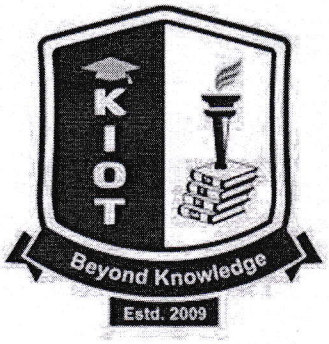
KNOWLEDGE INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, Affiliated to Anna University, Chennai.
Accredited by NBA (CSE, ECE, EEE & MECH), Accredited by NAAC with "A" Grade KIOT Campus, Kakapalayam (PO), Salem – 637 504, Tamil Nadu, India.



B.E. / B.Tech. Regulations 2023

B.E. – Computer Science and Engineering

Semester - VI

Curriculum and Syllabi

(For the Students Admitted from the Academic Year 2023-24 Onwards)

Version: 1.0	**Date:** 15.12.2025

CHAIRPERSON
Board of Studies
Faculty of CSE & IT
Knowledge Institute of Technology
KIOT Campus, Kakapalayam
Salem-637 504

KNOWLEDGE INSTITUTE OF TECHNOLOGY(AUTONOMOUS), SALEM -637504

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Website: www.kiot.ac.in

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B.E. / B.Tech. REGULATIONS 2023 (R 2023)
CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

B.E. COMPUTER SCIENCE AND ENGINEERING

VISION OF THE INSTITUTE
To be a world class institution to impart value and need based professional education to the aspiring youth and carving them into disciplined world class professional who have the quest for excellence, achievement orientation and social responsibilities.

MISSION OF THE INSTITUTE	
A	To promote academic growth by offering state-of-art undergraduate, postgraduate and doctoral programs and to generate new knowledge by engaging in cutting – edge research
B	To nurture talent, innovation, entrepreneurship, all-round personality and value system among the students and to foster competitiveness among students
C	To undertake collaborative projects which offer opportunities for long-term interaction with academia and industry
D	To pursue global standards of excellence in all our endeavors namely teaching, research, consultancy, continuing education and support functions
VISION OF THE DEPARTMENT	
To develop Computer Science engineers and skilled software professionals who can meet evolving industry demands and global challenges along with strong social values.	
MISSION OF THE DEPARTMENT	
M1	To provide **need-based technical education** through appropriate infrastructure, effective teaching and research.
M2	To meet industry requirements through **collaborative projects** on emerging technologies.
M3	To develop Computer Science and Engineering graduates with ethical values, social responsibility, **entrepreneurship skills, leadership and teamwork**.
PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	To enable graduates to pursue Higher Education and Research or have a successful career in industries associated with Computer Science and Engineering, or as Entrepreneurs.
PEO 2	To ensure that graduates will have the ability and attitude to adapt to emerging technological changes.
PEO 3	To acquire leadership skills to perform professional activities with social consciousness. adaptability and lifelong learning

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PROGRAM OUTCOMES (POs)	
Engineering Graduates will be able to:	
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, Resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)	
After the successful completion of B.E. Programme in Computer Science and Engineering, the graduates will able to	
PSO 1	Analyse large volume of data and make business decisions to improve efficiency with different algorithms and tools.
PSO 2	Have the capacity to develop web and mobile applications for real time scenarios.
PSO 3	Provide automation and smart solutions in various forms to the society with Internet of Things.

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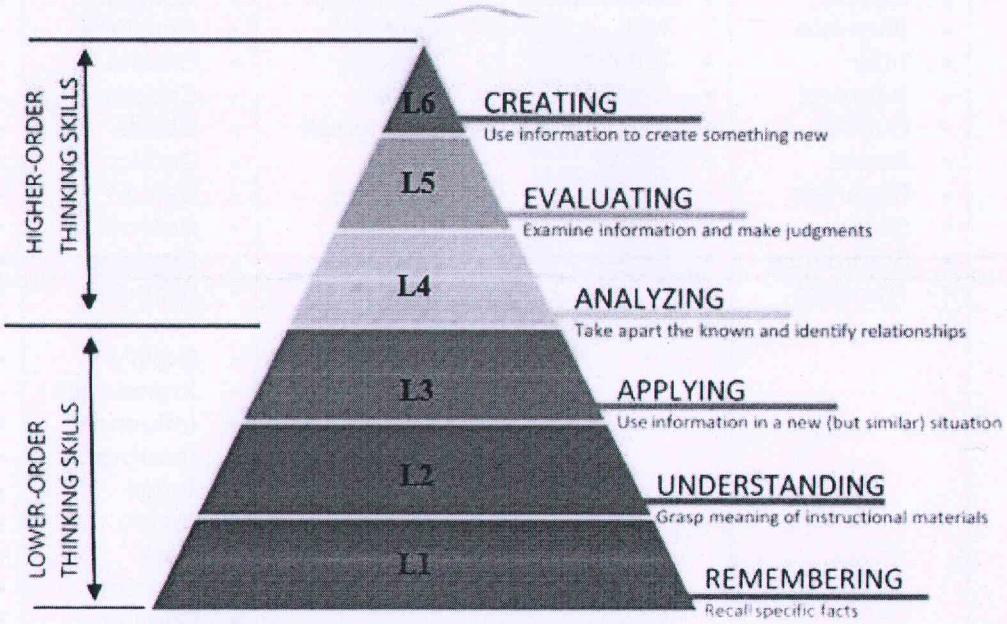
BLOOM'S TAXONOMY LEVELS AND ACTION VERBS

(A) BLOOM'S TAXONOMY LEVELS (BTL):

Bloom's Taxonomy (BT) is based on the belief that learners must first acquire basic foundational knowledge about a subject before progressing to more complex types of thinking, such as analysis and evaluation. Bloom's Taxonomy levels help faculty to guide students through the learning process, from fundamental remembering and understanding to more complex evaluating and creating.



At KIOT, Curriculum Design, Delivery and Assessment (CDDA) are carried out based on the Blooms' Taxonomy Levels (BTL). Its organized set of objectives helps teachers to plan and deliver appropriate instruction, design valid assessment tasks and schemes, and ensure that instruction and assessment are aligned with the objectives.

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(B) BLOOM'S TAXONOMY ACTION VERBS

I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing new Solutions.
• Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why	• Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate	• Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize	• Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme	• Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value	• Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory

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KNOWLEDGE INSTITUTE OF TECHNOLOGY (AUTONOMOUS), SALEM - 637504												
B.E. COMPUTER SCIENCE AND ENGINEERING											Version: 1.4	
Courses of Study and Scheme of Assessment (Regulations 2023)											Date: 15.12.25	
Sl. No.	Course Code	Course Title	Periods / Week						Maximum Marks			
			CAT	CP	L	T	P	C	IA	ESE	Total	
SEMESTER I												
1	BE23IP001	Induction Programme	IP	80	60	-	20	NC	-	-	-	
	THEORY											
2	BE23EN101	Communicative English - I	HS	2	1	1	0	2	40	60	100	
3	BE23MA201	Calculus for Engineers	BS	3	2	1	0	3	40	60	100	
4	BE23PH201	Basics and Applied Physics	BS	3	3	0	0	3	40	60	100	
5	BE23CY201	Engineering Chemistry	BS	3	3	0	0	3	40	60	100	
6	BE23GE301	Overview of Engineering and Technology	ES	3	3	0	0	3	40	60	100	
7	BE23MC901	தமிழர் மரபு / Heritage of Tamils	MC	1	1	0	0	1	40	60	100	
	THEORY CUM PRACTICAL											
8	BE23GE307	Problem Solving using C Programming	ES	5	3	0	2	4	50	50	100	
	PRACTICAL											
9	BE23BS201	Physics and Chemistry Laboratory	BS	4	0	0	4	2	60	40	100	
10	BE23GE305	Engineering Practices Laboratory	ES	4	0	0	4	2	60	40	100	
	EMPLOYABILITY ENHANCEMENT											
11	BE23PT801	Human Excellence and Value Education - I	EEC	2	1	0	1	NC	100	-	100	
Total				**30**	**17**	**2**	**11**	**23**	**510**	**490**	**1000**	
SEMESTER II												
	THEORY											
1	BE23EN102	Communicative English – II	HS	2	1	1	0	2	40	60	100	
2	BE23MA202	Vector Calculus and Numerical Methods	BS	3	2	1	0	3	40	60	100	
3	BE23GE304	Engineering Graphics and Network Drawings	ES	5	1	0	4	3	40	60	100	
4	BE23CS401	Digital Principles and Computer Organization	PC	3	3	0	0	3	40	60	100	
5	BE23MC902	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	MC	1	1	0	0	1	40	60	100	
6	BE23MC903	Universal Human Values and Ethics	MC	3	2	1	0	3	40	60	100	
	THEORY CUM PRACTICAL											
7	BE23GE310	Object Oriented Programming using C++	ES	5	3	0	2	4	50	50	100	
	PRACTICAL											
8	BE23GE311	Design Thinking	ES	4	0	0	4	2	100	-	100	
	EMPLOYABILITY ENHANCEMENT											
9	BE23PT802	Human Excellence and Value Education – II	EEC	2	1	0	1	NC	100	-	100	
10	BE23PT804	Engineering Clinic – I	EEC	2	0	0	2	1	100	-	100	
11	BE23PT806	Aptitude Skills – I	EEC	1	0	0	1	0.5	100	-	100	
Total				**31**	**14**	**3**	**14**	**22.5**	**690**	**410**	**1100**	

w.e.f. 22/12/2025
Passed in BoS Meeting held on 09/12/2025
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Sl. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
SEMESTER III											
	THEORY										
1	BE23MA203	Discrete Mathematics	BS	3	2	1	0	3	40	60	100
	THEORY CUM PRACTICAL										
2	BE23CS402	Computer Networks	PC	5	2	1	2	4	50	50	100
3	BE23CS403	Python for Data Science	PC	5	2	1	2	4	50	50	100
4	BE23CS404	Data Structures and Algorithms	PC	5	2	1	2	4	50	50	100
5	BE23CS405	Database Management System	PC	5	2	1	2	4	50	50	100
6	BE23CS406	Operating Systems	PC	5	2	1	2	4	50	50	100
	PRACTICAL										
7	BE23EN103	Professional Communication Laboratory – I	HS	2	0	0	2	1	60	40	100
	EMPLOYABILITY ENHANCEMENT										
8	BE23PT805	Engineering Clinic – II	EEC	2	0	0	2	1	100	-	100
9	BE23PT807	Aptitude Skills – II	EEC	1	0	0	1	0.5	100	-	100
Total				**33**	**12**	**6**	**15**	**25.5**	**550**	**350**	**900**
SEMESTER IV											
	THEORY										
1	BE23MA206	Mathematics for Business Analytics	BS	3	2	1	0	3	40	60	100
2	BE23CS407	Design and Analysis of Algorithms	PC	3	2	1	0	3	40	60	100
3	BE23CS408	Microprocessor and Microcontroller	PC	3	2	1	0	3	40	60	100
4	BE23MC904	Environmental Science and Sustainability	MC	2	2	0	0	NC	100	-	100
	THEORY CUM PRACTICAL										
5	BE23CS315	Java Programming	ES	5	2	1	2	4	50	50	100
6	BE23CS409	Foundations of Artificial Intelligence and Machine Learning	PC	5	2	1	2	4	50	50	100
7	BE23XX5XX	Professional Elective – I	PE	4	2	0	2	3	50	50	100
	PRACTICAL										
8	BE23EN104	Professional Communication Laboratory – II	HS	2	0	0	2	1	60	40	100
	EMPLOYABILITY ENHANCEMENT										
9	BE23PT808	Aptitude Skills – III	EEC	1	0	0	1	0.5	100	-	100
Total				**28**	**14**	**5**	**9**	**21.5**	**530**	**370**	**900**

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B.E. COMPUTER SCIENCE AND ENGINEERING											
Courses of Study and Scheme of Assessment (Regulations 2023)											
Sl. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
SEMESTER V											
	THEORY										
1	BE23XX6XX	Open Elective - I**	OE	3	2	1	0	3	40	60	100
2	BE23AC905	Indian Constitution	AC	2	2	0	0	NC	100	-	100
3	BE23MC906	Entrepreneurship and Start-ups	PW	3	2	1	0	NC	100	-	100
	THEORY CUM PRACTICAL										
4	BE23CS410	C# and Dot NET	PC	5	2	1	2	4	50	50	100
5	BE23CS411	Object Oriented Software Engineering	PC	5	2	1	2	4	50	50	100
6	BE23CS412	Embedded Systems and IoT	PC	5	2	1	2	4	50	50	100
7	BE23XX5XX	Professional Elective – II	PE	4	2	0	2	3	50	50	100
8	BE23XX5XX	Professional Elective – III	PE	4	2	0	2	3	50	50	100
	PRACTICAL										
9	BE23PW701	Make-A-Product – Phase I*	PW	1	0	0	1	NC	-	-	-
	EMPLOYABILITY ENHANCEMENT										
10	BE23PT809	Aptitude Skills – IV	EEC	1	0	0	1	0.5	100	-	100
11	BE23PT810	Coding Skills – I	EEC	2	0	0	2	1	100	-	100
12	BE23PT812	Technical Comprehension and Mock Interview – I	EEC	1	0	0	1	0.5	100	-	100
Total				**36**	**16**	**5**	**15**	**23**	**790**	**310**	**1100**
SEMESTER VI											
	THEORY										
1	BE23CS413	Mobile Application Design and Development	PC	3	2	1	0	3	40	60	100
2	BE23CS414	Automata Theory and Compiler Design	PC	3	2	1	0	3	40	60	100
3	BE23XX6XX	Open Elective – II**	OE	3	2	1	0	3	40	60	100
4	BE23MC907	Disaster Management and Preparedness	MC	2	2	0	0	NC	100	-	100
	THEORY CUM PRACTICAL										
5	BE23CS415	Cryptography and Cybersecurity	PC	5	2	1	2	4	50	50	100
6	BE23XX5XX	Professional Elective – IV	PE	4	2	0	2	3	50	50	100
7	BE23XX5XX	Professional Elective – V	PE	4	2	0	2	3	50	50	100
	PRACTICAL										
8	BE23PW702	Make-A-Product – Phase II	PW	2	0	0	2	1	100	-	100

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B.E. COMPUTER SCIENCE AND ENGINEERING												
Courses of Study and Scheme of Assessment (Regulations 2023)												
Sl. No.	**Course Code**	**Course Title**	**Periods / Week**						**Maximum Marks**		
			CAT	**CP**	**L**	**T**	**P**	**C**	**IA**	**ESE**	**Total**
	EMPLOYABILITY ENHANCEMENT										
9	BE23PT803	Human Excellence and Value Education – III	EEC	2	1	0	1	NC	100	-	100
10	BE23PT811	Coding Skills – II	EEC	2	0	0	2	1	100	-	100
11	BE23PT813	Technical Comprehension and Mock Interview – II	EEC	1	0	0	1	0.5	100	-	100
Total				**31**	**15**	**4**	**12**	**21.5**	**770**	**330**	**1100**
	SEMESTER VII										
	THEORY										
1	BE23HS105	Project Management and Finance	HS	3	2	1	0	3	40	60	100
2	BE23XX6XX	Open Elective – III**	OE	3	2	1	0	3	40	60	100
	THEORY CUM PRACTICAL										
3	BE23CS416	Data Warehousing and Data Mining	PC	5	2	1	2	4	50	50	100
4	BE23XX5XX	Professional Elective – VI	PE	4	2	0	2	3	50	50	100
	PRACTICAL										
5	BE23CS702	Project Work – Phase I	PW	2	0	0	2	1	100	-	100
	EMPLOYABILITY ENHANCEMENT										
6	BE23PT814	Industrial Training/ Entrepreneurship/ Undergraduate Research Activity/ Company Certification	EEC	6	0	0	6	3	100	-	100
Total				**23**	**8**	**3**	**12**	**17**	**380**	**220**	**600**
SEMESTER VIII											
	PRACTICAL										
1	BE23CS703	Project Work – Phase II	PW	18	0	0	18	9	60	40	100
Total				**18**	**0**	**0**	**18**	**9**	**60**	**40**	**100**
			Total Number of Credits: 163								

*The course will be considered for grading in semester VI only.

**Student shall choose a course from the list of open electives offered by other departments or from emerging technology verticals including online courses with prior approval.

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SEMESTER-WISE CREDITS DISTRIBUTION

SUMMARY											
Sl. No.	Course Category	Credits per Semester								Credits	Credit %
		I	II	III	IV	V	VI	VII	VIII		
1	HS	2	2	1	1	-	-	3	-	9	6
2	BS	11	3	3	3	-	-	-	-	20	12
3	ES	9	9	-	4	-	-	-	-	22	13
4	PC	-	3	20	10	12	10	4	-	59	36
5	PE	-	-	-	3	6	6	3	-	18	11
6	OE	-	-	-	-	3	3	3	-	9	6
7	PW	-	-	-	-	✓	1	1	9	11	7
8	EEC	✓	1.5	1.5	0.5	2	1.5	3	-	10	6
9	MC/NC/AC	1	4	-	✓	✓	✓	-	-	5	3
	Total	**23**	**22.5**	**25.5**	**21.5**	**23**	**21.5**	**17**	**9**	**163**	**100**

CAT	Category of Course	IP	Induction Programme	OE	Open Elective Courses
CP	Contact Period	HS	Humanities, Social Sciences and Management Courses	PW	Project Work Courses
L	Lecture Period	BS	Basic Science Courses	EEC	Employability Enhancement Courses
T	Tutorial Period	ES	Engineering Science Courses	MC/ NC/ AC	Mandatory Courses/Non-Credit Courses/Audit Courses
P	Laboratory Period	PC	Professional Core Courses	IA	Internal Assessment
C	Credits	PE	Professional Elective Courses	ESE	End Semester Examination

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

Professional Elective	VERTICAL - 1 Java Full Stack	VERTICAL - 2 Agile Methodology with DevOps Programming	VERTICAL - 3 Cybersecurity	VERTICAL - 4 Data Analytics and AI	VERTICAL - 5 Transformative AI and Business Analytics	VERTICAL - 6 Business Process Automation	VERTICAL - 7 Java Automation	VERTICAL - 8 Integrated Software System Design	VERTICAL - 9 CRM with Business Intelligence	VERTICAL - 10 IT Infrastructure Management	Diversified Courses
1	Fundamentals of Web Development	Cloud Fundamentals and DevOps	Foundations of Cybersecurity	Foundations of Data Engineering	Recommender System	Fundamentals of IT Service Management	Fundamentals of Web Development	Web Development Foundations	Customer Relationship Management System Administration	IT Infrastructure Fundamentals	Knowledge Engineering
2	Frontend Technologies	Agile with DevOps fundamentals and usage	Static Malware Analysis	Advanced Machine Learning	Advanced Machine Learning	Custom Application Development	Testing Fundamentals and Manual Testing	System Design	Customer Relationship Management System Development	IT Automation using Python for Infra	Data Exploration and Visualization
3	Java 8 and Advanced Java Features	Agile based Project Automation with DevOps	Dynamic Malware Analysis	Exploratory Data Analytics and Visualization	JAVA Script	IT Service Management Practices	Automation Testing with Selenium	Competitive Coding	API Integration Platform	Server Administration	Foundations of Digital and Social Media Marketing
4	Backend Development with Java	DevOps container services	Fundamentals of Malware Reverse Engineering	Deep Learning Techniques	Computer Vision	IT Operation Management	Advanced Testing with TestNG and CI/CD	Frontend Design and Development	Business Intelligence and Analytics	Storage and Backup Technologies Program	Fundamentals of Robotic Process Automation
5	Full Stack Development and Deployment	CI and CD (Continuous Integration and Continuous Development)	Malware Injection and Evasion Techniques	Natural Language Processing	Natural Language Processing	Automation for Digital Creators	Tools for Automated Testing	Backend Engineering and Deployment Practices	Artificial Intelligence in Data Modeling	Cloud Infrastructure Essentials	Cloud Computing
6	DevOps and Cloud Basics	Introduction to Azure and AWS DevOps	Android Malware Analysis	Large Language Models and AI agents	Large Language Models and AI Agents	IT Asset Management	Performance and Database Testing	AI and ML Foundations with Prompt Engineering and RAG Systems	Intelligent System Development	IT Service Management and Infra Operations	Cloud Services Management

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7	Quality Engineering and Full Stack Integration	IT World Essentials	Windows Operating System Security	AI for IoT	AI for IoT	Customer Workflow	API Testing and Automation	-	Data Visualization Techniques	Information Storage and Management	Foundations of Recommender Systems
8	Secure Rest API Development	Critical and Design Thinking Skills	Windows Threats and Defense Techniques	Intelligent Process Automation	Intelligent Process Automation	Employee Workflow	Testing using AI and ML Tools	-	Enterprise Resource Planning	Security Governance, Risk and Compliance	Fundamentals of Blockchain

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered during semesters IV, V, VI and VII depending on the programme of study. These courses are organized into verticals, each represents a specific area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a single vertical or select from multiple verticals, provided the necessary prerequisites for each course are satisfied.

