer scouting, Extracting kinetic affinity constant, Extracting kinetic rate constant, Sensor Surfaces and Receptor Depth, Molecular Interaction.		

UNIT - III	**OPTICAL AND BIOCHEMICAL BIOSENSORS**	**9**
Principles of Optical biosensing, Immobilization of bio-recognition elements, Types of optical biosensor: Fiber optic, planar waveguide, Evanescent, Interferometric, and Surface plasmon resonance-biosensor-Applications. Chemical and other sensors - Biocatalysis based biosensors, Bio affinity based biosensors & Microorganisms based biosensors, Biologically active material and analyte. Types of membranes used		

Program Coordinator

Approved by BOS Chairman

in biosensor constructions.

UNIT - IV	IMMUNOSENSOR	9
introduction to Immuno biosensor- Enzyme Biosensor, Bio Affinity Biosensor, Labelled Immuno sensors, Non-Labelled Immuno sensors. Transducer Aspects of Immuno sensor Optical Immunosensor, Piezoelectric Crystal Immunosensors, Electrochemical Immunosensors. Biological Aspects of biosensor- Antibody Development, Immunosensor based Assay Development.		
UNIT - V	**DIAGNOSTIC APPLICATION OF BIOSENSOR**	**9**
Preparation of Doped Sol-Gel Glasses, Application of Sol-Gel Glasses in Biosensors- Glucose Biosensor, Urea Biosensor, Cholesterol Biosensor, Lactate Biosensor. Application of enzymes in analysis; design of enzyme electrodes and their application as biosensors in healthcare.		
		Total Instructional hours : 45

Course Outcomes: Students will be able to	
CO1	Apply principles and concepts of biology and engineering to design biosensors.
CO2	Apply principles and concepts of electronics and electrochemistry to design electrochemical biosensors.
CO3	Recognize different types of transducers, and their application in biosensor design.
CO4	Apply principles and concepts of sensing and engineering to design biosensors for detection of markers in biofluids.
CO5	Apply engineering tools to evaluate parameters needed for point-of-care devices.

Program Coordinator	Approved by BOS Chairman

Text book	
1.	Bansi D Malhotra, Anthony, Advances in Biosensors, Volume 5, 2003, Elsevier, Oxford.
2.	Brian R Eggins - Biosensors an Introduction, First edition, John Wiley & Sons Publishers, 1996
3.	Loic J Blum, Pierre R Coulet - Biosensors Principles and Applications, First edition, Marcel Dekker,Inc, 1991.
4.	Donald G. Buerk - Biosensors Theory and Applications, First Edition Technomic Publishing. Co, Inc, 1993.

Reference Books	
1.	Elizabeth A Hall - Biosensors, First Edition, Open University, Milton Keynes, 1990.
2.	Graham Ramsay - Commercial Biosensors, First edition, John Wiley & Sons, Inc. 1998.
3.	Tran Minh Canh - Sensor Physics & Technology – Biosensors, First Edition, Champan & Hall, 1993.
4.	Mathew A.Cooper, Label free Biosensors Techniques and Applications, Cambridge, 2009.

Program Coordinator

Approved by BOS Chairman

B. TECH.	B23BTO501 – BIOFERTILIZER PRODUCTION AND MUSHROOM CULTIVATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To provide a comprehensive understanding of the principles and practices of biofertilizer production and mushroom cultivation.
2.	To equip students with knowledge of microbial inoculants and their applications in sustainable agriculture.
3.	To explore the cultivation techniques and nutritional aspects of various edible mushrooms.
4.	To enable students to understand industrial mushroom processing, value addition, and quality control, including nutraceuticals and waste management.
5.	To familiarize students with the quality control and commercial aspects of biofertilizers and mushroom production.

UNIT - I	INTRODUCTION TO BIOFERTILIZERS AND MICROBIAL INOCULANTS	9
Introduction to biofertilizers: Significance and scope. Types of biofertilizers: Nitrogen-fixing, phosphate-solubilizing, potassium-mobilizing, and mycorrhizal biofertilizers. Microbial inoculants: *Rhizobium, Azotobacter, Azospirillum, Pseudomonas, Bacillus, Trichoderma*, and mycorrhizal fungi. Mechanisms of action of biofertilizers: Nitrogen fixation, phosphate solubilization, plant growth promotion. Carrier materials and their properties. Quality control of biofertilizers: Viability, purity, and efficacy testing.		

UNIT - II	PRODUCTION TECHNOLOGY OF BIOFERTILIZERS	9
Isolation and characterization of effective microbial strains. Fermentation technology for biofertilizer production: Batch, fed-batch, and continuous fermentation. Scale-up and optimization of biofertilizer production. Formulation and packaging of biofertilizers. Storage and shelf-life of biofertilizers. Quality standards and FCO.		

UNIT - III	MUSHROOM CULTIVATION: PRINCIPLES AND PRACTICES	9
Introduction to edible mushrooms: Nutritional and medicinal value. Cultivation techniques for various mushrooms: Oyster, button, shiitake, and milky mushrooms. Substrate preparation and sterilization. Spawn production and inoculation. Environmental control in mushroom cultivation: Temperature, humidity, and ventilation. Pest and disease management in mushroom cultivation.		

UNIT - IV	MUSHROOM PROCESSING AND VALUE ADDITION	9
Post-harvest handling and preservation of mushrooms. Processing of mushrooms: Drying, canning, and pickling. Value-added products from mushrooms: Mushroom powder, extracts, and nutraceuticals. Mushroom waste utilization. Quality assessment of mushrooms: Sensory, chemical, and microbiological analysis.		

UNIT - V	COMMERCIAL ASPECTS AND ENTREPRENEURSHIP	9
Market potential and demand for biofertilizers and mushrooms. Economic analysis of biofertilizer and mushroom production. Entrepreneurial opportunities in biofertilizer and mushroom industries. Marketing and distribution strategies. Intellectual property rights (IPR) and patenting. Government schemes and subsidies.		
		Total Instructional hours : 45

Approved by BoS Chairman

Course Outcomes After the successful completion of the course, the students will be able to,		Knowledge Level
CO1	Illustrate the principles of microbial inoculant production and application.	K2
CO2	Classify the different types of biofertilizers and their impact on soil fertility.	K2
CO3	Explain the cultivation techniques and nutritional value of various edible mushrooms.	K2
CO4	Demonstrate the quality and safety parameters of biofertilizers and mushroom products.	K2
CO5	Identify the commercial aspects and entrepreneurial opportunities in biofertilizer and mushroom industries.	K3

Text Books	
1.	Subba Rao N.S., "Soil Microbiology", Oxford & IBH Publishing Company, New Delhi, 2002.
2.	Himadri Panda H., "Manufacture of Biofertilizer and Organic Farming", Asia Pacific Business Press Inc., 2024.
3.	Tewari R.P., "Mushrooms: Cultivation, Marketing and Consumption", Daya Publishing House, Delhi, 2005.
4.	Chang S.T., Miles P.G., "Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact", CRC Press, Boca Raton, 2004.

References Books	
1.	Alexander M., "Introduction to Soil Microbiology", John Wiley & Sons, New York, 1977.
2.	Stamets P., "Mycelium Running: How Mushrooms Can Help Save the World", Ten Speed Press, Berkeley, 2005.

CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	-	-	2	3	3
CO2	2	1	-	-	-	-	-	2	2	-	-	2	3	3
CO3	2	2	-	-	-	-	-	2	2	-	-	2	3	3
CO4	2	2	-	-	-	-	-	2	2	-	-	2	3	3
CO5	2	2	-	-	-	-	-	2	2	-	-	2	3	3
Wt. Avg.	2	2	-	-	-	-	-	2	2	-	-	2	3	3

Approved by BoS Chairman

B.E.	B23CSO501- FOUNDATIONS OF DBMS (Except CSE)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To learn the fundamentals of data models, relational algebra and SQL.
2.	To represent a database system using ER diagrams and to learn normalization techniques.
3.	To understand the concepts of transaction, concurrency and recovery processing.
4.	To understand the internal storage structures using different file and indexing techniques
5.	To have basic knowledge about the Distributed databases, NOSQL and DB security

UNIT - I	RELATIONAL DATABASES	9
Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL		
UNIT - II	**DATABASE DESIGN**	**9**
Entity-Relationship model – ER Diagrams – Enhanced-ER Model – ER to Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form		
UNIT - III	**TRANSACTIONS**	**9**
Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm.		
UNIT - IV	**IMPLEMENTATION TECHNIQUES**	**9**
RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations – Query optimization using Heuristics - Cost Estimation.		

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UNIT - V	ADVANCED TOPICS	9
Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection – Statistical Database security – Flow control – Encryption and Public Key infrastructures – Challenges.		
Total Instructional hours: 45		

Course Outcomes: Students will be able to	
CO1	Construct basic SQL Queries using relational algebra
CO2	Build database using ER model and normalize the database
CO3	Organize transaction-related queries while ensuring consistency and concurrency control
CO4	Evaluate various indexing and file organization strategies to optimize query performance
CO5	Analyze relational DB and NoSQL DB

Text Books	
1.	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2020.
2.	Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017.

Reference Books	
1.	C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

Approved by BoS Chairman

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K3														
CO2	K3														
CO3	K3														
CO4	K5														
CO5	K4														
Weighted Average															

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

B.E / B. TECH	B23ECO501 COMMUNICATION ENGINEERING (Common to All Except ECE)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the concepts of modulation techniques in generation of amplitude modulation and angle modulation.
2.	To impart knowledge in random process
3.	To familiarize students' optimum receivers for binary digital modulation schemes
4.	To examine digital modulation formats and their power spectral
5.	To understand the properties of spread spectrum techniques to design robust and efficient communication systems

UNIT – I FUNDAMENTALS OF ANALOG COMMUNICATION	9

Basics of communication systems; Fundamentals of Principles of amplitude modulation; AM envelope; frequency spectrum and bandwidth; modulation index and percent modulation; AM Voltage distribution; AM power distribution; Angle modulation; FM and PM waveforms; phase deviation and modulation index; frequency deviation and percent modulation; Frequency analysis of angle modulated waves; Bandwidth requirements for Angle modulated wave.

