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 TECHNOLOGY DEGREE IN COMPUTER SCIENCE AND BUSINESS SYSTEMS

Department of Computer Science and Business Systems

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Department of Computer Science and Business Systems

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	7	1-4	14
I to IV	Basic Sciences (BS)	4-5	7	4	26
I to II	Engineering Sciences (ES)	3-5	7	2-4	14
B - Professional Core Courses					
III to VII	Professional Core (PC)	3 – 4	24	2 - 4	71
C - Elective Courses					
V to VIII	Professional Elective (PE)	3	6	3	18
V to VIII	Open Elective (OE)	3	4	3	12
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	2	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**

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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	-	-	-	-	0	-	-	-
Theory / Theory with Practical										
B23ENT102	Business Communication & Value Science – I	HS	3	3	0	0	3	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
B23MET101	Engineering Graphics	ES	4	2	2	0	4	40	60	100
B23PHI101	Engineering Physics	BS	5	3	0	2	4	50	50	100
B23CBI101	Fundamentals of Computer Programming I	ES	5	3	0	2	4	50	50	100
Practical										
B23MEP101	Engineering Practices Laboratory	ES	4	0	0	4	2	60	40	100
Total credits to be earned							22			

Semester - II										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Theory / Theory with Practical										
B23ENT202	Business Communication &Value Science – II	HS	3	3	0	0	3	40	60	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
B23CBI202	Fundamentals of Computer Programming II	ES	5	3	0	2	4	50	50	100
B23CBI201	Programming for Data Structures	PC	5	3	0	2	4	50	50	100
B23CEP201	Soft Skills	CEC	2	0	0	2	NC	100	-	100
B23CEP202	Application Design and Development	CEC	2	2	0	0	NC	100	-	100
Total credits to be earned							20			

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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
B23CBT301	Fundamentals of Management	**PC**	3	3	0	0	**3**	40	60	100
B23CBT302	Object Oriented Programming with Java	**PC**	3	3	0	0	**3**	40	60	100
B23CBT303	Design Thinking	**PC**	3	3	0	0	**3**	40	60	100
B23CBT304	Web Application Development	**PC**	3	3	0	0	**3**	40	60	100
B23ADT401	Operating System Foundations	**PC**	3	3	0	0	**3**	40	60	100
Practical										
B23CBP301	Object Oriented Programming with Java Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CBP302	Web Application Development 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										
B23MAT405	Linear Algebra	**BS**	3	3	0	0	**3**	40	60	100
B23CBT401	Agile Software Engineering	**PC**	3	3	0	0	**3**	40	60	100
B23CBT402	Fundamentals of Economics	**PC**	3	3	0	0	**3**	40	60	100
B23CBT403	Computer Networks Essentials	**PC**	3	3	0	0	**3**	40	60	100
B23CST401	Database Management Systems	**PC**	3	3	0	0	**3**	40	60	100
B23CBT404	Advanced Data Structures and Algorithms	**PC**	3	3	0	0	**3**	40	60	100
Practical										
B23ENP401	Business Communication & Value Science – III	**HS**	4	0	0	4	**2**	60	40	100
B23CSP401	Database Management Systems Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CBP401	Advanced Data Structures and Algorithms Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CEP301	Professional Certificate Course	**CEC**	-	-	-	-	**1**	-	-	-
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										
B23MAT501	Business Statistics	**BS**	3	3	0	0	**4**	40	60	100
B23ADT302	Foundation of Data Science	**PC**	3	3	0	0	**3**	40	60	100
B23CBT501	Full Stack Development	**PC**	3	3	0	0	**3**	40	60	100
B23CBT502	Financial and Cost Accounting	**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**	3	3	0	0	**NC**	100	-	100
B23MCT505	Holistic insight into UN SDGs	**MC**	3	3	0	0	**NC**	100	-	100
Practical										
B23ADP301	Data Science Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CBP501	Full Stack Development 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										
B23CBT601	Operations Research	**PC**	4	3	1	0	**4**	40	60	100
B23CBT602	Customer Relationship Management	**PC**	3	3	0	0	**3**	40	60	100
B23CBT603	DevOps and Cloud Computing	**PC**	3	3	0	0	**3**	40	60	100
B23CBT604	Business Intelligence	**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**	3	3	0	0	**NC**	100	-	100
B23MCT605	Cyber Safety Concepts	**MC**	2	-	-	2	**NC**	100	-	100
Practical										
B23ENP601	Business Communication and Value Science IV	**HS**	4	0	0	4	**2**	60	40	100
B23CBP601	DevOps and Cloud Computing laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CBP602	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
B23CBI701	IT Project Management	**PC**	5	3	0	2	**4**	50	50	100
B23CBT702	Business Strategy with DSS	**PC**	3	3	0	0	**3**	40	60	100
B23CBT703	Human Resource Management	**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										
B23CBP701	Project work Phase-I	**PW**	4	0	0	4	**4**	40	60	100
Total credits to be earned							**22**			

Semester - VIII										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
Practical										
B23CBP801	Project Work Phase - II	**PW**	16	0	0	16	**8**	40	60	100
Total credits to be earned							**8**			

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	-	-	-	-	0	-	-	-
B23ENT102	Business Communication &Value Science – I	HS	3	3	0	0	3	40	60	100
B23HST101	தமிழர்மரபு / Heritage of Tamils	HS	1	1	0	0	1	40	60	100
B23HST201	தமிழரும் தொழில்நுட்பமும்/Tamils and Technology	HS	1	1	0	0	1	40	60	100
B23ENT202	Business Communication &Value Science – II	HS	3	3	0	0	3	40	60	100
B23ENP401	Business Communication &Value Science –III	HS	4	0	0	4	2	60	40	100
B23ENP601	Business Communication &Value Science –IV	HS	4	0	0	4	2	60	40	100
B23MGT701	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
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
B23CHI101	Engineering Chemistry	BS	5	3	0	2	4	50	50	100
B23MAT302	Discrete Mathematics	BS	4	3	1	0	4	40	60	100
B23MAT405	Linear Algebra	BS	3	3	0	0	3	40	60	100
B23MAT501	Business Statistics	BS	3	0	0	0	3	40	60	100

ENGINEERING SCIENCES (ES)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23CBI101	Fundamentals of Computer Programming I	ES	5	3	0	2	4	50	50	100
B23MET101	Engineering Graphics	ES	4	2	2	0	4	40	60	100
B23MEP101	Engineering Practices Laboratory	ES	4	0	0	4	2	60	40	100
B23CBI202	Fundamentals of Computer Programming II	ES	5	3	0	2	4	50	50	100

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PROFESSIONAL CORE (PC)

Course Code	Course Name	CT	Instructional Hours				Assessment			
			CP	L	T	P	C	CIA	ESE	Total
B23CBI201	Programming for Data Structures	PC	5	3	0	2	**4**	50	50	100
B23CBT301	Fundamentals of Management	PC	3	3	0	0	**3**	40	60	100
B23CBT302	Object Oriented Programming with Java	PC	3	3	0	0	**3**	60	40	100
B23CBT303	Design Thinking	PC	4	3	1	0	**3**	40	60	100
B23CBT304	Web Application Development	PC	3	3	0	0	**3**	40	60	100
B23ADT305	Operating Systems Fundamentals	PC	3	3	0	0	**3**	40	60	100
B23CBP301	Object Oriented Programming with Java Laboratory	PC	4	0	0	4	**2**	60	40	100
B23CBP302	Web Application Development Laboratory	PC	4	0	0	4	**2**	60	40	100
B23CBT401	Agile Software Engineering	PC	3	3	0	0	**3**	40	60	100
B23CBT402	Fundamentals of Economics	PC	3	3	0	0	**3**	40	60	100
B23CBT403	Essentials of Computer Networks	PC	3	3	0	0	**3**	40	60	100
B23CST401	Database Management Systems	PC	3	3	0	0	**3**	40	60	100
B23CBT404	Advanced Data Structures and Algorithms	PC	3	3	0	0	**3**	40	60	100
B23CBP401	Advanced Data Structures and Algorithms Laboratory	PC	4	0	0	4	**2**	60	40	100
B23CSP401	Database Management and Systems Laboratory	PC	4	0	0	4	**3**	40	60	100
B23ADT302	Foundation of Data Science	**PC**	3	3	0	0	**3**	40	60	100
B23CBT501	Full Stack Development	**PC**	3	3	0	0	**3**	40	60	100
B23CBT502	Financial and Cost Accounting	**PC**	3	3	0	0	**3**	40	60	100
B23ADP301	Data Science Lab	**PC**	4	0	0	4	**2**	60	40	100
B23CBP501	Full Stack Development Laboratory	**PC**	4	0	0	4	**2**	60	40	100
B23CBT601	Operations Research	**PC**	4	3	1	0	**4**	40	60	100
B23CBT602	Customer Relationship Management	**PC**	3	3	0	0	**3**	40	60	100
B23CBT603	DevOps and Cloud Computing	**PC**	3	3	0	0	**3**	40	60	100
B23CBT604	Software Testing	**PC**	3	3	0	0	**3**	40	60	100
B23CBP601	DevOps and Cloud Computing Laboratory	**PC**	4	0	0	4	**2**	40	60	100
B23CBP602	Innovative Design Practices	**PW**	4	0	0	4	**2**	60	40	100
B23CBI701	IT Project Management	**PC**	5	3	0	2	**4**	50	50	100
B23CBT702	Business Strategy with DSS	**PC**	3	3	0	0	**3**	40	60	100
B23CBT703	Human Resource Management	**PC**	3	3	0	0	**3**	40	60	100

PROJECT WORK (PW)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23CBP602	Innovative Design Practices	**PW**	4	0	0	4	**2**	60	40	100
B23CBP702	Project work Phase-I	**PW**	6	0	0	6	**2**	40	60	100
B23CBP801	Project Work Phase-II	**PW**	16	0	0	16	**8**	40	60	100

PROFESSIONAL ELECTIVE (PE)

Course Code	Course Name	CT	Instructional Hours				Assessment			
			CP	L	T	P	C	CIA	ESE	Total
Vertical I – Financial and Marketing Management										
B23CBE901	Business Process Management	**PE**	3	3	0	0	**3**	40	60	100
B23CBE902	Financial Management	**PE**	3	3	0	0	**3**	40	60	100
B23CBE903	Operation Management	**PE**	3	3	0	0	**3**	40	60	100
B23CBE904	Behavioral Economics	**PE**	3	3	0	0	**3**	40	60	100
B23CBE905	Talent Management	**PE**	3	3	0	0	**3**	40	60	100
B23CBE906	Supply Chain Management	**PE**	3	3	0	0	**3**	40	60	100
B23CBE907	Marketing Research and Marketing Management	**PE**	3	3	0	0	**3**	40	60	100
B23CBE908	Digital Marketing	**PE**	3	3	0	0	**3**	40	60	100

Course Code	Course Name	CT	Instructional Hours				Assessment			
			CP	L	T	P	C	CIA	ESE	Total
Vertical II – Data Analytics										
B23CBE909	Data Mining for Business Intelligence	**PE**	3	3	0	0	**3**	40	60	100
B23CBE910	Process Mining	**PE**	3	3	0	0	**3**	40	60	100
B23CBE911	Deep Learning for Business Systems	**PE**	3	3	0	0	**3**	40	60	100
B23CBE912	Bigdata Analytics	**PE**	3	3	0	0	**3**	40	60	100
B23CBE913	Marketing and Social media web analytics	**PE**	3	3	0	0	**3**	40	60	100
B23CBE914	Risk analytics	**PE**	3	3	0	0	**3**	40	60	100
B23CBE915	Business ethics	**PE**	3	3	0	0	**3**	40	60	100
B23CBE916	Data Security for Business systems	**PE**	3	3	0	0	**3**	40	60	100

Approved by BoS Chairman

Course Code	Course Name	CT	Instructional Hours				Assessment			
			CP	L	T	P	C	CIA	ESE	Total
Vertical III – 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 Architecture 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

Course Code	Course Name	CT	Instructional Hours				Assessment			
			CP	L	T	P	C	CIA	ESE	Total
Vertical IV – Cloud Computing										
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

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Course Code	Course Name	CT	Instructional Hours				Assessment			
			CP	L	T	P	C	CIA	ESE	Total
Vertical V – Artificial Intelligence										
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

Course Code	Course Name	CT	Instructional Hours				Assessment			
			CP	L	T	P	C	CIA	ESE	Total
Vertical VI – Data Science										
B23ADE909	Information Retrieval	**PE**	3	3	0	0	**3**	40	60	100
B23ADE910	Pattern Recognition	**PE**	3	3	0	0	**3**	40	60	100
B23ADE911	Health Care Analytics	**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 Analytics	**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

Approved by BoS Chairman

MANDATORY COURSE (MC)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23MCT* **	Mandatory Course I	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT505	Holistic insights into UN SDG's	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT* **	Mandatory Course II	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT605	Cyber Safety Essentials	**MC**	3	3	0	0	**NC**	100	-	100

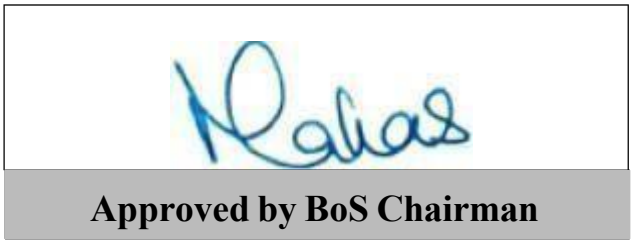
MANDATORY COURSE I (MC I)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23MCT501	Environmental Sustainability	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT502	Elements of Literature	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT503	Foundations of Yoga	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT504	Export Import Management	**MC**	3	3	0	0	**NC**	100	-	100

MANDATORY COURSE II (MC II)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23MCT601	Education Psychology	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT602	Life Style Education	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT603	Startup and Venture Funding	**MC**	3	3	0	0	**NC**	100	-	100
B23MCT604	Indian Knowledge System	**MC**	3	3	0	0	**NC**	100	-	100

Approved by BoS Chairman

CAREER ENHANCEMENT COURSE (CEC)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
B23CEP201	Soft Skills	CEC	2	0	0	2	NC	100	-	100
B23CEP202	Application Design and Development	CEC	2	2	0	0	NC	100	-	100
B23CEP301	Professional Certificate Course	CEC	-	-	-	-	1	100	-	100
B23CEP501	Summer Internship	CEC	-	-	-	-	1	100	-	100

OPEN ELECTIVE (OC)										
Course Code	Course Name	CT	Instructional Hours					Assessment		
			CP	L	T	P	C	CIA	ESE	Total
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



Approved by BoS Chairman

Semester - I

B.Tech	B23ENT102– BUSINESS COMMUNICATION &VALUE SCIENCE I	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To improve LSRW skills of the students for effective communication.
2.	To understand life skills and their values for their successful career.
3.	To learn and understand key concepts of business communication.
4.	To develop business communication skills through activity-based learning.
5.	To motivate the students to identify and enhance their personality traits by participating in Presentations & group discussions.

UNIT– I INTRODUCTION	9
Listening - importance of listening skills, difference between listening and hearing, types of listening, listening to formal and informal conversations, Reading short texts — skimming and scanning, Effective Communication, Types of Communication (verbal and non-verbal), Barriers to Communication, strategies to improve communication, role play based learning, Parts of Speech, Types of sentences.	

UNIT– II LIFE SKILLS AND VALUES	9
Overview of Leadership Oriented Learning (LOL), Introduction to Life skills, Values- Self exploration, self — awareness, Values of individuals, its importance and necessity, Understanding Corporate Values and behaviour; Self introduction - speaking about one‟s friend, self-work with immersion - mock interview - narration -overview of business communication, activity: write a newspaper report on an IPL match-record a conversation between a celebrity and an interviewer – quiz.	

UNIT – III VOCABULARY BUILDING AND COMMUNICATION	9
Listening to selected speeches and presentations, Speaking - role plays, Reading business communication, picture based and newspaper-based activities, group discussion, Writing - summary writing - story writing - resume writing, interpersonal skills - stress management - time management., Voices - Active and Passive voice, Impersonal passive voice, Tenses, Verbs - Auxiliary verbs.	

Approved by BoS Chairman

UNIT– IV WRITING AND LANGUAGE DEVELOPMENT	9
Listening to TED talks, participating in conversations, small talk conversations, Reading- Reading newspapers and magazines, note making, Question types-„Wh‟ question and yes or no questions, writing – paragraph writing, story writing, email writing, formal and informal Emails, Errors spotting, Idioms and Phrases, Degrees of comparison, Word formation.	

UNIT– V LANGUAGE DEVELOPMENT AND INTERPERSONAL SKILLS	9
Listening to longer texts and contextualizing - participating in group discussion, community service work with an NGO and make a presentation - leadership–teamwork - motivating people, Reading - reading and understanding technical articles, writing - short essays, Sentence pattern, Spelling and punctuations, Modal verbs.	
	Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Develop vocabulary skills to comprehend conversations.
CO2	Identify the need for life skills and values.
CO3	Explain strengths and opportunities through speaking and writing.
CO4	Build grammatical understanding.
CO5	Develop corporate communication through LSRW skills.

Text Books	
1.	Ashraf Rizvi. M, “Effective Technical Communication”, Second Edition, McGraw Hill, New Delhi, 2018.
2.	Dhanavel, S.P., “English and Communication Skills for Students of Science and Engineering”, Orient Blackswan, Chennai, 2011.

Reference Books	
1.	RizviM. Ashraf, “Effective Technical Communication”, Tata McGraw Hill Publishing Company; New Delhi, 2007.
2.	Alan Mc‟carthy and O‟dell, English Vocabulary in Use, Third Edition, Cambridge University Press 2017.
3.	Richards C. Jack, “Interchange”, Fourth edition; Cambridge University Press, 2012
4.	Butterfield, Jeff, “Soft skills for everyone”, Sixth Indian Reprint, 2015.

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.	

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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

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	B23MAT101 MATRICES AND DIFFERENTIAL CALCULUS (Common to all Branches)	L	T	P	C
		3		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

Approved by BoS Chairman

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).

Approved by BoS Chairman

B.E / B.Tech	B23MET101 – ENGINEERING GRAPHICS (Common to All)	L	T	P	C
		2	2	0	4

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

Approved by BoS Chairman

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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 Outcomes : Students 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.
3. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

Approved by BoS Chairman

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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.

Approved by BoS Chairman

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.

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).

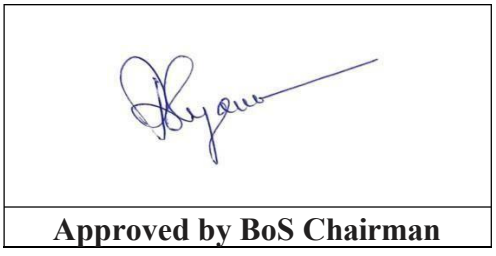
Determination of thickness of a thin wire by using travelling microscope.