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: JAVA FULL STACK

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23CS501	Fundamentals of Web Development	PE	4	2	0	2	3	50	50	100
2	BE23CS502	Frontend Technologies	PE	4	2	0	2	3	50	50	100
3	BE23CS503	Java 8 and Advanced Java Features	PE	4	2	0	2	3	50	50	100
4	BE23CS504	Backend Development with Java	PE	4	2	0	2	3	50	50	100
5	BE23CS505	Full Stack Development and Deployment	PE	4	2	0	2	3	50	50	100
6	BE23CS506	DevOps and Cloud Basics	PE	4	2	0	2	3	50	50	100
7	BE23CS507	Quality Engineering and Full Stack Integration	PE	4	2	0	2	3	50	50	100
8	BE23CS508	Secure Rest API Development	PE	4	2	0	2	3	50	50	100

VERTICAL 2: AGILE METHODOLOGY WITH DEVOPS PROGRAMMING

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23CS511	Cloud Fundamentals and DevOps	PE	4	2	0	2	3	50	50	100
2	BE23CS512	Agile with DevOps Fundamentals and Usage	PE	4	2	0	2	3	50	50	100
3	BE23CS513	Agile based Project Automation with DevOps	PE	4	2	0	2	3	50	50	100
4	BE23CS514	DevOps Container Services	PE	4	2	0	2	3	50	50	100
5	BE23CS515	CI and CD (Continuous Integration and Continuous Development)	PE	4	2	0	2	3	50	50	100
6	BE23CS516	Introduction to Azure and AWS DevOps	PE	4	2	0	2	3	50	50	100
7	BE23CS517	IT World Essentials	PE	4	2	0	2	3	50	50	100
8	BE23CS518	Critical and Design Thinking Skills	PE	4	2	0	2	3	50	50	100

VERTICAL 3: CYBERSECURITY

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23IT521	Foundations of Cybersecurity	PE	4	2	0	2	3	50	50	100
2	BE23IT522	Static Malware Analysis	PE	4	2	0	2	3	50	50	100
3	BE23IT523	Dynamic Malware Analysis	PE	4	2	0	2	3	50	50	100
4	BE23IT524	Fundamentals of Malware Reverse Engineering	PE	4	2	0	2	3	50	50	100
5	BE23IT525	Malware Injection and Evasion Techniques	PE	4	2	0	2	3	50	50	100

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6	BE23IT526	Android Malware Analysis	PE	4	2	0	2	3	50	50	100
7	BE23IT527	Windows Operating System Security	PE	4	2	0	2	3	50	50	100
8	BE23IT528	Windows Threats and Defense Techniques	PE	4	2	0	2	3	50	50	100

VERTICAL 4: DATA ANALYTICS AND AI

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23AD531	Foundations of Data Engineering	PE	4	2	0	2	3	50	50	100
2	BE23AD532	Advanced Machine Learning	PE	4	2	0	2	3	50	50	100
3	BE23AD533	Exploratory Data Analytics and Visualization	PE	4	2	0	2	3	50	50	100
4	BE23AD534	Deep Learning Techniques	PE	4	2	0	2	3	50	50	100
5	BE23AD535	Natural Language Processing	PE	4	2	0	2	3	50	50	100
6	BE23AD536	Large Language Models and AI agents	PE	4	2	0	2	3	50	50	100
7	BE23AD537	AI for IoT	PE	4	2	0	2	3	50	50	100
8	BE23AD538	Intelligent Process Automation	PE	4	2	0	2	3	50	50	100

VERTICAL 5: TRANSFORMATIVE AI AND BUSINESS ANALYTICS

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23AD541	Recommender System	PE	4	2	0	2	3	50	50	100
2	BE23AD532	Advanced Machine Learning	PE	4	2	0	2	3	50	50	100
3	BE23AD542	JAVA Script	PE	4	2	0	2	3	50	50	100
4	BE23AD543	Computer Vision	PE	4	2	0	2	3	50	50	100
5	BE23AD535	Natural Language Processing	PE	4	2	0	2	3	50	50	100
6	BE23AD536	Large Language Models and AI agents	PE	4	2	0	2	3	50	50	100
7	BE23AD537	AI for IoT	PE	4	2	0	2	3	50	50	100
8	BE23AD538	Intelligent Process Automation	PE	4	2	0	2	3	50	50	100

VERTICAL 6: BUSINESS PROCESS AUTOMATION

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23CB551	Fundamentals of IT Service Management	PE	4	2	0	2	3	50	50	100
2	BE23CB552	Custom Application Development	PE	4	2	0	2	3	50	50	100
3	BE23CB553	IT Service Management Practices	PE	4	2	0	2	3	50	50	100
4	BE23CB554	IT Operation Management	PE	4	2	0	2	3	50	50	100
5	BE23CB555	Automation for Digital Creators	PE	4	2	0	2	3	50	50	100

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6	BE23CB556	IT Asset Management	PE	4	2	0	2	3	50	50	100
7	BE23CB557	Customer Workflow	PE	4	2	0	2	3	50	50	100
8	BE23CB558	Employee Workflow	PE	4	2	0	2	3	50	50	100

VERTICAL 7: JAVA AUTOMATION

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23CS501	Fundamentals of Web Development	PE	4	2	0	2	3	50	50	100
2	BE23CS521	Testing Fundamentals and Manual Testing	PE	4	2	0	2	3	50	50	100
3	BE23CS522	Automation Testing with Selenium	PE	4	2	0	2	3	50	50	100
4	BE23CS523	Advanced Testing with TestNG and CI/CD	PE	4	2	0	2	3	50	50	100
5	BE23CS524	Tools for Automated Testing	PE	4	2	0	2	3	50	50	100
6	BE23CS525	Performance and Database Testing	PE	4	2	0	2	3	50	50	100
7	BE23CS526	API Testing and Automation	PE	4	2	0	2	3	50	50	100
8	BE23CS527	Testing using AI and ML Tools	PE	4	2	0	2	3	50	50	100

VERTICAL 8: INTEGRATED SOFTWARE SYSTEM DESIGN

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23CS541	Web Development Foundations	PE	4	2	0	2	3	50	50	100
2	BE23CS542	System Design	PE	4	2	0	2	3	50	50	100
3	BE23CS543	Competitive Coding	PE	4	2	0	2	3	50	50	100
4	BE23CS544	Frontend Design and Development	PE	4	2	0	2	3	50	50	100
5	BE23CS545	Backend Engineering and Deployment Practices	PE	4	2	0	2	3	50	50	100
6	BE23CS546	AI and ML Foundations with Prompt Engineering and RAG Systems	PE	4	2	0	2	3	50	50	100

VERTICAL 9: CRM WITH BUSINESS INTELLIGENCE

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23CB561	Customer Relationship Management System Administration	PE	4	2	0	2	3	50	50	100
2	BE23CB562	Customer Relationship Management System Development	PE	4	2	0	2	3	50	50	100
3	BE23CB563	API Integration Platform	PE	4	2	0	2	3	50	50	100
4	BE23CB564	Business Intelligence and Analytics	PE	4	2	0	2	3	50	50	100
5	BE23CB565	Artificial Intelligence in Data Modeling	PE	4	2	0	2	3	50	50	100
6	BE23CB566	Intelligent System Development	PE	4	2	0	2	3	50	50	100

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7	BE23CB567	Data Visualization Techniques	PE	4	2	0	2	3	50	50	100
8	BE23CB568	Enterprise Resource Planning	PE	4	2	0	2	3	50	50	100

VERTICAL 10: IT INFRASTRUCTURE MANAGEMENT

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23AD551	IT Infrastructure Fundamentals	PE	4	2	0	2	3	50	50	100
2	BE23AD552	IT Automation using Python for Infra	PE	4	2	0	2	3	50	50	100
3	BE23AD553	Server Administration	PE	4	2	0	2	3	50	50	100
4	BE23AD554	Storage and Backup Technologies Program	PE	4	2	0	2	3	50	50	100
5	BE23AD555	Cloud Infrastructure Essentials	PE	4	2	0	2	3	50	50	100
6	BE23AD556	IT Service Management & Infra Operations	PE	4	2	0	2	3	50	50	100
7	BE23AD557	Information Storage and Management	PE	4	2	0	2	3	50	50	100
8	BE23AD558	Security Governance, Risk and Compliance	PE	4	2	0	2	3	50	50	100

DIVERSIFIED COURSES

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23CS531	Knowledge Engineering	PE	4	2	0	2	3	50	50	100
2	BE23CS532	Data Exploration and Visualization	PE	4	2	0	2	3	50	50	100
3	BE23CS533	Foundations of Digital and Social Media Marketing	PE	4	2	0	2	3	50	50	100
4	BE23CS534	Fundamentals of Robotic Process Automation	PE	4	2	0	2	3	50	50	100
5	BE23CS535	Cloud Computing	PE	4	2	0	2	3	50	50	100
6	BE23CS536	Cloud Services Management	PE	4	2	0	2	3	50	50	100
7	BE23CS537	Foundations of Recommender Systems	PE	4	2	0	2	3	50	50	100
8	BE23CS538	Fundamentals of Blockchain	PE	4	2	0	2	3	50	50	100

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OPEN ELECTIVES

Students shall choose the open elective courses from the list of open electives either in category A or category B such that the course contents are not similar to any other course contents/title under other course categories.

CATEGORY A : OPEN CATEGORY

OPEN ELECTIVE-I (5th Semester)

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23ME601	Sustainability Engineering	OE	3	2	1	0	3	40	60	100
2	BE23EE601	Solar PV Systems	OE	3	2	1	0	3	40	60	100
3	BE23EC601	IoT and Applications	OE	3	2	1	0	3	40	60	100
4	BE23CS601	Robotic Process Automation	OE	3	2	1	0	3	40	60	100
5	BE23AD601	Data Analytics	OE	3	2	1	0	3	40	60	100
6	BE23PT651	Japanese Language – Level 1	OE	3	2	1	0	3	100	-	100

OPEN ELECTIVE-II (6th Semester)

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23EE602	Electric Vehicle Technology	OE	3	2	1	0	3	40	60	100
2	BE23EC602	Consumer Electronics	OE	3	2	1	0	3	40	60	100
3	BE23CB601	Mobile App Development	OE	3	2	1	0	3	40	60	100
4	BE23CS602	Data Visualization	OE	3	2	1	0	3	40	60	100
5	BE23CE601	Smart Buildings	OE	3	2	1	0	3	40	60	100
6	BE23PT652	Japanese Language – Level 2	OE	3	2	1	0	3	100	-	100

OPEN ELECTIVE-III (7th Semester)

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23ME602	Occupational Health and Safety	OE	3	2	1	0	3	40	60	100
2	BE23EE603	Drone Technology	OE	3	2	1	0	3	40	60	100
3	BE23EC603	Wearable Devices	OE	3	2	1	0	3	40	60	100
4	BE23IT601	Augmented Reality / Virtual Reality	OE	3	2	1	0	3	40	60	100
5	BE23CS603	Digital Marketing	OE	3	2	1	0	3	40	60	100
6	BE23PT653	Japanese Language – Level 3	OE	3	2	1	0	3	100	-	100

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CATEGORY B: EMERGING TECHNOLOGY VERTICALS

OPEN ELECTIVE-I, II, III

Students are permitted to choose all the open electives from a particular emerging technology vertical or from different verticals such that the course contents are not similar to any other course contents / title under other course categories.

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
	EmT Vertical: Sensors & IoT (For students of Mechanical, CSE, CIVIL, IT, CSBS, AI&DS department)										
1	BE23EC611	Introduction to Sensors and IoT	OE	3	2	1	0	3	40	60	100
2	BE23EC612	IoT System Development and Integration	OE	3	2	1	0	3	40	60	100
3	BE23EC613	Industrial Internet of Things	OE	3	2	1	0	3	40	60	100
	EmT Vertical: Renewable Energy Technologies (For students of ECE, CSE, CIVIL, IT, CSBS, AI&DS department)										
4	BE23ME611	Solar and Wind Energy Systems	OE	3	2	1	0	3	40	60	100
5	BE23ME612	Biomass and Hydro Energy Systems	OE	3	2	1	0	3	40	60	100
6	BE23ME613	Hydrogen and Hybrid Energy Systems	OE	3	2	1	0	3	40	60	100
	EmT Vertical: Frontend Technologies (For students of Mechanical, ECE, EEE, CIVIL department)										
7	BE23CS611	Foundation of Web Development	OE	3	2	1	0	3	40	60	100
8	BE23CS612	Frontend Development	OE	3	2	1	0	3	40	60	100
9	BE23CS613	Backend Development	OE	3	2	1	0	3	40	60	100
	EmT Vertical: CRM Fundamentals (For students of Mechanical, ECE, EEE, CIVIL department)										
10	BE23CB611	CRM Foundations and Tools	OE	3	2	1	0	3	40	60	100
11	BE23CB612	CRM Administration	OE	3	2	1	0	3	40	60	100
12	BE23CB613	CRM Development and Automation	OE	3	2	1	0	3	40	60	100

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Enrollment for B.E. / B. Tech. (Honours) / Minor degree (Optional)

A student can also optionally register for additional courses (18 credits) on any one of the specialization offered by various departments and become eligible for the award of B.E./B.Tech. (Honours)/Minor degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or from a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. These courses have to be in a particular vertical for Minor degree offered by any one of the other programmes.

Complete details are available in clause 4.19 of Regulations 2023.

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VERTICALS FOR MINOR DEGREE

Minor degree	Vertical-1	Vertical-2	Vertical-3	Vertical-4
	Artificial Intelligence & Machine Learning	**Data Analytics**	**Internet of Things**	**Automotive Electronics**
Offering departments	**AI&DS / CSBS**	**CSE / IT**	**ECE / EEE**	**EEE / ECE**
Offered to	**All B.E. (Mechanical, ECE, EEE and Civil) Programs**	**All B.E. (Mechanical, ECE, EEE and Civil) Programs**	**All B.E./B.Tech. programs except ECE and EEE**	**All B.E./B.Tech. programs except ECE**
Course 1	Fundamentals of Artificial Intelligence	Data Science Fundamentals	Fundamentals of IoT Systems	Fundamentals of Automotive Electronics
Course 2	Introduction to Machine Learning	AI & ML Fundamentals	Smart Sensor Networks and Data Acquisition	Sensors and Actuators
Course 3	Deep Learning and Neural Networks	Exploratory Data Analytics	Wireless Communication for IoT	Embedded Systems Design
Course 4	Introduction to Data Analytics	Visualization Techniques	IoT Edge Computing and Device Programming	Automotive Infotronics
Course 5	Fundamentals of Data Warehousing and Mining	Fundamentals of Data Warehousing and Mining	IoT Middleware and Interoperability	Vehicle Networking and Diagnostics
Course 6	Ethics in AI	Ethics in AI	IoT Systems Design and Deployment	ADAS and Connected Vehicle Technologies

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VERTICALS FOR MINOR DEGREE

VERTICAL 1: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23AD571M	Fundamentals of Artificial Intelligence	MI	4	2	0	2	3	50	50	100
2	BE23AD572M	Introduction to Machine Learning	MI	4	2	0	2	3	50	50	100
3	BE23AD573M	Deep Learning and Neural Networks	MI	4	2	0	2	3	50	50	100
4	BE23AD574M	Introduction to Data Analytics	MI	4	2	0	2	3	50	50	100
5	BE23CS565M	Fundamentals of Data Warehousing and Mining	MI	4	2	0	2	3	50	50	100
6	BE23AD575M	Ethics in AI	MI	4	2	0	2	3	50	50	100

VERTICAL 2: DATA ANALYTICS

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23CS561M	Data Science Fundamentals	MI	4	2	0	2	3	50	50	100
2	BE23CS562M	AI & ML Fundamentals	MI	4	2	0	2	3	50	50	100
3	BE23CS563M	Exploratory Data Analytics	MI	4	2	0	2	3	50	50	100
4	BE23CS564M	Visualization Techniques	MI	4	2	0	2	3	50	50	100
5	BE23CS565M	Fundamentals of Data Warehousing and Mining	MI	4	2	0	2	3	50	50	100
6	BE23AD575M	Ethics in AI	MI	4	2	0	2	3	50	50	100

VERTICAL 3: INTERNET OF THINGS

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23EC541M	Fundamentals of IoT Systems	MI	3	2	1	0	3	40	60	100
2	BE23EC542M	Smart Sensor Networks and Data Acquisition	MI	3	2	1	0	3	40	60	100
3	BE23EC543M	Wireless Communication for IoT	MI	3	2	1	0	3	40	60	100
4	BE23EC544M	IoT Edge Computing and Device Programming	MI	3	2	1	0	3	40	60	100
5	BE23EC545M	IoT Middleware and Interoperability	MI	3	2	1	0	3	40	60	100
6	BE23EC546M	IoT Systems Design and Deployment	MI	3	2	1	0	3	40	60	100

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VERTICAL 4: AUTOMOTIVE ELECTRONICS

Sl. No	Course Code	Course Title	Periods / Week						Maximum marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1	BE23EE541M	Fundamentals of Automotive Electronics	MI	3	2	1	0	3	40	60	100
2	BE23EE542M	Sensors and Actuators	MI	3	2	1	0	3	40	60	100
3	BE23EE543M	Embedded Systems Design	MI	3	2	1	0	3	40	60	100
4	BE23EE544M	Automotive Infotronics	MI	3	2	1	0	3	40	60	100
5	BE23EE545M	Vehicle Networking and Diagnostics	MI	3	2	1	0	3	40	60	100
6	BE23EE546M	ADAS and Connected Vehicle Technologies	MI	3	2	1	0	3	40	60	100

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BE23CS413	MOBILE APPLICATION DESIGN AND DEVELOPMENT	CP	L	T	P	C
		3	2	1	0	3
Programme & Branch	Common to B.E. (CSE) and B.Tech. (IT) Branches	Version: 1.0				

Course Objectives:		
1.	To understand the basic functions and technologies of mobile devices.	
2.	To explore the basics of android operating systems and application development.	
3.	To understand the essential Android UI elements and apply the layout design, animation techniques, and Figma tools to create effective user interfaces.	
4.	To understand and gain the basic knowledge of Android software stack by organize the application resources and developing the Android activities.	
5.	To apply suitable software tools and API's for the development of User Interface.	
	INTRODUCTION (Not for Examination)	**2**
Importance	Real-time mobile applications provide immediate feedback and updates which are crucial for various functionalities.	
Real-life Example(s)	Video Conferencing, Live Streaming, Online gaming, Instant messaging applications.	
Linkages	**Pre-requisite:** Computer Networks, Operating Systems. **Future courses: -**	
UNIT–I	**INTRODUCTION TO MOBILE TECHNOLOGIES**	**6+3**
	Mobile Technologies: Mobile operation systems – Mobile devices – Pros and Cons – Introduction to Android, Versions and Features – Mobile Architecture – Mobile Device Operating Systems – Constraints & Requirements – Software Development Kit – iOS, Android, BlackBerry, Windows Phone.	
UNIT–II	**ANDROID AND MOBILE PLATFORMS**	**6+3**
	Introduction to Android Operating System: Android Fundamentals – Event handling and navigation – Android development framework – Installing and running applications on Android Studio – Creating Android Visual Device (AVD) – Types of Android application.	
UNIT–III	**ANDROID USER INTERFACE DESIGN**	**6+3**
	Essentials in Android User Interface Design: Android Layouts – Views and Components – User Interface Screen elements – Designing User Interfaces with Layouts – Drawing and Working with Animation – Figma tool. ***Project Based Learning:** To Design and Develop an Interactive Android Application using User Interface Design.	