UNIT–II RANDOM PROCESS AND SAMPLING	9

Review of probability and random process; Gaussian and white noise characteristics; Noise in amplitude modulation systems; Noise in Frequency modulation systems; Pre-emphasis and Deemphasis; Threshold effect in angle modulation; Low pass sampling; Aliasing; Signal Reconstruction; Quantization; Uniform & non-uniform quantization; quantization noise; Nyquist criterion; Logarithmic Companding; PAM; PPM; PWM; PCM; TDM; FDM.

UNIT – III DIGITAL TRANSMISSION	9

Optimum Receiver for Binary Digital Modulation Schemes; Description of Binary ASK; PSK; and FSK Schemes; Binary PSK Signaling Schemes; M-ary Signaling Schemes; Synchronization Methods.

UNIT – IV DIGITAL MODULATION TECHNIQUES	9

Digital modulation formats; Coherent Binary Modulation Techniques: BFSK and BPSK; QPSK; MSK; M-ary QAM; Power spectra of BFSK; BPSK; QPSK and MSK.

UNIT – V SPREAD SPECTRUM AND MULTIPLE ACCESS	9

Approved by BOS Chairman

PN sequences: properties; m-sequence; DSSS; Processing gain; Jamming; FHSS; Synchronization and tracking; Multiple Access: FDMA; TDMA; CDMA.	
	Total Instructional hours:45

Course Outcomes: Students will be able to	
CO1	Apply principles of basic communication systems to design basic modulation schemes for efficient signal transmission.
CO2	Apply probability and random process principles to analyze noise in communication systems
CO3	Apply knowledge to design and assess optimum receivers for binary digital modulation schemes like ASK, PSK, FSK, and M-ary systems.
CO4	Analyze and differentiate between digital modulation formats and their power spectral.
CO5	Apply and evaluate concepts of PN sequences, DSSS, FHSS, and multiple access techniques

Text Books	
1.	K Sam Shanmugam, Digital and Analog Communication Systems, Wiley, 2019.
2.	Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th Edition, Pearson Education, 2018.
3.	Simon Haykin, “Communication Systems”, Wiley India, 4th edition, 2014.

Reference Books	
1.	H.Taub, D L Schilling and G Saha, “Principles of Communication”, 4th Edition, Pearson Education, 2017.
2.	B.P.Lathi, Zhi Ding, Hari Mohan Gupta “Modern Analog and Digital Communication Systems”, 4th Edition, Oxford University Press, 2017.
3.	Sanjay Sharma, “Communication Systems (Analog and Digital)”, S.K. Kataria & Sons; Reprint 2013.
4.	B.Sklar, “Digital communications: Fundamentals and Applications”, 2nd Edition, Pearson Education, 2012.

<table>
<tr><th colspan="5">Evaluation Pattern:</th></tr>
<tr><th colspan="4">Continuous Internal Assessment</th><th>End Semester Examinations</th></tr>
<tr><td colspan="2">CIA I (Theory)
(100 Marks)</td><td colspan="2">CIA II (Theory)
(100 Marks)</td><td rowspan="3">Theory End Semester Examinations
(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>* Alternate Assessment Tool (AAT)</td><td>Written Test</td><td>* Alternate Assessment Tool (AAT)</td><td>Written Test</td></tr>
<tr><td>40 Marks</td><td>60 Marks</td><td>40 Marks</td><td>60 Marks</td></tr>
<tr><td colspan="4">40 Marks</td><td>60 Marks</td></tr>
<tr><td colspan="5">Total: 100 Marks</td></tr>
</table>

* AAT - Individual Assignment/ Case Study/ Seminar/ Mini project/ MCQ/ Role Play/ Group Discussion/ Debates/ Oral Presentations/ Poster Presentations/ Technical Presentations can also be provided course coordinator can choose any one/two components based on the nature of the course.

Approved by BOS Chairman

B.E	B23EEO501- ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of electric vehicle history and components.
2.	To understand properties of batteries.
3.	To understand the electrical machine properties and classifications.
4.	To understand the properties of electric vehicle drive systems.
5.	To understand the concepts of hybrid electric vehicles.

UNIT-I	INTRODUCTION TO ELECTRIC VEHICLES	9

Present scenario of electric vehicles, Need of electric vehicles, economics, environmental impacts of using electric vehicles, challenges faced by electric vehicles in replacing ICE, major requirements of electric vehicles.

UNIT-II	TYPES OF ELECTRIC VEHICLES AND THE CHALLENGES	9

Types of electric vehicles: Plug-in Electric Vehicle (PEV), Battery Electric vehicle (BEV), Fuel Cell electric vehicle (FCEV), Hybrid electric vehicle (HEV), Challenges of battery electric vehicle, hybrid electric vehicle and fuel cell electric vehicle.

UNIT-III	BATTERY ELECTRIC VEHICLE	9

Components of BEV drive train: electric propulsion subsystem - power converter, driving wheels, suspension system, driveshaft, mechanical transmission, electric Motor, power electronics converters (DC-AC/DC-DC), electronic control unit, energy source subsystem, battery pack with battery management system, On board charger, auxiliary subsystem, power steering unit, common parts between ICE drive train and EV drive train.

UNIT-IV	HYBRID AND FUEL CELL ELECTRIC VEHICLE	9

Basic architecture of hybrid drive trains, components of HEV drive train system, classification of HEV: conventional HEV (Micro, Mild and Full hybrid- series hybrid, parallel hybrid, series-parallel hybrid, complex hybrid), Basic architecture of FCEV, components of FCEV drive train system.

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UNIT-V	ENERGY STORAGE	9
Battery-based energy storage, Overview of batteries, Battery parameters, battery charging, regenerative braking, alternative novel energy sources: solar photovoltaic cells, fuel cells, super capacitors, and flywheels.		
		Total Instructional hours:45

Course Outcomes: Students will be able to	
CO1	Illustrate the basics of electric vehicle history and components.
CO2	Classify the different types of electric vehicles.
CO3	Apply the battery properties in an electric vehicle.
CO4	Develop the hybrid and fuel cell electric vehicle.
CO5	Illustrate the concept of energy storage devices.

Text Books	
1.	Electric & Hybrid Vehicles – A.K. Babu, Khanna Publishing House, New Delhi, 2018.
2.	Electric & Hybrid Vehicles – Design Fundamentals – Iqbal Hussain, Second Edition, CRC Press, 2011.
3.	Electric Vehicle Battery Systems – Sandeep Dhameja, Newnes, 2000.
4.	Husain, I. (2021). Electric and Hybrid Vehicles: Design Fundamentals (3rd Edition). CRC Press.

Reference Books	
1.	Electric Vehicle Technology Explained - James Larminie, John Wiley & Sons, 2003
2.	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals – Mehrdad Ehsani,Yimin Gao, Ali Emadi, CRC Press, 2010.
3.	Chan, C. C., & Chau, K. T. (2001). Modern Electric Vehicle Technology. Oxford University Press.
4.	Larminie, J., & Lowry, J. (2023). Electric Vehicle Technology Explained (3rd Edition). Wiley.

Approved by BoS Chairman

B.E.	B23MEO501 - ROBOTICS	L	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the concepts of the basic components of a robot
2.	To apply the distinct drive systems and end effectors to control the robot actuation
3.	To study the role and application of various types of sensors and machine vision system
4.	To make use of the knowledge in the robot kinematics and to write Robot Programs
5.	To identify the social and economic challenges while implementing the robot systems

UNIT - I	FUNDAMENTALS OF ROBOT	9

Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification - Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Robot Parts and their Functions- Different Applications - A view on Global and Indian manufacturers of Robots - Need for Robots in Indian environment.

UNIT - II	ROBOT DRIVE SYSTEMS AND END EFFECTORS	9

Drives - hydraulic, pneumatic, mechanical, electrical, Servo motors, Stepper motors - salient features, application; End effectors – types; Grippers - mechanical, pneumatic, hydraulic, magnetic, vacuum - limitations, Multiple grippers.

UNIT - III	SENSORS AND MACHINE VISION	9

Requirements of sensors, principles, types and applications of Proximity (Inductive, Hall effect, Capacitive, Ultrasonic and Optical); – Range (Triangulation, Structured light approach); Speed, Position (resolvers, optical encoders); – Force – Torque – Touch sensors (binary, analog sensor). Introduction to Machine Vision; applications, functions; image processing and analysis; training the vision system.

UNIT - IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	9

Forward kinematics and Reverse kinematics of manipulators; two, three degrees of freedom, homogeneous transformation matrix; introduction to manipulator dynamics, trajectory generator, manipulator mechanism, Degeneracy and Dexterity; Lead through programming, Robot programming languages; VAL programming, motion commands, sensor commands, end effecter commands, simple programs (for loading, unloading and palletizing operations), introduction to advances in Robot Programming.

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UNIT - V	APPLICATION, IMPLEMENTATION AND ROBOT ECONOMICS	9
Robot cell design; types, application of robots in processing, assembly, inspection, material handling in automobile, medical, Nuclear Industries, RGV, AGV; Implementation of Robots in Industries; Safety considerations for robot operations, safety codes, Economic analysis of robots.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the concepts of industrial robots, classification, specifications and coordinate systems.
CO2	Illustrate the different types of robot drive systems as well as robot end effectors.
CO3	Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
CO4	Develop robotic programs for different operations and familiarize with the kinematics motions of robot.
CO5	Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

Text Books	
1.	Groover M.P., “Industrial Robotics - Technology Programming and Applications”, McGraw Hill, 2012.
2.	Deb S R and Deb S, Robotics Technology and Flexible Automation, Tata McGraw Hill Education Pvt. Ltd, 2010.
3.	Saha S K, Introduction to Robotics, Tata McGraw Hill Education Pvt. Ltd, 2010, 2nd Ed, 2014.

Reference Books	
1.	Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, Global Edition, 3rd Edition, 2014.
2.	Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 2013.
3.	Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis, Oxford University Press, Sixth impression, 2010.

J.P. [signature]

Approved by BoS Chairman

B.E / B.TECH	B23CBO501 FRONT END DEVELOPMENT	T	P	TU	C
		3	0	1	3

Course Objectives	
1.	To interpret the basics of front end development and modern development tools.
2.	To device a front end design with HTML Tags.
3.	To work with HTML Forms and Implement Layouts Using Frames and iFrames
4.	To design a dynamic webpage using CSS.
5.	To articulate client side activities on a web site using Javascript.