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



Approved by BoS Chairman

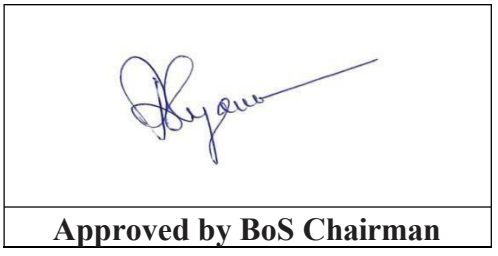
Course Outcomes : Students will be able to	
CO1	Categorize the basics of properties of matter and its applications, classify the elastic properties of materials by using uniform, non-uniform bending method and torsional pendulum apparatus.
CO2	Explain the basics of Laser, Fiber Optics and their applications, 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.
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	B23CBI101 – Fundamentals of Computer Programming I	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To know the basics of computer and working of computer programming.
2.	To provide exposure to problem-solving through C programming.
3.	To develop C programming language with conditional statements and loops.
4.	To develop modular applications in C using functions.
5.	To develop applications involving direct memory access in C using pointers.

UNIT - I	INTRODUCTION	9

Basic Computing Concepts - Number Systems - Compilation and Execution Phase of a Program - Low Level vs High Level Programming Languages - Programming Paradigms / Styles of Programming - Operating System - Introduction to C Programming.

UNIT - II	INTRODUCTION TO C PROGRAMMING	9

Writing C Programs - Variables and Data Types - Operators in C programming - Blocks and Compound statements.

UNIT - III	CONDITIONAL STATEMENTS AND FUNCTIONS	9

Control Flow - Conditional Statements and Loops: Control Conditions - If Statement - Switch Statements – Loop Statements - Storage classes - Control Flow - Functions in C.

UNIT - IV	ARRAYS	9

Introduction to Arrays: Types of indexing in Arrays- Array Representation- Array Declarations - Application on Arrays - Input and Output : Standard Input and Output - Formatted Input - Command Line Input.

UNIT - V	POINTERS AND MEMORY ADDRESS	9

Pointers and Addresses - Physical and Virtual Memory - Addressing Variables - Dereferencing Pointers - Casting Pointers - Arrays and Pointers - The sizeof() Operator - Pointer Arithmetic – Strings: Strings as arrays - String Utility functions.

Approved by BoS Chairman

Expt. No.	Description of the Experiments
1	Write a program to read an integer and display its square and cube.
2	Write a program to read the radius of a circle and calculate its area and circumference.
3	Write a program to read two integers and swap their values using a third variable.
4	Write a program to read three integers and find the maximum and minimum of them.
5	Write a program to check whether a given number is even or odd.
6	Write a program to find the sum of all natural numbers from 1 to n.
7	Write a program to print a pattern of asterisks in a right triangle shape.
8	Write a program to read an array of integer to find the sum and average of its elements.
9	Write a program to read a matrix and display its transpose.
10	Write a program to implement linear search in an array of integers.
	Total Instructional hours : (45+30) = 75

Course Outcomes : Students will be able to	
CO1	Demonstrate and explain the internal working of computer.
CO2	Demonstrate knowledge on C programming constructs.
CO3	Construct C programs using decision making and control statements.
CO4	Experiment with programs in C using an array.
CO5	Build programs in C using strings, pointers, functions.

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

Approved by BoS Chairman

Text Books	
1.	Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling
2.	Yashavant P. Kanetkar. “Let Us C”, 16th Edition, BPB Publications, 2016.

Reference Books	
1.	Byron S Gottfried, “Programming with C”, Schaum‟s Outlines, Fourth Edition, Tata
2.	Reema Thareja, “Programming in C”, Second Edition, Oxford University Press, 2016.
3.	Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First
4.	Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.

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

Approved by BoS Chairman

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	

EXCELLENCE BEYOND EXPECTATION KIT COIMBATORE

Approved by BoS Chairman

SEMESTER II

B.Tech	B23ENT202– BUSINESS COMMUNICATION & VALUE SCIENCE II	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To develop effective writing, reading and communication skills.
2.	To understand and use the tools of structured written communication.
3.	To motivate students to understand basics of business communication.
4.	To help students to identify personality traits and evolve as a better team player.
5.	To introduce key concepts of values, diversity and business ethics.

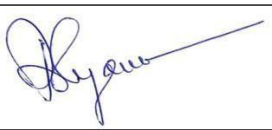
UNIT– I LANGUAGE DEVELOPMENT	9
Listening to social issues, Speaking — Group Discussion on Social Cause, Writing Good And Bad Writing, Techniques- Editing, Use of technical Words, Definitions, Compound Words, Jumbled Sentences. Creating an E-Magazine: To Share Concepts and Ideas, –contributing article to the magazine	

UNIT– II TECHNICAL WRITING	9
Listening to Group Discussion and meetings, Reading - Vision - Mission - Value Statements & Taglines, Reading user manuals of different products for specific information - Speaking: participating in discussions on organizing events, team discussions, Role Play, business letters, Inquiry letters, complaint letters, Sales Letters etc. One Word Substitutes, Sentences Expressing Purpose.	

UNIT – III CREATION OF COMMUNICATION	9
Listening: Short Film on Diversity - Discussion on The Concept Empathy - Group Activity: Create a Story of a person's life affected by Social Issues - Narrate The Story in First Person - Group Feedback - Write a Review in a Blog - Covering the topics discussed in class – Verbal Analogies, Cause & Effect Expressions.	

UNIT–IV PERSONALITY TRAITS	9
Brain Storming - Class Discussion on Social Issue - Activity: Create - Design a Skit on Social Issue/NGO - Readout the Skit - Role Play - Individual Feedback -Team Work: Intro to Dr. Meredith Belbin and his Research on Team Work - Belbin's Personality Traits - Writing: Report Writing.	

UNIT–V DEVERSITY AND INCLUSION	9



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Listening: "The Fish and I" by Babak Habibifar - Intro on Diversity & Inclusion - Different forms of Diversity in our society - Debate on the topics: diversity, morality and respect for individual - Group discussion: TCS Values - respect for individual and integrity - Writing: Job Application - resume preparation.
Total Instructional hours:45

Course Outcomes: Students will be able to	
CO1	Develop communication skills through LSRW skills.
CO2	Utilize tools of structured written communication.
CO3	Develop materials to create an identity for an organization dedicated to a social cause.
CO4	Identify individual personality types and role in a team.
CO5	Build the basic concepts of Morality and Diversity.

Text Books	
1.	Board of Editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.
2.	Richards, C. Jack. Interchange Students' Book – 2 New Delhi: CUP, 2015.

Reference Books	
1.	Sudharshana.N.P and Saveetha.C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.
2.	Raman, Meenakshi and Sharma, Sangeetha "Technical Communication Principles and Practice" Oxford University Press: New Delhi, 2014.
3.	Butterfield, Jeff "Soft Skills for Everyone" Cengage Learning, New Delhi, 2015

Approved by BoS Chairman

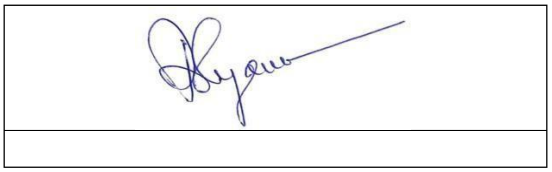
B.E / B.Tech	B23HST201- TAMILS AND TECHNOLOGY (Common to all Branches)	L	T	P	C
		1	0	0	1

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 – Gemstone 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,

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	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 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

Approved by BoS Chairman

B.E / B.Tech	B23CBI202 – Fundamentals of Computer Programming II	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To know the basics of creating user defined datatypes.
2.	To provide exposure to advanced problem-solving on array in C.
3.	To develop C programming language for handling multidimensional data.
4.	To develop applications using C libraries.
5.	To develop applications involving reading and writing to and from files

UNIT - I	USER DEFINED DATA TYPES AND ADVANCED POINTERS	9

User Defined Data Types : Structure - Structure Pointers - Arrays of Structures – Unions - Dynamic Memory Allocations - Advanced Concepts on Pointers: Pointers to Pointers – String Arrays - Function Pointers - Array of Function Pointers.

UNIT - II	ADVANCED CONCEPTS ON ARRAYS	9

Multi-dimensional arrays - Dynamic memory allocation - malloc(), calloc(), and realloc() - Pointers and arrays - using pointers to manipulate arrays - Array of pointers: Creating arrays that hold pointers to other variables or arrays - Function pointers and arrays: Understanding function pointers and using them in combination with arrays - - Array libraries and data structures: Exploring array libraries and data structures, such as dynamic arrays and sparse arrays.

UNIT - III	MARTICES / 2 – DIMENSIONAL ARRAYS	9

Introduction: 2D Arrays - Advanced array operations: Using advanced array operations such as matrix multiplication, transposition, and rotation 3D Arrays - Diagonal Matrix - Symmetric Matrix - Tri-Diagonal and Tri-Band Matrix - Toeplitz Matrix.

UNIT - IV	C STANDARD LIBRARIES	9

<stdio.h> - Opening, Closing Files - File Operations- Temporary Files - Raw I/O - File Position - File errors,<ctype.h> - Testing Characters,<string.h> - Memory Functions,<stdlib.h> - Utility – Exiting - Searching and Sorting,<assert.h> - Diagnostics,<stdarg.h> - Variable Argument lists,<time.h>, <math.h> - Mathematical Functions.

UNIT - V	FILE HANDLING	9

File handling functions in C: fseek() vs rewind() - EOF, getc() and feof() - fopen() - fgets() and gets(). Basics of File Handling: fsetpos() - rename function in C - tmpfile() function - fgetc() and fputc() fseek() - ftell() - lseek() - remove function in C - Merge contents of two files into a third file - Print contents of file in C. - Project Phase.

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Expt. No.	Description of the Experiments
1.	Create a program to store and manage student records using structures. Each structure should contain the student's name, ID number, and grade point average. Implement functions to add, delete, and modify student records, as well as a search function that allows the user to search for a specific student by name or ID number.
2.	Develop a program that uses structures to manage a library of books. Each structure should contain the book's title, author, publication date, and ISBN number. Implement functions to add, delete, and modify book records, as well as a search function that allows the user to search for a specific book by title, author, or ISBN.
3.	Implement a program to manage a car dealership using structures. Each structure should contain the car's make, model, year, price, and availability status. Implement functions to add, delete, and modify car records, as well as a search function that allows the user to search for a specific car by make, model, year, or price range. You can also add features such as sorting by price, filtering by availability, and generating sales reports.
4.	Create a program to represent complex numbers using unions. A complex number consists of a real part and an imaginary part. Use a union to represent the complex number, with one member for the real part and one member for the imaginary part. Implement functions to add, subtract, multiply, and divide complex numbers, and to print the result in the form a + bi.
5.	Develop a program that uses unions to represent different data types, such as integers, floats, and characters. Each union should contain one member for each data type, and a tag to indicate which member is currently active. Implement functions to set and get the value of the active member, and to convert between data types. You can also add features such as input validation and error handling.
6.	Implement a program that creates and manipulates a 2D matrix. Use a 2D array to represent the matrix, and implement functions to add, subtract, multiply, and divide matrices, as well as to find the transpose and determinant of a matrix. You can also add features such as input validation and error handling.

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7.	Develop a program that uses a 2D matrix to simulate a game of Tic Tac Toe. Use a 2D array to represent the game board, and implement functions to display the board, validate moves, and check for a win or draw condition.
8.	Implement a program that reads data from a text file, performs some operation on the data, and then writes the result to another text file. For example write a program that reads a list of numbers from a file, sorts them in ascending order, and then writes the sorted list to another file.
9.	Develop a program that creates a binary file containing student records. Each record should contain the student's name, ID number, and grade point average. Implement functions to add, delete, and modify student records, as well as a search function that allows the user to search for a specific student by name or ID number. You can also add features such as sorting by GPA or generating statistical reports.
10.	Implement a program that reads a CSV file containing sales data, performs some analysis on the data, and then writes the results to a text file. For example, write a program that reads a list of sales transactions, calculates the total revenue, and then writes the total revenue with features such as filtering by date range, calculating other metrics such as average revenue per transaction, or generating graphs and charts.
	Total Instructional hours : (45+30) = 75

Course Outcomes : Students will be able to	
CO1	Solve real world problems using user defined datatype in c programming.
CO2	Build solutions for solving advanced problems in arrays.
CO3	Construct C programs for handling multidimensional data.
CO4	Experiment with programs in c using various C libraries.
CO5	Build programs in C using FILE handling techniques.

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

Approved by BoS Chairman

Text Books	
1.	Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2016.
2.	Yashavant P. Kanetkar. “Let Us C”, 16th Edition, BPB Publications, 2016.

Reference Books	
1.	Byron S Gottfried, “Programming with C”, Schaum"s Outlines, Fourth Edition, Tata McGraw-Hill,2018
2.	Reema Thareja, “Programming in C”, Second Edition, Oxford University Press, 2016.
3.	Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009.
4.	Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.

Approved by BoS Chairman

B.E / B.Tech	B23CBI201 - PROGRAMMING FOR DATA STRUCTURES	L	T	P	C
		3	0	2	4

Course Objectives	
1.	To understand the concepts of ADTs.
2.	To design and implement stacks, queues and linked lists.
3.	To understand the complex data structures such as trees.
4.	To understand various hashing Techniques.
5.	To understand sorting and searching algorithms.

UNIT - I	ARRAYS AND LISTS	9

Abstract Data Types (ADTs), List ADT, array-based implementation – linked list implementation — singly linked lists- circularly linked lists - doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT - II	STACKS AND QUEUES	9

Stack ADT - Operations - Applications: Evaluating arithmetic expressions, Conversion of Infix to postfix expression - Queue ADT - Types of Queue: Simple Queue, Circular Queue, Priority Queue, deQueue - Operations on each types of Queues (Insertion, Deletion, and Traversal) – applications of queues.

UNIT - III	TREES	9

Basic Tree Terminologies-Tree Traversals-Different types of Trees: Binary Tree, Expression tree, Threaded Binary Tree, Binary Search Tree: Basics – Insertion and Deletion, AVL Tree - Tree operations on each of the trees (Insertion, Deletion, and Searching) and their algorithms

UNIT - IV	HASHING TECHNIQUES	9

Hashing-Address calculation techniques-Common hashing functions- Collision resolution - Separate Chaining – Open Addressing: Linear probing, Quadratic, Double hashing – Rehashing – Extendible Hashing.

UNIT - V	SEARCHING, SORTING	9

Searching: Linear Search - Binary Search. Sorting: Bubble sort - Selection sort - Insertion sort - Quick Sort - Merge Sort -Heap Sort- shell sort-radix sort- comparison of sorting and searching methods.

Approved by BoS Chairman

Expt. No.	Description of the Experiments
1	Implementation of Singly, Doubly and Circular Linked list.
2	Array implementation of Stack and Queue ADTs.
3	Linked list implementation of Stack and Queue ADTs.
4	Applications of Stack and Queue ADTs.
5	Implementation of Tree traversal algorithms.
6	Implementation of Binary Search Trees.
7	Implementation of AVL Trees.
8	Hashing – collision resolution techniques.
9	Implementation of searching algorithms.
10	Implementation of sorting algorithms.
	Total Instructional hours : (45+30) = 75

Course Outcomes : Students will be able to	
CO1	Build programs to implement linear data structures such as list
CO2	Apply the linear data structures such as stacks and queues to problem solutions
CO3	Apply the concept of tree data structure in real world scenarios
CO4	Analyze the various hashing algorithms
CO5	Analyze the various searching and sorting techniques

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	3	3	2	2	3	2	1	1	2	1	2	2
CO2	**K3**	3	2	3	3	2	2	3	3	2	1	2	2	2	2
CO3	**K3**	3	2	3	3	2	2	3	2	2	1	2	2	2	2
CO4	**K4**	3	2	3	3	2	2	3	2	2	1	2	2	2	2
CO5	**K4**	3	2	3	3	2	1	3	2	2	1	3	2	2	2
Weighted Average		3	2	3	3	2	2	3	2	2	1	2	2	2	2

3 – Strong **2- Moderate** **1- Weak**

Approved by BoS Chairman

Text Books	
1.	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2010

Reference Books	
1.	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition.
2.	Reema Thareja, “Data Structures Using C”, Second Edition, Oxford University Press, 2011.
3.	M. Tenenbaum and Augestien, “Data Structures using C”, Third Edition, Pearson Education 2007.
4.	J. P. Tremblay and P. G. Sorenson, "An Introduction to Data Structures with applications", Second Edition
5.	Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education,1983

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

Approved by BoS Chairman

B.E / B.Tech	B23CEP201 – SOFT SKILLS (Common to all Branches)	L	T	P	C
		2	0	0	2

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.	

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

Approved by BoS Chairman

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

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- 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

Approved by BoS Chairman

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.Tech	B23CBT301 – FUNDAMENTALS OF MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To help the students gain understanding of the functions and responsibilities of managers.
2.	To study about the forms of Business organization.
3.	To understand the tools and techniques used in strategic management.
4.	To learn how organizing and staffing are done in an organization.
5.	To study the process of effective directing and controlling in the organization

UNIT I	INTRODUCTION TO MANAGEMENT	9
Definition of Management – Manager Vs Entrepreneur – Types of managers -managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches — Current trends and issues in Management – Business Ethics.		
UNIT II	**BUSINESS ORGANIZATION**	**9**
Organization - Forms of Organizations: Sole Proprietorship, Partnership – Company - Statutory Bodies and Corporations - HUF and Family Business, Cooperatives, Societies and Trusts; Limited Liability Partnership - Organization culture and Environment.		
UNIT-III	**INTRODUCTION TO STRATEGIC MANAGEMENT**	**9**
Nature and purpose of planning – planning process – Types of planning – objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.		
UNIT-IV	**ORGANISING & STAFFING**	**9**
Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design – Staffing – Staffing process		
UNIT-V	**DIRECTING & CONTROLLING**	**9**
Controlling – Process – Forms and types of controlling - budgetary and non-budgetary control techniques – Productivity problems and management – control and performance – reporting.		
Total Instructional hours : 45		

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Course Outcomes : Students will be able to	
CO1	Outline the unique concepts of management and the responsibilities of a manager.
CO2	Identify the different forms of business organization.
CO3	Apply strategic management concepts in order to have a smooth working progress.
CO4	Build the ability to organize and staff effectively.
CO5	Inspect on directing and controlling functions.

Text Books	
1.	Stephen P. Robbins & Mary Coulter, “Management”, 14th Edition, Prentice Hall (India) Pvt. Ltd.,2018.
2.	JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.

Reference Books	
1.	Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” 10th Edition, Pearson Education, 2017.
2.	Robert Kreitner & MamataMohapatra, “Management”, Biztantra, 2008.
3.	Harold Koontz & Heinz Weihrich “Essentials of management” Tata McGraw Hill, 1998.
4.	Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999.

Approved by BoS Chairman

B.Tech	B23CBT302- OBJECT ORIENTED PROGRAMMING WITH JAVA	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To interpret the basics of Web and Web Architecture.
2.	To device a front end design with HTML Tags
3.	To design a dynamic webpage using CSS.
4.	To articulate client side activities on a web site using Javascript.
5.	To design a simple web application with database integration using Python.