UNIT–IV	**TESTING AND RESOURCE MANAGEMENT**	**6+3**
	Testing Android Applications: Understanding the Android Software Stack – Android Application Life Cycle – Managing Application resources in hierarchy – Working with different types of resources – Creating Android Activity – Views and Layout – Linking Activities. ***Project Based Learning:** To implement a Smart Health Reminder Application to schedule medicine reminders.	
UNIT–V	**ANDROID API's**	**6+3**
	Android Data and Storage APIs: Sharing Data between Applications with Content Providers – Using Android Networking API's – Using Android Web API's – Using Android Telephony API's – Deploying Android Application to the World. ***Project Based Learning:** To implement an Event Discovery and Ticketing Platform to browse and book events on Google Play Store.	
	Total (LT)	**47 Periods**
	*** INTERNAL EVALUATION ONLY**	
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Demonstrate the fundamental concepts of mobile device functions, architecture, and core mobile technologies.	**L2 - Understand**
CO2	Understand and run the basic android applications using Android Studio.	**L2 - Understand**
CO3	Design User Interfaces in Android using layouts and animations.	**L3 - Apply**
CO4	Develop and manage the resources in Android applications.	**L3 - Apply**
CO5	Use various Android API's for data storage and web services.	**L3 - Apply**
	TEXTBOOKS:	
1.	Lauren Darcey and Shane Conder, "Android Wireless Application Development", 2nd Edition, Pearson Education, 2023.	
2.	Reto Meier, "Professional Android 4 Application Development", 3rd edition, Wrox Pr Inc, 2012.	
	REFERENCE BOOKS:	
1.	Mark L Murphy, "Beginning Android", 2nd edition, Wiley India Pvt Ltd, 2015.	
2.	Mohamed Sarrab, Hafedh Al-Shihi, Naveen Safia, "Handbook of Mobile Application Development: A Guide to Selecting the Right Engineering and Quality Features", Bentham Science Publishers, 2021.	

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	WEB REFERENCES:		
S.No	**Publisher**	**Website link**	**Type of Content**
1.	Geeks for Geeks	https://www.geeksforgeeks.org/introduction-of-mobile-applications	Web Reference
2.	Coursera	https://www.coursera.org/courses?query=app%20development&msockid=18370a0798be612222f11871996c60b7	Course

	VIDEO REFERENCES:			
S.No	**Video Details**	**Name of the Expert**	**Type of Content**	**Video Link**
1.	NPTEL	Dr. Himanshu Patel	Lecture	https://onlinecourses.swayam2.ac.in/nou21_ge41/preview
2.	YouTube	VTU E-Learning Centre	Lecture	https://www.youtube.com/watch?v=jtK3RYjEH2I&list=PLcwp2fRcIXJVTScoTrGUmntyygrdXUGWt
3.	YouTube	Dr Krunal Patel	Lecture	https://www.youtube.com/playlist?list=PL01eZyFMpp8UY_CDK1UtoCDONRQ-VHJdE

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	2	1			1	1			1	2	
CO2	2	2	2	2	3	1			1	1	1	1		3	2
CO3	2	3	3	2	3	1			1	2	1	1		3	2
CO4	2	2	3	2	3	1			2	2	1	1		3	2
CO5	2	3	3	2	3	1			2	2	1	2	2	3	2
Avg.	**2.2**	**2.4**	**2.4**	**2.0**	**2.8**	**1.0**			**1.4**	**1.6**	**1.0**	**1.2**	**1.5**	**2.8**	**2.0**

1–Low, 2 –Medium, 3–High.

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BE23CS414	AUTOMATA THEORY AND COMPILER DESIGN	CP	L	T	P	C
		3	2	1	0	3
Programme & Branch	B.E. – Computer Science and Engineering	Version: 1.0				

Course Objectives:		
1.	To understand the fundamental concepts of formal languages and finite automata.	
2.	To apply the concept of regular languages and context free Languages for syntax representation.	
3.	To explore PDA and Turing Machines for language recognition and computation.	
4.	To learn lexical and syntax analysis and apply parsing techniques using Lex and parser tools.	
5.	To implement code generation strategies for translating intermediate code to target machine code.	
	INTRODUCTION (Not for Examination)	**2**
Importance	It helps students understand how languages and machines work in computing. It covers the basics of automata, grammar, and how compilers are built. These techniques are crucial for designing programming languages, developing software tools, and understanding how computers process instructions. Moreover, the principles involved are widely used in advanced domains like Machine Learning and Data Analysis.	
Real-life Example(s)	Traffic light control, ATM transaction system, Text search, Circuit Designs.	
Linkages	**Pre-requisite:** Discrete Mathematics, Data Structures and Algorithms. **Future courses:** -	
UNIT–I	**INTRODUCTION TO FORMAL LANGUAGES AND FINITE AUTOMATA**	**6+3**
	Fundamentals: Formal Languages, Alphabets, Strings and Languages – Chomsky Hierarchy of languages. **Finite Automata:** Introduction to Finite Automata – Regular Expressions (RE) – Acceptance of Strings and Languages – Deterministic Finite Automata (DFA) and Non-Deterministic Finite Automata (NFA) – Conversion of RE to NFA and NFA to DFA – Minimization of DFA.	
UNIT–II	**REGULAR LANGUAGES AND CONTEXT-FREE GRAMMARS**	**6+3**
	Regular Languages: Conversion of finite automata into a regular expression: State-Elimination method – Arden Method – Pumping lemma for regular sets – Closure properties of regular sets. **Context-free Grammar (CFG):** Derivations, Parse Trees – Leftmost and Rightmost Derivations – Ambiguity – Left recursion – Left factoring in Grammars – Simplification of CFGs.	

UNIT–III	**PUSHDOWN AUTOMATA AND TURING MACHINES**	**6+3**
	Pushdown Automata (PDA): Definition – Language acceptance by PDA - Equivalence between PDA and CFG – **Turing Machine:** Introduction to Turing Machine (TM) – Formal Description – Instantaneous Description – The language of a Turing machine – Language Acceptance of TM – Halting Problem.	
UNIT–IV	**INTRODUCTION TO COMPILER**	**6+3**
	Introduction: Overview of Compilers – Phases of a compiler. **Lexical Analysis:** Role of Lexical Analyzer – Input Buffering - Specification of tokens – Lex Tool. **Syntax Analysis:** Role of parser – Top-Down Parsing – LL(1), Bottom-up-Parsing – LR parsers (Simple LR, Canonical LR, LALR), Parser generator. **Syntax-Directed Translation:** Syntax-directed definitions – Evaluation orders for SDD's.	
UNIT–V	**CODE OPTIMIZATION AND CODE GENERATION**	**6+3**
	Intermediate Code Generation: Intermediate Languages – Three Address code – Implementation of three-address statements. **Runtime Environment:** Activation Records – Control Stack, Storage Allocation Strategies. **Code Optimization:** Basic Blocks and Flow Graph – DAG Representation. **Code generation:** Introduction – Issues in the design of Code generator – Design of a simple Code Generator.	
	Total (LT)	**47 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Construct and simplify finite automata to recognize regular languages.	**L3 - Apply**
CO2	Design context-free grammars for formal languages.	**L3 - Apply**
CO3	Construct PDA and Turing machines for the given set of languages.	**L3 - Apply**
CO4	Implement the lexical and syntax analysis phases of a compiler.	**L3 - Apply**
CO5	Develop various implementations of three-address statements and code optimization.	**L3 - Apply**
	TEXTBOOKS:	
1.	John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory Languages and Computation", 3rd Edition, Pearson Education, 2011.	

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2.	Alfred Aho, Monica S Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers - Principles Techniques and Tool", 2nd Edition, Pearson Education India, 2023.
	REFERENCE BOOKS:
1.	Kamala Krithivasan, Rama R, "Introduction to Formal languages Automata Theory and Computation", 1st Edition, Pearson Education, 2009.
2.	K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science – Automata Languages and Computation", 3rd Edition, PHI, 2010.
3.	John C. Martin, "Introduction to Languages and The Theory of Computation", 4th Edition, McGraw-Hill Education, 2010.
4.	V. Raghavan, "Principles of Compiler Design", 1st Edition, McGraw-Hill Education, 2017.
5.	John R. Levine, "flex and bison", 1st Edition, O'Reilly Media, 2009.

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	tutorialspoint	https://www.tutorialspoint.com/automata_theory/index.htm	Web reference
2.	geeksforgeeks	https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/	Web reference
3.	geeksforgeeks	https://www.geeksforgeeks.org/compiler-design-tutorials/	Web reference
4.	tutorialspoint	https://www.tutorialspoint.com/compiler_design/index.htm	Web reference

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video Link
1.	NPTEL	Prof. Kamala Krithivasan	Lecture	https://archive.nptel.ac.in/courses/106/106/106106049/
2.	YouTube	Jaison Joshy	Lecture	https://www.youtube.com/playlist?list=PLBlnK6fEyqRgp46KUv4ZY69yXmpwKOIev
3.	NPTEL	Prof.Santanu Chattopadhya	Lecture	https://archive.nptel.ac.in/courses/106/105/106105190/
4.	YouTube	Rishav Upadhyay	Lecture	https://www.youtube.com/playlist?list=PLBlnK6fEyqRjT3oJxFXRgjPNzeS-LFY-q

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2				1	2	1	2	2		1
CO2	3	3	2	2	2				1	1	1	2	2		1
CO3	3	3	2	3	2				1	2	1	2	3		2
CO4	3	3	3	3	3				2	2	1	2	2		1
CO5	3	3	3	3	3				2	2	1	2	3		2
Avg.	**3.0**	**3.0**	**2.4**	**2.6**	**2.4**				**1.4**	**1.8**	**1.0**	**2.0**	**2.4**		**1.4**

1–Low, 2 –Medium, 3–High.

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BE23MC907	DISASTER MANAGEMENT AND PREPAREDNESS	CP	L	T	P	C
		2	2	0	0	NC
Programme & Branch	Common to all B.E./B.Tech Branches	Version: 1.0				

Course Objectives:		
1.	To understand the basic concepts in disaster management.	
2.	To identify the types and categories of disasters.	
3.	To gain knowledge on disaster and its impacts on social, economic, and environmental.	
4.	To learn disaster risk reduction measures and role of government, NGOs and Engineers.	
5.	To understand the importance of Recovery-Reconstruction and Development Methods.	
	INTRODUCTION (Not for Examination)	**2**
Importance	The course is intended to provide a general concept in the dimensions of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response, and recovery. Engineers play a key role in designing resilient structures and systems. Knowledge of disaster management helps them incorporate preventive and mitigation measures into their projects. Engineers must ensure disaster preparedness and recovery plans include differently abled individuals, making infrastructure universally accessible.	
Real-life Example(s)	Bhopal Gas Tragedy (1984), Bhuj Earthquake, Gujarat (2001), Indian Tsunami (2004), COVID-19 pandemic in India (2020) etc.	
Linkages	-	
UNIT–I	**INTRODUCTION ON DISASTER**	**6**
	Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation.	
UNIT–II	**DISASTERS CLASSIFICATION**	**6**
	Disasters Classification - Natural Disasters - (Floods, Draught, Cyclones, Volcanoes, Earthquakes, Tsunami, Landslides, Coastal Erosion, Soil Erosion, Forest Fires etc.) Man Made Disasters - (Industrial Pollution, Artificial Flooding in Urban Areas, Nuclear Radiation, Chemical Spills, Transportation Accidents, Terrorist Strikes, etc.); Causes - Effects and Practical Examples for all Disasters.	

UNIT–III	**DISASTER IMPACTS**	**6**
	Introduction - Disaster Impacts (Environmental, Physical, Social, Ecological, Economic, Political, etc.) - Health, Psycho-Social Issues. Demographic Aspects (Gender, Age, Special Needs) - Hazard Locations; Global and National Disaster Trends; Climate Change and Urban Disasters.	
UNIT–IV	**DISASTER RISK REDUCTION**	**6**
	Disaster Management Cycle – Its Phases; Prevention, Mitigation, Preparedness, Relief, And Recovery. Structural and Non-Structural Measures; Risk Analysis, Vulnerability, and Capacity Assessment; Early Warning Systems, Post Disaster Environmental Response (Water, Sanitation, Food Safety, Waste Management, Disease Control, Security, Communications). Role of Government, International and NGO Bodies - Role of IT In Disaster Preparedness-Role of Engineers on Disaster Management.	
UNIT–V	**DISASTERS, ENVIRONMENT AND DEVELOPMENT**	**6**
	Factors Affecting Vulnerability - Impact of Developmental Projects and Environmental Modifications (Including of Dams, Land use Changes, Urbanization Etc.). Sustainable and Environmentally Friendly Recovery - Reconstruction and Development Methods. Application of Science and Technology in Disaster Management - Role of Educational Institute in Disaster -Education, Awareness and Preparedness.	
	Total (L)	**32 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Explain fundamental concepts in Disasters risk management.	**L2 – Understand**
CO2	Identify disaster types and understand its causes and effects with relevant case studies.	**L2 – Understand**
CO3	Describe disaster impacts and demographic aspects.	**L2 – Understand**
CO4	Identify disaster risk reduction strategies and relevant policies and legislation.	**L2 – Understand**
CO5	Outline accessibility measures in preparedness, response, mitigation, and reconstruction for Disaster impacts.	**L2 – Understand**

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	TEXTBOOKS:
1.	Singhal J.P., "Disaster Management", Laxmi Publications, 2019.
2.	Nidhi Gauba Dhawan, Ambrina Sardar Khan, "Disaster Management and Preparedness", CBS Publishers and Distributers Pvt. Ltd., 2012.
	REFERENCE BOOKS:
1.	Gupta Anil K, Sreeja S.Nair, "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011.
2.	Jagbir Singh, "Disaster Management: Future Challenges and Opportunities", K W Publishers Pvt. Ltd., 2013.

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	National Disaster Management Authority, Government of India.	https://ndma.gov.in/	Government Policies and Legislation document.
2.	National Disaster Alert Portal	https://sachet.ndma.gov.in/	Government Portal for Alerts and SOP Information
3.	Coursera	https://www.coursera.org/learn/ai-and-disaster-management	Online Course

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video Link
1.	NPTEL	Prof. Ram Satheesh Dept. of Architecture and Planning, Disaster Prevention Research Institute, IIT-Roorkee.	Video Tutorials	https://youtu.be/UtufcbtXKMk?si=AgotBPYt_npWCipb

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				1	1					2			
CO2	3	2				1	1					2			
CO3	3	2				1	1					2			
CO4	3	2				2	2					2			
CO5	3	2				2	2					2			
Avg.	**3.0**	**2.0**				**1.4**	**1.4**					**2.0**			

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BE23CS415	CRYPTOGRAPHY AND CYBERSECURITY	CP	L	T	P	C
		5	2	1	2	4
Programme & Branch	B.E. – Computer Science and Engineering	Version: 1.0				
Course Objectives:						
1.	To understand the computer security principles and cryptographic techniques.					
2.	To apply symmetric and asymmetric key cryptographic techniques to design a secure encryption system.					
3.	To learn and apply the various types of data integrity and authentication schemes.					
4.	To understand the basic principles of Cybersecurity.					
5.	To understand cyberthreats and apply cyber security models.					
	INTRODUCTION (Not for Examination)	**2**				
Importance	Cryptography and cybersecurity are essential for protecting sensitive data, ensuring secure communication, and maintaining trust in digital systems.					
Real-life Example(s)	Virtual Private Network, Cryptocurrency, Wi-Fi Security, Digital Signatures, Two-Factor Authentication.					
Linkages	**Pre-requisite:** Data Structures and Algorithms, Computer Networks. **Future courses:** Cybersecurity.					
UNIT–I	**FUNDAMENTALS OF CRYPTOGRAPHY**	**6+3**				
	Computer Security Concepts – OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques – **Foundations of modern cryptography:** Basic Principles – Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis.					
UNIT–II	**SYMMETRIC & ASYMMETRIC KEY CRYPTOGRAPHY**	**6+3**				
	Introduction to Number theory: Algebraic structures – Modular Arithmetic – **Symmetric Key Cryptography:** Introduction – Stream and Block Ciphers – Data Encryption Standard (DES) Analysis – Key Expansion, Key Distribution and Analysis – RC4 – **Asymmetric Key Cryptography:** RSA Cryptosystem – Diffie-Hellman Key Exchange – ElGamal Cryptosystem. ***Experiential learning:** Create visual diagrams or animations to illustrate how Diffie-Hellman works, showing the steps involved in the key exchange.					
UNIT–III	**INTEGRITY AND AUTHENTICATION ALGORITHMS**	**6+3**				
	Authentication Requirement – Authentication Function – Message Authentication Codes (MAC) – Hash Function – Security of Hash Function – Message Digest Algorithm (MD5) – Digital Signature					

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	Standard (DSS) – Schnorr – Pretty Good Privacy – Kerberos.	
UNIT–IV	**INTRODUCTION TO CYBERSECURITY**	**6+3**
	Cyber Security – Confidentiality, Integrity, Availability (CIA Triad) – **Malicious Attack Threats and Vulnerabilities:** Scope of Cyber-Attacks – Types of Malicious Attacks - Malicious Software – **Reconnaissance and Scanning Techniques:** Harvester – Nmap Command Switches – SYN Scan.	
UNIT–V	**CYBER THREATS AND PREVENTIVE TECHNIQUES**	**6+3**
	Introduction to Cyber Crime: Classifications of Cyber Crimes – **Tools and Method**s: Password Cracking – Keyloggers, Spywares, SQL Injection – Network Access Control – Overview of Cloud Security – Overview of Web Security – Overview of Wireless Security.	
	Total (LT)	**47 Periods**
	*** INTERNAL EVALUATION ONLY**	
	Bloom's Taxonomy Levels: Remember, Understand, Apply, Analyze, Evaluate, Create.	
	LIST OF EXPERIMENTS/EXERCISES:	
1.	Perform encryption, decryption using the following substitution techniques (i) Ceaser cipher, (ii) Playfair cipher iii) Hill Cipher	
2.	Write a program to implement RSA Encryption algorithm.	
3.	Write a program to implement the Diffie-Hellman Key Exchange mechanism.	
4.	Write a program to calculate the message digest of a text using the SHA-1 algorithm.	
5.	Write a program to calculate the message digest of a text using the MD-5 algorithm.	
6.	Perform network discovery and scanning tasks using Nmap.	
7.	Perform a stealth scan to identify open TCP ports on a target host.	
	Total (P)	**30 Periods**
	Total (LT+P)	**77 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities.	**L2 - Understand**

CO2	Apply the different cryptographic operations of symmetric and asymmetric cryptographic algorithms.	**L3 - Apply**
CO3	Implement the secure authentication protocols like Kerberos and Digital Signature Standard.	**L3 - Apply**
CO4	Understand the fundamentals of cyber security	**L2 - Understand**
CO5	Apply appropriate security controls for network, cloud, web, and wireless systems.	**L3 - Apply**

	TEXTBOOKS:
1.	William Stallings, "Cryptography and Network Security - Principles and Practice", 8th Edition, Pearson Education, 2023.
2.	Anand Shinde, "Introduction to Cyber Security: Guide to the World of Cyber Security", Notion Press, 2021.
3.	Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cybercrimes, Computer Forensics and Legal Perspectives", 1st Edition, Wiley India, 2011.
	REFERENCE BOOKS:
1.	Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2.	Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", 5th Edition, Prentice Hall, New Delhi, 2015.
	WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	GeeksforGeeks	https://shorturl.at/YWh8K	Lectures
2.	Cybersecurity Exchange	https://shorturl.at/HOvLa	Articles

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video Link
1.	YouTube (NPTEL)	Prof.Sourav Mukhopadhyay	Lecture	https://shorturl.at/ZqFVV
2.	YouTube	Prabhu Subramanian	Lecture	https://shorturl.at/C9kGR

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Mapping of COs with POs and PSOs															
COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3		1	1									1	
CO2	3	2	1	2	1							1		1	
CO3	3	2	2	2	1			1	2			2		3	1
CO4	3	3	2	3	2	2						1		2	1
CO5	3	3	3	2	2	2		2	3		2	2		3	2
Avg.	**2.8**	**2.6**	**2.0**	**2.0**	**1.4**	**2.0**		**1.5**	**2.5**		**2.0**	**1.5**		**2.0**	**2.0**
1–Low, 2 –Medium, 3–High.															