UNIT- I INTRODUCTION TO FRONT END DEVELOPMENT	9
Introduction to web - WWW - Web server and client, URL, URI,URN-Internet addresses and IP classes Web protocols -TCP/IP,UDP, MIME.SMTP,POP3,HTTP & HTTPS-MVC-Model, View, Controller of Web design-Role of front end developer and Modern Front end Tools.	

UNIT-II HTML (HYPERTEXT MARKUP LANGUAGE)	9
Introduction to HT ML - HTML s HTML5 - Basic HTML Structure - HTML Elements, Attributes and properties - Formatting tags - Lists & symbols -Ordered Lists -Unordered Lists-Descriptive Lists - Hyperlinks- Multimedia: Images, Audio, Video tags	

UNIT- III HTML TABLES & FORMS	9
HTML table :Table border, row, column header, rowspan & colspan, cell spacing and cell padding HTML forms: Form elements- Text, Textarea, Password field, Label-Checkbox, Radio Button. Selection List - Button -Frames & iFrames	

UNIT- IV CSS (Cascading style sheets)	9
Introduction to style sheets: Cascading style sheets-CSS properties - CSS selectors - Pseudo classes and elements - Types of CSS: Inline, Embedded, External style sheet-Case study Talwind CSS	

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UNIT- V CLIENT SIDE SCRIPTING	**9**
Introduction to Javascript, Javascript features -Datatypes, Variables , Literals & Operators – Control structures -Arrays - Predefine functions & User defined functions – Javascript - DOM objects - Case study- npm, NodeJs.	
	Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	**Interpret the working of web sites, web servers and modern front-end**
CO2	Build web pages of a website with HTML
CO3	Develop web site for process and Implement Layouts Using Frames and
CO4	Construct dynamic styles using CSS.
CO5	Build client side activities with Javascript.

Text Books:
1.Uttam K.Roy,"Web Technologies" by, Oxford University Press 2010, First edition, eight impression 2014.

Reference Books :
1.Thomas Powell , "HTML& css: The Complete Reference", Fifth Edition Paperback - 1, Tata McGrawHill, July 2017.
2.. Laurence Lars Svekis , Maaike Van Putten , Rob Percival ," JavaScript from Beginner to Professional: Leam JavaScript quickly by building fun, interactive, and dynamic web apps. games, and pages", Packt, December 2021.

Approved by BoS Chairman

Open Elective - II

B.E.	B23AEO601 – UNMANNED AIRCRAFT SYSTEMS OPERATION AND MRO (Common to all Except AERO)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To know the working principles of aircraft engine and fuel systems.
2.	To understand the lighting technologies and pressurization system of the aircraft cabin.
3.	To realize the warning and protection systems of the aircraft.
4.	To expose on terrain warning systems of the safety of the aircraft.
5.	To gain knowledge on FDR and anti-fire protection system.

UNIT - I	DRONE RULES & BASIC PRINCIPLES OF FLIGHT	9

International Rules- Regulations, Standards & Practices, Dos and Do not, Civil Aviation Requirements-AIPs, NOTAM, Classification & Categorization of drones, Type Certification of Drones, Registration, Sale & De-Registration of Drones, Operations of Drones, Dos and Donts, Remote Pilot Licensing, Drone Insurance Fundamentals of flight, Aerodynamics, Take-off, flight, and landing. Maneuvers, turns and circuit pattern.

UNIT - II	ATC PROCEDURES & RADIO TELEPHONY (NON FRTOL) WEATHER AND METEOROLOGY	9

Understanding ATC operations, Airspace structure and Airspace, Restrictions with knowledge of no drone zones, RT Phraseology & Communicating with ATC including Position and Altitude Reporting. Flight Planning Procedures including Altimeter setting procedures. Collision avoidance. Radio Telephony (RT) techniques, The standard atmosphere, Measuring air pressure, Heat and temperature, Wind. Moisture, cloud formation, icing and its effects. Effect of atmosphere on RPAS operation & hazardous weather avoidance, Met Terminal Aviation Routine Weather Report (METAR).

UNIT - III	FIXED-WING & ROTORCRAFT OPERATIONS AND AERODYNAMICS	9

Types of fixed wing drones, make, parts, terminology, Operation and maneuvers of fixed wing drones, Flight Performance. Intro to Mission Planning, Instrument Flying & Navigation (GCS). Applications of fixed-wing UAVs. Pros and Cons of Fixed Wing Drones Rotorcraft- Basic drone terminology & parts,

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Types of drones, material used and size of drones, Drone Anatomy: Different parts of drones, Avionics & C2 Link, Intro to Mission Planning, Instrument Flying & Navigation (GCS). Applications and operations of Multirotor, Flight Performance. Pros and Cons of Rotorcraft Drones.

UNIT - IV	HYBRID OPERATIONS, AERODYNAMICS & EQUIPMENT MAINTENANCE	9
Principles of Aerodynamics, Types of Hybrid Drones & Parts, Intro to Mission Planning, Instrument Flying & Navigation (GCS), Applications of Hybrid UAVs, Comparison with Rotorcraft & Aeroplane Drone Equipment Maintenance- Maintenance of drone, flight control box, ground station, Maintenance of ground equipment, batteries and payloads, Scheduled servicing, Repair of equipment, Fault finding and rectification.		

UNIT - V	SAFETY MANAGEMENT, PAYLOAD, & DATA & ANALYSIS	9
Drothe Emergency & Handling, Loss of C2-link, Fly-aways (Straying), Loss of power, Other Emergencies, Control surface failures, Human Performance & Pilot Incapacitation, Fail-Safe Features, Types of payloads - What to carry, what not to carry, Parts of payloads, Installation, Features of payloads, Utilization, Principles of Observation, Elements of Image & Video Interpretation, Introduction to Photogrammetry, Types of Image & Video Data, Analysis.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the Basics of Ignition and Fuel System of an Aircraft. (K2)
CO2	Illustrate the Flight Compartment Lighting Technologies and Cabin Air Conditioning system. (K2)
CO3	Identify the Warning and Protection Systems for the Ice Formation and Rain in the Airframe of the Aircraft During Flight. (K3)
CO4	Apply the Terrain Warning Systems to avoid the Terrain Collision of an Aircraft. (K3)
CO5	Examine the FDR and Fire Protection System to Monitor the Flying Performance of the Aircraft. (K4)

Text Books	
1.	"Aircraft Electrical and Electronic Systems", Principles, operation and maintenance by Mike Tooley and David Wyatt.

Programme Coordinator	BoS Chairman

Reference Books	
1.	Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Pearsons, Indian edition 2011.
2.	Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J., U.S.A. 1993.
3.	Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000.

Programme Coordinator

BoS Chairman

B.Tech.	B23AGO601 - Environmental Management in Agriculture	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To provide knowledge on natural resource use and environmental sustainability in agriculture.
2.	To understand the causes and impacts of pollution from agricultural activities.
3.	To explore the principles and methods of environmental impact assessment (EIA).
4.	To study the role of waste management and resource recycling in agriculture.
5.	To introduce climate-smart agriculture and mitigation strategies for sustainable development.

UNIT I	NATURAL RESOURCES AND SUSTAINABILITY	9

Natural resources – classification and utilization in agriculture – Sustainable use of soil, water, biodiversity – Ecological footprint – Concept of carrying capacity – Environmental indicators – Role of agriculture in environmental degradation – Policies for sustainable agriculture – SDGs related to environment and agriculture.

UNIT II	AGRICULTURE AND POLLUTION	9

Agricultural pollution – causes and effects – Soil pollution due to fertilizers, pesticides and heavy metals – Water pollution: runoff, eutrophication, groundwater contamination – Air pollution: burning of residues, methane, ammonia emissions – Noise pollution from farm machinery – Agrochemical residues and food chain contamination – Preventive strategies.

UNIT III	ENVIRONMENTAL IMPACT ASSESSMENT (EIA)	9

Concept and need for EIA – Components and stages of EIA – Screening, scoping, impact prediction, mitigation – EIA methods (checklist, matrix, network) – Public participation – Environmental Management Plan (EMP) – Environmental audit – Case studies of agricultural projects (dams, irrigation, fertilizer units).

UNIT IV	AGRICULTURAL WASTE AND RESOURCE MANAGEMENT	9

Types of agricultural waste – crop residues, livestock waste, agro-industrial waste – Collection, handling and disposal – Waste minimization – Composting, vermicomposting, biogas production – Biomass energy – Circular economy in agriculture – Integrated farming and nutrient recycling – Wastewater reuse in agriculture.

UNIT V	CLIMATE CHANGE AND SUSTAINABLE FARMING	9

Climate change: causes and impact on agriculture – GHG emissions from agriculture – Carbon sequestration – Climate-smart agriculture – Conservation agriculture – Precision farming – Agroforestry and carbon farming – Green technologies in agriculture – Institutional frameworks (UNFCCC, IPCC, ICAR).

Total Instructional Hours: 45

COURSE OUTCOMES: Students will be able to

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CO1	Understand the sustainable use of natural resources in agriculture.
CO2	Identify environmental pollution sources and their impact from agriculture.
CO3	Apply EIA techniques for environmental planning in agricultural projects.
CO4	Utilize waste management techniques for environmental protection.
CO5	Implement climate-resilient and sustainable agricultural practices.

Text Books	
1.	Rattan Lal and B.A. Stewart, *Soil and Environmental Management*, CRC Press, 2020.
2.	N.T. Kumbhar, *Environmental Management in Agriculture*, Himalaya Publishing House, 2018.
3.	G.N. Tiwari and R.K. Mishra, *Environmental Pollution and Management*, Narosa Publishing House, 2015.

References	
1.	D.W. Sims, *Agricultural Waste Management*, FAO Publications.
2.	Shukla, S.K. & Pandey, P., *Climate Smart Agriculture*, Springer, 2021.
3.	EIA Guidelines – Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India.
4.	NPTEL: https://nptel.ac.in/courses/120108004

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Approved by BoS Chairman

B.E/ B.TECH	B23ADO601-HUMAN COMPUTER COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To outline the basic knowledge of HCI.
2.	To classify the design process and rules.
3.	To apply the evaluation techniques and HCI models.
4.	To make use of communications and human factors.
5.	To develop the understanding of user interface.