UNIT - I	INTRODUCTION	9

Java features –Java Platform –Java Fundamentals – OOP in java – Datatypes - Input and output statements – Expressions- Operators and Control Structures – Classes and Objects, Constructors –– Array classes and methods.

UNIT - II	BASIC OOPS CONCEPTS	9

Polymorphism - Inheritance –Input and Output Streams, Files and Buffer – Multithreading – Exception Handling - Packages and Interfaces-Abstract methods and classes - Static methods, variables and Classes-Final and this keyword.

UNIT - III	APPLETS AND SWINGS	9

GUI Components - AWT package - Layouts –Containers - Event Package - Event Model –Painting –Garbage Collection – Java Applets – Applet Application – Swing Fundamentals - Swing Classes.

UNIT - IV	COLLECTION FRAMEWORKS	9

Collection: Iterators, Enumerators and interface collections - Collection objects- Set, Hash Set, Linked HashSet. - List, Linked List, Array List and Stack - . String: String Methods-String buffer – string Builder.

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UNIT - V	DATABASE	9
Introduction to JDBC ,ODBC.- Driver Manager , Connection , Statement , PreparedStatement.- Connecting with oracle / Mysql - MetaData- ResultSetMetaData, Database, MetaData. Case Study: Mini project – Swings / Applets as Front end , MySQL as Backend.		

Course Outcomes : Students will be able to	
CO1	Describe basic knowledge of Object Orientation using classes, objects.
CO2	Apply object oriented programming features to achieve the concepts of reusability for solving given problems using inheritance
CO3	Develop GUI Components in Java using Applet and AWT that takes user response through peripheral devices
CO4	Construct the Collection framework mechanisms and apply the ArrayList methods and String classes and methods.
CO5	Develop the simple java applications using data base connectivity (JDBC)

Text Books	
1.	Herbert Schildt, " The Complete reference Java" , Seventh Edition, McGraw Hill Education,2017.

Reference Books	
1.	E Balaguruswamy, "Programming with Java", Sixth Edition , McGraw Hill Education,2019.
2.	John Dean, Raymond Dean, " Introduction to Programming with JAVA –A Problem Solving Approach", Tata Mc Graw Hill,2012. Tata Mc Graw Hill,2013
3.	Ralph Bravaco, Shai Simonson, "Java Programming : From the Ground Up", Tata McGraw Hill Edition,2012

Approved by BoS Chairman

B.Tech	B23CBT303 – DESIGN THNIKING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To learn design thinking concepts and principles.
2.	To use design thinking methods in every stage of the problem.
3.	To learn the different phases of design thinking.
4.	To apply various methods in design thinking to different problems.
5.	To apply design thinking on real world case studies

UNIT I	INTRODUCTION	9
. Why Design? - Four Questions, Ten Tools - Principles of Design Thinking - The process of Design Thinking - How to plan a Design Thinking project.		
UNIT II	**UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM**	**9**
Search field determination - Problem clarification - Understanding of the problem – Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.		
UNIT-III	**IDEATION AND PROTOTYPING**	**9**
. Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.		
UNIT-IV	**TESTING AND IMPLEMENTATION**	**9**
Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking.		
UNIT-V	**FUTURE**	**9**
Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow.		
Total Instructional hours : 45		

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Course Outcomes : Students will be able to	
CO1	Planning of design thinking process.
CO2	Define key concepts of design thinking.
CO3	Prototyping of design thinking process.
CO4	Practice design thinking in all stages of problem solving.
CO5	Apply design thinking approach to real world problems

Text Books	
1.	Christian Mueller-Roterberg, Handbook of Design Thinking - Tips & Tools for how to design thinking, 2018
2.	Designing for Growth: a design thinking tool kit for managers By Jeanne Liedtka and Tim Ogilvie. 2018
3.	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown. 2018

Reference Books	
1.	Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media, 2017.
2.	Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
3.	Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011

Approved by BoS Chairman

B.Tech	B23CBT304 -WEB APPLICATION DEVELOPMENT (Common to AI&DS, CSBS)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To interpret the basics of Web and Web Architecture.
2.	To device a front end design with HTML Tags.
3.	To design a dynamic webpage using CSS.
4.	To articulate client side activities on a web site using Javascript.
5.	To design a simple web application with database integration using Python

UNIT - I	INTRODUCTION TO WEB	8

Internet and World wide web , Protocols governing the Web - Web applications and Web Architecture - Issues in web development , Web servers , Web browsers - Internet addresses , TCP/IP suite , IP addresses and classes - MIME , HTTP & HTTPS - Web servers and clients , URL, URI,URN -HTTP message formate , Request and response message-Testing HTTP using telnet.

UNIT - II	HTML FOUNDATION	10

History of HTML and W3C , HTML basics - Elements , Attributes and Tags - Basic HTML tags, HTML comments , paragraphs , Line breaks - Text styles, Font ,Bold ,Italic , Underline, Combining styles , Heading , Preformatted string, Strikethrough text - Lists and HTML symbols.- Table tags ,Border, Row, column header,- rowspan and column span, Cell spacing and Cell padding - Nested Tables.

UNIT - III	HTML FORMS & CSS	9

Form elements ,Text field, Text Area, Password field, Hidden field, Label - Checkbox, Radio Button, Selection List - Button , File Upload, Action Button, and Image Button- Frames and Layout , Iframes - Images , Meta tags , multimedia content - Cascading style sheets, , Embedded style sheet , Inline style sheet - External style sheet - Selectors and types of selectors , Pseudo classes and elements

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UNIT - IV	CLIENT SIDE JAVA SCRIPTING	9
Introduction to java script - Inserting Javascript code , Adding comments - Browser Incompatibility - Placement of JavaScript Code - Javascript Keywords, Variables ,Literals, Operators - Control structure, if ,if else ,else if ladder , Switch case – Looping ,while ,for ,do while - Arrays, Numeric array ,Associative array – JS Functions-Function Definitions, Function Parameters, Function Invocation, Function Call		
UNIT - V	JAVA SCRIPT OBJECTS & HTML DOM	9
JS Objects-Object Definitions, Object Properties & Methods, Object Display, Object Accessors, Object Constructors, Object Prototypes ,Object Iterables .Object Sets ,Object Map. JS HTML DOM - DOM Methods, DOM Document, DOM Elements ,DOM HTML, DOM Forms, DOM CSS, DOM Animations, DOM Events, DOM Event Listener, DOM Navigation, DOM Nodes, DOM Collections ,DOM Node Lists		
Total Instructional hours :45		

Course Outcomes : Students will be able to	
CO1	Interpret the working of web sites and web servers
CO2	Design web pages of a website with HTML
CO3	Design and create dynamic styles using CSS
CO4	Articulate client side activities with Javascript
CO5	Develop and manage client side activities with DOM objects

Text Books	
1.	Uttam K.Roy ,"Web Technologies" by, Oxford University Press 2010, First edition, eight impression 2014

Reference Books	
1.	Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book Paperback – 1 January 2009 , by Kogent Learning Solutions Inc
2.	HTML & CSS: The Complete Reference, Fifth Edition Paperback – 1 July 2017 , by Thomas Powell, TataMcGrawHill.

Approved by BoS Chairman

B.E/B.Tech.	B23ADT401 - OPERATING SYSTEM FOUNDATIONS Common to AI&DS, CSE(AI&ML), CSBS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To study the basic concepts and functions of operating system.
2.	To learn about the processes, threads and scheduling algorithms.
3.	To review the various memory management schemes with examples.
4.	To understand the I/O management and file systems.
5.	To interpret the basics of Linux system and perform administrative tasks on Linux servers

UNIT - I	OPERATING SYSTEM OVERVIEW	9

Computer System Overview - Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT - II	PROCESS MANAGEMENT	9

Processes —— Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling — Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization —— The critical-section problem, Synchronization hardware, Semaphores, Critical regions, Monitors; Deadlock — System model, Methods for handling deadlocks.

UNIT - III	STORAGE MANAGEMENT	9

Main Memory — Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory — Background, Demand Paging, Page Replacement, Allocation,
Thrashing; Allocating Kernel Memory, OS Examples.

UNIT - IV	FILE SYSTEM AND I/O SYSTEMS	9

Mass Storage system — Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management; File-System Interface — File concept, Access methods, File system mounting, File Sharing and Protection; File System Implementation- Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems — I/O Hardware, Application I/O interface.

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UNIT - V	CASE STUDY	9
Linux System — Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS — iOS and Android — Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.		
Total Instructional hours: 45		

Course Outcomes: Students will be able to	
CO1	Illustrate the operating system concepts and its functionalities.
CO2	Identify the issues in deadlock and apply various CPU scheduling algorithms.
CO3	Implement page replacement algorithms, memory management problems and segmentation
CO4	Apply various disk scheduling algorithms and disk management strategies.
CO5	Utilize the administrative tasks on Linux servers

Text Books	
1.	Silberschatz and Galvin, “Operating System Concepts”, Ninth Edition, John Wiley and Sons, 2012.

Reference Books	
1.	William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Prentice Hall,2011.
2.	Stevens W R and Rago S A, “Advanced Programming in the Unix Environment”, Second Edition, Addison-Wesley, 2013.
3.	Bhatt, Pramod, Chandra P, “An Introduction to Operating System” Fifth Edition, PHI Learning Pvt Ltd, 2019.
4.	Gary Nutt, “Operating Systems”, Third Edition, Pearson Education, 2009.
5.	Harvey M. Deitel, “Operating Systems”, Third Edition, Pearson Education, 2004.

Approved By BoS Chairman

B.Tech	B23CBP301-OBJECT ORIENTED PROGRAMMING WITH JAVA LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To teach fundamentals of object oriented programming in Java.
2.	To familiarize Java environment to create, debug and run simple Java programs
3.	To demonstrate java compiler and eclipse platform and learn how to use Net Beans IDE to create Java Application

Expt. No.	Description of the Experiments
1	Create a program to implement basic concepts of java control structures.
2	Create a program to implement classes and objects.
3	Create a program to implement constructors with array of objects.
4	Construct a program to demonstrate Method overloading.
5	Develop a program to implement different types of inheritances.
6	Develop a program to demonstrate the use of abstract, final, static blocks and
7	Build a program to demonstrate File streams and functions.
8	Design a program to perform string operations using string builder and string
9	Build a program to demonstrate exception handling techniques.
10	Develop a Front end window application using swing concepts.

Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Solve Object oriented features using Java
CO2	Apply the concept of polymorphism and inheritance.
CO3	Build solutions with exception handling
CO4	Solve problems involving strings using String Builder and String Buffer.
CO5	Build network and window application using swings

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 , jdk 1.5 or higher Java ide :Netbeans or Eclipse.	30

Approved by BoS Chairman

B.Tech	B23CBP302- WEB APPLICATION DEVELOPMENT LABORATORY (Common to AI&DS, CSBS)	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To understand the basics of Web and Web Architecture.
2.	To learn about front end design with HTML Tags
3.	To design a dynamic webpage using CSS.
4.	To manage client side activities on a web site using JavaScript.
5.	To create a simple javascript project.

Expt. No.	Description of the Experiments
1	Create a Web page using HTML5- Formatting Tags
2	Create a Web page using HTML5 – List & Tables
3	Design a Web page to capture data using HTML forms
4	Create a web page with CSS Styles –Internal and external style sheet
5	Create a web page with navigation menu and hover effect using HTML and CSS
6	Perform a client side validation using JavaScript user defined functions and DOM objects.
7	Design a Web page to illustrate the concept of event handling through JavaScript.
8	Develop a Web page and perform login validation and Navigation using JavaScript.
9	Design a Java script project for a game – Sudoku solver , Tic-Tac toe
10	Design a java script project – Numeric converter, Basic calculator
	Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the working of web sites and web servers
CO2	Develop Web pages of a web site using HTML
CO3	Design a dynamic webpage using HTML controls and CSS.
CO4	Apply Client side activities on a web site using Javascript.
CO5	Design a Simple Web application using Javascript

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. Chrome or Mozilla Firefox browser	30

SEMESTER - IV

B.TECH	B23MAT405 – LINEAR ALGEBRA (CSBS)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To analyze the matrices and system of linear equations.
2.	To understand the principles of matrix algebra and decomposition.
3.	To enhance the knowledge of vector space and its properties.
4.	To use transformation techniques in diagonalization of matrices.
5.	To introduce inner product spaces and orthogonalization.

UNIT – I MATRICES AND SYSTEM OF LINEAR EQUATIONS	9
Matrices - Row reduction and echelon form - Rank - System of linear equations - Consistency - Gauss elimination method - Gauss Jordon method.	

UNIT – II EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION	9
Eigen Value Problems: Applications of Eigen Values and Eigen Vectors: Stretching of an elastic membrane - Jacobi rotation method - Power method - Singular Value decomposition - QR decomposition- LU decomposition - CR decomposition.	

UNIT – III VECTOR SPACES	9
Definition and examples - Vector spaces over Real and Complex fields - Subspace - Linear space - Linear independence and dependence - Basis and dimension.	

UNIT – IV LINEAR TRANSFORMATION	9
Linear transformation - Rank space and null space - Rank and nullity - Dimension theorem - Matrix representation of linear transformation - Eigen values and eigen vectors of linear transformation - Diagonalization: Similarity transformation - Orthogonal transformation.	

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UNIT – V INNER PRODUCT SPACES	9
Inner product and norms - Definition and properties - Length and Orthogonality - Orthogonal sets - Orthogonal projections - Orthonormal sets - Gram Schmidt process - Least square problems.	
	Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Make use of Matrix to test the consistency and solve linear equations.
CO2	Solve eigen values of a matrix using numerical techniques and perform matrix decomposition.
CO3	Apply the knowledge of vector spaces in solving engineering problems.
CO4	Illustrate the matrix of linear transformation and diagonalization.
CO5	Apply skills in applications of inner product spaces and orthogonality.

Text Books	
1.	Friedberg, A.H., Insel, A.J. and Spence, L., “Linear Algebra”, Pearson Education Limited, 2nd Edition, 2014.
2.	Lay, D.C., “Linear Algebra and its Applications”, 5th Edition, Pearson Education, 2015.

Reference Books	
1.	Kreyszig, E, “Advanced Engineering Mathematics”, John Willey and Sons, 10th Edition, 2018.
2.	James, .G. “Advanced Modern Engineering Mathematics”, Pearson Education, 2007.
3.	Veerarajan T., "Linear Algebra and Partial Differential equations", Tata McGraw Hill Publications, 2019.
4.	Gilbert Strang, "Introduction to Linear Algebra", 5th edition Wellesley- Cambridge Press, 2017.
5.	Kolman, B. Hill, D.R., "Introductory Linear Algebra", Pearson Education, New Delhi, First Reprint, 2009.

Approved by BoS Chairman

B.Tech	B23CBT401 – AGILE SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the phases in a software project.
2.	To understand fundamental concepts of requirements engineering and Analysis Modelling.
3.	To understand the various software design methodologies.
4.	To learn various testing and maintenance measures.
5.	To learn various agile execution methodologies.

UNIT - I	SOFTWARE PROCESS AND AGILE DEVELOPMENT	9

Introduction to Software Engineering, Software Process, Introduction to Agility- Agile Software Engineering – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles

UNIT - II	REQUIREMENTS ANALYSIS AND AGILE PROCESS	9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management- Lean Production - SCRUM, Scrum roles : Product Owner, Scrum Master, Scrum Team, Adaptive Software Development.

UNIT - III	SOFTWARE DESIGN	9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- Agile Design: Agile design practices, Agile design philosophies, Agile design methodology and process, Agile Documentations, Agile SDLC(Software Development Life Cycle).

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UNIT - IV	TEST DRIVEN DEVELOPMENT	9
Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model.		
UNIT - V	**TRANSITION AND APPLICATION OF AGILE**	**9**
Business Leadership Transition, Customer Relationship Transition, Project Management Transition, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline.		

Course Outcomes : Students will be able to	
CO1	Identify the key activities in managing a software project and compare different process
CO2	Concepts of requirements engineering and Analysis Modelling.
CO3	Apply systematic procedure for software design and deployment.
CO4	Compare the various testing and maintenance.
CO5	Explain the purpose and benefits of agile execution methodologies.

Text Books	
1.	Roger S. Pressman, “Software Engineering – A Practitioner‟s Approach”, 8th Edition, McGraw-Hill International Edition, 2019.
2.	David J. Anderson and Eli Schragenheim, ―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results‖, Prentice Hall, 2003.

Reference Books	
1.	Ian Sommerville, “Software Engineering”, 10th Edition, Pearson Education Asia, 2017.
2.	Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media, 2017.
3.	Agile Software Development, Principles, Patterns and Practices by Robert C. Martin Publisher:

Approved by BoS Chairman

B.TECH	B23CBT402 – FUNDAMENTALS OF ECONOMICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To learn the principles of microeconomics relevant to managing an organization.
2.	To study about firms and their decisions about optimal production.
3.	To understand the market structure.
4.	To understand the fundamentals of macroeconomics.
5.	To familiarize the students about the money market.

UNIT - I	INTRODUCTION TO MICROECONOMICS	9

Economics – Definition - Types of Economic Analysis – Micro and Macro Economics, Demand - Types, Determinants; Supply - Determinants - Demand Curve - Supply Curve - Market Equilibrium - Elasticity of Demand and Supply.

UNIT - II	COST AND PRODUCTION FUNCTION	9

Production Function – Types, Return to scale and ISO-quants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs – Law of Production - Return to scale.

UNIT - III	MARKET STRUCTURE	9

Market Structure – Types of Market structure – Perfect Competition - Monopoly and Monopsony – Sources of monopoly power - Pricing with Market Power - Monopolistic Competition – Oligopoly

UNIT - IV	MACRO ECONOMICS	9

Macro vs. Micro Economics - Limitations of Macroeconomics - Stock and Flow variables - Equilibrium and Disequilibrium - Partial and General Equilibrium Statics – Comparative Statics and Dynamics - National Income Concepts – GDP, GNP, NDP and NNP at market price, factor cost, real and nominal - Disposable personal Income.

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UNIT - V	MONEY MARKET	9
Demand for Money - Supply of Money - Integrating Money and Commodity Markets – Monetary Policy – Fiscal Policy - Central Bank and the Government; The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment.		

Course Outcomes : Students will be able to	
CO1	Classify the basic principles and concepts of Microeconomics and use them to solve
CO2	Identify the fundamentals of national income and aggregate supply and aggregate demand consumption.
CO3	Explain the market structure for proper analysis of the market.
CO4	Analyse the basic macroeconomic principles.
CO5	Identify the concepts of money market.

Text Books	
1.	Robert S.Pindyck, and Daniel L. Rubinfeld, “Microeconomics”, Pearson Publishing House 9th Edition.
2.	Dornbusch, Fischer and Startz, “Macroeconomics”, McGraw-Hill, 12th Edition, 2018.
3.	D N Dwivedi, “Macroeconomics: Theory and Policy”, McGraw-Hill, 5th Edition.