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BE23PW702	MAKE-A-PRODUCT – PHASE II	CP	L	T	P	C
		2	0	0	2	1
Programme & Branch	Common to all B.E/B.Tech. Branches	Version: 1.0				

Course Objectives:

1.	To develop a Product / Solution / Software / App / Application to solve a real-world problem.
2.	To inculcate Innovation, Creativity and Problem-Solving Skills among students.
3.	To develop Higher Order Thinking skills (HOTs) needed for innovative product development.
4.	To promote Entrepreneurship and Startup culture
5.	To nurture System Thinking and adopt to Interdisciplinary Mindset.

A. BACKGROUND

Emerging industrial and business environment need engineers to be not only technically competent, but also innovative, entrepreneurial, and prepared to face industry challenges. World Economic Forum-Future Skills report 2025 lists the following future skills:

- Customer centric thinking
- Offering customer centric solutions
- Critical thinking and Creative problem solving
- Systemic thinking or overall product-based problem-solving approach
- Analysis and optimization skills
- Team work & Adaptability
- Effective Communication and presentation skills
- Legal, Ethical, Social and Sustainability-driven solution approaches
- Project Management and Cost estimation
- Proficiency in modern engineering tools etc.,

Such skills can be developed only by Project based Learning Approach (rather than traditional classroom teaching or Fixed Hour Examinations).

With this view MAP (Make-A-Product), a Customer Centric, Outbound as well as Inbound, Hands-on based Project based Learning Methodology has been introduced in the V & VI Semester of B.E./B.Tech. Curriculum.

This initiative bridges the gap between theoretical knowledge and practical application, enabling students to design, develop, and deliver innovative products that solve real customer problems, while simultaneously gaining exposure to product lifecycle management, team collaboration, and entrepreneurial thinking.

B. EXECUTION

B1	Preparation Work [4th Semester]
•	Forming Interdisciplinary Team and identifying MAP domain and Assigning mentors.
•	Assigning a suitable Technical Club.
•	Conducting Orientation session on MAP.
•	Conducting Zeroth Review.

B2	MAKE A PRODUCT (PHASE –I) [5th Semester]
	Stage-I: Problem/Product Identification (Use Design Thinking approach): Week (01-06)
•	Use Go To Customer (GTC) approach and identify potential problems.
•	Identify and finalize a specific problem to solve.
•	Using GTC approach, develop an Exact Problem Statement" and define various assumptions (Problem-Customer Fit).
•	Map the identified problem to a relevant UN Sustainable Development Goals (SDGs).
•	Review I.
	Stage-II: Design/Development of Solution (Use Design Thinking, Startup Methodology concept): Week (07-15)
•	Explore all possible solutions and narrow down to a most feasible solution.
•	Develop Minimum Viable Product (MVP) idea, GTC, validate it (Solution-Customer Fit).
•	Iterate and improve the Concept MVP.
•	Review II.
	TOTAL: 15 PERIODS
B3	**MAKE A PRODUCT (PHASE –II) [6th Semester]**
	Stage-III: Fabrication/Prototype Development (Use Design Thinking, Startup Methodology concept): Week (01-06)
•	Develop physical prototype - Use GTC approach to enhance MVP.
•	Review – III.
•	Using GTC approach, iterate till MVP is satisfactory (Product-Market Fit).
•	Review – IV.
	Stage-IV: Business Model Development (Use Startup Methodology, Lean Business Model Canvas concept): Week (07-10) (Not for Examination)
•	Develop a Lean Business Model Canvas (BMC).
•	Estimate the Market Potential.
•	Develop a Marketing Plan and Business Plan.
•	Go to market (GTM) – Get feedback.
•	Iterate and finalize the BMC, Business Plan, and Marketing Plan.
•	Final MVP, Final BMC, Final Business Plan and Final Marketing Plan.
•	Review (Not for Examination).
	Stage-V: Final Report Submissions/ Final Assessment: Week (12-15)
•	Final Report preparation and Report Submission.
•	PPT Preparation (Pitch Deck).
•	Review – V / Final Assessment.
	TOTAL: 30 PERIODS

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C. ASSESSMENT	
C1	**MAKE A PRODUCT (PHASE –I) [5th Semester]**

Internal Assessment (Review based – 30 Marks) *

1. Review 0: Nil
2. Review I: 10 Marks
3. Review II: 20 Marks

*IA marks for the course are accounted for grading in the 6th semester only.

C2	MAKE A PRODUCT (PHASE–II) [6th Semester]

Internal Assessment (Review based – 70 Marks)

1. Review III: 20 Marks
2. Review IV: 20 Marks
3. Review V: 30 Marks

For grading MAP Phase-(I & II): (30 Marks + 70 Marks) = 100 Marks

Course Assessment is on Internal Mode only. No End Semester Examinations.

	Course Outcomes: Upon completion of this course, the students will be able to:	**BLOOM'S Taxonomy**
CO1	**Identify** and define a customer-centric problem using Design Thinking and the Go-To-Customer (GTC) approach.	**L2 - Understand**
CO2	**Apply** design thinking and Startup Methodology to develop a customer-focused solution leading to an improved MVP through iterative feedback.	**L3 - Apply**
CO3	**Develop** user-centric prototype through iterative design thinking processes.	**L6 - Create**
CO4	**Evaluate** customer needs and deploy Go-To-Customer strategies to ensure market alignment.	**L5 - Evaluate**
CO5	**Compile** and present the final report and pitch deck effectively, showcasing the complete product development process.	**L4 - Analyze**

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3						2	3	2		2			
CO2	3	3	3	3	3	1	2	2	3	3	2	2			
CO3	3	3	3	2	2	2	1	2	2	2	2	3			
CO4	2	3	3	3	2	3	2	2	2	3	2	3			
CO5	2	2			3			2	3	3	3	3			
Avg.	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**			

1–Low, 2 –Medium, 3–High.

BE23PT803	Human Excellence and Value Education – III	CP	L	T	P	C
		2	1	0	1	NC
Programme & Branch	Common to all B.E. / B.Tech. Branches	Version: 1.0				

Course Objectives:		
1.	To enable students to create impactful resumes and write professional emails.	
2.	To develop students' skills in participating effectively in group discussions and confidently facing job interviews.	
3.	To familiarize students with professional conduct in a corporate environment and cultivate their ability to adapt and learn continuously.	
4.	To equip students with foundational financial knowledge and practical skills in budgeting, saving, basic investing, debt management and financial planning for informed decision-making.	
5.	To introduce students to fundamental leadership concepts and develop their potential to lead and influence others.	
	INTRODUCTION (Not for Examination)	**1**
Importance	This subject equips students with essential professional and life skills that bridge the gap between academic knowledge and real-world workplace expectations. It helps students craft strong resumes, communicate effectively, handle interviews, and behave appropriately in corporate settings. Additionally, it fosters adaptability, financial literacy, and leadership—key traits for success in any career path. The course not only prepares students for employment but also promotes personal growth and responsible decision-making.	
Real-life Example(s)	a. A student who learns to write a tailored resume and emails impresses a recruiter and get good placement offer from a leading company. b. A graduate confidently leads a group discussion during a campus interview and secures a core job in a multinational firm. c. A young employee avoids debt traps by applying budgeting and saving principles learned in this course. d. A fresher adjusts quickly to a work culture and move ahead in the career ladder by applying adaptability and corporate etiquette skills. e. An engineering student uses leadership principles shall successfully coordinate a team in the workplace	
Linkages	Human Excellence and Value Education – I & Human Excellence and Value Education – II	
UNIT–I	**RESUME & EMAIL WRITING**	**3+3**
	Resume Writing: Purpose and key components of a professional resume - Different resume formats (chronological, functional, combination) - Crafting compelling objective/summary statements - Effectively highlighting education, skills (technical and soft), and experience (projects, internships, extracurricular activities) - Using action verbs and quantifiable achievements - Importance of keywords and tailoring	

	resumes to specific job descriptions - Common resume writing mistakes to avoid - Resume formatting and presentation guidelines – Video Resume. **Email Writing:** Understanding the principles of professional email communication - Crafting effective subject lines - Appropriate salutations and closings - Maintaining a professional tone and language - Structuring email content for clarity and conciseness - Etiquette for replying, forwarding, and using CC/BCC - Writing different types of professional emails (inquiries, follow-ups, requests, etc.) . **Activities:** • Analyzing sample resumes (good and bad examples). • Individual resume drafting and peer review. • Writing emails for various scenarios and receiving feedback.	
UNIT–II	**GROUP DISCUSSION & INTERVIEW TECHNIQUES**	**3+3**
	Group Discussion Techniques: Understanding the objectives and dynamics of group discussions - Strategies for initiating, contributing meaningfully, and summarizing discussions - Effective listening and articulation skills in a group setting - Handling disagreements and maintaining a respectful tone - Body language and etiquette in group discussions - Different roles participants play in a group discussion . **Interview Techniques:** Preparing for different types of interviews (HR, technical, panel) - Understanding common interview questions and strategies for answering them effectively (STAR method) - Projecting confidence and a positive attitude – Stress interview – Online Interview - Importance of body language and professional attire - Asking insightful questions - Following up after an interview . **Activities:** • Mock group discussions with feedback sessions. • Role-playing different interview scenarios. • Analyzing interview questions and formulating effective answers.	
UNIT–III	**CORPORATE ETIQUETTES, ADAPTABILITY, AND LEARNING AGILITY**	**3+3**
	Corporate Etiquettes: Understanding workplace norms and expectations - Professional behaviour in meetings, conferences, and social events - Communication etiquette (face-to-face, phone, virtual) - Respecting diversity and maintaining inclusive behavior - Time management and punctuality - Professional attire and grooming - Digital etiquette and social media professionalism. **Adaptability and Learning Agility:** Understanding the importance of adaptability in a changing professional landscape - Developing a growth mindset and embracing new challenges - Strategies for managing change and uncertainty - Cultivating continuous learning habits and identifying learning	

	resources -Developing resilience and the ability to learn from mistakes . **Activities:** • Case studies and discussions on corporate etiquette scenarios . • Interactive sessions on developing a growth mindset . • Activities promoting self-reflection on adaptability and learning styles .	
UNIT – IV	**FINANCIAL LITERACY**	**3+3**
	Introduction to Financial Literacy (Understanding the Basics) - Budgeting and Expense Management (Taking Control of Your Money) - Saving and Building an Emergency Fund (Securing Your Future) - Introduction to Investments (Growing Your Money) - Managing Debt and Borrowing Responsibly (Avoiding Financial Strain) - Financial Planning for the Future (Charting Your Course) .	
UNIT–V	**LEADERSHIP SKILLS**	**3+3**
	Understanding different leadership styles (authoritative, democratic, laissez-faire, etc.) - Identifying personal leadership strengths and weaknesses - Developing effective communication and interpersonal skills for leadership - Motivating and inspiring teams - Delegation and empowerment - Conflict management and resolution within a team - Ethical leadership and its importance - Team building and collaboration. **Activities:** • Case studies of successful leaders and their styles . • Role-playing leadership scenarios . • Team-based activities requiring leadership and collaboration . • Self-assessment of leadership potential .	
	Total	**31 Periods**
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Summarize the key steps involved in constructing professional resumes tailored to specific job requirements and composing clear, concise, and effective professional emails for various workplace scenarios.	L2– Understand
CO2	Interpret the process of participating actively in group discussions by demonstrating effective communication and interpersonal skills, and explain the techniques and strategies used to confidently navigate job interviews.	L2– Understand
CO3	Describe how to apply corporate etiquettes in various professional settings and explain the significance of adaptability and continuous learning in a changing work environment.	L2– Understand
CO4	Outline the key ideas behind budgeting, saving, basic investments, and debt management, and describe the importance of financial planning.	L2– Understand
CO5	Interpret fundamental leadership concepts, recognize personal leadership strengths, and describe how to contribute effectively in team settings to meet common goals.	L2– Understand

	TEXTBOOKS:	
	Trainer and Faculty Lecture Notes and PPT	
	REFERENCE BOOKS:	
1.	CA Shivam Palan, "Interview Ready: From Crafting a Resume to Crushing the Interview", Zebra Learn Books, 1st Edition, 2024.	
2.	Kusumakar Pant, "Beyond the Resume: Beyond the Resume Paperback", Bluerose Publishers Pvt. Ltd., 1st Edition, 2025.	
3.	Finnegan L, "Email Etiquette: 7 Easy Steps to Master Email Writing, Business Etiquette, Email Productivity Hacks & Remote Teams", Ingram Spark, 2023.	
4.	Dr Y Narasimha Raja, "Group Discussion Techniques: 101 Group Discussion Techniques for participants & HR", Notion Press, 2024.	
5.	Deepak Tralshawala, "Personal and Professional Etiquette in the Corporate World Paperback", Indie press Publications 2024.	
6.	Abhijeet Kolapkar, "Money Works: The Guide to Financial Literacy", Penguin Business, 2023.	
7.	Raman Keane, "Financial Literacy for Young Adults Simplified: Discover How to Manage, Save, and Invest Money to Build a Secure & Independent", Independent Publisher, 2023	
8.	Dale Carnegie, "The Leader in You", Prabhat Prakashan Pvt. Ltd., 2018.	
9.	Jocko Willink, "Leadership Strategy and Tactics: Field Manual", Pan Macmillan India 2024.	
	WEB REFERENCES:	

S.No.	Publisher	Website link	Type of Content
1.	Harvard University	https://careerservices.fas.harvard.edu/resources/create-a-strong-resume/	Reference Material
2.	HP Foundation	https://www.life-global.org/course/362-resume-writing-and-job-interviewing	Online Course
3.	Open Learn University	https://www.open.edu/openlearn/money-business/facilitating-group-discussions/content-section-0?active-tab=description-tab	Online Course
4.	TCS iON	https://www.tcsion.com/courses/interview-and-job-prep/stand-out-in-group-discussion/	Online Course
5.	Indiana University of Pennsylvania	https://www.iup.edu/career/students/finding-employment/interviewing-and-etiquette/etiquette/index.html	Reference Material
6.	The Muse	https://www.themuse.com/advice/how-to-do-a-practice-interview-thatll-actually-help-you	Article
7.	Great Learning	https://www.mygreatlearning.com/blog/group-discussion-in-interviews/	Reference Material

8.	University of Kansas.	https://ctb.ku.edu/en/table-of-contents/leadership/group-facilitation/group-discussions/main	Reference Material
9.	Rifah Tamanna Aurpa	https://www.linkedin.com/pulse/essential-guide-corporate-etiquette-what-you-need-know-aurpa-uqsic/	Article
10.	TCS iON	https://www.tcsion.com/courses/tcs-ion/business-etiquette/	Online Course
11.	Investopedia	https://www.investopedia.com/terms/f/financial-literacy.asp	Article
12.	Khan academy	https://www.khanacademy.org/college-careers-more/financial-literacy	Online Course
13.	Coursera	https://www.coursera.org/learn/leadershipskills	Online Course
14.	Udemy	https://www.udemy.com/course/practical-leadership/?couponCode=NVDINCTA35CTR	Online Course

VIDEO REFERENCES:

S.No.	Video Details	Name of the Expert	Type of Content	Video Link
1.	YouTube	Alex	Lecture	https://www.youtube.com/watch?v=3Tu1jN65slw
2.	YouTube	Jeff Su	Lecture	https://www.youtube.com/watch?v=Tt08KmFfIYQ
3.	YouTube	Simplilearn	Lecture	https://www.youtube.com/watch?v=3w32jIsRIsw
4.	YouTube	Simplilearn	Lecture	https://www.youtube.com/watch?v=O4i8eQ_RiR8
5.	YouTube	Tutorials Point	Lecture	https://www.youtube.com/watch?v=I4uL5mkcAJc
6.	YouTube	Rachana Ranade	Lecture	ttps://www.youtube.com/@CARachanaRanade
7.	YouTube	Brian Tracy	Lecture	https://www.youtube.com/watch?v=LsyUnsJTvcc

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8.	YouTube	Simon Sinek	Lecture	https://www.youtube.com/watch?v=eXDNkwIeOqA

Mapping of COs with POs and PSOs															
COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								2		2					
CO2								2	3	3					
CO3								3	1						
CO4								2			1				
CO5								3	3	3					
Avg.								**2.4**	**2.3**	**2.7**	**1**				
1–Low, 2 –Medium, 3–High.															

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BE23PT811	CODING SKILLS – II	CP	L	T	P	C
		2	0	0	2	1
Programme & Branch	Common to all B.E/B.Tech. Branches	Version: 1.0				
	The Coding Skills – II course is designed to elevate students' programming proficiency by focusing on advanced problem-solving techniques, database fundamentals, and object-oriented programming concepts.					
Course Objectives:						
1.	To enable students to solve programming problems using arrays, lists, tuples, sets, dictionaries, and class-based data representations.					
2.	To strengthen students' ability to implement and apply OOP principles and linear data structures like stacks, queues, and linked lists to real-time problems.					
3.	To develop problem-solving skills through the use of SQL queries, file handling, and the integration of multiple programming concepts in real-world scenarios.					
	INTRODUCTION (Not for Examination)	**1**				
Importance	Coding is a vital skill for all engineering students. It sharpens problem-solving, boosts confidence, and opens diverse career paths. It supports learning emerging technologies, encourages innovation, and builds adaptability.					
Real-life Example(s)	• C / C++/ Java / Python and Data structure algorithms are used in GPS-based systems, ride-sharing apps, logistics planning, autonomous vehicles, and delivery optimization. • Banking software development, Transaction monitoring, Audit and logging systems uses SQL and Programming languages. • In IoT and Smart Home Devices, Java is used in edge devices and gateways for control and communication. • In Game Development, programming in C++ is used for speed and efficiency.					
Linkages	**Pre-requisite:** Coding Skills - I **Future courses:** -					
UNIT–I	This course, is designed to bridge the gap between theoretical knowledge and practical application. It focuses on strengthening students' core programming abilities and logical thinking, enabling them to approach complex problems systematically. A set of problems at 3 difficulty levels shall be given in a programming portal. Students can solve problems in the given portal throughout the semester. Each level focuses on specific skill levels, allowing students to gradually advance from foundational programming concepts to real-world challenges. Students will complete the minimum required	30				

problems in each level in the given programming portal as given below:

Problem Solving in Programming Portal

S. No.	Topics	Complexity Level	No. of Problems Available	Min. No. Problems to be Solved	Programming Language
1.	Arrays, Lists, Tuple, Sets, Dictionaries, Basic Class Implementation	Level 1	50	50	Java/Python
2.	Stack, Queue, Linked List, OOP Concepts (Inheritance, Polymorphism)	Level 2	50	35	C/C++/Java /Python
3.	SQL Queries, File Handling, Real-world Applications	Level 3	40	20	Java/Python + SQL Integration

The performance of the students in the problem-solving activities on the portal will be taken for Continuous Assessment (CA).