UNIT - I	INTRODUCTION TO HCI	9

Introduction to HCI - A discipline involved in HCI- Importance of HCI - The psychology of everyday things - Principles of HCI - Input–output channels - Human memory -Thinking: reasoning and problem solving - Conceptual Models – Interface Metaphors – Interaction Types – Paradigms and Frameworks. Cognitive Aspects: Cognition – Cognitive Framework. Social Interaction – Emotional Interaction.

UNIT - II	HCI DESIGN PROCESS AND DESIGN RULES	9

The software design process - User focus – Scenarios - Navigation Design - Screen Design - Prototyping techniques - Wire-Framing - Understanding the UI Layer and Its Execution Framework, Model-View-Controller(MVC) Framework - Principles that support usability, Design standards, Design Guidelines, Golden rules and heuristics, User interface management system (UIMS).

UNIT - III	EVALUATION TECHNIQUES AND HCI MODELS	9

Goals of evaluation - Evaluation Criteria - Evaluation through expert analysis - Evaluation through user participation - Choosing an Evaluation Method - Goal and task hierarchy model - Linguistic model - Physical and device models - Cognitive architectures - Hierarchical task analysis (HTA) - Uses of task analysis - Diagrammatic dialog design notations - Computer mediated communication - Ubiquitous Computing.

UNIT - IV	COMMUNICATION AND HUMAN FACTORS	9
Face-to-face Communication - Conversation - Text-based Communication - Group working - Dialog design notations - Diagrammatic notations - Textual dialog notations - Dialog semantics - Dialog analysis and design – Groupware - Meeting and decision support systems - Shared applications and artifacts - Frameworks for groupware Implementing synchronous groupware - Mixed - Augmented and Virtual Reality.		

UNIT - V	FUTURE OF HCI AND USER INTERFACE	9
The future of HCI - perceptual interfaces, context-awareness and perception –User centered design - Interfaces: Types – Natural User Interfaces, Importance of user Interface and good design - Principles of user interface. - The graphical user interface – popularity of graphics, the concept of direct manipulation - graphical system - Characteristics - Web user – Interface popularity.		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Illustrate the importance of human computer interaction.
CO2	Explain the design process and design rules.
CO3	Develop the understanding of evaluation techniques and HCI models.
CO4	Demonstrate the concept of communication and human factors.
CO5	Apply the user centered deign methods.
	Text Books
1.	A Dix, Janet Finlay, G D Abowd, R Beale., Human-Computer Interaction, 3rd Edition, Pearson Publishers,2018
2.	Wilbert O. Galitz, “The Essential Guide to User Interface Design: An Introduction to Gui Design Principles and Techniques”, Third Edition, John Wiley Sons, 2017..
Reference Books	
1.	Sharp, H., Rogers, Y., and Preece, J, “Interaction Design: Beyond Human – Computer Interaction”, Third Edition, John Wiley & Sons, Inc., 2021.
2.	Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies for Effective Human Computer Interaction, 5th Edition, Pearson Publishers, 2020.

Approved by BoS Chairman

B.E / B.Tech	B23AMO601 - AI FOR SMART SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To recall the different types of AI based on capabilities and functionality
2.	To discuss the ethical implications of AI and how they affect societal impact
3.	To analyze a case study of AI-enhanced weather forecasting and evaluate its effectiveness in agricultural applications
4.	To evaluate the potential future trends and ethical dilemmas in the integration of AI in healthcare and autonomous systems
5.	To design a functional interactive AI system, such as a food delivery app, integrating AI technologies like voice recognition and user interaction design

UNIT - I	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	9
Basics of AI: Definition and origins - Intelligence and its measurement - History and evolution of AI technologies - Overview of AI applications in smart systems - Types of AI: Based on Capabilities and Functionality - The Role of Ethics in AI Governance - Symbolic AI vs. Connectionist AI - Autonomous Vehicles and Intelligent Transportation Systems		

UNIT – II	AI METHODOLOGIES AND TECHNIQUES	9
Introduction to Robotics and AI – Ethics of AI – Machine learning basics – Supervised learning - Unsupervised learning – AI in smart homes - Impact of AI in society		

UNIT – III	ADVANCED AI TOPICS	9
Soft Computing: Overview and applications - Chat Bots and Conversational AI: Design and development - AI in Cyber-Physical Systems: Integration and challenges - AI-enabled IoT: Concepts – Case study : Agriculture: AI-Enhanced Weather Forecasting		

UNIT – IV	APPLICATIONS OF AI IN SMART SYSTEMS	9
AI in Healthcare: Diagnostics and personalized medicine - AI in Automotive Systems: Autonomous vehicles - AI in Robotics: Intelligent control and navigation - Ethical considerations and future trends in AI		

UNIT – V	INTERACTIVE AI SYSTEM DESIGN	9
Fundamentals of Human-AI Interaction - Role of AI in personal assistants – Interactive AI in customer service – AI in Education – Voice recognition systems - Future Trends in Interactive AI Design - Case Study: Designing an Interactive Food Delivery App		

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes : Students will be able to	
CO1	Recall the definition and origins of AI, including its historical evolution and types based on capabilities and functionality.
CO2	Apply AI methodologies, such as machine learning, to analyze and solve problems in smart home systems.
CO3	Evaluate the effectiveness of AI in solving real-world problems.
CO4	Discuss the ethical considerations and predict future trends in the development of AI technologies.
CO5	Analyze trends in the future of interactive AI design, including advancements in voice recognition systems and their potential impact on different sectors.

Text Books	
1.	Khan, I. U., Ouaissa, M., Ouaissa, M., Fayaz, M., & Ullah, R., Artificial Intelligence for Intelligent Systems: Fundamentals, Challenges, and Applications, CRC Press, 1st Edition, 2024.
2.	Ramana, T. V., Ghantasala, G. S. P., Sathiyaraj, R., & Khan, M., Artificial Intelligence and Machine Learning for Smart Community, CRC Press, 1st Edition, 2023.

Reference Books	
1.	P, M., Kumar, M. V., & Umamaheswari, R., Machine Learning and IoT for Intelligent Systems and Smart Applications, CRC Press, 1st Edition, 2022.
2.	Venkatesh, C., Rengarajan, N., Ponmurugan, P., & Balamurugan, S., Smart Systems for Industrial Applications, Scrivener Publishing, 1st Edition, 2022.
3.	Tanwar, R., Bhatia, S., Sapra, V., & Ahuja, N. J. (Eds.). (2024). Artificial Intelligence and Machine Learning: An Intelligent Perspective of Emerging Technologies. CRC Press.
4.	Kose, U., Prasath, V. B., Mondal, M., Podder, P., & Bharati, S. (Eds.). (2022). Artificial Intelligence and Smart Agriculture Technology. *Auerbach Publications.*

B.E / B.Tech	BM23BMO601- MEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the electrode behavior and amplifiers
2.	To gain knowledge of various biopotential measurement
3.	To familiarize various electrical and non-electrical physiological parameters.
4.	To learn biochemical measurement
5.	To learn recent trends for biomedical applications

UNIT - I	BIOPOTENTIAL ELECTRODES AND AMPLIFIERS	9
Cell potential- Resting and Action potential, Electrode Electrolyte Interface, Types of electrodes, Bio signal characteristics– frequency and amplitude ranges, Bioamplifier, isolation amplifiers – transformer and optical isolation, Artifacts and removal.		

UNIT - II	BIOPOTENTIAL MEASUREMENT	9
ECG – Einthoven 's triangle, standard 12 lead system, block diagram. Measurement of heart sounds - PCG. EEG – 10-20 electrode system, unipolar, bipolar and average mode, Functional block diagram. EMG – unipolar and bipolar mode, block diagram, EOG and ERG		

UNIT - III	PHYSIOLOGICAL PARAMETER MEASUREMENT	9
Temperature, Respiration rate and pulse rate measurements, Plethysmography, Pulse oximetry, Blood Pressure measurement-direct and indirect method. Blood flow - Ultrasound blood flow measurement. Cardiac output measurement- Indicator dilution, dye dilution and thermodilution method, GSR Measurement, Patient Monitoring system		

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UNIT - IV	BIOCHEMICAL MEASUREMENT	9
Blood gas Analyzer, Blood Glucose measurement, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyser.		
UNIT - V	**RECENT TRENDS**	**9**
Point of care devices, Endoscopy unit, Radio pill, laproscopy, Applications of Laser in medicine, cryogenic application. Biotelemetry, Telemedicine, m-health.		
		Total Instructional hours : 45

Course Outcomes: Students will be able to	
CO1	Understand the electrode behavior
CO2	Comprehend the fundamentals of Bio potential recording.
CO3	Design various bio amplifiers
CO4	Measure various electrical and non-electrical physiological parameters.
CO5	Understand different monitoring system

Text book	
1.	Joseph J. Carr and John M. Brown, “Introduction to Biomedical equipment technology”,Pearson Education, 4th Edition, 2014.
	John G.Webster, “Medical Instrumentation Application and Design”, John Wiley and and Sons,New York, 4th Edition, 2009.

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Reference Books	
1.	Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi,3 rd Edition, 2014.
2.	Richard Aston, "Principles of Biomedical Instrumentation and Measurement" Merril PublishingCompany, 1990.
3.	L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", 3 rd Edition,John Wiley and Sons, Reprint 2008.

Program Coordinator	Approved by BOS Chairman

B. Tech.	B23BTO601 – BIOINFORMATICS	L	T	P	C
		3	0	0	3

Course Objectives

1.	To know the knowledge of databases and its maintenance.
2.	To provide the basic concept of various algorithms
3.	To deliver the knowledge on protein designing and its interactions.