Reference Books	
1.	Hal R, Varian, “Intermediate Microeconomics: A Modern Approach”, W W Norton & Co
2.	N. Gregory Mankiw, “Principles of Macroeconomics”, Cengage Learning, Eight Edition,
3.	Paul Anthony Samuelson, William D. Nordhaus, “Economics”, McGrawHill, 19th Edition, 2011

Approved by BoS Chairman

B.TECH	B23CBT403 – COMPUTER NETWORK ESSENTIALS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To study the concepts of data communications and functions of different layers of ISO/OSI reference architecture
2.	To understand the error detection and correction methods and types of LAN
3.	To study the concepts of sub netting and routing mechanisms.
4.	To understand the different types of protocols and network components.
5.	To study and configure Switches and Routers.

UNIT - I	INTRODUCTION	9

Computer networks and distributed systems, Classifications of computer networks, Preliminaries of layered network structures. Data communication Components: Representation of data and its flow, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media. LAN: Wired LAN, Wireless LAN, Virtual LAN. Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT - II	DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER	9

Fundamentals of Error Detection and Error Correction, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go-back–N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.

UNIT - III	NETWORK LAYER	9

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP– Delivery, Forwarding and Unicast Routing protocols.

Approved by BoS Chairman

UNIT - IV	TRANSPORT LAYER	9
Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service (QoS), QoS improving techniques - Leaky Bucket and Token Bucket algorithms.		
UNIT - V	**APPLICATION LAYER AND SECURITY**	**9**
Application Layer: DNS, DDNS, TELNET, EMAIL, FTP, WWW, HTTP, SNMP, Bluetooth, Firewalls. Network Security: Electronic mail, directory services and network management, Basic concepts of Cryptography.		

Course Outcomes : Students will be able to	
CO1	Understand the fundamentals of data communications and functions of layered architecture.
CO2	Practice the error detection and correction methods and understand the different network technologies in Data link layer and MAC.
CO3	Analyse the requirements for a given organizational structure and select the most
CO4	Configure Routers and Switches for efficient Data Transfer.
CO5	Understand the application layer protocols and also the use of cryptography and network

Text Books	
1.	James F.Kurose & Keith W.Ross, "Computer Networking", 8th Edition, Pearson Education, 2022.
2.	William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2021.

Reference Books	
1.	Charlie Kaufman, Radia Perlman, Mike Speciner & Ray Perlner, "Network Security: Private Communication in a Public World" 3rd Edition, Pearson Education, 2022.
2.	W. Richard Stevens, "UNIX Network Programming, Vol. 1,2 & 3", Prentice-Hall of India, 2004.

Approved by BoS Chairman

B.E	B23CST401- DATABASE MANAGEMENT SYSTEMS (Common to CSE, 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

Approved by BoS Chairman

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.Tech	B23CBT404- ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To design and implement binary search trees & types of trees.
2.	To design and implement graph algorithms.
3.	To understand various network flows.
4.	To understand techniques used for designing algorithms.
5.	To understand the concepts of algorithms.

UNIT - I	HIERARCHICAL DATA STRUCTURES	9

Binary Search Trees: Basics – Insertion and Deletion- AVL –Insertion ,Deletion ,Segment Tree – Construction –Overlapping – Range sum query –Range minimum query – Binary Heap – Minimum binary heap – Maximum binary heap.

UNIT - II	PROPERTIES OF GRAPH	9

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth- First Search –Minimum Spanning Trees: Kruskal and Prim- Single Source Shortest Paths: Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; All-Pairs Shortest Paths: The Floyd Warshall Algorithm.

UNIT - III	ROLE OF ALGORITHMS IN COMPUTING	9

Algorithms – Algorithms as a Technology- Sum of first N natural numbers – Analysing Algorithms – Designing Algorithms- Growth of Functions: Asymptotic Notation – Standard Notations and Common Functions- Recurrences: The Substitution Method – The Recursion-Tree Method.

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UNIT - IV	ALGORITHM DESIGN TECHNIQUES	9
Dynamic Programming: Memorization, Tabulation- Longest palindrome subsequence, Longest common subsequence problem , Optimal sub structure property , Back tracking –Nqueens , Sub set sum , Divide and conquer – Merge sort , Binary searching ,String algorithm-KMP algorithm.		
UNIT - V	**ADVANCED ALGORITHM DESIGN TECHNIQUES**	**9**
Longest increasing subsequence –O / I knapsack problem. Greedy algorithms: An activity selection problem – Elements of Greedy Strategy – Fractional knapsack problem. Mathematical algorithm – Sieve of Eratosthenes –Binary exponentiation –Euclidian GCP-Extended Euclidean gcd		

Course Outcomes : Students will be able to	
CO1	Analyze the asymptotic performance of algorithms.
CO2	Apply suitable design strategy for problem solving
CO3	Apply suitable design strategy for advanced problem solving
CO4	Implement the concept of hierarchical data structures in real world scenarios.
CO5	Analyze important algorithmic design paradigms to implement graph data structure

Text Books	
1.	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2010
Reference Books	
1.	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures
2.	Reema Thareja, “Data Structures Using C”, Second Edition, Oxford University Press,
3.	M. Tenenbaum and Augestien, “Data Structures using C”, Third Edition, Pearson
4.	J. P. Tremblay and P. G. Sorenson, "An Introduction to Data Structures with applications", Second Edition, Tata McGraw Hill, 2007
5.	Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education,1983

Approved by BoS Chairman

B.TECH.	B23ENP401 – BUSINESS COMMUNICATION &VALUE SCIENCE III	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To enhance effective workplace communication through language skills.
2.	To equip learners towards grooming as a professional with values and skills.
3.	To develop learners' ability to read and write complex texts, summaries, articles and blogs.
4.	To understand and solve problems by critical analysis of situations.
5.	To learn group dynamics and develop professionalism.

UNIT- I EFFECTIVE COMMUNICATION	12

Concepts and Principles of Communication - listening to TED Talks and making presentations, Reading Business magazines and Journals, Writing summaries of documents and Business articles, learning Idioms and Corporate terms - discussing and making plans - Role play (group activity).

UNIT-II HUMAN VALUES AND SKILLS	12

Values–understanding values of individuals, identifying skills and values of famous personalities, use of life skills in personal and social life, identification of goals, SWOT Analysis, Self-exploration - connecting with emotions, expression of emotions, identifying positive and negative emotions, Impact of conflicts - Guideline to manage conflicts - Activity; Each group will draw up a list of tips to manage conflicts at workplace - value analysis through case studies.

UNIT- III BUSINESS CORRESPONDENCE	12

Types of correspondence — understanding business correspondence - principles of business writing, use of business idioms and corporate terms in business letters, Writing Memos, E-Mails, Agenda, Minutes of meetings, writing report on Articles, drafting business proposal to get funding to begin a start-up of their choice, Practice activity on writing business articles and blogs (team activity).

Approved by BoS Chairman

UNIT- IV CRITICAL AND CREATIVE THINKING	12
Meaning and Purpose of creativity, developing creativity and critical thinking skills, steps to improve critical thinking skills, developing problem solving, decision making and analytical skills, Debate on current situations/events, quiz on critical reasoning and verbal ability.	

UNIT- V GROUP DYNAMICS	12
Recognizing difference between groups and teams, Cross-cultural communication and its implications learning and understanding Morality and the art of Negotiation, Peer learning - dynamics of group behaviour - Group activity: Each group to perform a short role play on different themes: College, Workplace, Family and Friends, Group etiquette and Mannerisms- discussion on current affairs, social issues and technologies.	
	Total Instructional hours: 60

Course Outcomes: Students will be able to	
CO1	Make effective use of language skills in corporate environment.
CO2	Identify the importance of values and skills in real life scenario.
CO3	Apply writing techniques in different types of Business Correspondence.
CO4	Build confidence and self-competency to solve problems in workplace.
CO5	Develop leadership and employability skills.

Reference Books	
1.	Sutapa Banerjee, Soft skill Business and Professional Communication, Dream tech Press, Wiley India, 2021.
2.	Kumar Sanjay.and Pushpa Lata, “Communication Skills “, Oxford University Press; New Delhi, 2015.
3.	Sundar K, A Kumara Raj, “Business Communication”, Vijay Nicole Imprints Pvt. Ltd., Chennai, 2012.
4.	Butterfield, Jeff, “Soft skills for everyone”, Sixth Indian Reprint, 2015.
5.	Dhanavel, S P. “English and Communication Skills for Students of Science and Engineering”, Orient Blackswan Private Limited, Chennai, 2013.

Approved by BoS Chairman

B.E	B23CSP401- DATABASE MANAGEMENT SYSTEMS LABORATORY (Common to CSE, CSBS)	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

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CO3	Take part in simple applications that use Views
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

2- Moderate **1- Low**

3 – Substantial **– No Correlation**

Approved by BoS Chairman

B.E / B.Tech	B23CBP401- ADVANCED DATASTRUCTURE AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To design and implement binary search trees & types of trees.
2.	To design and implement graph algorithms.
3.	To design and implement problems through backtracking algorithms.
4.	To develop solutions for real world problem using dynamic programming approach.
5.	To develop solution for sorting and searching using divide and conquer technique.

Expt. No.	Description of the Experiments
1	**Binary Tree Traversal**: Implement algorithms for inorder, preorder, and postorder traversal of a binary tree.
2	**Binary Tree Diameter**: Write a function to find the diameter of a binary tree (the longest path between any two nodes).
3	**Breadth-First Search (BFS)**: Implement BFS to traverse a graph and find the shortest path from a source node to all other nodes.
4	**Depth-First Search (DFS)**: Write a function to perform DFS on a graph and identify connected components.
5	**N-Queens Problem**: Implement a solution to place N queens on an NxN
6	**Sudoku Solver**: Write a program to solve a Sudoku puzzle using backtracking.
7	**Fibonacci Series**: Implement a function to find the nth Fibonacci number using dynamic programming to optimize recursive calls.
8	**Longest Common Subsequence (LCS)**: Write a function to find the length of the
9	Merge Sort: Implement the merge sort algorithm to sort an array of elements
10	**Binary Search**: Write a function to perform binary search on a sorted array to find a target element.
	Total Instructional hours : 45

Approved by BoS Chairman

Course Outcomes : Students will be able to	
CO1	Apply binary tree concepts for solving real world problems.
CO2	Build solutions for traversal problems using graph algorithms.
CO3	Develop solutions for applications through backtracking techniques
CO4	Model solutions using dynamic programming approach
CO5	Solve problems on searching and sorting using divide and conquer techniques.

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++ or Higher.	30

Approved by BoS Chairman

SEMESTER V

B. TECH	B23MAT501 - BUSINESS STATISTICS	L	T	P	C
		3	1	0	4

Course Objectives	
1.	To use the statistical tools in engineering problems.
2.	To organize and summarize data by using descriptive statistics and appropriate statistical graphics.
3.	To gain knowledge on probability and distributions.
4.	To interpret simple correlation and linear regression analysis in business decision making.
5.	To provide the basic concept of classification of design of experiments

UNIT – I	INTRODUCTION TO STATISTICS	12

Definition of Statistics - Basic objectives - Collection of Data : Internal and external data- Primary and secondary Data - Population and sample - Representative sample - Descriptive Statistics : Classification and tabulation of univariate data - Graphical representation : Simple bar diagram, Pie chart, Pareto chart - Frequency curves : Histogram, Frequency curve, Frequency polygon.

UNIT – II	MEASURES OF CENTRAL TENDENCY AND DISPERSION	12

Measures of central tendency : Mean, Median, Mode, Harmonic mean, Geometric mean
Quartiles, Deciles, Percentiles - Measures of dispersion : Range, quartile deviation, Mean deviation, standard deviation, coefficient of variation..

UNIT – III	PROBABILITY & DISTRIBUTIONS	12

Probability - The axioms of probability - Conditional probability - Baye‘s theorem - Discrete and continuous random variables - Moments - Moment generating functions - Discrete : Binomial, Poisson and Geometric distributions - Continuous : Uniform, Exponential and Normal
distributions.

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UNIT – IV CORRELATION AND REGRESSION	12
Correlation coefficient - Spearman rank correlation - non repeated and repeated items - Karl Pearson's coefficient of correlation - Regression Analysis - Lines of Regression- Regression Coefficients.	

UNIT – V DESIGN OF EXPERIMENTS	12
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.	
Total Instructional hours	**60**

Course Outcomes : Students will be able to	
CO1	Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
CO2	Develop the statistical data for measures of central tendency and dispersion
CO3	Apply Probability and random variables in engineering problems
CO4	Explain the techniques of correlation and regression.
CO5	Construct the estimation theory to diagnose the population parameters.

Text Books	
1.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2.	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2009.
3.	Kandasamy P., Thilagavathy K., and Gunavathy K., "Statistics and Numerical Methods" S. Chand & Company Ltd., Edition 2018.
4.	Montgomery, Douglas C., and George C. Runger., “Applied Statistics and Probability for Engineers”, John Wile & sons, 2010.

Approved by BoS Chairman

Reference Books	
1.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences, Cengage Learning, New Delhi, 9th Edition, 2016.
2.	Gupta. C., Kapoor V. K., “Fundamental of Statistics", Sultan Chand Publications, Edition 2017.
3.	Papoulis. A. and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2017.
4.	Iyengar. T. K. V, Krishna Gandhi. B, Ranganthan. S and Prasad. M.V.S.S.N "Probability and Statistics", S.Chand Publications, Edition 2017.
5.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2013.

Approved by BoS Chairman

B.E.	B23ADT302 FOUNDATIONS OF DATA SCIENCE (Common to AI&DS, CSE(AI&ML) & CSBS)	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To introduce the basic concepts of Vector spaces in linear algebra.
2.	To introduce the basic concepts of Data Science.
3.	To understand the mathematical skills in statistics
4.	To acquire the skills in data pre-processing steps.
5.	To learn the concept of clustering approaches and to visualize the processed data using visualization techniques.

UNIT - I	VECTOR SPACES	9

Vector spaces and subspaces – Linear independence and dependence – Basis and Dimension - Null spaces, column spaces and Linear transformations - LU decomposition method - Singular Value Decomposition method.

UNIT - II	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 - III	DESCRIBING DATA	9

Frequency distributions – Outliers – Relative frequency distributions – Cumulative frequency distributions – Frequency distributions for nominal data – Interpreting distributions – Graphs – Averages – Mode – Median – Mean – Averages for qualitative and ranked data – Describing variability Tentative– Range – Variance – Standard deviation – Degrees of freedom – Interquartile range – Variability for qualitative and ranked data

UNIT - IV	DATA PREPROCESSING	9

Data pre-processing: Data cleaning - Data integration and Data transformation - Data Reduction - Data Discretization - Exploratory Data Analysis - Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA - The Data Science Process

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UNIT - V	CLUSTERING AND DATA VISUALIZATION	9
Clustering: Choosing distance metrics - Different clustering approaches - Hierarchical and agglomerative clustering - k-means — Applications — Visual Analytics. - Visualization with Matplotlib – Line plots – Scatter plots – Visualizing errors – Density and contour plots– Histograms, Binnings and density – Three dimensional plotting.		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the concepts of Vector spaces
CO2	Summarize the data science basics and its life cycle
CO3	Outline the relationship between data dependencies using statistics
CO4	Summarize the data pre-processing methods and implement the EDA
CO5	Build the visualization of data using the visualization tools.
Text Books	
1.	David C. Lay, “Linear Algebra and its Applications”, Pearson Education Asia, New Delhi, 5 th Edition, 2016.
2.	David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
3.	Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.

Reference Books	
1.	Kreyzig E., “Advanced Engineering Mathematics”, 10th Edition, John Wiley and sons, 2011
2.	Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 2017.
3.	Mario Dobler and Tim Großmann, “The Data Visualization Workshop”, O’Reilly Media, 2020.
4.	Jake VanderPlas, “Python Data Science Handbook”, O’Relly,2017.

Approved By BoS Chairman

B.Tech	B23CBT501 FULL STACK DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the various components of full stack development
2.	To learn Node.js features and applications
3.	To develop applications with MongoDB
4.	To understand the role of Angular and Express in web applications
5.	To develop simple web applications with React

UNIT- I	BASICS OF FULL STACK	9

Understanding the Basic Web Development Framework - User - Browser – Webserver – Backend Services – MVC Architecture - Understanding the different stacks –The role of Express – Angular– Node – Mongo DB – React

UNIT-II	NODE JS	9

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js

UNIT- III	MONGO DB	9

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts –Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications

UNIT- IV	EXPRESS AND ANGULAR	9

Implementing Express in Node.js - Configuring routes - Using Request and Response objects - Angular - Typescript - Angular Components - Expressions - Data binding - Built-in directives

UNIT- V	REACT	9
MERN STACK – Basic React applications – React Components – React State – Express REST APIs Modularization and Webpack - Routing with React Router – Server-side rendering		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the various stacks available for web application development
CO2	Use Node.js for application development
CO3	Develop applications with MongoDB
CO4	Use the features of Angular and Express
CO5	Develop React applications Outline the foundation concepts of decision support system

Text Books:

1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018

2. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.

Reference Books :

1.Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018

2. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018

Websites:

1. https://www.tutorialspoint.com/the_full_stack_web_development/index.asp
2. https://www.coursera.org/specializations/full-stack-react
3. https://www.udemy.com/course/the-full-stack-web-development/

Approved by BoS Chairman

B.Tech	B23CBT502 FINANCIAL AND COST ACCOUNTING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the need of accounting and basic accounting terminologies.
2.	To acquire the reasonable knowledge of accounting.
3.	To understand the financial statements of an organization for planning and decision making.
4.	To describe the fundamentals of cost sheet.
5.	To understand the marginal costing techniques and budgets.

UNIT- I	FUNDAMENTALS OF ACCOUNTING	9

Introduction to accounting – evolution of accounting- meaning and definition of accounting – accounting cycle – need, objectives, function and importance of accounting – basic accounting terminologies – branches of accounting – bases of accounting

UNIT-II	CONCEPTUAL FRAMEWORK OF ACCOUNTING	9

Book keeping –An Introduction – Book keeping vs Accounting - Generally Accepted Accounting Principles and Practices (GAPP), Basic concepts and conventions. Accounting Standards in India. Origin and Analysis of Business Transactions - Types of Accounts, Journal, Ledger and Trail Balance and subsidiary books.

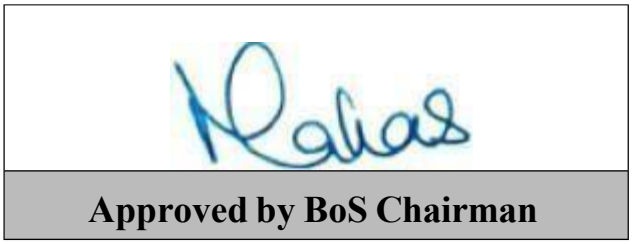
UNIT- III	DEPRECIATION AND FINAL ACCOUNTS	9

Meaning and nature of depreciation. Methods of computing depreciation: straight line method and diminishing balance method.