Two Internal Assessment Tests (IAT) will also be conducted and weightages for the CA and IATs shall be assigned as given below:

Assessment Structure:

S. No.	Assessment	Type of questions	Marks	Weightage
1.	CA	MCQ, Debugging, Problem Solving	Level 1: 25 marks Level 2: 35 marks Level 3: 40 marks Total: 100 marks	60%
2.	IAT - I	MCQ, Debugging, Problem Solving	MCQ : 20 Marks Debugging: 50 Marks Problem Solving:30 Marks Total : 100 marks	20%
3.	IAT - II	MCQ, Debugging, Problem Solving	MCQ : 20 Marks Debugging: 50 Marks Problem Solving:30 Marks Total : 100 marks	20%

		Total	**31 Periods**

	Course Outcomes: Upon completion of this course, the students will be able to:	BLOOM'S Taxonomy
CO1	Apply fundamental and advanced data structures to solve computational problems using appropriate programming constructs in Java / Python.	**L3 - Apply**
CO2	Design and implement object-oriented solutions using concepts like inheritance and polymorphism for real-world problems.	**L3 - Apply**
CO3	Apply fundamental and advanced data structures to solve computational problems using appropriate programming constructs in Java / Python.	**L3 - Apply**

REFERENCE BOOKS:

1.	Kathy Sierra and Bert Bates, "Head First Java", 2nd Edition, O'Reilly Media, 2005.
2.	Al Sweigart, "Automate the Boring Stuff with Python", 2nd Edition, No Starch Press, 2019.
3.	Kernighan B.W. & Ritchie, D.M, "The C Programming Language", 2nd Edition, Prentice Hall, 1988.
4.	Stroustrup B., "The C++ Programming Language", 4th Edition, Addison-Wesley, 2013.
5.	Schildt, H., "Java: The Complete Reference", 10th Edition, McGraw-Hill Education, 2018.
6.	Silberschatz A., Korth, H.F., & Sudarshan S., "Database System Concepts", 6th Edition, 2010.

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	HackerRank	https://www.hackerrank.com	Coding practice
2.	GeeksforGeeks	https://www.geeksforgeeks.org	Tutorials & problems
3.	LeetCode	https://leetcode.com	Competitive coding
4.	W3Schools	https://www.w3schools.com	Programming basics,SQL
5.	Programiz	https://www.programiz.com	Python, C, Java

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video Link
1.	YouTube	Knowledge Center	Leedcode Problems	https://www.youtube.com/@KnowledgeCenter
2.	YouTube	Priyansh	CodeChef Starters	https://www.youtube.com/@TLE_Eliminators

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Mapping of COs with POs and PSOs															
COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1										
CO2	3	2	3	3	2										
CO3	3	3	3	3	2										
AVG	**3**	**2.6**	**2.6**	**2.6**	**1.6**										
1–Low, 2 –Medium, 3–High.															

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<table>
<tr><td>BE23PT813</td><td>TECHNICAL COMPREHENSION AND MOCK INTERVIEW – II</td><td>CP
1</td><td>L
0</td><td>T
0</td><td>P
1</td><td>C
0.5</td></tr>
<tr><td>Programme & Branch</td><td colspan="2">Common to all B.E./B.Tech. Branches</td><td colspan="4">Version: 1.0</td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td>1.</td><td colspan="6">To prepare the students for campus placement and competitive exams through structured technical assessments.</td></tr>
<tr><td>2.</td><td colspan="6">To enhance students' readiness for real-world job interviews by providing exposure to mock interview scenarios.</td></tr>
<tr><td></td><td colspan="5">INTRODUCTION (Not for Examination)</td><td>01</td></tr>
<tr><td>Importance</td><td colspan="5">The Technical Comprehension and Mock Interview – II course is a critical component in the holistic development of engineering students. It is designed not only to reinforce technical understanding but also to simulate real-world hiring scenarios through mock interviews.</td><td></td></tr>
<tr><td>Linkages</td><td colspan="5">Technical Comprehension and Mock Interview – I</td><td></td></tr>
<tr><td>UNIT–I</td><td colspan="5">TECHNICAL COMPREHENSION</td><td>13</td></tr>
<tr><td></td><td colspan="5">1. 3 - 5 Department Core subjects (not included in Technical Comprehension and Mock Interview – I), which are essential for Core / Product placements, are to be chosen.
2. About 25 Keywords, which essential for the placements, are to be prepared from the subjects selected by the department.</td><td></td></tr>
<tr><td>UNIT–II</td><td colspan="5">MOCK INTERVIEW</td><td>02</td></tr>
<tr><td></td><td colspan="5">One-on-one Mock Interview will be conducted by the faculty team nominated by the HOD.</td><td></td></tr>
<tr><td></td><td colspan="5">Conduction of Classes:

Faculty will prepare Lesson plan and conduct the sessions accordingly.
The keywords will be discussed by the team of students.
The faculty will moderate the deliberations and clarify the queries.

Execution Plan:

<table>
<tr><th>S. No.</th><th>Phase</th><th>Activity</th><th>Duration</th></tr>
<tr><td>1.</td><td rowspan="3">Phase I</td><td>Introduction</td><td>1</td></tr>
<tr><td>2.</td><td>Discussions</td><td>7</td></tr>
<tr><td>3.</td><td>Mock Interview</td><td>1</td></tr>
<tr><td>4.</td><td rowspan="2">Phase II</td><td>Discussions</td><td>6</td></tr>
<tr><td>5.</td><td>Mock Interview</td><td>1</td></tr>
</table></td><td></td></tr>
</table>

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	Assessment Procedure: **S. No.** | **IAT** (Assessment | Method of assessment | Marks | Weightage) | **ESE** | **IAT + ESE** 1. | IAT - 1 | Written Test | 30 | 30% | - | 30 2. | Mock Interview 1 | Interview | 20 | 20% | - | 20 3. | IAT - 2 | Written Test | 30 | 30% | - | 30 4. | Mock Interview 2 | Interview | 20 | 20% | - | 20 Total | 100 | 100% | - | 100	
	Total	**16 Periods**
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Apply fundamental concepts from core departmental subjects relevant to placement and competitive exams.	**L3 - Apply**
CO2	Apply technical knowledge and communication skills effectively in simulated interview scenarios.	**L3 - Apply**

Mapping of COs with POs and PSOs

COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2													
CO2	3	1								3					
Avg.	**3.0**	**1.5**								**3.0**					

1–Low, 2 –Medium, 3–High.

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PROFESSIONAL ELECTIVES

VERTICAL 1 – JAVA FULL STACK

BE23CS504	BACKEND DEVELOPMENT WITH JAVA	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	**Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches**	**Version: 1.0**				

Course Objectives:		
1.	To understand the basics of Java backend development using Servlets and JSP.	
2.	To build applications using Spring MVC and template engines.	
3.	To implement JPA and Hibernate for database operations.	
4.	To create and test REST APIs using Spring Boot.	
5.	To deploy Java backend applications and integrate them with databases & cloud platforms.	
	INTRODUCTION (Not for Examination)	**2**
Importance	Backend development forms the foundation of modern web applications. This course equips students to build scalable, secure, and database-driven Java web applications.	
Real-life Example(s)	E-commerce platforms, Online banking systems, Social media applications, Enterprise web portals	
Linkages	**Pre-requisite:** • Fundamentals of Web Development • Frontend Technologies • Java 8 and Advanced Java Features **Future courses:** • Full Stack Development and Deployment • Devops and Cloud Basics • Secure Rest API Development	
UNIT–I	**SERVLET AND JSP**	**6**
	Introduction to Web Applications and Java EE – HTTP Protocol and Request/Response Model – **Servlet Lifecycle:** init(), service(), destroy () – Handling Form Data (GET, POST methods) – Introduction to JSP (Java Server Pages) – JSP Directives, Scripting Elements, Action Tags – MVC Architecture using Servlet and JSP – **Session Management:** Cookies and HttpSession.	
UNIT–II	**JPA WITH HIBERNATE**	**6**
	Introduction to ORM (Object Relational Mapping) – Hibernate Configuration and Architecture – Entity Classes and Hibernate Annotations – Performing CRUD Operations with Hibernate – **Relationships:** One-to-One, One-to-Many – Introduction to JPA and JPQL.	

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UNIT–III	**SPRING CORE AND SPRING MVC**	**6**
	Introduction to Spring Framework – Dependency Injection and Inversion of Control (IoC) – Bean Configuration and Lifecycle – Spring MVC Architecture – Request Mappings and Controllers – Introduction to Thymeleaf Template Engine – Setting up Thymeleaf with Spring MVC – Data Binding and Dynamic HTML Rendering using Thymeleaf – Form Handling and Validation using Spring MVC.	
UNIT–IV	**SPRING BOOT**	**6**
	Overview of Spring Boot vs Traditional Spring – Spring Initializer Setup – Auto Configuration and Starter Dependencies – Spring Boot DevTools for Fast Development – Profiles and Property Management – Packaging and Running Spring Boot Applications – Spring Boot Database Connection (JPA Integration).	
UNIT–V	**REST API DEVELOPMENT USING SPRING BOOT**	**6**
	REST Architecture and Principles – Building REST APIs (GET, POST, PUT, DELETE) – Request Handling and Response Entities – Exception Handling in REST Services –Introduction to API Authentication (JWT Overview) – Testing APIs using Postman.	
	Total (L)	**32 Periods**
	LIST OF EXPERIMENTS:	
1.	Build Servlet applications, create dynamic web pages using JSP, implement a Login system using Servlet and JSP.	
2.	Build a Java application using Hibernate ORM, Integrate JPA with MySQL Database, Perform CRUD and Relationship operations.	
3.	Build a Spring MVC Application, Handle form data with Thymeleaf Templates, Dynamic rendering using Spring and Thymeleaf.	
4.	Build a CRUD Application with Spring Boot, Connect and manage databases in Spring Boot Apps.	
5.	Develop a complete RESTful API, Test APIs using Postman.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Describe the process of creating Java web applications using Servlets and JSP.	**L2 – Understand**
CO2	Explain how data is managed using JPA and Hibernate.	**L2 – Understand**

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CO3	Design modular applications using Spring Core and MVC architecture.	**L3 – Apply**
CO4	Create and deploy RESTful APIs using Spring Boot.	**L3 – Apply**
CO5	Implement security measures and perform testing of Java backend applications using appropriate tools and techniques.	**L3 – Apply**

	TEXTBOOKS:
1.	K. Somasundaram, P. Suresh Kumar, "Java Programming and Web Development", Tata McGraw-Hill, 2019.
	REFERENCE BOOKS:
1.	Herbert Schildt, "Java: The Complete Reference", 12th Edition, McGraw-Hill, 2022.
2.	Ramesh Fadatare, "Spring 5 Design Patterns", Packt Publishing, 2018.
3.	Craig Walls, "Spring in Action", 6th Edition, Manning Publications, 2022.
4.	Christian Bauer, Gavin King, Gary Gregory, "Java Persistence with Hibernate", 2nd Edition, Manning Publications, 2015.
5.	Rod Johnson, Juergen Hoeller, Alef Arendsen, Thomas Risberg, Colin Sampaleanu, "Professional Java Development with the Spring Framework", Wrox, 2009.

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	Spring.io	https://spring.io/projects/spring-boot	Web Reference
2.	Hibernate.org	https://hibernate.org/orm/documentation	Web Reference
3.	Thymeleaf.org	https://www.thymeleaf.org/documentation.html	Web Reference

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video Link
1.	YouTube	Selenium Express	Tutorial and Demonstration	https://www.youtube.com/watch?v=zzwoJvAGg5o
2.	YouTube	Dan Vega	Tutorial and Demonstration	https://www.youtube.com/watch?v=UgX5lgv4uVM

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Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	1	2				2	2		2		3	
CO2	3	2	2	2	3				1	2		2		2	
CO3	3	2	3	1	2				2	2		2		3	
CO4	3	2	3	2	3				1	2		2		2	
CO5	2	2	2	3	3			2	1	2		3		2	
Avg.	**2.8**	**2.0**	**2.6**	**1.8**	**2.6**			**2.0**	**1.4**	**2.0**		**2.2**		**2.4**	
1–Low, 2 –Medium, 3–High.															

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VERTICAL 2 – AGILE METHODOLOGY WITH DEVOPS PROGRAMMING

BE23CS514	DEVOPS CONTAINER SERVICES	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To understand the fundamentals of DevOps and containerization principles.	
2.	To provide insights in container orchestration and Kubernetes.	
3.	To explore docker essentials for creating, managing and securing containers.	
4.	To integrate containers with CI/CD pipelines.	
5.	To apply best practices through case studies.	
	INTRODUCTION (Not for Examination)	**2**
Importance	With the rapid adoption of DevOps practices and microservices architecture, container technology like Docker and Kubernetes has become essential for modern software delivery. It automates the software lifecycle with CI/CD, and gain exposure to security, monitoring, and scalability aspects of real-time containerized environments.	
Real-life Example(s)	Netflix, Spotify, pinterest, eBay.	
Linkages	**Pre-requisite:** Foundational Knowledge, Operating Systems, Cloud Computing, Programming and Scripting. **Future courses:** Introduction to Azure and AWS DevOps.	
UNIT–I	**INTRODUCTION TO DEVOPS AND CONTAINERS**	**6**
	Introduction to DevOps Principles – Containers: A Revolution in Software Deployment – Containerization vs. Virtualization – Docker and Container Ecosystem Overview – Use Cases for Containers in DevOps.	
UNIT–II	**CONTAINER ORCHESTRATION**	**6**
	Introduction to Container Orchestration – Deep Dive into Kubernetes – Managing Containers with Kubernetes – Service Discovery and Load Balancing – Kubernetes Operators and Custom Resources.	
UNIT–III	**DOCKER ESSENTIALS**	**6**
	Docker Fundamentals and Installation – Building and Managing Docker Images – Networking and Data Management in Docker – Docker Compose for Multi-Container Applications – Docker Security Best Practices.	

UNIT–IV	**CONTINUOUS INTEGRATION AND DELIVERY (CI/CD) WITH CONTAINERS**	**6**
	Integrating Containers into CI/CD Pipelines – Automated Docker Builds with Dockerfile – Container Registry and Image Management – Deploying Containers in CI/CD Pipelines – Blue-Green Deployments with Containers.	
UNIT–V	**ADVANCED TOPICS IN DEVOPS CONTAINERS**	**6**
	Container Security Scanning and Compliance – Monitoring and Logging in Containerized Environments – Scaling and Auto-Scaling with Kubernetes – High Availability and Disaster Recovery Strategies – Case Studies and Best Practices in DevOps Container Services.	
	Total (L)	**32 Periods**
	COURSE PROJECT:	
1.	To prepare a Document the steps taken to implement in any project.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Understand DevOps principles and container concepts.	**L2 - Understand**
CO2	Apply Kubernetes orchestration techniques to manage applications.	**L3 - Apply**
CO3	Implement Docker containers and security practices.	**L3 - Apply**
CO4	Apply CI/CD pipelines in containers.	**L3 - Apply**
CO5	Implement advanced strategies in real-time applications.	**L3 - Apply**
	TEXTBOOKS:	
1.	Nigel Poulton, "Docker Deep Dive", Publish Dive, 2023.	
2.	Jez Humble and David Farley, "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation", Pearson Education, 2010.	
	REFERENCE BOOKS:	
1.	Sean P. Kane, Karl Matthias, "Docker – Up & Running", O'Reilly, 2023.	

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2.	Marko Luksa, Kevin Conner, "Kubernetes in Action: Second Edition", 2nd Edition, Manning Publications, 2024.			
	WEB REFERENCES:			
S.No	**Publisher**	**Website link**		**Type of Content**
1.	Amazon Web Services	https://aws.amazon.com/what-is/containerization/		Learning Content
2.	github	https://github.com/resources/articles/devops/containerization		Web content
	VIDEO REFERENCES:			
S.No	**Video Details**	**Name of the Expert**	**Type of Content**	**Video Link**
1.	YouTube	freecodecamp	Learning	https://www.youtube.com/watch?v=fqMOX6JJhGo
2.	YouTube	Nana	Lecture	https://www.youtube.com/watch?v=s_o8dwzRIu4

Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2			1									2	2
CO2	3	2	3		3				1				2	2	3
CO3	3	3	3	2	3					1				3	2
CO4	3	3	3	2	3				1				2	3	2
CO5	3	3	3	3	3	2	1						3	2	3
Avg.	**3.0**	**2.6**	**3.0**	**2.3**	**2.6**	**2.0**	**1.0**		**1.0**	**1.0**			**2.3**	**2.4**	**2.4**
1–Low, 2 –Medium, 3–High.															

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VERTICAL 3 – CYBERSECURITY

BE23IT524	FUNDAMENTALS OF MALWARE REVERSE ENGINEERING	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To apply processor architecture and low-level concepts to identify malware behaviour.	
2.	To use instruction formats, addressing modes, and assembly operations to solve malware analysis tasks.	
3.	To implement assembly instructions to construct malicious behaviour patterns.	
4.	To apply debugging and disassembly techniques to build reverse-engineering workflows.	
5.	To use stack, registers, flags, and memory flow to model malware execution behaviour.	
	INTRODUCTION (Not for Examination)	**2**
Importance	Builds essential low-level skills in architecture, assembly, and debugging needed to analyse malware behaviour and interpret disassembled code.	
Real-life Example(s)	Ransomware disassembly - Malicious API tracing – Shellcode identification - Malware unpacking - Thread and stack tracing.	
Linkages	**Pre-requisite:** Foundations of Cybersecurity, Static Malware Analysis, Dynamic Malware Analysis. **Future courses:** Android Malware Analysis, Windows Operating System Security, Windows Threats and Defense Techniques.	
UNIT–I	**BASICS OF X86/X64 PROCESSOR ARCHITECTURE**	**6**
	x86 vs x64 instruction set comparison - General purpose registers - CPU and ALU internal structure - Stack and frame pointer concepts - Instruction Pointer / Program Counter - Memory layout and stack operations - Flags Register.	
UNIT–II	**INSTRUCTION STRUCTURE & ADDRESSING METHODS**	**6**
	Opcodes, mnemonics, operand types - Instruction format and length - Addressing modes in x86/x64 - Register–memory operand encoding - Machine code instruction format - ModR/M byte decoding - Effective address calculation.	
UNIT–III	**CORE ASSEMBLY INSTRUCTIONS**	**6**
	Data transfer instructions - Stack transfer instructions - Arithmetic instructions - Increment & decrement instructions - Bitwise logic instructions - Comparator instructions - Branching & flow control instructions.	