Pre-requisite (if any)

Biochemistry, Molecular Biology, Protein Engineering

UNIT 1	INTRODUCTION TO BIOINFORMATICS	9
Scope of Bioinformatics, Databases- DBMS, Biological databases-classification-importance, Sequence Databases- GenBank, NCBI, DDBJ, EMBL, UniProt, SWISS-PROT, PIR, TrEMBL, Structural Databases-PDB, SCOP, CATH, pfam.		
UNIT 2	**SEQUENCE ANALYSIS**	**9**
Sequence Alignment- Sequence Homology Vs Sequence Identity Vs Sequence Similarity, Types of Sequence alignment methods- PSA, MSA, Scoring Function and Substitution Matrices-PAM & BLOSUM, Algorithms-Needleman-Wunch & Smith-Watermann, BLAST and its types, FASTA.		
UNIT 3	**PHYLOGENETIC RELATIONSHIPS**	**9**
Introduction to Phylogenetics-Parts of Phylogenetic Tree-Types of trees, Molecular Clock Theory, Distance Based Method- UPGMA, NJ, Character Based Method- Maximum Parsimony Method, Maximum Likelihood Method, Method of evaluating phylogenetic tree- Bootstrapping, Jackknife resampling, Data perturbation.		
UNIT 4	**STRUCTURAL ANALYSIS**	**9**
Protein Structure Visualization, Structural Prediction- Primary structure & Secondary Structure, tertiary Structure-Homology Modelling, Hidden Markov Model, Threading, Ab-initio method, Validation by Ramachandran plot.		
UNIT 5	**APPLICATIONS**	**9**
System Biology-Introduction and its importance, Microarray Data analysis, Approaches to drug designing and discovery.		
		Total Instructional Hours: 45

Course Outcomes After the successful completion of the course, the students will be able to,		Knowledge Level
CO1	Examine various biological databases.	K4
CO2	Compare genomic and proteomic sequences using various bioinformatics tools.	K5
CO3	Measure the evolutionary relationship using phylogenetic methods	K5
CO4	Compare vast genomic and proteomic dataset.	K5
CO5	Develop basic bioinformatics scripts with Perl programming.	K6

Approved by BoS Chairman

Text Books	
1.	Introduction to Bioinformatics by Arthur K. Lesk, Oxford University Press. ,4th edition 2014
2.	Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press. 1999
3.	Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by R.Durbin, S.Eddy, A.Krogh, G.Mitchison, Cambridge University Press. 2013
4.	Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press. 2nd edition, 2004.

Reference Books	
1.	Next Generation Sequencing Data Analysis, by Xinkun Wang CRC Press 2016

CO-PO-PSO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	2	3	3	3	2	3	3	2	3
CO2	3	2	3	3	2	2	2	3	1	3	3	3	3	2
CO3	3	3	2	2	3	3	2	2	2	3	2	2	3	3
CO4	2	3	2	3	3	3	3	3	2	2	2	3	2	3
CO5	3	3	3	2	2	3	2	3	3	3	3	3	2	2
Wt. Avg.	**2.8**	**2.6**	**2.6**	**2.4**	**2.6**	**2.6**	**2.4**	**2.8**	**2.2**	**2.6**	**2.6**	**2.8**	**2.4**	**2.6**

Approved by BoS Chairman

B.E.	B23CSO601- FOUNDATIONS OF WEB DEVELOPMENT (Except CSE)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the structure of websites and fundamental web technologies such as HTML5 and CSS3.
2.	To understand basic programming concepts using Java for web development.
3.	To explore dynamic client-side functionalities using JavaScript and DHTML.
4.	To identify the role of server-side programming and databases in web applications.
5.	To apply web development knowledge for building basic interactive applications.

UNIT - I	BASICS OF WEB	9
Basics of Internet – Web Clients and Servers – HTTP Protocol – Web Communication. HTML5: Tags, Forms, Tables, Lists, Multimedia Integration (Audio, Video). CSS3: Styling Text and Layout – Inline, Embedded, External Style Sheets – Responsive Layout		
UNIT - II	**PROGRAMMING CONCEPTS**	**9**
Need for Programming in Web Development – Java Overview – Simple Java Program Structure – Variables, Data Types, Operators, Control Structures – Arrays – Methods – Introduction to Classes and Objects (no inheritance). Use of Java in Web and GUI Applications		
UNIT - III	**JAVASCRIPT AND DYNAMIC WEB PAGES**	**9**
JavaScript Basics: Variables, Operators, Conditional Statements, Loops – Functions. Working with Forms – Validations – DOM Manipulation – Popups and Events. DHTML: Combining HTML, CSS, JavaScript for Simple Interactions.		
UNIT - IV	**SERVER-SIDE PROGRAMMING BASICS**	**9**
Overview of Server-Side Scripting – Introduction to Java Servlets – Servlet Lifecycle – Handling Form Data using GET and POST – Session Management – Basics of Cookies. Web Server Setup: Apache Tomcat (Overview and Setup).		

UNIT - V	DB CONNECTIVITY AND APPLICATIONS	9
Basics of Database for Web – Introduction to JDBC – Connecting Java Applications to Databases – Sample Data Insertion and Retrieval – Use Cases in Industry and Healthcare Systems. Mini Case Study: Simple Web Application with Form Input and Database Storage.		
		Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Outline core components of web applications including HTML5 and CSS3.
CO2	Apply basic Java programming for developing interactive functionalities
CO3	Develop dynamic client-side interactions using JavaScript and DHTML
CO4	Explain the workflow of server-side programs and sessions using Java servlets
CO5	Construct a simple web application integrating frontend, server-side logic, and database

Text Books	
1.	Kogent Learning Solutions Inc., Web Technologies Black Book, Dreamtech Press, 2018.
2.	Budi Kurniawan, Servlet & JSP: A Tutorial, 2nd Edition, Brainy Software Inc., 2015.

Reference Books	
1.	Deitel P.J. & Deitel H.M., Internet and World Wide Web How to Program, Pearson Education, 2020.
2.	Jeffrey C. Jackson, Web Technologies: A Computer Science Perspective, Pearson Education, 2011.
3.	Herbert Schildt, Java: A Beginner's Guide, McGraw-Hill, 2018.

CO Mapping with PO & PSO

CO/PO & PSO		PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K6)	PO6 (K3) (A3)	PO7 (K2) (A3)	PO8 (K3) (A3)	PO9 (A3)	PO10 (A3)	PO11 (K3) (A3)	PO12 (A3)	PSO1 (K4) (A3)	PSO2 (K3) (A3)
CO1	K2														
CO2	K3														
CO3	K3														
CO4	K2														
CO5	K3														
Weighted Average															

3 – Substantial **2- Moderate** **1- Low** **'-' – No Correlation**

Approved by BoS Chairman

B.E / B. TECH	B23ECO601 - WIRELESS TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives	
1.	Understand Introduction about wireless Communication.
2.	Study the basic concepts of channel modeling.
3.	Learn the access schemes in wireless communication.
4.	Understand channel capacity in wireless communication system.
5.	Learn evolution of wireless technologies.

UNIT I INTRODUCTION	9
Introduction to wireless communication systems-Cellular concept – system design fundamentals Handoff Strategies- Interference and system capacity, Improving Coverage and Capacity	

UNIT II CHANNEL MODELING	9
Free space propagation model, Reflection- Diffraction — Scattering - Log-normal shadowing. Small-scale multipath propagation, Types of small-scale fading, Rayleigh and Ricean distribution, Input /output model of the wireless channel-Time and frequency coherence-Statistical channel models	
UNIT III ACCESS SCHEMES AND DIVERSITY	**9**
FDMA, TDMA, CDMA, SDMA and CSMA, OFDMA. Diversity Techniques—Frequency diversity, Time diversity, Code diversity, Antenna diversity–RAKE Receiver-SIMO, MISO, MIMO, MIMO-OFDM Technique	
UNIT IV CAPACITY OF WIRELESS CHANNELS	**9**
AWGN channel capacity — capacity of flat fading channels, Frequency-selective fading channels, Multiuser capacity, Downlink channel capacity, Uplink channel capacity, Outage capacity	
UNIT V EVOLUTION OF WIRELESS TECHNOLOGIES	**9**
Mobile Technologies - GSM, 3G, 4G (LTE) and 5G technologies, Wireless LAN Technologies and WLL.	
	Total Instructional hours: 45

Approved by BOS Chairman

Course Outcomes: Students will be able to	
CO1	Learn fundamentals of wireless communication.
CO2	Understand the concepts of channel modeling.
CO3	Study various access schemes in wireless communication.
CO4	Understand channel capacity in wireless networks.
CO5	Learn evolution of wireless technologies.

Text Books	
1.	Andrea Gold smith, " Wireless Communications", Cambridge University Press, 2012.
2.	DavidTse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2015.

Reference Books	
1.	Kamilo Feher,"Wireless Digital Communications, Modulation & Spread Spectrum Applications", PHI, 2015.
2.	William C.Y.Lee, "Mobile Communication Engineering", McGraw Hill, 2014.
3.	Theodore S.Rappaport, "Wireless Communications", Pearson Education,2017
4.	Andreas F.Molisch,"Wireless Communications", Wiley, 2011.
5.	Learn evolution of wireless technologies.

<table>
<tr><th colspan="5">Evaluation Pattern:</th></tr>
<tr><th colspan="4">Continuous Internal Assessment</th><th>End Semester Examinations</th></tr>
<tr><td colspan="2">CIA I (Theory)
(100 Marks)</td><td colspan="2">CIA II (Theory)
(100 Marks)</td><td rowspan="3">Theory End Semester Examinations
(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>* Alternate Assessment Tool (AAT)</td><td>Written Test</td><td>* Alternate Assessment Tool (AAT)</td><td>Written Test</td></tr>
<tr><td>40 Marks</td><td>60 Marks</td><td>40 Marks</td><td>60 Marks</td></tr>
<tr><td colspan="4">40 Marks</td><td>60 Marks</td></tr>
<tr><th colspan="5">Total: 100 Marks</th></tr>
</table>

- AAT - Individual Assignment/ Case Study/ Seminar/ Mini project/ MCQ/ Role Play/ Group Discussion/ Debates/ Oral Presentations/ Poster Presentations/ Technical Presentations can also be provided course coordinator can choose any one/two components based on the nature of the course.

Approved by BOS Chairman

B.E	B23EEO601 – GREEN ELECTRONICS AND SUSTAINABLE TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of Green Electronics.
2.	To explain sustainable materials and design practices.
3.	To reveal the renewable energy in Electronics.
4.	To understand the E-Waste management and recycling strategies.
5.	To explain the emerging trends in sustainable technologies.

UNIT-I	Introduction to Green Electronics	9
Overview of Green Electronics and Sustainability-Environmental Impact of Electronic Waste (E-Waste)- Energy Consumption in Electronics Manufacturing-Green Engineering Principles-Life Cycle Assessment (LCA) of Electronic Devices.		

UNIT-II	Sustainable Materials and Design	9
Eco-friendly and Biodegradable Electronic Materials-Sustainable Circuit Design Techniques-Low-power and Energy-efficient Semiconductor Technologies-Flexible and Organic Electronics-Sustainable PCB (Printed Circuit Board) Manufacturing.		