Final Accounts: Capital and revenue expenditures and receipts, Preparation of financial statements – trading Account, Profit and Loss A/C (P/L), Balance Sheet

UNIT- IV	COST ACCOUNTING	9

Cost Accounting: Definition, Meaning and objectives - Distinction between Cost and Financial Accounting. Elements of cost and preparation of cost sheets and tender.



Approved by BoS Chairman

UNIT- V	MARGINAL COSTING	9
Marginal Costing: The Concept - Break Even Analysis - Break - Even Chart - Importance and assumptions - Application of Profit Volumes Ratio (P/V Ratio)- Different types of problems (with special emphasis on decision making problems). Budget and Budgetary Control: Procedure and Utility - Preparation of different types of Budget – Cash Budget, Sales Budget and Flexible Budget		
	Total Instructional hours: 45	

Course Outcomes: Students will be able to	
CO1	Outline the Importance and branches of accounting.
CO2	Identify the events that need to be recorded in the accounting books.
CO3	Make use of Depreciation methods and identify the suitable decisions through the results of Final accounts.
CO4	Categorize the different overhead cost to operate a business.
CO5	Analyze cost accounting methods for project business performance and examine the role of budgets and Budgetary Control system in business organization.

Text Books:

1. Narayanaswamy R, Financial Accounting - A managerial perspective, NewDelhi,PHI Learning, 2020.
2. Jain and Narang, Cost and Management Accounting, 15th edition, Ludhiana Kalyani Publishers, 2018.
3. CA Dr.P C Tulsian and CA Bharat Tulsian, Financial Accounting, 2nd Edition, S.Chand Publishing, New Delhi, 2016.

Reference Books :

1. Sawyers, Jackson, Jenkins & Arora, Managerial Accounting, 2nd edition, Cengage, 2011.
2. Godwin, Alderman, Sanyal, Financial Accounting, 2nd edition, Cengage, 2011.
3. Jan Williams, Financial and Managerial Accounting - The basisfor business Decisions, 15th edition, Tata McGraw Hill Publishers, 2010.
4. Stice & Stice, Financial Accounting Reporting and Analysis, 8th edition, Cengage, 2010.

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 / B.Tech	B23ADP301- DATA SCIENCE LABORATORY (Common to AI&DS, CSE(AI&ML) & CSBS)	L	T	P	C
		0	4	0	2

Course Objectives	
1.	To understand the Python Programming packages like Numpy, Pandas and Matplotlib.
2.	To prepare data for data analysis through understanding its distribution.
3.	To understand and implement the Classification and Regression Model.
4.	To learn the concept of Clustering model.
5.	To acquire knowledge in plotting using visualization tools.

Expt. No.	Description of the Experiments
1.	Working with Jupyter Notebook on fundamental Concepts
2.	Computations using NumPy functions – Computation on Arrays, Aggregation, Indexing and Sorting.
3.	Data manipulations using Pandas – Handling of missing data and hierarchical indexing
4.	Case study to demonstrate Curve Fitting.
5.	Regression model for prediction
6.	Classification Model
7.	Find the outliers using plot.
8.	Plot the histogram, bar chart and pie chart on sample data
9.	Clustering model
10.	Data Visualization using Matplotlib – Implementation of 2D plotting and 3D plotting

Course Outcomes : Students will be able to	
CO1	Experiment with Jupyter Notebook, Pandas and Matplotlib for data analysis.
CO2	Apply statistical methods to hypotheses testing and inference problems.
CO3	Build a regression model to predict the data.
CO4	Make use of packages for classification and evaluate the performance of the classifier.
CO5	Apply different visualization techniques on various massive datasets.

Approved by BoS Chairman

B.TECH CSBS	B23CBP501 FULL STACK DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To develop full stack applications with clear understanding of user interface, business logic and data storage
2.	To design and develop user interface screens for a given scenario
3.	To develop the functionalities as web components as per the requirements
4.	To implement the database according to the functional requirements
5.	To integrate the user interface with the functionalities and data storage.

Expt. No.	List of Experiments
The Instructor can choose the technology stack to develop the following full stack experiments – based on the Full Stack Development Theory Course.	
1	Develop a portfolio website for yourself which gives details about yourself for a potential recruiter
2	Create a web application to manage the TO-DO list of users, where users can login and manage their to-do items
3	Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them
4	Create a food delivery website where users can order food from a particular restaurant listed in the website
5	Develop a classifieds web application to buy and sell used products
6	Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days.
7	Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, InProgress or Completed.
8	Develop an online survey application where a collection of questions is available and users are asked to answer any random 5 questions.
	Total Instructional hours = 45

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Course Outcomes : Students will be able to	
CO1	Design full stack applications with clear understanding of user interface, business logic and data storage
CO2	Design and develop user interface screens
CO3	Implement the functional requirements using appropriate tool
CO4	Design and develop database based on the requirements
CO5	Integrate all the necessary components of the application

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: Oracle 11g, XAMPP Server 7.	30

EXCELLENCE IN EDUCATION KIT COIMBATORE

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SEMESTER VI

B. Tech - CSBS	B23CBT601 – OPERATIONS RESEARCH	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To understand the basic concepts in operations research techniques for analysis and modeling in computer applications.
2.	To solve Transportation and assignment problems.
3.	To understand the basic concepts of operations research in game theory.
4.	To introduce network modeling for planning and scheduling the project activities.
5.	To study the characteristics and different types of queueing models.

UNIT- I LINEAR PROGRAMMING PROBLEMS	9
Mathematical Formulation of LPP -Graphical solution to Linear Programming Problems - Simplex method – Big M method – Two phase method	

UNIT-II TRANSPORTATION AND ASSIGNMENT PROBLEM	9
Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy –Mathematical formulation of assignment models –Hungarian Algorithm	

UNIT- III GAME THEORY	9
Game Theory-Two person Zero sum games - Saddle point, Dominance Rule, Convex Linear Combination (Averages), methods of matrices, graphical and LP solutions.	

UNIT- IV NETWORK ANALYSIS	9
Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling.	

UNIT- V QUEUEING MODELS	9
Characteristics of Queueing Models – Poisson Queues - (M / M / 1) : (FIFO / ∞ /∞), (M / M / 1) : (FIFO / N / ∞), (M / M / C) : (FIFO / ∞ / ∞), (M / M / C) : (FIFO / N / ∞) models.	
	Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Apply the concept of linear programming in Formulation, Graphical method, Simplex and Artificial variable techniques.
CO2	Solve transportation and assignment problems to get the optimal solutions
CO3	Apply the concepts of game theory in operations research.
CO4	Construct the network modeling for planning and scheduling the project activities.
CO5	Identify and analyze appropriate queuing model to reduce the waiting time in queue.

Text Books:

1. Natarajan A M, Balasubramanie P, Tamilarasi R,"Operations Research", 2nd Edition, Pearson Education 2014.
2. Taha H.A., "Operations Research : An Introduction " 10th Edition, Pearson Education, 2017.
3. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.

Reference Books :

1.Gupta Prem Kumar and Hira D.S., Operations Research, Sultan Chand, Revised Edition,2017.

2.Donald Gross, John F. Shortle, James M. Thompson, Carl M. Harris, "Fundamentals of Queueing Theory", John Wiley & Sons, 5th Edition, New Jersy, 2020.

3.Ibe, O.C. "Fundamentals of Applied Probability and Random Processes", Elsevier, U.P., 2nd Edition, 2014.

4. John W. Chinneck "Feasibility and Infeasibility in Optimization Algorithms and Computational Methods' Springer, 2015.

5. N. D Vohra, Quantitative Techniques in Management, TataMcgraw Hill, 5th Edition 2017.

B.Tech	B23CBT602 CUSTOMER RELATIONSHIP MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	Understand the fundamentals of CRM and its importance in business.
2.	Gain hands-on experience with CRM functionalities.
3.	Create detailed reports to analyze performance metrics and identify growth opportunities.
4.	Apply CRM concepts in real-world scenarios across different business contexts.
5.	Analyze real-world case studies to apply CRM strategies effectively.

UNIT- I	ZOHO CRM INTRODUCTION AND SALES PROCES AUTOMATION	9

CRM Introduction, Meaning and importance – About ZOHO CRM and its benefit to Business - role of ZOHO CRM in business / customer handling - Company creation / setup – details – Business idea – product / services - Product or service awareness creation strategy – understanding of companies marketing strategy - various modules in ZOHO CRM - Lead – Various Sources - Lead Qualification – Contact – Accounts – Deals.

UNIT-II	INVENTORY MANAGEMENT AND DATA SHARING IN CRM	9

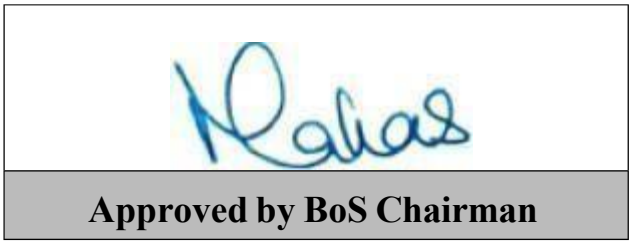
Inventory Management: Understanding inventory modules - Products, Price, Books, Vendors, Quotes, Sales orders, Purchase orders and invoices Data sharing settings & rules - Reporting hierarchy. Territory Management - Basics of Territory management - Decision guides for territory management - Linking sales forecasting with the territories - Building dashboards and reports based on the territories.

UNIT- III	ZOHO CRM MARKETING CHANNELS & SEGMENTATION	9

Significance of marketing channels, E-Mail communications, E-Mail parse, E-Mail deliverability – BCC Drop box and E-Mail intelligence. Web forms - Significance and execution. Integration with social profile - Other forms of communication - Telephony, chat and portals. Segmentation - Significance - RFM Metrics - Labeling, Configuring and executing the segmentation strategy in CRM account. Dealing with product configuration - setting pricing rules in CRM, Guided selling.

UNIT- IV	MARKETING AUTOMATION CRM REPORTS AND DASHBOARDS	9

Marketing automation - Workflow, Actions, Schedule, Assignment and case escalation. Understanding and building reports - Using single and multiple modules in generating reports – Customizing reports, Reading and interpreting the default dashboards, Creating customizing dashboards. Using AI tools in data enrichment, sales prediction and recommendation.



Approved by BoS Chairman

UNIT- V	ZOHO Case Studies and Practical Applications	9
Setting up CRM accounts - User roles and permissions - Account configuration. Navigating the CRM interface - Dashboard overview, Accessing key features and tools. Lead Management- Creating and Managing Leads - Converting Leads to Contacts - Tracking Interactions. Sales Pipeline Development- Setting Up a Sales Pipeline, Analyzing Sales Pipelines. Sales Analysis and Reporting - Generating Sales Reports - Analyzing Sales Data. Customer Support Management - Creating a Support Ticket System - Managing Support Tickets. Customer Engagement Strategies - Developing Engagement Strategies - Measuring Engagement Success. Analyzing Real-World CRM Case Studies - Implementing CRM Strategies.		
	Total Instructional hours: 45	

Course Outcomes: Students will be able to	
CO1	Identify key CRM concepts and features of CRM.
CO2	Utilize CRM for managing leads and sales.
CO3	Analyze data and generate reports in CRM.
CO4	Evaluate CRM strategies in real-world scenarios.
CO5	Develop a comprehensive CRM strategy.

Text Books:

1. Jagdish N Sheth, Parvatiyar Atul, G Shainesh, Customer Relationship Management: Emerging Concepts, Tools and Applications, 1st Edition, Tata McGraw Hill, June 2008

Reference Books :

1. Judith W .Kincaid , Customer Relationship Management Getting it Right, Pearson Education
2. H.Peeru Mohamed , A Sagadevan, Custmer Relationship Management, A Step by Step Approach, Vikas Publishing House
3. Customer Centricity –Focus on right customer for strategic advantage, by Peter Fader, Wharton Digital Press, 2012

Approved by BoS Chairman

B.Tech	B23CBT603 - DEVOPS AND CLOUD COMPUTING (Common to AI & DS , CSBS)	L	T	P	C
		3	0	0	3

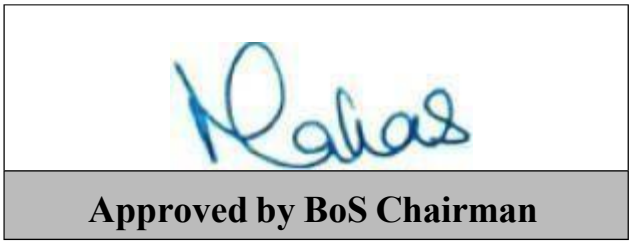
Course Objectives	
1.	Understand the fundamentals of DevOps and its role in modern software development.
2.	Gain knowledge of cloud computing platforms such as AWS, GCP, and Azure.
3.	Learn about Continuous Integration and Deployment using Jenkins.
4.	Explore containerization, configuration management, and monitoring tools.
5.	Understand cloud storage solutions and security best practices in cloud environments.

UNIT- I	INTRODUCTION TO DEVOPS	9
Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.		

UNIT-II	CLOUD ON DEVOPS	9
Cloud computing basics -Evolution of Cloud Computing-IAAS (Infrastructure as a Service) - SAAS (Software as a Service) - PAAS (Platform as a Service) - Private, Public and Hybrid Cloud - Google Cloud Services – service models – deployment models – cloud providers – cloud computing with AWS – Lifecycle of a cloud computing solutions – AWS – AWS products and services - Microsoft Azure services		

UNIT- III	CONTINUOUS INTEGRATION – JENKINS	9
Introduction to Jenkins-Continuous Integration with Jenkins-Configure Jenkins-Jenkins Management- Maven Build Scripts- Support for the GIT version control System- Different types of Jenkins Jobs- Jenkins Build Pipe Line- Jenkins Master & Slave Node Configuration-Jenkins Workspace Management-Securing Jenkins- Jenkins Plugins– Case study and ranked data		

UNIT- IV	DEVOPS OPERATIONAL TOOLS	9
Continuous Deployment: Containerization with Docker - Configuration Management using Ansible and Puppet - Software Testing using Selenium - Container Orchestration using Kubernetes – Continuous Monitoring using Nagios.		



Approved by BoS Chairman

UNIT- V	CLOUD STORAGE AND SECURITY	9
Cloud storage: Cloud Storage –Advantages of Cloud Storage – Cloud Storage Providers – S3 (Simple Storage Service) - S3 Features. Security in cloud: Software-as-a-Service Security – Security Governance – Virtual Machine Security-Security types: network level, host level, application level.		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Understand the core concepts of DevOps and its role in modern software development
CO2	Demonstrate proficiency in cloud computing platforms, including AWS, GCP, and Azure.
CO3	Implement Continuous Integration and Deployment (CI/CD) using Jenkins and Git.
CO4	Utilize DevOps operational tools like Docker, Kubernetes, Ansible, and Nagios for automation and monitoring
CO5	Apply cloud storage solutions and security best practices to protect applications and data in cloud environments.

Text Books:

1. Mitesh Soni, “Agile, Devops and Cloud Computing with Microsoft Azure: Hands-On Devop
2. Practices Implementation Using Azure Devops”, BPB Publications, 2019
3. Mikael Krief, “Learning DevOps”, Packt Publishing, 1st Edition, 2019.
4. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.

Reference Books :

1. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015
2. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
3. Hideto Saito, Hui-Chuan Chloe Lee and Cheng-Yang Wu, “DevOps with Kubernetes: Accelerating software delivery with container orchestrators”, Packt Publishing, 1st edition, 2017.
4. Roman Pichler, “DevOps. Building CI/CD Pipelines with Jenkins, Docker Container, AWS ECS, JDK 11, Git and Maven 3”, Addison-Wesley publisher, 1st Edition, 2010.

Approved by BoS Chairman

B.Tech	B23CBT604 - BUSINESS INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the foundational concepts of Business Intelligence and its role in effective and timely decision-making.
2.	To explore various BI architectures and the development process of BI systems with ethical considerations.
3.	To gain knowledge on different knowledge delivery methods and tools for effective data visualization and analysis.
4.	To apply mathematical and efficiency models for performance evaluation and pattern analysis in business data.
5.	To evaluate real-world BI applications, emerging trends, and future directions including AI/ML integration and advanced analytics.

UNIT- I	BUSINESS INTELLIGENCE	9
Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.		

UNIT-II	KNOWLEDGE DELIVERY	9
The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.		

UNIT- III	EFFICIENCY	9
Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification o good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models Pattern matching – cluster analysis, outlier analysis		

Approved by BoS Chairman

UNIT- IV	BUSINESS INTELLIGENCE APPLICATIONS	9
Marketing models – Logistic and Production models – Case studies.		

UNIT- V	FUTURE OF BUSINESS INTELLIGENCE	9
Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.		
		Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Explain the importance of business intelligence in decision-making and describe the architectures and ethical considerations involved.
CO2	Demonstrate the use of knowledge delivery mechanisms such as reports, dashboards, and visual analytics for actionable insights.
CO3	Analyze business data using efficiency models like CCR and perform pattern matching, clustering, and outlier analysis.
CO4	Evaluate and compare the application of business intelligence techniques in various domains such as marketing, logistics, and production through case studies.
CO5	Discuss and predict the impact of emerging technologies such as machine learning, text analytics, and advanced visualization on the future of business intelligence.

Text Books:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, 9th Edition, Pearson 2013.

Reference Books :

1. Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making”, Addison Wesley, 2003.
2. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager’s Guide”, Second Edition, 2012.
4. Cindi Howson, “Successful Business Intelligence: Secrets to Making BI a Killer App”, McGraw- Hill, 2007.
5. Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, “The Data Warehouse Lifecycle Toolkit”, Wiley Publication Inc.,2007.

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.TECH. CSBS	B23ENP601 – BUSINESS COMMUNICATION &VALUE SCIENCE IV	L	T	P	C
		0	0	4	2

Course Objectives	
1.	To strengthen learners' presentation skills for effective communication.
2.	To enable learners to create impactful resumes for job opportunities.
3.	To train learners to approach interviews with confidence.
4.	To enhance participants' communication, critical thinking, teamwork, and problem-solving skills.
5.	To foster professionalism through personality development.

UNIT-I	PRESENTATION SKILLS	12

Fundamentals of Presentation Skills, Types of Presentation - Technical and Business Presentation - Virtual Presentation, Planning and Structuring a Presentation, Organizing Content - Visual Aids and Slide Design, Verbal & Non Verbal Communication – Pronunciation - Clarity of Speech – Body Language.

UNIT-II	RESUME PREPARATION	12

Reading job advertisements, Understanding job specifications and skills, Difference between Bio-data, Resume & CV, Writing job application letter- Cover Letter- Building Resume – Basic Resume formats – Types of Resume – Preparing different resume styles, Resume Preparation by online tools – Analysing ATS evaluation for Resume.