UNIT–IV	**MISCELLANEOUS & CONTROL INSTRUCTIONS**	**6**
	Looping and jumping instructions - Function calls & return instructions - Interrupt and exception instructions – Flag control instructions - NOP and miscellaneous instructions - Basic shellcode behaviour - Instruction optimization basics.	
UNIT–V	**INTRODUCTION TO DEBUGGING & DISASSEMBLY**	**6**
	Disassembler vs decompiler - Code, register, stack windows - Execution flow tracing - Setting software & hardware breakpoints - Viewing strings and memory – Listing modules & APIs - Call stack interpretation.	
	Total (L)	**32 Periods**
	LIST OF EXPERIMENTS:	
1.	Write an assembly program to examine EAX, EBX, ECX, EIP and observe changes in ZF, CF, OF using a debugger.	
2.	Write and execute a simple assembly program using MOV, ADD, SUB to understand basic arithmetic operations.	
3.	Write a basic assembly program using PUSH and POP and trace ESP/RSP changes using a debugger.	
4.	Develop assembly instructions using C program demonstrating immediate, register, and memory addressing modes, and verify using a disassembler.	
5.	Write a simple C program and use a debugger to set breakpoints and trace execution using step-into and step-over.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Apply processor architecture concepts to identify low-level malware execution behaviours.	**L3 - Apply**
CO2	Utilize instruction formats, addressing modes, and assembly structures for malware analysis.	**L3 - Apply**
CO3	Use core assembly instructions to construct malicious behaviour patterns.	**L3 - Apply**
CO4	Apply debugging and disassembly tools to develop reverse-engineering workflows.	**L3 - Apply**
CO5	Experiment with stack, registers, flags, and memory flow to model and detect malware execution.	**L3 - Apply**

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	TEXTBOOKS:
1.	Daniel Kusswurm, "Modern X86 Assembly Language Programming", 2nd Edition, Apress, 2021.
2.	Jonathan Bartlett, "Programming from the Ground Up", 3rd Edition, Bartlett Publishing, 2022.
	REFERENCE BOOKS:
1.	Sergey Bronnikov, "Low-Level Programming", 2nd Edition, Leanpub, 2023.
2.	Chris Eagle, "The IDA Pro Book", 3rd Edition, No Starch Press, 2020.
3.	Michael Hale Ligh, "Practical Malware Analysis (Updated)", No Starch Press, 2023.

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	Wikibooks	https ://en. Wiki books. org/ wiki/ X86_Assembly	Article
2.	Wikipedia	https://en. wikipedia. Org /wiki /X86_ assembly_language	Article
3.	O'Reilly	https://www.oreilly.com/search/skills/assembly/	Article

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video Link
1.	YouTube	Davy Wybiral	Lecture	https://www.youtube.com/playlist?list=LmxT2pVYo5LB5Ez TPZGfFN0c2GDiSXgQe
2.	YouTube	OllyDbg	Tutorial	https://www.youtube.com/watch?v=bkj 8wSVEDR4
3.	YouTube	jeFF0Falltrades	Lecture	https://www.youtube.com/watch?v=ZX oW5iqbFJE

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			3					2			2	1	2
CO2	2	3		2								2	2	1	2
CO3	3	2	3		3						2		3	2	2
CO4	3			3	3					2		3	2	2	3
CO5		3		3							3	3	3	2	2
Avg.	**2.7**	**2.5**	**3.0**	**2.6**	**3.0**					**2.0**	**2.5**	**2.6**	**2.4**	**1.6**	**2.2**

1–Low, 2 –Medium, 3–High.

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VERTICAL 4 – DATA ANALYTICS AND AI

BE23AD534	DEEP LEARNING TECHNIQUES	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To understand fundamental linear algebra, probability, and optimization techniques for building deep learning models.	
2.	To master the principles of convolutional operations and their application in CNN architectures.	
3.	To learn the design and application of recurrent neural networks for sequence modeling and handling long-term dependencies.	
4.	To develop skills in evaluating and optimizing neural network performance through hyperparameter tuning and debugging.	
5.	To explore the design and application of autoencoders and generative models for unsupervised learning tasks.	
	INTRODUCTION (Not for Examination)	**2**
Importance	Sub-field of Artificial Intelligence - Deep Learning (DL) powers most of the cutting-edge AI technologies including Computer Vision, Natural Language Processing, Speech Recognition, Recommendation Systems.	
Real-life Example(s)	Face recognition, object detection, autonomous vehicles, chatbots, language translation, sentiment analysis.	
Linkages	**Pre-requisite:** Probability and Statistics, Linear Algebra, Python programming, Machine Learning. **Future courses:** Natural Language Processing, Large Language Models & AI Agents.	
UNIT–I	**DEEP NETWORKS BASICS**	**6**
	Linear Algebra: Scalars – Vectors – Matrices and tensors; Probability Distributions – Gradient-based Optimization – Machine Learning Basics: Capacity – Overfitting and underfitting – Hyper parameters and validation sets – Estimators – Bias and variance – Stochastic gradient descent – Challenges motivating deep learning – Deep Networks: Deep feed forward networks – Regularization – Optimization.	
UNIT–II	**CONVOLUTIONAL NEURAL NETWORKS**	**6**
	Convolution Operation – Sparse Interactions – Parameter Sharing – Equivariance – Pooling – Convolution Variants: Strided – Tiled – Transposed and dilated convolutions – CNN Learning: Non linearity Functions – Loss Functions – Regularization – Optimizers – Gradient Computation.	

UNIT–III	**RECURRENT NEURAL NETWORKS**	**6**
	Unfolding Graphs – RNN Design Patterns: Acceptor – Encoder – Transducer – Gradient Computation – Sequence Modeling Conditioned on Contexts – Bidirectional RNN – Sequence to Sequence RNN – Deep Recurrent Networks – Recursive Neural Networks – Long Term Dependencies – Leaky Units: Skip connections and dropouts – Gated Architecture: LSTM.	
UNIT–IV	**NEURAL NETWORKS**	**6**
	Performance metrics – Baseline Models – Hyperparameters: Manual Hyperparameter – Automatic Hyperparameter – Grid search – Random search – Debugging strategies.	
UNIT–V	**AUTOENCODERS AND GENERATIVE MODELS**	**6**
	Autoencoders: Undercomplete autoencoders – Regularized autoencoders – Stochastic encoders and decoders – Learning with autoencoders – Deep Generative Models: Variational autoencoders – Generative adversarial networks. ***Experimental Learning:** Implement a variational autoencoder to denoise corrupted images, leveraging undercomplete and regularized autoencoders for generative tasks.	
	Total (L)	**32 Periods**
	*** INTERNAL EVALUATION ONLY**	
	LIST OF EXPERIMENTS:	
1.	Implement Anomaly Detection in Credit Card Transactions to predict whether a transaction is fraudulent or legitimate using Multilayer Perceptron (MLP).	
2.	Implement an Artificial Neural Network (ANN) to recognize Handwritten Digits and Characters using datasets like MNIST.	
3.	Design Traffic Sign Recognition system using CNN.	
4.	Design Face Aging Simulation using GAN.	
5.	Implement Time series Anomaly Detection for ECG Data using LSTM.	
6.	Implement Real-Time Colorization of Old Photographs using Autoencoders.	
7.	Design Sentiment Analysis for Flipkart Product Reviews using LSTM.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**

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	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Explain the fundamental principles and architectures of Neural Networks and Deep Learning	**L2 – Understand**
CO2	Use Convolutional Neural Network (CNN) models to enhance performance in image classification tasks.	**L3 – Apply**
CO3	Apply advanced neural network architectures and training techniques to address complex sequential data challenges.	**L3 – Apply**
CO4	Implement Autoencoder algorithms for dimensionality reduction and deep learning applications.	**L3 – Apply**
CO5	Design and implement deep learning models to address real-world problems effectively.	**L3 – Apply**

	TEXTBOOKS:
1.	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", 2nd Edition, MIT Press, 2017.
2.	Andrew Glassner, "Deep Learning: A Visual Approach", 1st Edition, No Starch Press, 2021.
	REFERENCE BOOKS:
1.	Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", 1st Edition, O'Reilly Media, 2017
2.	Ian Good Fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", 1st Edition, MIT Press, 2016.
3.	Simon Haykin, "Neural Networks and Learning Machines", 3rd Edition, Pearson Prentice Hall, 2008
4.	Navin Kumar Manaswi, "Deep Learning with Applications Using Python", 1st Edition, Apress, 2018.

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	Geeks for Geeks	https://www.geeksforgeeks.org/introduction-deep-learning	Notes & Coding for the related topics
2.	JavaTpoint	https://www.javatpoint.com/deep-learning	Notes & Coding for the related topics

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video Link
1.	YouTube	Mr.Dhavel Patel, (NVDIA)	Lecture	https://www.youtube.com/watch?v=FmnVGuWPxJ8

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2.	NPTEL	Prof.Prabir Kumar Biswas	Lecture	https://onlinecourses.nptel.ac.in/noc25_ee16/preview

Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2		1				2	3		2	2	1	
CO2	2	2	2	3	3						2		3	3	
CO3	3	3	3		3				2	1	1	2	3	2	3
CO4	3	3	1	1	1				1		1		2	2	1
CO5	3	2	2	2	3				2	3	2	2	3	2	3
Avg.	**2.8**	**2.4**	**2**	**2.0**	**2.2**				**1.7**	**2.3**	**1.5**	**2.0**	**2.6**	**2.0**	**2.3**
1–Low, 2 –Medium, 3–High.															

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VERTICAL 6 – BUSINESS PROCESS AUTOMATION

BE23CB554	IT OPERATION MANAGEMENT	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To explain the concepts, role, and significance of IT Operation Management.	
2.	To describe the components of the IT operations management suite and interpret their capabilities.	
3.	To apply IT operation management tools to perform basic Event Management, Discovery, and Service Mapping activities.	
4.	To demonstrate automation in IT Operations using Orchestration and Cloud Management techniques.	
5.	To analyze and utilize IT Operations Management data integrated with the Configuration Management Database.	
	INTRODUCTION (Not for Examination)	**2**
Importance	It enables effective monitoring and control of IT infrastructure, supporting proactive management, reduced downtime, and better service quality.	
Real-life Example(s)	E-commerce companies like Amazon and Azure Banking environment.	
Linkages	**Pre-requisite:** Fundamentals of IT Service Management, Custom Application Development. **Future courses:** Automation for Digital Creators, IT Asset Management.	
UNIT–I	**FOUNDATIONS OF IT OPERATIONS MANAGEMENT**	**6**
	Definition – Importance of IT Operation Management in Enterprises – Role of IT Operation Management in IT Service Management – IT Operation Management vs IT Service Management – Challenges and Use Cases in IT Operations.	
UNIT–II	**ENTERPRISE IT OPERATIONS**	**6**
	IT Operation Management Modules – Key Components – Event Management – Discovery – Service Mapping – Operations – Licensing Models – Integration with other products.	
UNIT–III	**EVENT MANAGEMENT AND DISCOVERY**	**6**
	Event Management Overview – Event Sources – Alert Correlation – Impact and Priority – Discovery Overview – MID Server – Horizontal Discovery – Credentials and Probes – Patterns and Classifications.	

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UNIT–IV	**SERVICE MAPPING AND CLOUD MANAGEMENT**	**6**
	Service Mapping Fundamentals – Top-Down Mapping – Pattern-Based vs Traffic-Based Mapping – Dependency Views – Introduction to Cloud Management – Cloud Service Catalog – Cloud Resource Provisioning – Multi-Cloud Environments.	
UNIT–V	**ORCHESTRATION AND CONFIGURATION MANAGEMENT**	**6**
	Introduction to Orchestration – Workflow Design – Orchestration Process – Integration Hub – Use Cases of Orchestration – Introduction to Configuration Management Database – Configuration Items (CI) – IT Operation Management Data Flow to Configuration Management Database.	
	Total (L)	**32 Periods**
	LIST OF EXPERIMENTS:	
1.	Simulate IT events and analyze alerts.	
2.	Set up and configure a MID Server.	
3.	Perform a Discovery on a sample network.	
4.	Create a basic Service Map using Service Mapping.	
5.	Deploy a cloud resource using Cloud Management.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Explain the IT Operation Management principles and their relevance to IT service delivery.	**L2 - Understand**
CO2	Apply tools for monitoring and managing IT infrastructure.	**L3 - Apply**
CO3	Implement Discovery and Service Mapping processes.	**L3 - Apply**
CO4	Design orchestration workflows and manage cloud services.	**L3 - Apply**
CO5	Integrate IT Operation Management data into the Configuration Management Database for enhanced visibility and control.	**L3 - Apply**
	TEXTBOOKS:	
1.	Ajaykumar Guggilla, "ServiceNow IT Operations Management: Demystifying IT Operations Management", ServiceNow Press, 2017.	

2.	Muhammad Zeeshan Ali & Saqib Javed John, "ServiceNow ITOM (Information Technology Operations Management) Knowledge Guide", Independently, 2023.
	REFERENCE BOOKS:
1.	ServiceNow Documentation Team, "IT Operations Management with ServiceNow", 2023.
2.	Mohammad Khaleelullah Khan, "ServiceNow for IT Service Management: Manage, Transform, and Deliver IT Operations and Services", Orange Education Pvt. Ltd., 2025.

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	Servicenow	https://www.servicenow.com/products/it-operationsmanagement.html?utm_source=chatgpt.com	Web Content
2.	Servicenow	https://www.servicenow.com/community/itom-blog/itom-overview-it-operations-management/bap/2332668?utm_source=chatgpt.com	Web Content
3.	Servicenow	https://www.servicenow.com/products/service-mapping.html?utm_source=chatgpt.com	Web Content

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video Link
1.	YouTube	HKR Trainings	Lecture	https://youtu.be/HAfhHNW_Pu4?si=YVZD0waKNI7UjeMN
2.	YouTube	IT Canvass	Lecture	https://youtu.be/tqeYKIwUPeA?si=FPLcFtXkNecK_pfn
3.	YouTube	IT Canvass	Lecture	https://youtu.be/HAfhHNW_Pu4?si=8O0QHzudJyCQWarT

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	3				1	3			2		1
CO2	3	1	2	3	3				1	2			3	1	2
CO3	3	3	2	3	3				2	3			3	2	3
CO4	3	2	1	2	2				1	2			3	3	3
CO5	3	3	3	3	3				3	1			3	1	2
Avg.	**3.0**	**2.2**	**2.0**	**2.4**	**2.8**				**1.6**	**2.2**			**2.8**	**1.8**	**2.2**

1–Low, 2 –Medium, 3–High.

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VERTICAL 7 – JAVA AUTOMATION

BE23CS523	ADVANCED TESTING WITH TESTNG AND CI/CD	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To understand the importance of testing frameworks, create and run test cases using TestNG in Eclipse IDE.	
2.	To understand XML file structure of TestNG, Integrate with selenium for End-to-End Automation.	
3.	To explore Maven lifecycle and apply Maven for building, executing Selenium and TestNG projects.	
4.	To practice GIT commands to create Maven-based automation projects for repository management.	
5.	To design and configure CI/CD pipelines in Jenkins with Selenium and TestNG integration for executing automated test workflows.	
	INTRODUCTION (Not for Examination)	**2**
Importance	Advanced testing using TestNG and CI/CD supports the development of robust, scalable, and data-driven automation frameworks. It enhances the execution process through real-time reporting. This integration boosts software quality, speeds up the skills needed for modern DevOps-driven testing environments.	
Real-life Example(s)	Banking application, E-commerce Application, Business Applications.	
Linkages	**Pre-requisite:** Java programming, Testing Fundamentals and Manual Testing, Automation Testing with Selenium. **Future courses:** Tools for Automated Testing.	
UNIT–I	**INTRODUCTION TO TESTNG FRAMEWORK**	**6**
	Importance of Testing Frameworks in Automation – **Overview:** TestNG vs Junit – Installing TestNG Plugin in Eclipse – TestNG Annotations and Execution Flow – Creating and Running a Simple TestNG Test – Grouping Test Cases – Prioritizing and Sequencing Tests – Disabling and Enabling Test Cases.	
UNIT–II	**TESTNG ADVANCED FEATURES AND ASSERTIONS**	**6**
	Understanding TestNG XML File Structure – Parameterization using TestNG.xml – Soft vs Hard Assertions – Data Providers for Data-Driven Testing – Handling Failed Tests (Retry Mechanisms) – Integrating TestNG with Selenium for End-to-End Automation – Generating TestNG Reports.	

UNIT–III	**BUILD MANAGEMENT WITH MAVEN**	**6**
	Introduction to Maven for Automation Projects – Maven Lifecycle and POM (Project Object Model)– Creating a Maven-Based Selenium and TestNG Project – Adding Dependencies via Maven Central Repository – Running TestNG Tests using Maven (mvn test) – Generating Maven Surefire Reports.	
UNIT–IV	**VERSION CONTROL WITH GIT AND GITHUB**	**6**
	Introduction to Version Control – Git and GitHub Overview – Installing Git on Windows – **Basic Git Commands:** init, clone, add, commit, push, pull – Managing Branches and Merges – Ignoring Files using gitignore– Connecting Maven Project to GitHub – Best Practices for Commit Messages and Repository Management.	
UNIT–V	**ADVANCED CI/CD AND REAL-TIME INTEGRATION**	**6**
	Introduction to CI/CD Concepts – Jenkins Overview and Installation – Jenkins Configuration for Automation – Integrating Jenkins with Selenium WebDriver – Installing and Using Maven Plugin in Jenkins– Creating Freestyle and Maven Jobs – Integrating Jenkins with GitHub – Publishing HTML and TestNG Reports through Jenkins.	
	Total (L)	**32 Periods**
	LIST OF EXPERIMENTS:	
1.	Create parameterized tests using testng.xml and Data Providers.	
2.	Implement soft and hard assertions in test automation.	
3.	Execute Selenium + TestNG scripts and generate TestNG HTML reports.	
4.	Create and configure a Maven-based Selenium + TestNG project.	
5.	Add dependencies and manage project builds using Maven.	
6.	Generate Surefire Reports for executed test cases.	
7.	Initialize and manage a local Git repository.	
8.	Push a Maven project to GitHub and manage branches.	
9.	Implement collaborative version control using Git CLI.	
10.	Install and configure Jenkins for CI/CD.	
11.	Integrate Jenkins with GitHub and Maven.	
12.	Automate Selenium + TestNG builds and publish TestNG reports through Jenkins.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**

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	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Understand the testing frameworks in automation and along with the steps to install and create TestNG tests in Eclipse IDE.	**L2 – Understand**
CO2	Integrate TestNG with Selenium to build end-to-end automated test frameworks for web applications.	**L2 – Understand**
CO3	Manage build automation and project dependencies using Maven for seamless test execution.	**L3 – Apply**
CO4	Implement Maven-based automation project using Git and collaborate effectively using GitHub repositories.	**L3 – Apply**
CO5	Demonstrate the configuration and operation of CI/CD pipelines in Jenkins using Selenium and TestNG for automating continuous testing.	**L3 – Apply**
	TEXTBOOKS:	
1.	Pranoday Pramod Dingare, "Selenium and TestNG: A Beginner's Guide", Packt Publishing.	
	REFERENCE BOOKS:	
1.	Boni García, "Mastering Software Testing with TestNG and Selenium", Packt Publishing, 2017.	
2.	Pallavi sharma., "Selenium WebDriver with Java – Basics to Advanced & Interview Guide", BPB Publications, 2021.	
3.	John Ferguson Smart, Jenkins, "The Definitive Guide", O'Reilly Media, 2011.	
4.	Stephen Nelson-Smith, "Test-Driven Infrastructure with Jenkins", O'Reilly Media, 2013.	
5.	Tim O'Brien, "Maven: The Complete Reference", Sonatype, 2010.	
	WEB REFERENCES:	

S.No.	Publisher	Website link	Type of Content
1.	TestNG Documentation	https://testng.org/	Web Reference
2.	Selenium with TestNG Tutorials	https://www.toolsqa.com/testng/testng-tutorial/	Web Reference
3.	Apache Maven Project	https://maven.apache.org/	Web Reference
4.	Git Documentation	https://git-scm.com/doc	Web Reference
5.	Jenkins Official Documentation	https://www.jenkins.io/doc/	Web Reference

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	VIDEO REFERENCES:			
S.No.	**Video Details**	**Name of the Expert**	**Type of Content**	**Video Link**
1.	YouTube	Naveen Automation Labs	Video content	https://www.youtube.com/watch?v=0Gew2XOuum8
2.	YouTube	Mukesh otwani	Tutorial	https://www.youtube.com/watch?v=OTtFSnZY4f8

Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	3	1					1	2	3	3	2
CO2	3	3	2	2	3	1					2	2	3	3	2
CO3	2	2	3	1	3	1					3	2	2	3	3
CO4	2	2	2	1	3	2					3	2	2	3	2
CO5	3	3	3	2	3	2					3	3	3	3	3
Avg.	**2.6**	**2.4**	**2.4**	**1.4**	**3.0**	**1.4**					**2.4**	**2.2**	**2.6**	**2.6**	**2.4**
1–Low, 2 –Medium, 3–High.															