UNIT-III	Renewable Energy for Electronics	9
Solar Energy: Photovoltaics in Electronics-Energy Harvesting Techniques (Piezoelectric, Thermoelectric, etc.)- Battery Technologies and Green Energy Storage Solutions- Supercapacitors and Fuel Cells for Sustainable Electronics-Smart Grid and IoT for Energy Efficiency.		

UNIT-IV	Waste Management and Recycling of Electronics	9
E-Waste Recycling Techniques and Challenges-Circular Economy in Electronics-Regulations and Policies for Electronic Waste Management-Extended Producer Responsibility (EPR)- Case Studies on Successful E-Waste Management.		

UNIT-V	Emerging Trends and Future of Green Electronics	9
AI and IoT for Energy-efficient Systems-Sustainable Computing and Cloud Technologies-Green 5G and Communication Technologies-Carbon Footprint Reduction in Semiconductor Industries-Future Innovations in Sustainable Electronics.		
		Total Instructional hours:45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Illustrate the concept of green electronics and sustainability.
CO2	Explain the Sustainable Materials and Design with low-power and energy-efficient semiconductor technologies.
CO3	Demonstrate green energy storage solutions such as batteries, supercapacitors, and fuel cells.
CO4	Interpret the principles of e-waste recycling and the circular economy.
CO5	Infer the advancements in green computing, energy-efficient communication, and semiconductor technologies.

Text Books	
1.	John Lamb, “Green Electronics/Green Bottom Line: A Commonsense Guide to Environmentally Responsible Engineering and Management”, CRC Press, 2007.
2.	Santosh K. Kurinec, Krzysztof Iniewski, “Energy-Efficient Computing and Electronics: Devices to Systems”, CRC Press, 2019.
3.	Sunil Kumar, Vineet Kumar, “Electronic Waste Management: Policies, Processes, Technologies, and Impact”, Wiley Publications, 2023.
4.	Wayne C. W. Chan, Alan C. L. Wong, “Sustainable Electronics and Photonics”, Wiley publications, 2021.

Reference Books	
1.	Mohammad S. Obaidat, Alagan Anpalagan, Isaac Woungang, “Handbook of Green Information and Communication Systems”, Academic Press, 2013.
2.	Kaka Ma, “Sustainable Materials and Green Processing for Energy Conversion”, Trans Tech Publications, Elsevier, 2021
3.	Muhammad Zaffar Hashmi, Ajit Varma, “Environmental Impact of Electronic Waste and Sustainable Recycling Methods”, Springer, 2019.

Approved by BoS Chairman

B.E. / B.Tech	B23MEO601 - 3D PRINTING AND TOOLING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To explore the technology used in additive manufacturing.
2.	To develop CAD models for 3D printing.
3.	To acquire knowledge, techniques and skills to select relevant additive manufacturing process.
4.	To select a 3D printing process for an application.
5.	To produce a product using 3D Printing or Additive Manufacturing (AM).

UNIT - I	INTRODUCTION TO ADDITIVE MANUFACTURING (AM)	9
Overview – History – Need – classification - Additive Manufacturing Technology in product development – Materials for Additive Manufacturing.		

UNIT - II	CAD AND REVERSE ENGINEERING	9
Basic concept – 3D scanning – digitization techniques – Model reconstruction – data processing for reverse engineering - Additive Manufacturing Technology : CAD model preparation – Part orientation and support generation – Model slicing – Tool path generation.		

UNIT - III	LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING	9
Classification – liquid based system – stereo lithography apparatus (SLA) – principle, process, advantages and applications – solid based system – Fused Deposition Modeling – principle, process, advantages.		

UNIT - IV	LASER BASED ADDITIVE MANUFACTURING SYSTEMS	9
Selective laser sintering – principles of SLS process – process, advantages and applications, 3D Printing - principle, process, advantages - Laser Engineered Net Shaping (LENS).		

Approved by BoS Chairman

UNIT - V	RAPID TOOLING AND APPLICATIONS OF ADDITIVE MANUFACTURING	9
Principles and typical process for quick batch production of plastic and metal parts through quick tooling – applications for Aerospace, defence, automobile, Bio-medical and general engineering industries		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the importance of Additive Manufacturing.
CO2	Apply technique of CAD and reverse engineering for geometry transformation in Additive Manufacturing.
CO3	Define the various process used in Additive Manufacturing.
CO4	Identify and select suitable process used in Additive Manufacturing.
CO5	Understand the basic concept of quick tooling and additive manufacturing application.

Text Books	
1.	Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies : Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2.	Andreas Gebhardt, "Understanding Additive Manufacturing : Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
3.	Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.

Reference Books	
1.	J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Material Science, 2013.
2.	Dougles Bryden, "CAD and Prototyping for Product Design", 2014.
3.	CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.

Approved by BoS Chairman

B.E / B.TECH	B23CBO601 DATA SCIENCE FOR BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the basic concepts of Data Science.
2.	To understand the Analytics Life Cycle.
3.	To understand the process of acquiring Business Intelligence & various types of analytics for Business Forecasting
4.	To model the supply chain management for Analytics.
5.	To apply analytics for different functions of a business

UNIT- I Introduction to Data Science	9
Need for Data Science – Benefits and uses – Facets of data – Types of data- Organization of data - Data Science process- Data Science life cycle- Role of Data Science - Big Data – sources and characteristics of Big Data	

UNIT-II Introduction to Business Analytics	9
Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration	

UNIT- III Business Intelligence & Forecasting	9
Data Warehouses and Data Mart – Knowledge Management –Types of Decisions – Decision-Making Process – Decision Support Systems – Business Intelligence –OLAP – Analytic functions - Introduction to Business Forecasting and Predictive analytics – Logic and Data-Driven Models – Data Mining and Predictive Analysis Modeling –Machine Learning for Predictive analytics.	

Approved by BoS Chairman

UNIT- IV HR & Supply Chain Analytics	9
Human Resources – Planning and Recruitment – Training and Development – Supply chain network – Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain. Apply HR Analytics to make a prediction of the demand for hourly employees for a year.	

UNIT- V Marketing & Sales Analytics	9
Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales. Do predictive analytics for customers' behaviour in marketing and sales.	
Total Instructional hours: 45	

Course Outcomes: Students will be able to	
CO1	Understand the data science basics and its life cycle.
CO2	Understand the role of data science in business decision-making and strategy formulation.
CO3	Apply business intelligence tools and analytic functions.
CO4	Apply analytics in various HR functions such as recruitment, planning, and training.
CO5	Use predictive analytics to interpret and forecast customer behavior in marketing and sales contexts.

Text Books:
1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Efrain Turban, Jay E.Aronson, Teng-Peng Liang, Ramesh Sharada "Decision Support Systems and Intelligent Systems" 8^{th} Edition, Pearson Education, 2007.

Reference Books :
1. R. Evans James, Business Analytics, 2017.
2. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2017.
3. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2016.

Approved by BoS Chairman

MANDATORY COURSE I

B.E / B.Tech	B23MCT501- Environmental Sustainability (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand ecosystems and the environment, including how they work and their importance.
2.	To learn about biodiversity and ways to protect endangered species.
3.	To Identify causes and solutions for pollution and waste management.
4.	To explore natural resources and how human activities affect them.
5.	To discuss global issues like climate change, population growth, and sustainable living.

SYLLABUS:

UNIT - I	ENVIRONMENT AND ECOSYSTEM	6
Scope and importance of environment - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers –energy flow in the ecosystem - food chains and food webs – structure and function of the (a) forest ecosystem (b) desert ecosystem (c) aquatic ecosystems (pond & marine).		

UNIT - II	BIODIVERSITY	6
Introduction to Biodiversity: Genetic, species and ecosystem diversity. Value of biodiversity - hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.		

UNIT - III	ENVIRONMENTAL POLLUTION	6
Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) soil pollution - solid waste management: causes, effects and control measures of municipal solid wastes.		

Approved by BoS Chairman

UNIT - IV	NATURAL RESOURCES	6
Forest resources: Use and over-exploitation, deforestation - Water resources: Use and over-utilization of surface and ground water - Land as a resource, land degradation, man induced landslides, soil erosion and desertification.		

UNIT - V	HUMAN POPULATION, SOCIAL ISSUES AND THE ENVIRONMENT	6
Population growth, variation among Nations – Population explosion. climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.		
	TOTAL INSTRUCTIONAL HOURS	30

Course Outcomes: Students will be able to	
CO1	Explain the structure and function of various ecosystems and explain the flow of energy through food chains and food webs.
CO2	Relate the types, values, and threats to biodiversity and differentiate between in-situ and ex-situ conservation methods.
CO3	Summarize the causes and impacts of major types of environmental pollution and suggest appropriate control measures.
CO4	Interpret the usage and over-exploitation of natural resources and analyse their environmental consequences.
CO5	Outline the impact of human population growth and social issues on environmental degradation and global climate phenomena.

Text Books	
1.	Gilbert M. Masters, ‘Introduction to Environmental Engineering and Science’, 2nedition,Pearson Education, 2004.
2.	Benny Joseph, ‘Environmental Science and Engineering’, Tata McGraw-Hill, New Delhi, 2006

Reference Books	
1.	G.Tyler Miller and Scott E. Spoolman, ―’Environmental Science’,Cengage LearningIndia Pvt, Ltd, Delhi, 2014
2.	Erach Bharucha, ―Textbook of Environmental Studies‖, Universities Press (I) PVT, LTD, Hydrabad, 2015.

Approved by BoS Chairman

B.E / B.Tech	B23MCT502 - ELEMENTS OF LITERATURE (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand and identify key literary elements in various texts.
2.	To analyze how authors use literary devices to convey themes and messages.
3.	To examine how character, setting, plot, and other elements contribute to the overall meaning of a work.
4.	To appreciate the different forms and genres of literature.
5.	To develop writing and analytical skills through discussions, essays, and presentations.

UNIT-I INTRODUCTION TO LITERARY ELEMENTS 6

- **Overview of Literary Elements:** Definition and significance of literary elements
- **Introduction to the core components:** plot, setting, character, theme, and conflict
- Understanding literary genres (fiction, poetry, drama, nonfiction)

UNIT-II PLOT AND STRUCTURE 6

- The five stages: Exposition, Rising Action, Climax, Falling Action, Resolution
- Types of conflict (man vs. man, man vs. self, man vs. nature, etc.)
- Plot devices (foreshadowing, flashbacks, etc.)