UNIT-III	INTERVIEW SKILLS	12

Types of interviews, Interview Techniques, Preparing for interview, Interview etiquettes, Managing stress and Emotions, Open and closed ended questions, Mock interviews Sessions – Conduct simulated interview rounds (HR, Technical, Stress, Panel Interviews) – Demo on Virtual Interview

UNIT-IV	GROUP DISCUSSION	12

Importance of Group discussion, Difference between GD and Debate, Participating in discussions, Acquiring leadership traits, GD for Interviews, Do's and Don'ts of Group Discussion, Opening a GD, Participating in discussion, Activity based – Extempore, Summarizing, Real-Time Group discussion on various topics.

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UNIT-V	PERSONALITY DEVELOPMENT	12
Definition of Personality, Types of Personalities, Personality dimensions and traits, Building a positive attitude — Creative Thinking Challenge, Character building, Confidence Building Exercises (Public speaking, impromptu storytelling, and voice modulation training.), Setting goals for personal development, Applying SWOT analysis in real life scenario.		
	Total Instructional hours:60	

Course Outcomes: Students will be able to	
CO1	Demonstrate structured and engaging presentations using effective communication skills. (K2)
CO2	Develop professional resumes and cover letters for interviews. (K3)
CO3	Perceive interviews skills through etiquette and mock interviews. (K5)
CO4	Develop teamwork and leadership skills through group discussions. (K3)
CO5	Build professionalism through interpersonal skills. (K3)

Text Books	
1.	Dutt Kiranmai P., Geetha Rajeevan and C L N Prakash, “A Course in Communication Skills” Cambridge University Press Pvt. Ltd, New Delhi, 2013.
2.	Sajitha Jayaprakash., “Interview Skills” Himalaya Publishing House, 2010.

Reference Books	
1.	Peter John, “Self Development and Professional Excellence”, Cengage Learning India Pvt. Ltd., 2019.
2.	Sobana S., RManivannan and G Immanuel, “Communication and Soft Skills", VK Publications, Sivakasi, 2016.
3.	Whitby Norman, “Business Benchmark Pre –Intermediate to Intermediate Preliminary" Gopson’s Papers Limited, Noida, 2008.

Approved by BoS Chairman

B.TECH	B23CBP601 DEVOPS AND CLOUD COMPUTING LABORATORY (Common to AI & DS , CSBS)	L	T	P	C
		0	0	4	2

Course Objectives	
1.	Understand the process of creating and setting up an AWS account for cloud infrastructure management.
2.	Explore the integration of DevOps with cloud computing by analyzing various cloud service models.
3.	Gain proficiency in DevOps development tools for automation, version control, and continuous integration.
4.	Familiarize with DevOps operational tools for configuration management, monitoring, and deployment.
5.	Learn and apply cloud computing services for scalable and efficient application deployment.

Expt . No.	List of Experiments
1.	AWS- Create and setup AWS account.
2.	AWS- Create a VPC and subnets.
3.	AWS- Create EC2 instance & volume.
4.	AWS- Create a S3 bucket.
5.	AWS- Create a RDS instance with private access only.
6.	AWS-Deploy a server with EC2 instance, S3 bucket and RDS instances.
7.	Deploy and configure Prometheus & Grafana for system monitoring.
8.	Configure IAM roles, security groups, and access policies for AWS resources.
9.	Configure Jenkins with git hub and deploy it on a server/computer.
10.	Create a configuration with Jenkins with git push auto deploy functionality.
11.	Create a configuration with Jenkins with manual deploy functionality.
12.	Run MySQL in docker and configure query login to host disk (system memory rather than docker memory) and check the health of this container every 10 seconds.
13.	Run nginx in docker and configure any web location/url to redirect to an url and limit only 5 connection per user each minute.
	Total Instructional hours = 45

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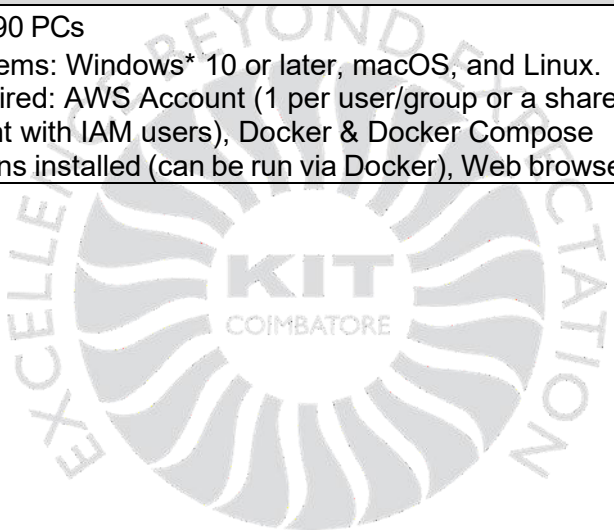
Course Outcomes : Students will be able to	
CO1	Build and manage an AWS account for deploying cloud-based applications.
CO2	Demonstrate an understanding of cloud computing models and their role in DevOps.
CO3	Utilize DevOps development tools such as Git, Jenkins, and Docker for automation and CI/CD.
CO4	Implement DevOps operational tools like Ansible, Kubernetes, and Terraform for configuration management and orchestration.
CO5	Deploy and manage cloud computing services including compute, storage, and database solutions on AWS.

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: AWS Account (1 per user/group or a shared training account with IAM users), Docker & Docker Compose installed, Jenkins installed (can be run via Docker), Web browser.	30



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PROFESSIONAL ELECTIVE

VERTICAL I

B.Tech	B23CBE901 BUSINESS PROCESS MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the transition from functional to process-centric enterprise models.
2.	To understand the BPM life cycle and tools for analyzing and improving business processes.
3.	To understand the development process of BPM solutions, from requirement gathering to deployment.
4.	To examine the integration strategies and automation technologies within BPM, including the application of RPA.
5.	To apply the skills in process modeling and the integration of business rules within BPM frameworks.

UNIT- I	FUNDAMENTALS OF BUSINESS PROCESS MANAGEMENT	9

Definition and importance of BPM– Functional vs. process-centric enterprise - The evolution and transformation to process-centric models - Business value and strategic benefits of BPM - Risks and challenges in business process automation - Introduction to BPM life cycle: design, modeling, execution, monitoring, optimization

UNIT- II	BUSINESS PROCESS LIFE CYCLE AND ANALYSIS	9

In-depth exploration of the BPM life cycle - Business process identification and documentation - Workflow modeling techniques - Business process analysis: tools and techniques - Key performance indicators (KPIs) for process evaluation - Process improvement methodologies (Six Sigma, Lean, etc.)

UNIT- III	BUSINESS PROCESS MANAGEMENT SOLUTION DEVELOPMENT	9

Overview of BPM solution architectures – BPM Process Development: from requirement gathering to deployment - BPM monitoring and reporting mechanisms - BPM tools and platforms: features and capabilities - Case studies on BPM implementations

UNIT- IV	BPM INTEGRATION AND AUTOMATION TECHNOLOGIES	9

BPM and application/system integration - Introduction to Robotic Process Automation (RPA) in BPM - Use cases and benefits of RPA - Configuration of BPM solutions - Evaluation criteria for BPM software vendors - Comparative analysis of leading BPM platforms (e.g., IBM BPM, Appian, Pega, etc.)

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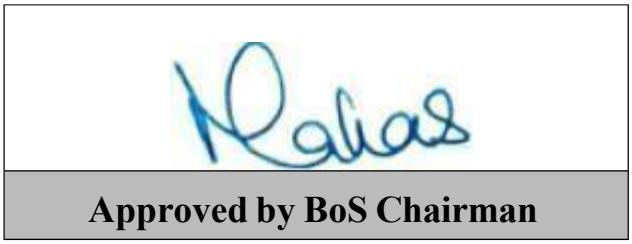
UNIT- V	PROCESS MODELING AND RULES MANAGEMENT	9
Process Modeling Standards: Business Process Modeling Notation (BPMN) – Best practices for BPMN modeling – Process repository: purpose and implementation – Business Rules Management Systems (BRMS) – Integration of BRMS with BPM - Real-world modeling scenarios and tools (e.g., Camunda, Bizagi)		
		Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Explain the fundamental concepts, importance, and life cycle of Business Process Management in modern enterprises.
CO2	Apply workflow modeling techniques and analysis tools to evaluate and improve business processes.
CO3	Design and develop BPM solutions from requirements to deployment using appropriate tools and architectures.
CO4	Demonstrate the integration of BPM with enterprise systems and apply RPA technologies to automate processes.
CO5	Model business processes using BPMN and integrate business rules using BRMS in real-world scenarios.

Text Books	
1.	Paul Harmon, Business Process Change: A Business Process Management Guide for Managers and Process Professionals, Morgan Kaufmann, 3rd Edition, 2014.
2.	John Jeston and Johan Nelis, Business Process Management: Practical Guidelines to Successful Implementations, Routledge (Taylor & Francis), 3rd Edition, 2014.
Reference Books	
1.	James F. Chang, Business Process Management Systems: Strategy and Implementation, Auerbach Publications (Taylor & Francis), 2006.
2.	Roger Burlton, Business Process Management: Profiting from Process, SAMS Publishing, 1st Edition, 2001.
3.	Howard Smith and Peter Fingar, Business Process Management: The Third Wave, Meghan-Kiffer Press, 2003.
4.	Ravindran, A. Ravi, Donald P. Warsing Jr., Supply Chain Engineering: Models and Applications, CRC Press, 2012.



Approved by BoS Chairman

B.E./ B.Tech	B23CBE902 - FINANCIAL MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	**To provide foundational knowledge** on the principles, concepts, and techniques of financial management for effective decision-making in business organizations.
2.	**To develop analytical skills** for evaluating investment, financing, and dividend decisions that maximize shareholder wealth.
3.	**To familiarize students** with the tools and techniques of financial planning, capital budgeting, cost of capital, and working capital management.
4.	**To enhance understanding** of financial markets, institutions, and instruments and their role in business financing.
5.	**To cultivate the ability** to apply financial management theories to real-world business problems and strategic decision-making.

UNIT- I	FOUNDATIONS OF FINANCE	9
Introduction to finance - Financial Management – Nature, scope and functions of Finance, organization of financial functions, objectives of Financial management, Major financial decisions – Time value of money – features and valuation of shares and bonds – Concept of risk and return – single asset and of a portfolio.		
UNIT- II	**INVESTMENT DECISIONS**	**9**
Capital Budgeting: Principles and techniques - Nature of capital budgeting- Identifying relevant cash flows - Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of Return, Profitability Index - Comparison of DCF techniques Concept and measurement of cost of capital - Specific cost and overall cost of capital.		
UNIT- III	**FINANCING AND DIVIDEND DECISION**	**9**

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Leverages - Operating and Financial leverage – measurement of leverages – degree of Operating & Financial leverage – Combined leverage, EBIT – EPS Analysis- Indifference point.		
UNIT-IV	**WORKING CAPITAL MANAGEMENT**	**9**
Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital - Accounts Receivables Management and factoring - Inventory management - Cash management - Working capital finance : Trade credit, Bank finance and Commercial paper.		
UNIT-V	**LONG TERM SOURCES OF FINANCE**	**9**
Indian capital and stock market, New issues market Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity.		

Total Instructional hours: 45

Course Outcomes : Students will be able to	
CO1	Apply the basic fundamentals required for the foundations of finance in an organization
CO2	Analyse the various techniques towards the Investment Decisions for the projects
CO3	Design the requirements of Financing and Dividend Decision.
CO4	Evaluate the principles of working capital management.
CO5	Develop the various long term sources of finance.

Text Books	
1.	I M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 11th edition, 2018
2.	M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 8th edition, 2017.
3.	AswathDamodaran, Corporate Finance Theory and practice, John Wiley & Sons, 2011.

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Reference Books	
1.	Brigham and Ehrhardt, Financial Management, 14th edition, Cengage, 2015
2.	William R.Lasher, Financial Management, 7th Edition, Cengage, 2014 .
3.	Parasuraman.N.R, Financial Management, Cengage, 2014.

Approved by BoS Chairman

B.E./ B.Tech	B23CBE903 - OPERATION MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To provide awareness on the roles and responsibilities of operations managers in different organizational contexts and understand drivers of operational performance for gaining competitive advantage.
2.	Acquire knowledge of production planning and resource management.
3.	Develop capabilities for designing production/service systems.
4.	Learn to plan, control operations and manage operations.
5.	To appreciate the prominence of quality to attain global competitive advantage.

UNIT- I	INTRODUCTION TO OPERATIONS MANAGEMENT	9
Operations Management — Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends, Operations Strategy – Strategic fit, framework. Productivity; case study.		
UNIT- II	**OPERATIONS AND THE VALUE CHAIN**	**9**
Capacity Planning — Long range, Types, Developing capacity alternatives, tools for Capacity planning. Facility Location — Theories, Steps in Selection, Location Models. Sourcing and procurement - Strategic Sourcing, Make or Buy decision, procurement process, Managing vendors. Supply Chain Management. case study.		
UNIT- III	**DESIGNING OPERATIONS**	**9**
Product Design - Criteria, Approaches. Product development process - stage-gate approach - tools. Process design, strategy, types, analysis. Facility Layout — Principles, Types, Planning tools and techniques. case study.		
UNIT- IV	**PLANNING AND CONTROL OF OPERATIONS**	**9**
Demand Forecasting – Need, Types, Objectives and Steps - Overview of Qualitative and Quantitative methods. Operations planning- Resource planning - Inventory Planning and		

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Control. Operations Scheduling- problems and discussions.		
UNIT- V	**QUALITY MANAGEMENT**	**9**
Definitions of quality, The Quality revolution, quality gurus; TQM philosophies; Quality management tools, certification and awards. Lean Management-philosophy, elements of JIT manufacturing, continuous improvement, Six sigma- case study.		

Total Instructional hours: 45

Course Outcomes :Students will be able to	
CO1	Comprehend the strategic importance of operations function leading to competitive advantage.
CO2	Understand facility alternatives (location and layout) and the capacity decisions.
CO3	Apply the various methods of Designing products and processes.
CO4	Deduce different plans for the operations
CO5	Apply techniques for forecasting and scheduling of jobs and services.

Text Books	
1.	Panneer selvam. R, Production and Operations Management, 3rd Edition, PHI Learning, 2012.
2.	Richard B. Chase, Ravi Shankar, F. Robert Jacobs, Operations and Supply Chain Management, McGraw Hill Education (India) Pvt. Ltd, 14th Edition, 2014.

Reference Books	
1.	Mahadevan B, Operations Management: Theory and practice. Pearson Education India; 2015.
2.	William J Stevenson, Operations Management, Tata McGraw Hill, 9th Edition, 2009.
3.	Russell and Taylor, Operations Management, Wiley, 5th Edition, 2006.
4	Norman Gaither and Gregory Frazier, Operations Management, SouthWestern Cengage Learning, 9th edition, 2015.
5.	Cecil C. Bozarth, Robert B. Handfield, Introduction to Operations and Supply Chain Management, Pearson, 4th Edition, 2016.

Approved by BoS Chairman

B.E./ B.Tech	B23CBE904 – BEHAVIOURAL ECONOMICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	Provide a foundational understanding of how psychological insights influence economic decision-making.
2.	Critically analyze the limitations of traditional economic models of rationality.
3.	Familiarize students with key behavioural theories such as heuristics, biases, and prospect theory.
4.	Explore how social preferences, fairness, and cooperation shape economic interactions.
5.	Apply behavioural insights to public policy, finance, health, and consumer behaviour.

UNIT- I	Introduction to Behavioural Economics	9
Evolution of Behavioural Economics – from Classical to Neoclassical to Behavioural - Rationality vs. Bounded Rationality - Core principles: heuristics, biases, framing, and prospect theory - Comparison with traditional economics assumptions.		
UNIT- II	Decision-Making under Risk and Uncertainty	**9**
Expected Utility Theory and its limitations - Prospect Theory – value function and probability weighting - Risk aversion, loss aversion, and reference dependence - Mental accounting.		
UNIT- III	Heuristics and Biases	**9**
Availability, Representativeness, and Anchoring heuristics - Overconfidence bias, Status quo bias, Endowment effect - Time inconsistency and hyperbolic discounting - Choice architecture and nudges.		
UNIT- IV	Social Preferences and Behaviour	**9**
Fairness, reciprocity, and altruism - Trust and cooperation in economic interactions - Inequality aversion - Experimental evidence from dictator, ultimatum, and public goods games.		

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UNIT- V	Applications of Behavioural Economics	9
Behavioural insights in public policy ‘‘Nudge theory’’- Consumer behaviour and marketing applications - Savings, investment, and retirement decisions - Behavioural finance – anomalies in financial markets - Health, education, and environmental applications		

Total Instructional hours: 45

Course Outcomes :Students will be able to	
CO1	Explain the evolution and core concepts of behavioural economics in contrast to classical and neoclassical economics.
CO2	Analyze decision-making processes under risk and uncertainty using behavioural models.
CO3	Identify and evaluate common heuristics, biases, and their impact on individual and market behaviour.
CO4	Assess the role of fairness, trust, and reciprocity in shaping economic and social outcomes.
CO5	Apply behavioural economic theories to real-world problems in public policy, marketing, health, and finance.
Text Books	
1.	Kahneman, D. (2011). Thinking, Fast and Slow. New York: Farrar, Straus and Giroux.
2.	Thaler, R. H., & Sunstein, C. R. (2008). Nudge: Improving Decisions About Health, Wealth, and Happiness. Yale University Press.
3.	Thaler, R. H. (2015). Misbehaving: The Making of Behavioral Economics. W. W. Norton & Company.
Reference Books	
1.	Camerer, C. F. (2003). Behavioral Game Theory: Experiments in Strategic Interaction. Princeton University Press.
2.	Camerer, C. F., Loewenstein, G., & Rabin, M. (Eds.). (2011). Advances in Behavioral Economics. Princeton University Press.
3.	Dhami, S. (2016). The Foundations of Behavioral Economic Analysis. Oxford University Press.
4	Ariely, D. (2008). Predictably Irrational: The Hidden Forces That Shape Our Decisions. HarperCollins.
5	Mullainathan, S., & Shafir, E. (2013). Scarcity: Why Having Too Little Means So Much. Times Books.

Approved by BoS Chairman

B.E./ B.Tech	B23CBE905 - TALENT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	Develop comprehensive understanding of the objectives, process competencies in Talent Management.
2.	To familiarize with succession planning process, program and compensation management.
3.	To learn the importance in talent acquisition process and retention.
4.	Understand different types of competencies, steps, approaches and competency mapping.
5.	Develop an understanding of competency framework and methodology.