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VERTICAL 1 – JAVA FULL STACK

BE23CS505	FULL STACK DEVELOPMENT AND DEPLOYMENT	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To understand and use REST APIs, HTTP requests, CORS, and environment settings for frontend–backend communication.	
2.	To apply secure login and authorization using JWT, user roles, protected pages, and token handling.	
3.	To analyze and develop full-stack applications by connecting frontend forms with backend CRUD APIs using a clean structure and proper error handling.	
4.	To deploy frontend and backend applications with secure settings, correct API links, and production best practices.	
5.	To understand modern development practices such as containerization and basic CI/CD workflows for complete web solutions.	
	INTRODUCTION (Not for Examination)	**2**
Importance	The course empowers students to create complete full-stack applications, focusing on secure authentication, smooth frontend-backend integration, and efficient deployment. It also introduces modern DevOps practices, preparing learners for practical, real-world web development.	
Real-life Example(s)	E-commerce Platform, Banking Application, Task Management Tool (like Trello)	
Linkages	**Pre-requisite:** • Fundamentals of Web Development • Frontend Technologies • Java 8 and Advanced Java Features • Backend Development with Java **Future courses:** • Devops and Cloud Basics • Secure Rest API Development	
UNIT–I	**FRONTEND–BACKEND COMMUNICATION BASICS**	**5**
	Introduction to REST API Integration – HTTP Requests from Frontend (fetch, axios) – Understanding CORS (Cross-Origin Resource Sharing) and Solutions – API Authentication Tokens (Introduction to JWT) – Environment Variable Management (Frontend side).	
UNIT–II	**USER AUTHENTICATION AND AUTHORIZATION**	**6**
	Authentication Flows (Sign up, Login, Token Handling) – Authorization Flows (Role-based access control basics) – Building a Secure Login System (Frontend + Backend) – Handling Protected Routes on	

	Frontend – Token Expiry and Auto-Logout Handling.	
UNIT–III	**FULL STACK APPLICATION DEVELOPMENT**	**7**
	Full Stack Project Planning (ERD + Frontend and Backend Sync) – Folder Structure for Full Stack Applications – Connecting Frontend Forms to Backend CRUD APIs – Error Handling and User Feedback (Frontend) – Optimizing API Calls and Code Refactoring.	
UNIT–IV	**DEPLOYMENT OF FRONTEND AND BACKEND**	**6**
	Deployment of Frontend Apps – Deployment of Spring Boot Backend Apps – Managing Environment Variables securely – Handling Domain Linking and API URLs – Best Practices for Production Deployment.	
UNIT–V	**INTRODUCTION TO DEVOPS BASICS**	**6**
	Introduction to Docker Concepts – Building Simple Docker Containers (Spring Boot Backend) – Awareness of CI/CD Pipelines (GitHub Actions overview) – Version Controlling Deployment.	
	Total (L)	**32 Periods**
	LIST OF EXPERIMENTS:	
1.	Create a frontend app fetching data from backend API.	
2.	Handle API token storage (local Storage/session Storage)	
3.	Build a login + protected dashboard full stack mini app.	
4.	Build a small full stack CRUD application.	
5.	Integrate API error handling and toast notifications.	
6.	Deploy full stack app live.	
7.	Solve CORS, domain issues, secure API keys.	
8.	Create a basic Dockerfile for Spring Boot app.	
9.	Setup auto-deploy from GitHub to Vercel for frontend.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Integrate React/Angular/Next.js frontend apps with Spring Boot REST APIs.	**L2 – Understand**

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CO2	Apply user authentication and authorization in full stack applications.	**L3 – Apply**
CO3	Deploy full stack applications with separated frontend and backend hosting.	**L3 – Apply**
CO4	Execute techniques to resolve deployment issues involving CORS, environment variables, and API proxying.	**L3 – Apply**
CO5	Interpret the basic concepts of Docker, GitHub Actions and basic CI/CD practices.	**L2 – Understand**

	TEXTBOOKS:
1.	David Clinton, Tracy Wallace, "Practical GitHub Actions", O'Reilly Media 2023.
	REFERENCE BOOKS:
1.	Robin Wieruch, "The Road to React", 2020.
2.	K. Somasundaram, P. Suresh Kumar, "Java Programming and Web Development", Tata McGraw-Hill, 2019.
3.	Craig Walls, "Spring in Action", 5th Edition, Manning Publications, 2018.
4.	Ramesh Fadatare, "Spring 5 Design Patterns", Packt Publishing, 2018.
	WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	React Official Documentation	https://react.dev/	Web Reference
2.	Angular Official Documentation	https://angular.io/docs	Web Reference
3.	Next.js Official Documentation	https://nextjs.org/docs	Web Reference
4.	Spring Boot Official Documentation	https://spring.io/projects/spring-boot	Web Reference
5.	Docker Official Documentation	https://docs.docker.com	Web Reference
6.	GitHub Actions Documentation	https://docs.github.com/en/actions	Web Reference

VIDEO REFERENCES:

S.No.	Video Details	Name of the Expert	Type of Content	Video Link
1.	YouTube	Daily Code Buffer	Tutorial	https://www.youtube.com/watch?v=Gp3c0vPp9GM
2.	YouTube	Traversy Media (Brad Traversy)	Tutorial	https://www.youtube.com/playlist?list=PLXXI5Oe3aCLk16U-DrbZTl17X1BFEJaVs

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Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	1	3				1	1		2	1	3	1
CO2	3	3	3	1	2			2	1	1		2	1	3	1
CO3	2	2	3	1	3				2	2	2	3	1	3	2
CO4	3	3	2	2	3				2	1		3	1	3	2
CO5	2	2	3	1	3				2	2	3	3	1	2	3
Avg.	**2.6**	**2.4**	**2.8**	**1.2**	**2.8**			**2.0**	**1.6**	**1.4**	**1.0**	**2.6**	**1.0**	**2.8**	**1.8**
1–Low, 2 –Medium, 3–High.															

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VERTICAL 2 – AGILE METHODOLOGY WITH DEVOPS PROGRAMMING

BE23CS515	CI AND CD (CONTINUOUS INTEGRATION AND CONTINUOUS DEVELOPMENT)	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	**Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches**	**Version: 1.0**				

Course Objectives:		
1.	To understand the concepts of CI/CD pipeline setup.	
2.	To setup and manage the components of CI/CD pipeline.	
3.	To explore deployment strategies in software development.	
4.	To integrate CI/CD in Agile and DevOps environment.	
5.	To understand the implementation strategies in real-world scenario.	
	INTRODUCTION (Not for Examination)	**2**
Importance	It is crucial in modern software engineering as it enables faster and more reliable software delivery through automation of builds, testing, and deployments. It promotes early bug detection, ensures high-quality code, and supports Agile and DevOps practices.	
Real-life Example(s)	Facebook - to test and deploy code across millions of users, Netflix - uses CI/CD to deploy code thousands of times a day, Amazon - to push updates every 11.7 seconds on average.	
Linkages	**Pre-requisite:** Foundational Knowledge, Agile and DevOps, Programming and Scripting. **Future Course:** Introduction to Azure and AWS DevOps.	
UNIT–I	**INTRODUCTION TO CI/CD**	**6**
	Introduction to Continuous Integration (CI) – Introduction to Continuous Development (CD) – Benefits of CI/CD in Software Development – CI/CD Principles and Workflow – CI/CD Tools and Ecosystem.	
UNIT–II	**CI/CD FUNDAMENTALS**	**6**
	Setting Up CI/CD Pipelines – Automated Testing in CI/CD – Version Control Integration – Artifact Management in CI/CD – Code Quality and Code Reviews.	
UNIT–III	**ADVANCED CI/CD PRACTICES**	**6**
	Continuous Deployment and Delivery – Containerization for CI/CD – Infrastructure as Code (IaC) – Blue-Green and Canary Deployments – Security in CI/CD Pipelines.	
UNIT–IV	**CI/CD IN AGILE AND DEVOPS**	**6**
	CI/CD in Agile Methodologies – CI/CD Integration with DevOps – CI/CD Best Practices in DevOps – CI/CD for Microservices	

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	Architecture – Monitoring and Metrics in CI/CD.	
UNIT–V	**CI/CD CASE STUDIES AND IMPLEMENTATION**	**6**
	Real-world CI/CD Case Studies – Designing Effective CI/CD Pipelines – Continuous Improvement in CI/CD – Implementing CI/CD in Your Organization – CI/CD Challenges and Solutions.	
	Total (L)	**32 Periods**
	COURSE PROJECT:	
1.	To integrate CI/CD with DevOps.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Understand the principles and workflow of CI/CD and identify appropriate tools.	**L2 - Understand**
CO2	Apply and configure CI/CD pipelines with automation and version control integration.	**L3 - Apply**
CO3	Apply CI/CD practices and integrate security in software deployment.	**L3 - Apply**
CO4	Analyze the role of CI/CD in Agile and DevOps for microservices and performance monitoring.	**L3 - Apply**
CO5	Evaluate CI/CD implementations for deployments in real- world environments.	**L3 - Apply**
	TEXTBOOKS:	
1.	Jez Humble and David Farley, "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation", Pearson Education, 2010.	
2.	Nicole Forsgren, Jez Humble, and Gene Kim, "Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations", 1st Edition, IT Revolution Press, 2018.	
	REFERENCE BOOKS:	
1.	Mandi Walls, "Building a DevOps Culture", O'Reilly Media, 2013.	
2.	Henry van Merode, "Continuous Integration (CI) and Continuous Delivery (CD): A Practical Guide to Designing and Developing Pipelines", 1st Edition, Bio-Green, 2023.	

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	WEB REFERENCES:		
S.No	**Publisher**	**Website link**	**Type of Content**
1.	GitLab	https://docs.gitlab.com/ci/pipelines/	Learning Content
2.	Atlassian	https://www.atlassian.com/continuous-delivery	Web Content

	VIDEO REFERENCES:			
S.No	**Video Details**	**Name of the Expert**	**Type of Content**	**Video Link**
1.	Yotube	Abhishek Veeramalla	Learning	https://www.youtube.com/watch?v=Ke_Wr5zPE0A

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2			2								2	1	3
CO2	3	2	3	2	3				1				2	3	3
CO3	3	3	3	2	3					1			3	3	3
CO4	3	3	3	2	3				1				3	3	3
CO5	3	3	3	3	3	2	1						3	2	3
Avg.	**3.0**	**2.6**	**3.0**	**2.2**	**2.8**	**2.0**	**1.0**		**1.0**	**1.0**			**2.6**	**2.4**	**3.0**
1–Low, 2 –Medium, 3–High.															

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VERTICAL 3 – CYBERSECURITY

BE23IT525	MALWARE INJECTION AND EVASION TECHNIQUES	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To apply debugging techniques to identify malware behaviour.	
2.	To use IDA Pro and OllyDbg to analyse malicious code.	
3.	To implement behaviour analysis to detect evasion methods.	
4.	To apply Windows API operations for malware injection.	
5.	To demonstrate advanced injection techniques.	
	INTRODUCTION (Not for Examination)	**2**
Importance	Develops essential skills to analyse, detect, and counter modern malware by understanding how malicious code injects into processes, evades detection, and manipulates system APIs.	
Real-life Example(s)	DLL injection detection - Ransomware hollowing - API-hooking malware - Anti-VM tricks - Thread hijacking	
Linkages	**Previous Courses:** Foundations of Cyber Security, Static Malware Analysis, Dynamic Malware Analysis. **Future Courses:** Android Malware Analysis, Windows Operating System Security, Windows Threats and Defense Techniques.	
UNIT–I	**OLLYDBG & IDA PRO FUNDAMENTALS**	**6**
	OllyDbg interface windows - Navigating and searching in OllyDbg - Understanding program control flow - Breakpoint usage - Listing module and API names - Viewing strings in memory - Call stack visualization.	
UNIT–II	**ADVANCED IDA PRO ANALYSIS TECHNIQUES**	**6**
	Compiler recognition in IDA - Import information analysis - Displaying and analyzing strings - Navigating Ida View-A - Sample disassembly analysis - Packed sample analysis - Unpacking & decryption basics.	
UNIT–III	**MALWARE BEHAVIOUR & ANTI-ANALYSIS TECHNIQUES**	**6**
	Identifying process injection behaviour - Bypassing anti- reversing techniques - Detecting anti-VM techniques - Malware memory behaviour - String-based indicators - Function flow tracing - Basic deobfuscation methods.	

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UNIT–IV	**WINDOWS API FOR MALWARE OPERATIONS**	**6**
	Process creation APIs - Process memory read/write APIs - Registry manipulation APIs - Network communication APIs - Persistence & service APIs - Detection avoidance APIs - DLL loading & execution APIs.	
UNIT–V	**ADVANCED PROCESS INJECTION TECHNIQUES**	**6**
	Basic process injection - DLL injection - PE injection - Reflective DLL injection - Process hollowing - Thread execution hijacking - PEB & TEB structure usage.	
	Total (L)	**32 Periods**
	LIST OF EXPERIMENTS:	
1.	Experiment with OllyDbg to view interface windows and identify registers, modules, APIs, and strings in a loaded executable.	
2.	Write a small C program and apply breakpoints in OllyDbg to trace basic program control flow.	
3.	Experiment with IDA Pro to identify strings, functions, and imports in a simple executable.	
4.	Write a simple C program that uses Windows APIs and analyze the disassembly in IDA Pro.	
5.	Develop a C program to identify basic anti-VM indicators such as MAC address prefixes or known virtualization registry keys.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Apply debugging and disassembly techniques to identify malware behavior.	**L3 - Apply**
CO2	Use IDA Pro and OllyDbg to interpret malicious executables.	**L3 - Apply**
CO3	Implement behavior analysis to detect evasion mechanisms.	**L3 - Apply**
CO4	Execute Windows API calls for malware operation flow.	**L3 - Apply**
CO5	Demonstrate malware injection techniques.	**L3 - Apply**
	TEXTBOOKS:	
1.	Michael Hale Ligh, "Practical Malware Analysis", No Starch Press, 2023.	

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2.	Chris Eagle, "The IDA Pro Book", 3rd Edition, No Starch Press, 2020.
	REFERENCE BOOKS:
1.	Bruce Dang, "Practical Reverse Engineering", Wiley, 2021.
2.	Monnappa K A, "Malware Analysis Techniques", Packt Publishing, 2022.
3.	Alex Matrosov, 'Rootkits and Bootkits", No Starch Press, 2023.

	WEB REFERENCES:		
S.No	**Publisher**	**Website link**	**Type of Content**
1.	MalwareTech	https://www.malwaretech.com	Article
2.	MITRE ATT&CK	https://attack.mitre.org	Article
3.	FireEye Threat Research	https://www.fireeye.com	Article

	VIDEO REFERENCES:			
S.No	**Video Details**	**Name of the Expert**	**Type of Content**	**Video Link**
1.	YouTube	Debasish Mandal	Lecture	https://www.youtube.com/watch?v=N_3AGB9Vf9E
2.	YouTube	Stephen Sims	Expert Session	https://www.youtube.com/watch?v=Tox 5Kb8V97M

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2			3					3			2		
CO2	2	3		2	2						3	2	2		1
CO3	3	3	3	3	3					3	2		2	2	2
CO4		3		3	3						2	2	1	2	3
CO5			3	3						2			3	1	3
Avg.	**2.6**	**2.7**	**3.0**	**2.6**	**3.0**					**2.6**	**2.3**	**2.0**	**2.0**	**1.7**	**2.5**

1–Low, 2 –Medium, 3–High.

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VERTICAL 4 – DATA ANALYTICS AND AI

BE23AD535	NATURAL LANGUAGE PROCESSING	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To understand basics of linguistics, probability and statistics.	
2.	To outline different parsing techniques associated with NLP.	
3.	To explore semantics of words and semantic role labeling of sentences.	
4.	To prepare the basic concepts of speech processing along with analysis and modeling.	
5.	To know the basic concepts of speech analysis along with speech modelling.	
	INTRODUCTION (Not for Examination)	**2**
Importance	NLP is the engine that powers language-aware AI. It connects multiple disciplines, empowers real-world applications and opens pathways to cutting-edge technologies like generative AI and conversational systems.	
Real-life Example(s)	E-commerce, Web Search, Virtual assistants, Chatbots and Education, etc.,	
Linkages	**Pre-requisite:** Python for data science, Data structures and algorithms, Machine Learning, Deep learning. **Future courses:** Large Language Models, AI Agents, Agentic AI.	
UNIT–I	**INTRODUCTION**	**6**
	Natural Language Processing – Origins of NLP – Components – The Challenges of NLP – Language and Grammar – NLP Applications – Language Modeling: Basics of Linguistics and Probability and Statistics – Words – Tokenization – Morphology – Finite State Automata.	
UNIT–II	**WORD LEVEL ANALYSIS AND SYNTACTIC ANALYSIS**	**6**
	Regular Expressions – Morphological Parsing – Spelling Error Detection and Correction – Words and Word Classes – Part-of Speech Tagging – Context-Free Grammar – Top-down and Bottom-up Parsing – CYK Parsing.	
UNIT–III	**SEMANTIC ANALYSIS**	**6**
	Word Senses and WordNet – Word Sense Disambiguation – Semantic Role Labeling – Proposition Bank – FrameNet – Selectional Restrictions – Information Extraction – Template Filling.	