UNIT-III CHARACTERIZATION 6

- **Types of Characters:** Protagonist, antagonist, dynamic, static, round, flat, etc. Direct vs. indirect characterization
- **Character Development:**
- How characters change or grow throughout a story
- Analyzing motivations, conflicts, and relationships

UNIT-IV SETTING 6

- **Understanding Setting:**
- The time, place, and social environment of a story
- How setting influences plot and character development
- Symbolism and mood created through setting

Approved by BoS Chairman

UNIT-V	ANALYZING LITERARY WORKS	6
• **Close Reading and Analysis:** • Developing analytical skills through in-depth examination of texts • Understanding the role of diction, syntax, and tone in literature • **Comparative Analysis:** • Comparing works of literature across genres or time periods • Drawing connections between themes, characters, and literary devices		
	Total Instructional hours:30	

Course Outcomes: Students will be able to	
CO1	Identify and Interpret Literary Elements. (K2)
CO2	Analyze Literary Devices. (K4)
CO3	Evaluate Narrative Structure. (K5)
CO4	Explore various literary forms and genres. (K3)
CO5	Develop Critical Thinking and Writing Skills. (K6)

Text Books	
1.	Narayan RK, “Malgudi Days”, Indian Thought Publications, New York, 2015
2.	Shaw, George Bernard, “Greatest works of George Bernard Shaw”, Maple Press, 2010
3.	Nair, Anita, “Ladies Coupe-A Novel in Parts”, Penguin Books, 2014

Reference Books	
1.	Abram, “A Glossary of Literary Terms”, Thomson India, 2008
2.	Trivedi, “India’s Shakespeare”, Pearson, 2008
3.	Orwell, George “Animal Farm”, Penguin Books Press, India, March 2011.
4.	Shakespeare, William “As You Like It”, Om Books International published, 2025.
5.	Allan Poe, Edgar, “The Raven”, Penguin Books Press, India, Oct 2013
6.	O. Henry, “The Gift Of The Magi”, Arcadia Publishing, December 2024

B.E / B.Tech	B23MCT503 - FOUNDATIONS OF YOGA	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To introduce the fundamental concepts and philosophy of Yoga and its relevance to modern life.
2.	To develop awareness of the physical, mental, and emotional benefits of Yoga through an understanding of its principles.
3.	To impart knowledge about the ethical and moral foundations of Yoga as described in Patanjali's Yoga Sutras (Yama, Niyama, etc.).
4.	To promote a healthy and disciplined lifestyle by integrating Yogic practices and values into daily routines.
5.	To enable students to manage stress and enhance concentration through the theoretical understanding of pranayama, meditation, and yogic relaxation techniques.

SYLLABUS:

UNIT - I	INTRODUCTION TO YOGA	6

- Definition, origin and evolution of Yoga.
- Aim, objectives, and relevance of Yoga in modern life.
- Different schools of Yoga (Raja Yoga, Karma Yoga, Bhakti Yoga, Jnana Yoga, Hatha Yoga).

UNIT - II	HEALTH AND YOGA	6

- Concept of health in Yoga.
- Holistic approach of Yoga to health and well-being.
- Role of Yoga in stress management.
- Yoga as preventive and therapeutic tool.

UNIT - III	YOGIC LIFESTYLE	6

- Yogic principles of food and diet.
- Importance of discipline (Yama, Niyama) in daily life.
- Daily routine and time management.
- Positive thinking and mental hygiene through Yoga.

Approved by BoS Chairman

UNIT - IV	ASANAS	6
• Standing Asanas: Tadasana, Trikonasana, Vrikshasana. • Sitting Asanas: Padmasana, Vajrasana, Ardha Matsyendrasana. • Lying Asanas: Bhujangasana, Shalabhasana, Sarvangasana, Savasana. • Benefits and precautions.		

UNIT - V	MEDITATION AND RELAXATION	6
• Basics of Meditation. • Guided Meditation Techniques. • Yoga Nidra / Deep Relaxation Technique (DRT). • Stress management through meditation.		
	TOTAL INSTRUCTIONAL HOURS	30

Course Outcomes: Students will be able to	
CO1	Illustrate the origin, definition, and philosophy of Yoga and its significance in holistic well-being.
CO2	Explain the principles and practices of Ashtanga Yoga as outlined by Patanjali.
CO3	Outline the role of Yoga in promoting physical health, mental clarity, and emotional stability.
CO4	Interpret the ethical and lifestyle principles of Yoga (Yama and Niyama) for personal development.
CO5	summarize how Yogic practices help in stress management and enhancing concentration in daily life.

Text Books	
1.	Light on Yoga – B.K.S. Iyengar. Publisher: HarperCollins,1966
2.	Patanjali Yoga Sutras – Swami Vivekananda commentary, Publisher: Advaita Ashrama, 1896.

Reference Books	
1.	Yoga for Health – Swami Kuvalayananda. *Publisher: Kaivalyadhama, Lonavala 1931.*
2.	Common Yoga Protocol – Ministry of AYUSH, Govt. of India, 2015

Approved by BoS Chairman

B.E /B.Tech	B25MCT504- EXPORT IMPORT MANAGEMENT (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To learn the basics of international trade and its importance for businesses.
2.	To understand how goods are transported, paid for, and insured in global trade.
3.	To know how to choose the right products and markets for export.
4.	To get hands-on knowledge of export-import documents and procedures.
5.	To use digital tools and government support to grow your export business.

SYLLABUS:

UNIT - I	Introduction to Export and Import	6

Overview of International Trade, Importance of Export and Import in Business, International Trade Bodies and Local Regulatory Authorities, Export-Import Cycle: Step-by-Step Process, Online IEC (Import Export Code) Application, Myths and Opportunities in Global Trade.

UNIT - II	Logistics, Transportation & Payment Terms	6

Types of Transportation in International Trade, Containers, Packaging, and Shipment Handling, IncoTerms: Delivery Terms, Costs & Risks, Payment Terms: Modes of Payment & Risk Involved, Insurance and Risk Management in Trade.

UNIT - III	Product & Market Selection, Buyer Identification	6

Selecting the Right Product for Export, Market Research and Identifying Potential Markets, Importance of Trade Fairs & Exhibitions, Finding Genuine Buyers & Verification Process, Effective Communication with International Buyers.

UNIT - IV	Export & Import Documentation and Procedures	6

Understanding Proforma Invoice & Letter of Credit (LC), Pre & Post Shipment Documents, GST, Customs Clearance & Compliance Procedures, How to Fill Pre & Post Shipment Documents – Practical Exercise, Import Documentation and Procedures.

Approved by BoS Chairman

UNIT - V	Marketing, Incentives & Digital Trade Strategies	6
Export Incentives and Government Benefits, Pricing Strategies & Preparing Export Quotations, B2B Listing and Online Marketplaces, Digital Marketing & Social Media for Export Promotion, Buyer Calling, Data Collection & Product Portfolio Development.		

Course Outcomes: Students will be able to	
CO1	Explain the fundamentals of international trade, the role of trade bodies, and the complete export-import process. (K2)
CO2	Outline various transportation methods, Incoterms, packaging, payment terms, and risk management in international trade. (K2)
CO3	Apply knowledge to select suitable products and markets for export, identify genuine buyers, and effectively communicate in global trade. (K3)
CO4	Develop the ability to prepare and process export/import documentation, customs clearance, and GST compliance. (K3)
CO5	Utilize digital marketing, government incentives, and online platforms to develop export strategies and expand business opportunities. (K3)

Text Books	
1.	Thomas E. Johnson & Donna L. Bade, *Export/Import Procedures and Documentation*, 8th Edition, Ashgate Publishing, 2016.
2.	S. Tamer Cavusgil, Gary Knight, John R. Riesenberger, *International Business: The New Realities*, 3rd Edition, Pearson, 2017.
3.	P.K. Khurana, *Export-Import Theory, Practices, and Procedures*, 1st Edition, Atlantic Publishers & Distributors, 2016.
4.	Warren J. Keegan, Mark C. Green, *Global Marketing Management*, 9th Edition, Pearson, 2017.
5.	Francis Cherunilam, *International Trade and Export Management*, 9th Edition, Himalaya Publishing House, 2020

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Reference Books	
1.	Anders Grath, *The Handbook of International Trade and Finance*, 3rd Edition, Kogan Page, 2020.
2.	Francis Cherunilam, *International Trade and Export Management*, 9th Edition, Himalaya Publishing House, 2020.
3.	V.K. Bhalla, *International Business: Theories and Practices*, 2nd Edition, Anmol Publications, 2020.
4.	S.K. Bhatia, *Export Management*, 1st Edition, Vikas Publishing House, 2018.
5.	R. Palaniappan, *International Trade and Export Management*, 1st Edition, Oxford University Press, 2019.

Approved by BoS Chairman

MANDATORY COURSE II

B.E / B.Tech	B23MCT601 – EDUCATION PSYCHOLOGY (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To enable students to acquire knowledge about various methods of psychology.
2.	To gain knowledge about the concept of learning and its related theories.
3.	To understand motivation and its influence on human behaviour.
4.	To comprehend in-depth concepts of intelligence and creativity.
5.	To explain the concepts and theories of personality.

SYLLABUS:

UNIT - I	EDUCATIONAL PSYCHOLOGY AND HUMAN GROWTH AND DEVELOPMENT	6
Psychology: Meaning - Educational psychology: Meaning, scope and significance - Dimensions of human growth and development: Physical, cognitive, emotional, social, moral and language.		

UNIT - II	ATTENTION AND MEMORY	6
Attention: Meaning, nature and determinants of attention - Memory: Meaning, types of memory and Strategies for improving memory.		

UNIT - III	MOTIVATION AND LEARNING	6
Motivation: Meaning and definitions - Level of aspiration learning: Theories of learning and its educational implications Cognitive Theory: Jean Piajet, Behaviourist Theory- Pavlov's Classical, Conditioning.		

UNIT - IV	INTELLIGENCE AND CREATIVITY	6
Intelligence: Meaning, and types - Theories of Intelligence: Two factor, Thurston's Group factor - Intelligence Quotient (IQ) - Creativity: Concept, factors and process - Strategies for fostering creativity.		