UNIT- I	INTRODUCTION TO TALENT MANAGEMENT	9
Definition of Talent Management - Objectives & Role - Key Processes of Talent Management, Source of Talent, Consequences of failure in managing talent, Tools for Managing Talent. Building Blocks of talent management. Competencies.		
UNIT- II	**TALENT SUCCESSION PLANNING**	**9**
Succession management process, Integrating succession planning and career planning, designing succession planning program, talent development budget, contingency plan for talent; building a reservoir of talent, compensation management within the context of talent management.		
UNIT- III	**TALENT ACQUISITION AND RETENTION**	**9**
Talent Acquisition- Defining Talent Acquisition, Develop high potential employees, Importance of Talent Development Process, Steps in developing talent. Talent Retention: Model (Satisfy, Motivate and Reward).Best practices in employee retention.		
UNIT- IV	**COMPETENCY MAPPING**	**9**
Concepts and definition of competency; types of competencies Competency mapping procedures and steps , 5 - level competency model, Developing competency models from raw data- data recording, analysing the data, content analysis of verbal expression, how competencies relate to career development and organizational goals.		
UNIT- V	**METHODOLOGY OF COMPETENCY MAPPING**	**9**

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Competency models people capability maturity model, developing competency framework, competency profiling, competency mapping tools, use of psychological testing in competency mapping , competency-based interviewing, BEI, validation of competencies

Total Instructional hours: 45

Course Outcomes :Students will be able to	
CO1	Comprehend and define the concept of talent management and its importance in an organizational context.
CO2	Summarize the concept of succession planning and compensation management.
CO3	Students will be able to analyze the importance of talent acquisition and retention strategies.
CO4	Analyze the concept and steps of competency mapping.
CO5	Students will be able apply the models of competency mapping in organizations.
Text Books	
1.	Lance A. Berger, The Talent Management Handbook, Making Culture a Competitive Advantage by Acquiring, Identifying, Developing, and Promoting
2.	Best People Tata McGraw Hill, 3rd Edition, 2018 Bickham, T, ATD Talent Management Handbook, 1st Edition, ATD Press,2015

Reference Books	
1.	Seema Sanghi, The Handbook of Competency Mapping, Sage Publications, 3rd Edition, 2016
2.	Edward J Cripe, Competency Development Guide, Workitect Inc., 1st Edition, 2012.
3.	Lyle M. Spencer, Signe M. Spencer, Competence at work: Models for Superior Performance, John Wiley Publishing,1st Edition 2008.
4	Rao T.V., Performance Management: Toward Organizational Excellence, SAGE, 2nd Edition, 2015.
5	Sumati Ray Anindya Basu Roy, Competency Based Human Resource Management, SAGE, 1st Edition, 2019.

Approved by BoS Chairman

B.E./ B.Tech	B23CBE906 - SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	Understand the concepts and importance of supply chain management in organizations.
2.	Explore techniques for analyzing and improving the efficiency and effectiveness of supply chain networks.
3.	Develop an understanding of supply chain risk management and strategies for mitigating disruptions and enhancing resilience.
4.	Understand the design and structure of supply chain networks and distribution strategies.
5.	To develop skills in inventory management, demand planning, and supply chain forecasting.

UNIT- I	INTRODUCTION	9
Supply Chain – Evolution, Fundamentals, SCOR Model, Role in Economy, Importance, Decision Phases, Enablers & Drivers of Supply Chain Performance; Supply chain strategy; Supply Chain Performance Measures.		
UNIT- II	**SUPPLY CHAIN NETWORK**	**9**
Distribution Network Design – Role in supply chain, Influencing factors, design options, online sales and distribution network, Distribution Strategies; Network Design in supply chain – Role, influencing factors, framework for network design, Impact of uncertainty on Network Design.		
UNIT- III	**PLANNING DEMAND, INVENTORY AND SUPPLY**	**9**
Managing supply chain cycle inventory and safety inventory - Uncertainty in the supply chain , Analyzing impact of supply chain redesign on the inventory, Risk Pooling, Managing inventory for short life-cycle products, multiple item -multiple location inventory management; Pricing and Revenue Management.		
UNIT- IV	**LOGISTICS**	**9**
Transportation – Role, Modes and their characteristics, infrastructure and policies, transport documentation, design options, trade-offs in transportation design, intermodal transportation. Logistics outsourcing – catalysts, benefits, value proposition. 3PL, 4PL, 5PL, 6PL; International Logistics - objectives, importance in global economy, Characteristics of global supply chains, Incoterms.		

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UNIT- V	SUPPLY CHAIN INNOVATIONS	9
Supply Chain Integration, SC process restructuring, IT in Supply Chain; Agile Supply Chains, Legible supply chain, Green Supply Chain, Reverse Supply chain; Supply chain technology trends – AI, Internet of Things, Augmented Data Intelligence, Warehouse automation, Robotics, Immersive technologies.		

Total Instructional hours: 45

Course Outcomes :Students will be able to	
CO1	Comprehend the fundamental concepts of Supply chain and how it Improve performance measures.
CO2	Analyze the pivotal role of distribution network design, strategies within the supply chain.
CO3	Analyze the impact of supply chain redesign on the inventory
CO4	Analyze the Role, design options, infrastructure and policies related to logistics.
CO5	Analyze outsourcing, green supply related to logistics.
Text Books	
1.	Sunil Chopra, Peter Meindl and Dharam Vir Kalra, Supply Chain Management – Strategy Planning and Operation, Pearson Education, Sixth Edition, 2016.
2.	Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 2009
Reference Books	
1.	Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education, 5th Edition, 2007.
2.	David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies, and Cases, Tata McGraw- Hill, 2005. Pierre David, International Logistics, Biztantra, 2011.

Approved by BoS Chairman

B.E./ B.Tech	B23CBE907 - MARKETING RESEARCH AND MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To develop an understanding of ideas and nuances of modern marketing.
2.	To describe the process to formulate and manage the B2B marketing strategy including all key components.
3.	To explain the techniques to conduct market analysis practices including market segmentation and targeting.
4.	To compare and contrast different perspectives that characterize the study of consumer behavior.
5.	To explain the role of IMC in the overall marketing program.

UNIT-I	INTRODUCTION	9
Marketing - Definitions – evolution - Conceptual frame work - Marketing environment: Internal and External -Marketing interface with other functional areas - Production, Finance, Human Relations Management, Information System.		
UNIT-II	**MARKETING MIX DECISIONS**	**9**
Product planning and development - Product life cycle - New product Development and Management - Market Segmentation - Targeting and Positioning - Channel Management - types of distribution channels; Distribution channel intermediaries Advertising and sales promotions - Pricing Objectives, Policies and methods.		
UNIT-III	**MARKETING STRATEGY**	**9**
Marketing strategy formulations - Key Drivers of Marketing Strategies - Strategies for Industrial Marketing - Consumer Marketing - Services marketing - Competitor analysis - Analysis of consumer and industrial markets - Strategic Marketing Mix components, 8Ps.		
UNIT-IV	**BUYER BEHAVIOUR**	**9**
Understanding industrial and individual buyer behavior- Influencing factors- Buyer Behaviour Models - Online buyer behaviour - Building and measuring customer satisfaction- Customer relationships management - Customer acquisition, Retaining, Defection.		
UNIT-V	**MARKETING RESEARCH & TRENDS IN MARKETING**	**9**
Marketing Information System- Research Process- Concepts and applications: Product-Advertising - Promotion - Consumer Behaviour - Retail research - Customer driven organizations -Cause related marketing - Ethics in marketing -Online marketing – Emerging trends.		

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Develop awareness of marketing management.
CO2	Make use of marketing mix decisions.
CO3	Discover about marketing strategic mix components.
CO4	Analyze industrial and individual buying behavior.
CO5	Assess marketing research & trends in marketing management.
Text Books	
1.	Philip Kotler and Kevin Lane Keller, Marketing Management, PHI 14th Edition, 2012.
2.	KS Chandrasekar, “Marketing management-Text and Cases”, Tata McGraw Hill, First edition,2010.
Reference Books	
1.	Lamb, hair, Sharma, Mc Daniel- Marketing - An Innovative approach to learning and teaching- A south Asian perspective, Cengage Learning, 2012.
2.	Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2 nd Edition,2011.
3.	MichealR.Czinkota& Masaaki Kotabe, Marketing Management, Cengage, 2000.

Approved by BoS Chairman

B.E./ B.Tech	B23CBE908 - DIGITAL MARKETING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the concept of Online Market Space and develop effective Digital Marketing Strategies.
2.	To learn Search Engine Optimization (SEO) techniques for improving website visibility and performance in search engines.
3.	To apply Email Marketing and Mobile Marketing strategies for customer engagement and lead generation.
4.	To explore Social Media Marketing platforms and learn techniques for customer interaction, brand promotion, and influencer marketing.
5.	To analyze Digital Marketing performance using Analytics tools like Google Ads, Social Media Analytics, Email Analytics, and Web Analytics for better decision-making

UNIT-I	INTRODUCTION	9
Online Market space- Digital Marketing Strategy- Components -Opportunities for building Brand Website - Planning and Creation- Content Marketing - Recent trends in Digital marketing.		
UNIT-II	**SEARCH ENGINE OPTIMISATION**	**9**
Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factor - OnPage Techniques - Off-Page Techniques. Search Engine Marketing - How Search Engine works- SEM components- PPC advertising - Display Advertisement.		
UNIT-III	**E-MAIL AND MOBILE MARKETING**	**9**
E-Mail Marketing – Types of E-Mail Marketing – Email Automation – Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximising email campaign Integrating Email with Social Media and Mobile- Measuring and maximising email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns- Profiling and targeting.		
UNIT-IV	**SOCIAL MEDIA MARKETING**	**9**
Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful / benchmark Social media campaigns Engagement Marketing - Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.		
UNIT-V	**DIGITAL ANALYTICS**	**9**
Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis.		

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Comprehend the functions and metrics of digital marketing and its skills in today‟s rapidly changing business environment.
CO2	Apply the strategies and skills of search engine optimization and its significance in digital marketing.
CO3	Apply the concepts of email marketing and various techniques in digital marketing for improve business performance.
CO4	Analyze various components and technologies of mobile marketing including mobile advertising, mobile apps and mobile website optimization to enhance brand visibility and customer engagement.
CO5	Analyze different social media platforms and their unique features, audience demographics and best practices for marketing purposes.
Text Books	
1.	Ryan, D.(2014).Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited
2.	Fundamentals of Digital Marketing by Puneet Singh Bhatia; Publisher: Pearson Education; First edition (July 2017); ISBN-10: 933258737X; ISBN-13: 978-9332587373
Reference Books	
1.	**Chaffey, D., & Ellis-Chadwick, F.** (2019*). Digital Marketing: Strategy, Implementation and Practice. 7th Edition. Pearson Education Limited.*
2.	**Kotler, P., Kartajaya, H., & Setiawan, I.** (2017). *Marketing 4.0: Moving from Traditional to Digital. Wiley. ISBN-13: 978-1119341208.*
3.	**Barker, M., Barker, D., Bormann, N., & Roberts, D.** *(2017). Social Media Marketing: A Strategic Approach. 2nd Edition. Cengage Learning.*

Approved by BoS Chairman

PROFESSIONAL ELECTIVE VERTICAL II

Approved by BoS Chairman

B.E./ B.Tech	B23CBE909-DATA MINING FOR BUSINESS INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand basics of data, text, and web mining.
2.	To learn key data mining processes.
3.	To study prediction and time series techniques.
4.	To apply classification, association, and clustering.
5.	To introduce machine learning and AI methods.

UNIT-I	INTRODUCTION	9
Data mining, Classification on Data Mining system, Various risks in Data Mining, Advantages and disadvantages of Data Mining, Ethical issues in Data Mining, Analysis of Ethical issues, Global issues. Text mining, Web mining, Data ware house.		
UNIT-II	**DATA MINING PROCESS**	**9**
Datamining process – KDD, CRISP-DM, SEMMA –Prediction performance measures.		
UNIT-III	**PREDICTION TECHNIQUES AND DATA MINING APPLICATIONS**	**9**
Data visualization, Time series – ARIMA, Winter Holts. Applications in various sectors Retailing, CRM, Banking, Stock Pricing, Production, Crime, Genetics, Medical, Pharmaceutical.		
UNIT-IV	**DATA MINING TOOLS, METHODS AND TECHNIQUES**	**9**
Data mining, Text mining, Web mining, Spatial mining, Process mining, BI processPrivate and Public intelligence, Strategic assessment of implementing BIData Mining Techniques: Introduction, Statistical Perspective on Data Mining, Statistics-need and algorithms, Naïve Bayes Algorithm, CHI-Square Automatic Interaction-Detectors (CHAID)- Classification and Regression Tree (CART) - Analysis of Unstructured Data.		
UNIT-V	**MACHINE LEARNING AND AI**	**9**
Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm optimization.		

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes: Students will be able to	
CO1	Demonstrate an understanding of the importance of data mining and the principles of business intelligence.
CO2	Be able to interact competently on the topic of data mining for business intelligence.
CO3	Apply various prediction techniques.
CO4	Learn about supervised and unsupervised learning technique.
CO5	Develop and implement machine learning algorithms.
Text Books	
1.	Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006.
2.	Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
3.	Michel Berry and Gordon Linoff, Mastering Data mining, John Wiley and Sons Inc,2nd Edition, 2011.

Reference Books	
1.	W.H.Inmon, Building the Data Warehouse, fourth edition Wiley India pvt. Ltd. 2005.
2.	Michel Berry and Gordon Linoff, Data mining techniques for Marketing, Sales and Customer support, John Wiley, 2011.
3.	G. K. Gupta, Introduction to Data mining with Case Studies, Prentice hall of India, 2011.
4	Elizabeth Vitt, Michael Luckevich Stacia Misner, Business Intelligence, Microsoft, 2011.
5	Business Analytics and Data Mining Modeling using R (IIT Roorkee) - https://onlinecourses.nptel.ac.in/noc22_mg09/preview
6	Data Mining (IIT Kharagpur) - https://onlinecourses.nptel.ac.in/noc21_cs06/preview

Approved by BoS Chairman

B.E./ B.Tech	B23CBE910-PROCESS MINING	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the foundations and importance of Process Mining.
2.	To learn how to extract, clean, and prepare event log data from information systems.
3.	To understand different process discovery, conformance checking, and performance analysis techniques
4.	To acquire the ability to use popular process mining tools and simulate business processes.
5.	To apply process mining concepts to case studies and real-world business scenarios.

UNIT- I	Introduction to Process Mining	9
Definition of Process Mining – Relation to Data Mining and Business Process Management (BPM) – History and Evolution – Types of Process Mining: Process Discovery, Conformance Checking, Enhancement – Applications in Industries.		
UNIT- II	**Event Logs and Data Preparation**	**9**
Event Logs: Concepts – Structure – Case ID, Activity, Timestamp – Requirements – Sources of Event Logs (ERP, CRM, Workflow Systems).Data Preparation: Cleaning – Filtering – Dealing with Incomplete or Noisy Data – Data Import Formats (XES, CSV, JSON).		
UNIT- III	**Process Discovery Techniques**	**9**
Alpha Miner – Heuristic Miner – Inductive Miner – Comparison of Discovery Algorithms – Strengths and Limitations – Visualization of Process Models (Petri Nets, BPMN).		
UNIT-IV	**Conformance Checking and Performance Analysis**	**9**
Conformance Checking: Alignments, Token Replay, Deviations – Fitness, Precision, Generalization, and Simplicity Metrics. Performance Analysis: Bottleneck Analysis – Throughput Times – Resource Utilization – KPI Analysis.		
UNIT-V	**Tools, Applications and Future Directions**	**9**
Process Mining Tools: ProM, Celonis, Disco – Hands-on with Tools – Integrating Process Mining with Machine Learning & AI – Case Studies in Healthcare, Finance, Manufacturing, IT Services – Challenges and Future Trends in Process Mining.		

Total Instructional hours: 45

Approved by BoS Chairman

Course Outcomes : Students will be able to	
CO1	Understand the fundamental concepts and applications of Process Mining.
CO2	Extract and preprocess event log data for process analysis.
CO3	Apply process discovery techniques to identify business process models.
CO4	Evaluate process conformance and perform performance analysis.
CO5	Use process mining tools for real-world applications and explore research trends.
Text Books	
1.	Wil van der Aalst, "Process Mining: Data Science in Action", 2nd Edition, Springer, 2016.
2.	Rojas, Edison, "Process Mining Techniques in Business Environments", Springer, 2020.
3.	Wil van der Aalst, "Process Mining Manifesto", Springer Lecture Notes in Business Information Processing, 2011.
Reference Books	
1.	Wil van der Aalst, "Data Science in Action", Springer, 2016.
2.	Celonis Academic Alliance Learning Resources, https://www.celonis.com/academic-alliance
3.	IEEE Task Force on Process Mining, https://www.tf-pm.org/
4	Coursera Course: "Process Mining: Data Science in Action" by Eindhoven University of Technology. https://promtools.org/ https://fluxicon.com/disco/

Approved by BoS Chairman

B.E./ B.Tech	B23CBE911 - DEEP LEARNING FOR BUSINESS SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of artificial intelligence and machine learning in business contexts
2.	To introduce neural networks and deep learning architectures for business applications
3.	To understand computer vision techniques for business process automation
4.	To acquire skills in natural language processing for business intelligence and customer service
5.	To introduce deployment strategies and MLOps practices for business-ready AI systems

UNIT- I	AI/ML Fundamentals & Business Applications	9
Introduction to Artificial Intelligence and Machine Learning: History - Types of Learning (Supervised, Unsupervised, Reinforcement) - Business Use Cases - Data Preprocessing and Feature Engineering - Business Intelligence: Introduction to Business Analytics - KPIs and Metrics - Data-Driven Decision Making - ROI Analysis - Ethics in AI for Business - Bias Detection and Mitigation		
UNIT- II	**Neural Networks & Deep Learning Architectures**	**9**
Neural Network Fundamentals: Perceptron - Multi-layer Perceptrons - Activation Functions - Backpropagation - Loss Functions - Optimization Algorithms (SGD, Adam, RMSprop) - Deep Learning Architectures: Convolutional Neural Networks (CNNs) - Recurrent Neural Networks (RNNs) - Long Short-Term Memory (LSTM) - Transformer Architecture - Transfer Learning for Business Applications		
UNIT- III	**Computer Vision for Business Operations**	**9**
Image Processing Fundamentals - Object Detection and Recognition - Optical Character Recognition (OCR) for Document Processing - Quality Control and Defect Detection - Facial Recognition for Security Systems - Medical Image Analysis - Retail Analytics: Customer Behavior Analysis - Inventory Management through Computer Vision - Autonomous Systems in Manufacturing		
UNIT- IV	**Natural Language Processing & Business Intelligence**	**9**
Text Processing and Analysis - Sentiment Analysis for Customer Feedback - Chatbots and Virtual Assistants - Named Entity Recognition - Document Classification - Machine Translation for Global Business - Text Summarization - Social Media Analytics - Customer Service Automation - Voice Recognition Systems		
UNIT- V	**MLOps & Business System Integration**	**9**
Model Development Lifecycle - Version Control for ML Models - Data Pipeline Management - Model Training and Validation - Hyperparameter Tuning - Cloud Platforms: AWS, Azure, Google Cloud ML Services - Model Deployment Strategies - API Development for ML Models - Monitoring and Maintenance - A/B Testing - Performance Metrics - Scalability and Cost Optimization - Developer Communities: Kaggle - GitHub ML Projects - Stack Overflow - MLOps Communities		

Approved by BoS Chairman

Total Instructional hours: 45

Course Outcomes :Students will be able to	
CO1	Understand AI/ML fundamentals and apply data preprocessing techniques for business analytics and decision-making processes
CO2	Design and implement neural network architectures suitable for specific business problem domains and applications
CO3	Apply computer vision techniques to automate business processes and enhance operational efficiency
CO4	Build NLP applications for customer service automation, business intelligence, and text analytics solutions
CO5	Deploy and maintain machine learning models in production environments using MLOps practices and cloud platforms
Text Books	
1.	Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press, 2016
2.	Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O'Reilly Media, 2019
3.	Foster Provost and Tom Fawcett, "Data Science for Business", O'Reilly Media, 2013
Reference Books	
1.	François Chollet, "Deep Learning with Python", 2nd Edition, Manning Publications, 2021.
2.	Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning", 3rd Edition, Packt Publishing, 2019
3.	Chip Huyen, "Designing Machine Learning Systems", O'Reilly Media, 2022
4	https://www.tensorflow.org/tutorials

Approved by BoS Chairman

B.E./ B.Tech	B23CBE912 - BIGDATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand big data.
2.	To learn and use NoSQL big data management.
3.	To learn mapreduce analytics using Hadoop and related tools.
4.	To work with map reduce applications.
5.	To understand the usage of Hadoop related tools for Big Data Analytics.