UNIT - V	PERSONALITY	6
Personality: Meaning, definitions, and determinants of personality - Theories of Personality: Type, trait, and psychoanalytic Assessment of personality: Projective and non-projective techniques.		
TOTAL INSTRUCTIONAL HOURS		30

Course Outcomes: Students will be able to	
CO1	Explain various methods of psychology.
CO2	Describe the concept of learning and its related theories.
CO3	Discuss motivation and its influence on human behaviour.
CO4	Summarize the concepts of intelligence and creativity.
CO5	Interpret the concepts and theories of personality.

Text Books	
1.	Bert Laura, E. (2014). Child development. New Delhi: PHI Learning
2.	Chauhan, S. S. (2002). Advanced educational psychology. New Delhi: Vikas Publishing house.
3.	Hurlock, Elizabeth, B. (2015). Child development. New Delhi: McGraw Hill Education.
4.	Mangal, S.K. (2002). Advanced educational psychology. New Delhi: Prentice Hall of India.
5.	Matthews. G., Deary, L. J., & Whiteman, M.C. (2009). (2nd ed.). Personality: Theory and research. New York: Guilford Publications.

Reference Books	
1.	AnithaWoolfolk. (2004). Educational psychology. Singapore: Pearson Education.
2.	Cloninger, S.C. (2008) (5thed.). Theories of personality: Understanding persons. Englewood Cliffs, New Jersey: Prentice Hall.
3.	Schunk, D.H. (2007) (5thed.). Learning theories: An educational perspective. New York: Prentice Hall of India.
4.	Skinner, C.E. (2003) (4thed.). Educational psychology. New Delhi: Prentice Hall of India.
5.	Sprint Hall Norman, A, & Sprint Hall, Richard, C. (1990) (5thed.). Educational psychology: A developmental approach. New Delhi: McGraw Hill.

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B.E / B.Tech	B23MCT602- Life Style Education (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand the importance of a healthy lifestyle and its impact on overall well-being.
2.	To learn about balanced nutrition, the role of essential nutrients, and healthy eating habits.
3.	To explore the benefits of regular exercise and different types of physical activities.
4.	To identify common lifestyle diseases and strategies for their prevention.
5.	To develop mental wellness through stress management, mindfulness, and better sleep habits.

UNIT - I Introduction to a Healthy Lifestyle — 6

- Definition & importance of a healthy lifestyle
- Nutrition, exercise, sleep, and mental well-being.
- Assessing current lifestyle habits.

UNIT - II Nutrition & Balanced Diet — 6

- Macronutrients & micronutrients: Their roles and sources.
- Healthy eating habits and meal planning.
- Importance of hydration.
- Harmful effects of processed food and unhealthy eating habits.

UNIT - III Physical Fitness & Exercise — 6

- Benefits of regular exercise on physical and mental health.
- Types of workouts: Cardio, strength training, yoga, and flexibility exercises.
- Designing a personalized fitness routine.

UNIT - IV Lifestyle Diseases & Prevention — 6

- Causes and prevention of obesity, diabetes, heart disease, and hypertension.
- Role of diet, exercise, and mental health in disease prevention.
- Importance of regular health check-ups.

UNIT - V Mental Health & Stress Management — 6

- Understanding stress, anxiety, and depression.
- Techniques for relaxation: Meditation, deep breathing, and mindfulness.
- Importance of sleep for overall health.
- Tips for improving sleep hygiene.

TOTAL INSTRUCTIONAL HOURS — 30

Course Outcomes: Students will be able to	
CO1	Explain the importance of a healthy lifestyle and its key aspects like nutrition, exercise, sleep, and mental well-being.
CO2	Describe the role of nutrients, healthy eating habits, and the effects of processed food.
CO3	Summarize different types of exercises and their benefits for physical and mental health.
CO4	Identify common lifestyle diseases, their causes, and ways to prevent them.
CO5	Discuss stress, anxiety, and sleep issues, along with techniques to manage them.

Text Books	
1.	*Francesc García, Héctor,Miralles*, Ikigai: The Japanese Secret to a Long and Happy Life, Penguin Audio, 2017.
2.	Relationship, wellbeing and behaviour, Harry T. Reis, World Library of Psychological series, Reutledge, Taylor and Francis Group, 2018.

Reference Books	
1.	Shawn Achor, The Happiness Advantage: How a Positive Brain Fuels Success in Work and Life, Crown Currency, 2018.
2.	James Clear, Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones, Penguin Audio, 2018.

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B.E / B.Tech	B25MCT603 STARTUP AND VENTURE FUNDING (Common to ALL)	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To understand new venture creation opportunities, its resources, and requirements for Enterprise Start-up
2.	To understand the legal environment.
3.	To learn about the start-up environment and survival.
4.	To study the various funding availabilities for startups.
5.	To analyse the venture capital funding and its stages.

UNIT - I	Start-up An Overview	6
Introduction to start ups - The rise of startup economy – Ideation- Venture Choices - The Start-up Equation – The Entrepreneurial Ecosystem – Entrepreneurship in India. Government Initiatives.		

UNIT - II	Start-up Capital Requirements and Legal Environment	6
Identifying startup capital requirements - estimating startup cash requirements - Startup financing metrics – Risk mitigation strategies - The legal framework for startups - Incorporation and commencement of businesses and registration of a company.		

UNIT - III	Start-up Survival and Growth	6
Feasibility Study - Stages of growth of start-ups – Reasons for new start up failures- Scaling new ventures – preparing for change - Leadership succession. Support for growth and sustainability of the venture.		

UNIT - IV	Funding of Start Up Ventures	6
Financing Opportunities for startups – Equity investment process – Angel Investors - Funding startups with bootstrapping- crowd funding- strategic alliances.		

UNIT - V	Venture Capital Funding	6
Venture Capital – Meaning and features – Seed capital – Financing various stages of startup ventures – Exit strategy for venture capital funds.		

Course Outcomes: Students will be able to	
CO1	Implement entrepreneurship concepts in a start-up idea. (K3)
CO2	Use budgeting and legal setup processes for the venture. (K3)
CO3	Demonstrate feasibility through market and financial analysis. (K3)
CO4	Execute funding strategies suited for a new business. (K3)
CO5	Apply suitable funding methods for different stages of a new business using basic financial models and strategies. (K3)

Text Books	
1.	Kathleen R Allen, Launching NewVentures, An Entrepreneurial Approach, Cengage Learning, 2016.
2.	AnjanRaichaudhuri, Managing New Ventures Concepts and Cases, Prentice Hall International, 2010.
3.	S. R. Bhowmik& M. Bhowmik, Entrepreneurship, New Age International, 2007.

Reference Books	
1.	Steven Fisher, Ja-nae' Duane, The Startup Equation -A Visual Guidebook for Building Your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd, 2016.
2.	Donald F Kuratko, Jeffrey S. Hornsby, New Venture Management: The Entrepreneur's Road Map, 2e, Routledge, 2017.
3.	Vijay Sathe, Corporate Entrepreneurship, 1e, Cambridge, 2009.

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B.E / B.Tech	B23MCT604 – INDIAN KNOWLEDGE SYSTEM	L	T	P	C
		2	0	0	0

Course Objectives	
1.	To introduce the scope and significance of Indian Knowledge Systems in the context of modern education and engineering.
2.	To explore ancient Indian contributions in science, mathematics, technology, and architecture.
3.	To understand core Indian philosophies, ethics, and values and their relevance in personal and professional life.
4.	To connect traditional practices with modern innovations through case studies and project-based learning.
5.	To promote sustainable thinking and design approaches inspired by indigenous knowledge and practices.

SYLLABUS:

UNIT - I	INTRODUCTION TO INDIAN KNOWLEDGE SYSTEM	6

- Meaning and scope of IKS
- Importance of IKS in modern education
- Relevance of IKS to science, technology, and engineering.

UNIT - II	SCIENCE AND TECHNOLOGY IN ANCIENT INDIA	6

- Contributions in mathematics (e.g., zero, decimal system, algebra – Aryabhata, Bhaskara)
- Ancient metallurgy (e.g., Iron Pillar of Delhi, zinc extraction)
- Astronomy and calendar systems (e.g., Surya Siddhanta, Jantar Mantar)
- Ayurveda and traditional health sciences.

UNIT - III	ENGINEERING AND ARCHITECTURE	6

- Vastu Shastra and ancient Indian architecture
- Temple construction and civil engineering marvels
- Water management systems (step wells, tanks, canals)
- Town planning in Harappan civilization.

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UNIT - IV	INDIAN PHILOSOPHY, ETHICS & VALUE SYSTEM	6
• Core concepts of Indian philosophy (Dharma, Karma, Yoga) • Ethical principles in Indian tradition • Role of values in professional and personal life • Indian view on environmental sustainability.		

UNIT - V	ARTS, CULTURE, AND LITERATURE	6
• Overview of Indian classical music and dance • Ancient literature (Vedas, Upanishads, Ramayana, Mahabharata) • Sanskrit and its scientific relevance • Cultural practices and their scientific background.		
	TOTAL INSTRUCTIONAL HOURS	30

Course Outcomes: Students will be able to	
CO1	Explain the meaning, scope, and importance of Indian Knowledge Systems in the context of modern education.
CO2	Outline the key scientific and technological advancements of ancient India in fields like mathematics, metallurgy, and astronomy.
CO3	Interpret traditional Indian architectural and engineering practices, including Vastu Shastra and water management systems.
CO4	Illustrate the ethical values and philosophical principles of Indian traditions and their relevance in contemporary life.
CO5	Summarize the applications of IKS in modern innovation, entrepreneurship, and sustainable engineering practices.

Text Books	
1.	Introduction to Indian Knowledge Systems: Concepts and Applications, B. Mahadevan, Publisher: PHI Learning Pvt. Ltd. 2016.
2.	Science and Technology in Ancient India,: Roshen Dalal,Publisher: Penguin Books.2003
3.	Foundations of Indian Culture, Govind Sadashiv Ghurye, Publisher: Popular Prakashan. 1951

Reference Books	
1.	Indian Knowledge Systems – Volume 1, Kapil Kapoor & Michel Danino Publisher: Central Sanskrit University & Bharatiya Vidya Bhavan, 2021.
2.	The Argumentative Indian, By: Amartya Sen, Publisher: Picador, 2005.

Approved by BoS Chairman