UNIT- I	Understanding Big Data	9
Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.		
UNIT- II	**NOSQL Data Management**	**9**
Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients.		
UNIT- III	**Map Reduce Applications**	**9**
MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.		
UNIT- IV	**Basics Of Hadoop**	**9**
Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration.		
UNIT- V	**Hadoop Related Tools**	**9**
Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.		

Total Instructional hours: 45

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Course Outcomes :Students will be able to	
CO1	Describe big data and use cases from selected business domains.
CO2	Explain NoSQL big data management.
CO3	Install, configure, and run Hadoop and HDFS.
CO4	Perform map-reduce analytics using Hadoop.
CO5	Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.
Text Books	
1.	Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2.	Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3.	Sadalage, Pramod J. “NoSQL distilled”, 2013.
Reference Books	
1.	E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2.	Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3.	Big Data Computing (NPTEL) - https://onlinecourses.nptel.ac.in/noc20_cs92/preview
4	Big Data Analytics (Coursera) - https://www.coursera.org/learn/big-data-analytics-1

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B.E./ B.Tech	B23CBE913 - MARKETING AND SOCIAL MEDIA WEB ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of marketing analytics and performance measurement.
2.	To learn concepts of community building and social media management.
3.	To explore social media policies, privacy, and ethical considerations.
4.	To acquire skills in web analytics, KPI tracking, and reporting.
5.	To understand search analytics, SEO, and user engagement metrics.

UNIT- I	Marketing Analytics	9
Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis.		
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 Basics of Tracking Social Media.		
UNIT- IV	**Web Analytics**	**9**
Data Collection, Overview - Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of Successful Web Analytics Strategy, Web Data Analytics.		
UNIT- V	**Search Analytics**	**9**
Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization.		

Total Instructional hours: 45

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Course Outcomes :Students will be able to	
CO1	Understand and apply marketing analytics techniques for performance measurement.
CO2	Build and manage online communities using social media platforms.
CO3	Evaluate social media policies, privacy issues, and ethical considerations..
CO4	Analyze web data using KPIs, reports, and web analytics tools.
CO5	Apply search analytics techniques including SEO, user engagement, and traffic analysis.
Text Books	
1.	K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013.
2.	Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014.
3.	Bittu Kumar, Social Networking, V & S Publishers, 2013.
Reference Books	
1.	Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007.
2.	Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004.
3.	Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016.
4	Marketing Analytics (NPTEL) - https://onlinecourses.nptel.ac.in/noc20_mg30/preview
5	Introduction to Social Media Analytics (Coursera) - https://www.coursera.org/learn/social-media-analytics-introduction

Approved by BoS Chairman

B.E./ B.Tech	B23CBE914 -RISK ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To develop a basic understanding of risk assessment and its role within the risk management process.
2.	To understand risk assessment and its role within the risk management process.
3.	To differentiate between risk assessment and risk management.
4.	To develop a basic understanding of how to conduct and evaluate an uncertainty analysis for a risk assessment.

UNIT- I	Introduction	9
Introduction, Fundamentals of Risk- Risk Planning, Assessment and Management Process and the Systems Approach-Types of Risk Assessment- Risk, Hazard, Performance and Engineering Risk Assessment.		
UNIT- II	**Risk Identification**	**9**
Preliminary Hazard Analysis (PHA), Hazards and Operability Analysis (HAZOP) - Job Safety Analysis (JSA) - Failure Modes and Effects Analysis (FMEA)- Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Decision Trees- Cause-Consequence Analysis (CCA).		
UNIT- III	**Credit and Market Risk Analytics**	**9**
Credit Risk Analysis: Credit risk fundamentals and credit scoring models - Probability of Default (PD), Loss Given Default (LGD), Exposure at Default (EAD) - Credit portfolio models - CreditMetrics, KMV model - Credit derivatives and credit risk mitigation - Retail vs. corporate credit risk assessment. Market Risk Management: Interest rate risk and duration analysis - Foreign exchange risk and hedging strategies - Equity risk and portfolio optimization - Commodity risk assessment - Options and derivatives in risk management - Market risk capital calculation.		
UNIT- IV	**Risk Prioritization & Treatment**	**9**
Risk Probability and Impact Assessment, Risk Index and Risk Ranking - – Risk Matrix, EV Analysis, Sensitivity and Tradeoff Analysis, Modeling and Simulation- Risk Attitude and Risk Tolerance, As Low As Reasonably Practicable (ALARP)- Avoidance, Separation, Reduction, Transfer, Acceptance- Detection, Control, Response and Recovery- Performance Monitoring.		
UNIT- V	**Risk Analytics Tools and Applications**	**9**
ISO3100, Quality and Reliability- Supply Chain Risk Management- Project Risk ManagementPositive Risk/ Opportunities Management- Risk and TOC. Industry Applications: Banking sector risk management - ICAAP, ILAAP - Insurance risk analytics - underwriting, pricing, reserving - Investment management risk analytics - Corporate risk management frameworks - Fintech and digital banking risk considerations - ESG risk assessment and climate risk modeling.		

Total Instructional hours: 45

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Course Outcomes :Students will be able to	
CO1	Identify the core types of project risks.
CO2	Use qualitative and quantitative risk assessment methods.
CO3	Competently use risk simulation techniques.
CO4	Use risk analysis tools/methods and work in a group to create a risk management plan based on the ISO 31000:2009.
CO5	Identify a range of risk management issues/challenges and the risks as complex systems cascade and be competent to initiate potential actions in response.
Text Books	
1.	Marvin Rausand Stein Haugen , Risk Assessment: Theory, Methods, and Applications, Wiley, 2020.
2.	Mohammad Modarres , Risk Analysis in Engineering Techniques, Tools, and Trends, CRC Press, 2006.
Reference Books	
1.	Safety and Risk Analytics (IIT Kharagpur) - https://onlinecourses.nptel.ac.in/noc22_mg55/preview
2.	Introduction to Risk Management (Part of Risk Management Specialization) - https://www.coursera.org/learn/introduction-to-risk-management
3.	Risk Management Specialization (New York Institute of Finance) - https://www.coursera.org/specializations/risk-management

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B.E./ B.Tech	B23CBE915-BUSINESS ETHICS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the foundations, principles, and importance of Business Ethics in organizational settings.
2.	To analyze ethical dilemmas and apply decision-making frameworks to resolve them effectively.
3.	To explore the concepts, models, and practices of Corporate Social Responsibility (CSR) and Sustainability.
4.	To study the frameworks and guidelines for Corporate Sustainability and Governance.
5.	To apply business ethics, CSR, and governance concepts to real-world case studies and organizational practices.

UNIT-I	Business Ethics	9
Business Ethics: Characteristics, Principles, Types, Importance, Factors highlighting the importance of Business Ethics, Myths about Business Ethics. Ethical Values, Theories of Ethics, Absolutism versus Relativism, Teleological approach, the Deontological approach, Kohlberg's six stages of moral development (CMD), Code of Ethics.Business Ethics and Social Responsibilities of the firm – relationship of the firms with customers, competitors, stockholders, dealers, and suppliers. Ethics versus Ethos, Indian versus Western Management, Globalisation and Business Ethics. Emerging issues of Business Ethics.		
UNIT-II	**Ethical Dilemmas and Functional Ethics**	**9**
Ethical Dilemma: Characteristics, ethical decision making, ethical reasoning, the dilemma resolution process. Ethical Considerations in Marketing, Ethics in Accounting and Finance, Ethical Implications at Top Level. Ethical Considerations in Human Resource Management, Environmental Ethics. Note: Relevant case studies regarding ethical issues in Marketing, HRM, Accounting and Finance, and Environmental Management should be discussed in the class.		
UNIT-III	**Corporate Social Responsibility (CSR): Foundations**	**9**
Corporate Social Responsibility: Concept, Definition, Need, Arguments in favour of and against CSR. Historical Phases of CSR, Perspectives of CSR. Models of CSR, Drivers of CSR. Corporate Governance, Business Ethics and CSR.		
UNIT-IV	**Corporate Social Responsibility and Sustainability**	**9**
Corporate Social Responsibility and Corporate Sustainability: Meaning, Need and importance of Sustainability. Sustainability Case Studies – Triple Bottom Line (TBL). Corporate Sustainability Reporting Frameworks – Global Reporting Initiative (GRI) Guidelines, National Voluntary Guidelines on Social, Environmental and Economic Responsibilities of Business.		
UNIT-V	**CSR Practices and Corporate Governance**	**9**

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Corporate Social Responsibility within the organisation, CSR and Society, Strategic Planning and CSR, Environmental Aspects of CSR, CSR under the Companies Act, 2013. CSR Practices in India, Case Studies of Major CSR Initiatives. Corporate Governance: Introduction, Need, Models.

Total Instructional hours: 45

Course Outcomes: Students will be able to	
CO1	Apply contemporary Ethics & Governance issues in a business context.
CO2	Analyze and apply ethics to contemporary business practices.
CO3	Analyze key perspectives on corporate social responsibility and their application.
CO4	Evaluate different corporate ownership structures and their key governance features.
CO5	Understand the ethical decision making, ethical reasoning, the dilemma resolution process.
Text Books	
1.	Crane, Andrew & Matten, Dirk, *Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalization*, Oxford University Press, 2016.
2.	Fernando, A.C., *Business Ethics and Corporate Governance*, Pearson Education, 2019.
3.	Carroll, Archie B. & Buchholtz, Ann K., *Business and Society: Ethics, Sustainability, and Stakeholder Management*, Cengage Learning, 2014.
Reference Books	
1.	Fernando, A. C. (2010). Business Ethics and corporate governance. Pearson Education.
2.	Velasuez, M. G. (2011). Business Ethics: Concepts and Cases.. PHI Learning.
3.	Gosh, B. N. (2009). Business Ethics and Corporate Governance. Tata McGraw Hill. T
4	Thomas M. Garrett - Business Ethics - The times of India Press Bombay.

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B.E./ B.Tech	B23CBE916-DATA SECURITY FOR BUSINESS SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of Information Security
2.	To know the legal, ethical and professional issues in Information Security
3.	To equip the students' knowledge on digital signature, email security and web security

UNIT-I	Introduction to Data Security in Business Systems	9
History and Evolution of Data Security – Importance in Business Context – Critical Characteristics of Information (Confidentiality, Integrity, Availability, Authenticity, Accountability) – NSTISSC Security Model – Components of a Business Information System – Securing Organizational Assets – Balancing Security and Accessibility – System Development Life Cycle (SDLC) – Security SDLC in Business Systems.		
UNIT-II	**Threats, Risks and Security Policies**	**9**
Business Needs for Security – Types of Threats and Attacks (Insider Threats, Social Engineering, Malware, Cyber Espionage) – Legal, Ethical and Professional Issues in Business Security – Access Control Models and Matrix – Security Policies in Business: Confidentiality Policies, Integrity Policies, Hybrid Policies – Case Studies of Corporate Security Failures.		
UNIT-III	**Authentication and Digital Security Mechanisms**	**9**
Digital Signatures: Concepts, Schemes, Standards, Variants – Mechanisms of Business System Authentication – Requirements, Protocols, Applications – Business System Authentication Frameworks – Kerberos – Directory Services X.509 – Role-Based Authentication in Business Organizations – Multi-Factor Business System Authentication.		
UNIT-IV	**Secure Business Communication**	**9**
E-mail Security in Organizations: Architecture, PGP, S/MIME – Key Management and Trust Models – IP Security for Enterprises: Overview, Architecture, Authentication Header (AH), Encapsulating Security Payload (ESP) – IPSec Modes – Security Association – Business Applications of VPNs and Secure IP Channels.		
UNIT-V	**Web and Transaction Security in Business Systems**	**9**
Web Security Needs – Transport Layer Security (TLS) and Secure Sockets Layer (SSL) in E-Business – SSL/TLS Protocols – SET: Secure Electronic Transactions – SET Processing, DS Verification, Entities – Online Banking, Cloud-Based Business Applications, and E-Commerce Security – Business Web Security Case Studies.		

Total Instructional hours: 45

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Course Outcomes: Students will be able to	
CO1	Understand the fundamental principles of data security in business systems.
CO2	Identify threats, risks, and ethical considerations in business information security..
CO3	Apply digital signature schemes and authentication mechanisms in organizational contexts..
CO4	Implement secure communication protocols for email, IP-based systems, and enterprise networks.
CO5	Analyze and apply web and transaction security mechanisms in real-world business environments.
Text Books	
1.	William Stallings, *Cryptography and Network Security: Principles and Practice*, 8th Edition, Pearson, 2023.
2.	Fernando, A.C., *Business Ethics and Corporate Governance*, Pearson Education, 2019.
3.	Nina Godbole & Sunit Belapure, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley, 2017.
Reference Books	
1.	Charles P. Pfleeger & Shari Lawrence Pfleeger, *Security in Computing*, Prentice Hall, 5th Edition, 2015
2.	William Stallings & Lawrie Brown, *Computer Security: Principles and Practice*, Pearson, 4th Edition, 2018.
3.	Whitman, Michael E. &Mattord, Herbert J., *Principles of Information Security*, Cengage, 6th Edition, 2021.
4	Harold F. Tipton, Micki Krause Nozaki,, “Information Security Management Handbook, Volume 6, 6th Edition, 2016.

Approved by BoS Chairman

PROFESSIONAL ELECTIVE VERTICAL III

		L	T	P	C

Approved by BoS Chairman

B.E / B.Tech	B23CSE901-AGILE METHODOLOGIES FOR SOFTWARE	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).

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:

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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.

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**

Total Instructional hours: 45

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.

EXCELLENCE BEYOND EXPECTATION KIT COIMBATORE

Approved by BoS Chairman

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)	PSO1 (K4) (A3)	PSO2 (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

PROFESSONAL ELECTIVE

VERTICAL IV

Approved by BoS Chairman

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.

Approved by BoS Chairman

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

Approved by BoS Chairman

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

Approved by BoS Chairman

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

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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

PROFESSONAL ELECTIVE

VERTICAL V

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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

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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,

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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

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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

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.

Approved by BoS Chairman

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

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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.		
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

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

Approved By BoS Chairman

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

Approved by BoS Chairman

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

Professional Elective

Vertical VI

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.

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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.

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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.		

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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		

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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

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Face Recognition - Introduction-Applications of Face Recognition - Process of Face Recognition Deep Face solution by Facebook - FaceNet for Face Recognition-Implementation sing FaceNetGesture Recognition.

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.

Approved By BoS Chairman

Approved By BoS Chairman

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

Approved By BoS Chairman

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.

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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 LearnedKnowledge.

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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

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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.

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.		

Programme Coordinator

BoS Chairman

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

EXCELLENCE BEYOND EDUCATION KIT COIMBATORE

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.

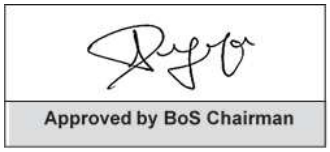
UNIT - IV	UNSUPERVISED LEARNING	9

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.

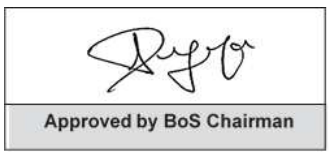
Total Instructional hours: 45



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



B.E / B.Tech	BM23BMO501- PRINCIPLES OF BIOSENSORS	L	T	P	C
		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

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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.

EXCELLENCE BEYOND EDUCATION KIT COIMBATORE

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.

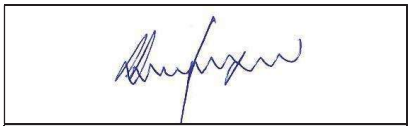
UNIT - IV	MUSHROOM PROCESSING AND VALUE ADDITION	9

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



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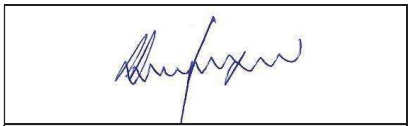
Course Outcomes After the successful completion of the course, the students will be able to,		Knowledge Level
CO1	Illustrate the principles of microbial inoculant production and application.	K2
CO2	Classify the different types of biofertilizers and their impact on soil fertility.	K2
CO3	Explain the cultivation 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.

Approved by BoS Chairman

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.

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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.

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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.

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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.

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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.

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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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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.

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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.

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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

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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.*

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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.

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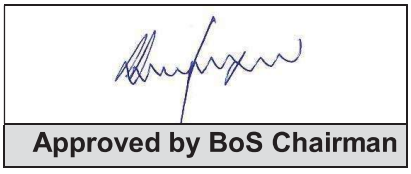
B. Tech.	B23BTO601 – BIOINFORMATICS	L	T	P	C
		3	0	0	3

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



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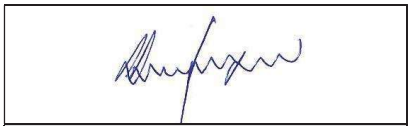
Text Books	
1.	Introduction to Bioinformatics by Arthur K. Lesk, Oxford University Press. ,4th edition 2014
2.	Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press. 1999
3.	Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by R.Durbin, S.Eddy, 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="2">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><td></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	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" 8th 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

Approved by BoS Chairman

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.

EXCELLENCE BEYOND EXPECTATION
KIT
COIMBATORE

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.		

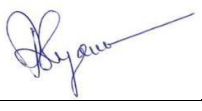
UNIT - IV	INTELLIGENCE AND CREATIVITY	6
Intelligence: Meaning, and types - Theories of Intelligence: Two factor, Thurston's Group factor - Intelligence Quotient (IQ) - Creativity: Concept, factors and process - Strategies for fostering creativity.		

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.



Approved by BoS Chairman

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.

Approved by BoS Chairman

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.

Approved by BoS Chairman

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