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UNIT–IV	**SPEECH PROCESSING**	**6**
	Speech fundamentals – Production and classification of speech sounds – Acoustics of speech production – Chatbots and Dialogue systems – Frame-based Dialogue Systems – Dialogue – State Architecture.	
UNIT–V	**SPEECH-ANALYSIS AND SPEECH MODELING**	**6**
	Introduction to Speech Processing – Time-Domain Analysis – Frequency-Domain Analysis – Linear Predictive Coding (LPC) – Speech Modeling Techniques – Speech Synthesis and Recognition – Tools and Projects. ***Experiential Learning:** Analyze, model and recognize speech signals using time-domain and frequency-domain techniques and simple speech processing tools.	
	Total (L)	**32 Periods**
	*** INTERNAL EVALUATION ONLY**	
	LIST OF EXPERIMENTS:	
1.	Write a Python program for the following preprocessing of text in NLP: • Tokenization • Filtration • Script Validation • Stop Word Removal • Stemming	
2.	Carry out Morphological Tagging and Part-of-Speech Tagging for a sample text.	
3.	Write a Python program to find synonyms and antonyms of the word "active" using WordNet.	
4.	Implement the machine translation application of NLP where it needs to train a machine translation model for a language with limited parallel corpora. Investigate and incorporate techniques to improve performance in low-resource scenarios.	
5.	Give the design of a Chatbot.	
6.	Create an attack for tampering with recommender systems and write a program to implement top-down and bottom-up parser using appropriate context free grammar.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments	

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	and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Define the fundamental concepts and principles of Natural Language Processing and Finite State Automata.	**L2 – Understand**
CO2	Recall syntactic and morphological analysis techniques in Natural Language Processing.	**L2 – Understand**
CO3	Discuss semantic analysis techniques for word sense disambiguation and information extraction in Natural Language Processing.	**L2 – Understand**
CO4	Apply speech fundamentals and dialogue system concepts to develop basic speech-enabled and frame-based dialogue systems.	**L3 – Apply**
CO5	Summarize speech processing techniques for speech analysis, modeling, synthesis and recognition using appropriate tools.	**L2 – Understand**
	TEXTBOOKS:	
1.	Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", 3rd Edition, Pearson Publication, 2025.	
2.	Nitin Indurkhya, Fred J. Damerau, "Handbook of natural language processing", 2nd Edition, MIT press, 2010.	
	REFERENCE BOOKS:	
1.	Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", 1st Edition, OReilly Media, 2009.	
2.	Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", 1st Edition, Pearson Education, 2008.	
3.	Amber Stubbs and James Pustejovsky, "Natural Language Annotation for Machine Learning - A Guide to Corpus-Building for Applications", 1st Edition, OReilly Media, 2012.	

WEB REFERENCES:

S.No	Publisher	Website link	Type of Content
1.	Geeks for Geeks	https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/	Web Reference
2.	Analytics Vidhya	https://www.analyticsvidhya.com/blog/2023/12/nlp-learning-path/?utm_source=chatgpt.com	Web Reference

VIDEO REFERENCES:

S.No	Video Details	Name of the Expert	Type of Content	Video Link
1.	NPTEL	Prof. Pawan Kayal, IIT Khargapur	Lecture	https://nptel.ac.in/courses/106105158
2.	YouTube	Prof. Karthick Mohan, Data Science DOJO	Lecture	https://www.youtube.com/watch?v=R-AG4-qZs1A

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Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2			3	1			1	1	1	1	3	1	2
CO2	3	3		2	3	1				1			3	1	1
CO3	2	3	2	2	3	1			1			1	3	3	1
CO4	2	2	3	2	3	1				1	1		2	3	2
CO5	3	2	2	2	3	1			1		1	1	3	3	3
Avg.	**2.6**	**2.4**	**2.3**	**1.8**	**3.0**	**1.0**			**1.0**	**1.0**	**1.0**	**1.0**	**2.8**	**2.2**	**1.8**
1–Low, 2 –Medium, 3–High.															

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VERTICAL 6 – BUSINESS PROCESS AUTOMATION

BE23CB555	AUTOMATION FOR DIGITAL CREATORS	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To understand the structure and dynamics of the digital creator ecosystem.	
2.	To learn AI-based tools for ideation, scripting, content creation, and optimization.	
3.	To apply productivity strategies for workflow automation and content repurposing.	
4.	To apply platform-specific approaches for growth, engagement, and visibility.	
5.	To implement the Service Catalog and its relationship to Request Management.	
	INTRODUCTION (Not for Examination)	**2**
Importance	It is important because they streamline operations, enhance platform performance and scalability, reduce costs, and enable sustainable revenue generation through efficient processes, optimized user experiences.	
Real-life Example(s)	Scriptwriting with ChatGPT – image generation – Creator Ecosystems – Automation.	
Linkages	**Pre-requisite:** Fundamentals of IT Service Management, Custom Application Development, It Operation Management. **Future courses:** IT Asset Management.	
UNIT–I	**INTRODUCTION TO CREATOR ECOSYSTEMS**	**6**
	Introduction – Types of creators – Key platforms – Challenges and opportunities in content creation – AI tools for ideation, scripting, and editing.	
UNIT–II	**WORKFLOW OPTIMIZATION AND PRODUCTIVITY TOOLS**	**6**
	Content planning tools – Automation basics – Scriptwriting – Storyboarding – Transcriptions – Content repurposing strategies.	
UNIT–III	**PLATFORM-SPECIFIC IMPLEMENTATION**	**6**
	Tailoring – SEO and algorithm optimization tips – Feedback loops – Revenue streams – Toolkits and APIs overview.	
UNIT–IV	**MONETIZATION AND GROWTH TOOLS**	**6**
	Retention – Membership program – Ad revenue- Sponsorships and brand deals – Payment processing – Community-building tools – Instructor feedback.	
UNIT–V	**CUSTOM IMPLEMENTATION PROJECTS**	**6**
	Content production – Workflow automation – Audience engagement	

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	– Monetization optimization – Creating templates, automations, or workflows – Backup and data privacy.	
	Total (L)	**32 Periods**
	LIST OF EXPERIMENTS:	
1.	To identify and compare various types of digital creators, platforms they use, and the tools available to them.	
2.	To use AI tools to generate content ideas and scripts for a selected content type.	
3.	To build a simple automation for a creator workflow.	
4.	To analyze SEO and algorithmic strategies for a chosen platform.	
5.	To design and simulate a monetization strategy for a content brand.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Understand different types of creators, platforms, and their roles in ecosystem.	**L2 - Understand**
CO2	Use AI and digital tools to support ideation, scripting, editing, and planning.	**L2 - Understand**
CO3	Implement workflow automation and productivity tools for content optimization.	**L3 - Apply**
CO4	Analyze and apply growth strategies, SEO, and monetization techniques.	**L3 - Apply**
CO5	Build and document a custom creator system including automation and monetization.	**L3 - Apply**
	TEXTBOOKS:	
1.	Joe Pulizzi, "Start a Content-First Business, Build a Massive Audience and Become Radically Successful", 2nd Edition, McGraw-Hill, 2021.	
2.	Muhammad Zeeshan Ali & Saqib Javed John, "ServiceNow ITOM (Information Technology Operations Management) Knowledge Guide", OGMC Publications, 2023.	
	REFERENCE BOOKS:	
1.	Derral Eves, "The YouTube Formula: How Anyone Can Unlock the Algorithm to Drive Views, Build an Audience, and Grow Revenue", Wiley, 2021.	
2.	Cheryl B. Jordan, "Creative Economy Entrepreneurs: From Startup to Success" Routledge, 2020.	

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	WEB REFERENCES:		
S.No	**Publisher**	**Website link**	**Type of Content**
1.	Geeksforgeeks	https://www.geeksforgeeks.org/search-engine- optimization-seo-basics/	Web Content
2.	Servicenow	https://www.servicenow.com/docs/bundle/zurich-platform-user-nterface/page/build/service-portal/concept/seosp.html? utm_source=chatgpt.com	Web Content
3.	Servicenow	https://www.servicenow.com/platform.html?utm_source=chatgpt.com	Web Content

	VIDEO REFERENCES:			
S.No	**Video Details**	**Name of the Expert**	**Type of Content**	**Video Link**
1.	YouTube	Skillademia	Lecture	https://www.youtube.com/watch?v=-dvMJ938MIQ
2.	YouTube	Mr.Abhishek	Lecture	https://www.youtube.com/watch?v= 9LF73Sev9YQ
3.	YouTube	IT Canvass	Lecture	https://youtu.be/HAfhHNW_Pu4?si=8O0QHzudJyCQWarT

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	3				1	3			2	2	3
CO2	3	1	2	3	3				1	2			2	1	3
CO3	3	3	2	3	3				2	3			2	3	1
CO4	3	2	1	2	2				1	2			3	1	2
CO5	3	3	3	3	3				3	1			2	3	3
Avg.	**3.0**	**2.2**	**2.0**	**2.4**	**2.8**				**1.6**	**2.2**			**2.2**	**2.0**	**2.4**

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VERTICAL 7 – JAVA AUTOMATION

BE23CS524	TOOLS FOR AUTOMATED TESTING	CP	L	T	P	C
		4	2	0	2	3
Programme & Branch	Common to B.E. (CSE) and B.TECH. (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To understand the behavior driven development evolution and lifecycle scenarios.	
2.	To understand the Gherkin language and test scenarios.	
3.	To learn how to set up and use the Cucumber framework and to run BDD test scenarios.	
4.	To implement the various automated test reporting techniques.	
5.	To learn how to use AutoIt tools for compiling and execution.	
	INTRODUCTION (Not for Examination)	**2**
Importance	It provides a clear collaboration between testers, developers and business stakeholders. Cucumber and Gherkin help automate and structure tests, while ExtentReports and Allure provide detailed execution insights. AutoIt enhances automation by handling Windows dialogs and file operations, reducing manual effort.	
Real-life Example(s)	Banking application, E-commerce, Job portals	
Linkages	**Pre-requisite:** Java Programming, Testing Fundamentals and Manual Testing. **Future courses:** Performance and Database Testing.	
UNIT–I	**INTRODUCTION TO BEHAVIOR DRIVEN DEVELOPMENT**	**6**
	Behavior Driven Development: Behavior-Driven Development (BDD) – History and Evolution of BDD – Difference between TDD and BDD – Benefits of BDD for Testers, Developers, and Business Stakeholders – BDD Lifecycle and Flow in Agile/Scrum Environments – Following a BDD Approach – Mapping User Stories to BDD Scenarios.	
UNIT–II	**GHERKIN LANGUAGE AND SCENARIO DESIGN**	**6**
	Introduction to Gherkin Language: Introduction to Gherkin Language – Role of Gherkin in BDD – Supported Tools and Languages – Syntax and Structure of Gherkin Files – Gherkin Keywords: Feature, Scenario, Given, When, Then, And, But – Writing BDD Tests using DSL (Domain Specific Language) – Types of Gherkin Scenarios.	

UNIT–III	**BDD IN AUTOMATION USING CUCUMBER**	**6**
	Introduction to Cucumber: Introduction to the Cucumber Framework – Setting up Cucumber with Java and Maven – Cucumber Project Structure and Key Components – Writing Step Definitions for Gherkin Scenarios – Executing BDD Scenarios with Cucumber – Parameterizing Scenarios with Scenario Outline and Data Tables.	
UNIT–IV	**TEST EXECUTION REPORTS IN AUTOMATED TESTING**	**6**
	Automated Testing: Introduction to Test Reporting – Generating ExtentSpark Reports – ExtentReports Library Overview – Adding ExtentReports – Dependency in Maven – Setting Up ExtentSpark Reporter – Logging Test Status (Pass, Fail, Skip, Info) – Attaching Screenshots to Reports – Generating Allure Reportsc – Allure Reporting Framework Overview – Adding Allure TestNG Dependency – Configuring Allure Annotations (@Step, @Attachment) – Generating Allure Results and Viewing Reports.	
UNIT–V	**AUTOMATED WINDOWS DIALOGS USING AUTOIT**	**6**
	Introduction to AutoIt: Introduction to AutoIt – Installing AutoIt and Overview of Script Editor – Script Structure and Syntax (Comments, Variables, Functions) – Identifying Windows Elements – Working with Key AutoIT Commands – Automating File Upload Operations – Compiling AutoIt Scripts to Executable (.exe) Files.	
	Total (L)	**32 Periods**
	LIST OF EXPERIMENTS:	
1.	Analyze user stories and derive BDD scenarios.	
2.	Write simple feature descriptions for a sample user story using BDD principles.	
3.	Write multiple Gherkin feature files for login, registration, and search functionalities.	
4.	Practice different scenario types using Given-When-Then structure.	
5.	Create and execute a Cucumber project integrated with Maven.	
6.	Implement step definitions and parameterized scenarios.	
7.	Integrate Cucumber with Selenium for end-to-end test automation.	
8.	Integrate ExtentReports with Cucumber project and generate visual reports.	
9.	Capture screenshots on test failure and attach to reports.	
10.	Configure Allure Reporting and generate HTML reports for automated test suites.z	
11.	Write AutoIt scripts to automate Windows-based dialogs and pop-ups.	

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12.	Integrate AutoIt with Selenium test cases for file upload automation.	
13.	Compile and execute AutoIt scripts from Java programs.	
	Total (P)	**30 Periods**
	Total (L+P)	**62 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Explain the principles and workflow of behavior-driven development.	**L2 – Understand**
CO2	Describe how BDD scenarios are written using Gherkin language	**L2 – Understand**
CO3	Implement automation frameworks using Cucumber with Java and Maven.	**L3 – Apply**
CO4	Generate detailed execution reports using ExtentReports and Allure.	**L3 – Apply**
CO5	Automate Windows-based dialogs and file uploads using AutoIt.	**L3 – Apply**
	TEXTBOOKS:	
1.	John Ferguson Smart, "BDD in Action: Behavior-Driven Development for the Whole Software Lifecycle", Manning Publications, 2014.	
2.	Richard Lawrence & Paul Rayner, "BDD with Cucumber: Specification by Example for Java Developers", Packt Publishing, 2019.	
	REFERENCE BOOKS:	
1.	Boni García, "Mastering Software Testing with TestNG and Selenium", Packt Publishing, 2017.	
2.	Gojko Adzic, "Specification by Example: How Successful Teams Deliver the Right Software", Addison-Wesley, 2011.	
3.	Alan Richardson, "Automating and Testing a REST API: A Practical Guide for Testers and Automation Engineers", Compendium Developments, 2018.	
	WEB REFERENCES:	

S. No.	Publisher	Website link	Type of Content
1.	Gherkin	https://cucumber.io/docs/gherkin/	Web Reference
2.	ExtentReports	https://www.extentreports.com/docs/versions/5/java/	Web Reference
3.	ToolsQA	https://www.toolsqa.com/cucumber/	Web Reference

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	VIDEO REFERENCES:			
S. No.	**Video Details**	**Name of the Expert**	**Type of Content**	**Video Link**
1.	YouTube	Suresh SDET Automation	Tutorial with Demonstartion	https://www.youtube.com/watch?v=d06-kXQnW9w
2.	YouTube	Cool IT Help	Tutorial with Demonstartion	https://www.youtube.com/watch?v=f2EjgUeUHIg

Mapping of COs with POs and PSOs															
COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	1				1	2		1	1	1	1
CO2	3	2	2	1	1				1	2		1	1	2	1
CO3	3	2	3	2	3				2	2		2	1	3	2
CO4	2	1	2	2	2				1	2		3	1	2	2
CO5	2	1	2	2	3				1	1		2	1	1	3
Avg.	**2.6**	**1.6**	**2.2**	**1.6**	**2.0**				**1.2**	**1.8**		**1.8**	**1.0**	**1.8**	**1.8**
1–Low, 2 –Medium, 3–High.															

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BE23EE602	ELECTRIC VEHICLE TECHNOLOGY	CP	L	T	P	C
		3	2	1	0	3
Type of Course	Open Elective					
Offering Dept.	B.E. ELECTRICAL AND ELECTRONICS ENGINEERING					
Programme & Branch	Common to B.E. (Mechanical, ECE , CSE, CIVIL) and B.Tech (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To introduce the fundamentals and evolution of Electric Vehicle (EV) technology.	
2.	To understand the structure and control of various electric drive systems.	
3.	To explain the working of key EV components and review current industry trends.	
4.	To develop knowledge of EV Charging Mechanism and Charging station.	
5.	To explore real-world EV applications, adoption challenges, and policy support.	
	INTRODUCTION (Not for Examination)	**2**
Importance	This course builds a strong foundation in EV fundamentals, components, and operating principles essential for modern transportation. It helps to understand batteries, motors, power electronics, and charging systems. Also creates awareness of national EV policies, government incentives, and real-world challenges in EV adoption.	
Real-life Examples	Electric scooters, EV buses and cars.	
UNIT–I	**FUNDAMENTALS OF ELECTRIC VEHICLE**	**6+3**
	Evolution and History - Basics of Electric Vehicles, components, and layout - EV Classification - Comparison with ICE vehicles - National policy for Adoption of EV's.	
UNIT–II	**ELECTRIC VEHICLE COMPONENTS**	**6+3**
	Overview: Battery, Motor, Controller, Inverter, and Chassis – Basic working principles of BLDC motor and PMSM motor - Basics of battery technology: types (Lead-acid, Li-ion) – SoC - Role of controllers - power electronics in EV operation.	
UNIT–III	**HYBRID ELECTRIC VEHICLES**	**6+3**
	Concept of hybridization and classification: series, parallel, and series-parallel - Architecture and operation of HEVs - Energy sources and power split - Advantages and limitations of hybrid EVs compared to pure EVs	
UNIT – IV	**CHARGING SYSTEMS AND INFRASTRUCTURE**	**6+3**
	Types: Level 1, Level 2, DC fast charging - On-board vs. off-board charging systems - Charging connectors and standards (Bharat EV, CHAdeMO, CCS – basics) - Charging station components and layout. . ***Experiential Learning** : Li-ion battery charger using Battery Management System (BMS)	

UNIT–V	TYPES AND DEVELOPMENT	6+3
	Applications: e-bikes, e-autos, electric buses, delivery vehicles – Scope of EVs in public transport and personal mobility – Challenges in EV adoption: cost, range, infrastructure, awareness – Government initiatives and incentive schemes.	
	Total(LT)	**47 Periods**
	*** INTERNAL EVALUATION ONLY**	
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Explain the evolution, classification, components, and layout of EVs, and understand national policies.	L2 - Understand
CO2	Describe the working principles of major EV components such as batteries, motors, and controllers.	L2 - Understand
CO3	Describe the hybrid EV architectures and compare them with pure EVs in terms of design and performance.	L2 - Understand
CO4	Apply knowledge of charging systems, connectors, and standards in EV infrastructure planning.	L3 - Apply
CO5	Explain the applications of EV, adoption challenges, and government initiatives in transport.	L2 - Understand
	TEXTBOOKS:	
1.	Ali Emadi, "Advanced Electric Drive Vehicles", CRC Press, First Edition, 2017.	
2.	James Larminie and John Lowry, "Electric Vehicle Technology Explained", Wiley, Second Edition, 2012.	
	REFERENCE BOOKS:	
1.	A.K. Babu and K.R. Prabhu, "Electric and Hybrid Vehicles", Scitech Publications, Chennai, 2nd Edition, 2020.	
2.	Erik Schaltz, "Electrical Vehicle Technology", Springer Briefs in Electrical and Computer Engineering, 2020.	
3.	Christopher D. Rahn, Chao-Yang Wang, "Battery Systems Engineering", Wiley, 2013.	

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	WEB REFERENCES:		
S.No.	Publisher	Website link	Type of Content
1.	E-Amrit (Gov)	https://e-amrit.niti.gov.in/types-of-electric-vehicles	Policy Document
2.	Research gate	https://www.researchgate.net/publication/376077125_A_Review_of_Electric_Vehicle_Technology_Development	Study Material

	VIDEO REFERENCES:			
S.No.	Video Details	Name of the Expert	Type of Content	Video Link
1.	NPTEL	Prof. Ashok Jhunjhunwala, IIT Madras	Lecture	https://nptel.ac.in/courses/108106170?utm_source=chatgpt.com
2.	NPTEL	Prof. S.S. Murthy, IIT Delhi	Lecture	https://archive.nptel.ac.in/courses/108/102/108102121/

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													
CO2	3	2													
CO3	3	2					1	1							
CO4	3	2	1	1	1	1	1	1				1			
CO5	3	2					1	1				1			
Avg.	3	2	1	1	1	1	1	1				**1**			

1–Low, 2 –Medium, 3–High.

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BE23EC602	CONSUMER ELECTRONICS	CP	L	T	P	C
		3	2	1	0	3
Type of Course	Open Elective					
Offering Dept.	Electronics and Communication Engineering					
Programme & Branch	Common to B.E. (Mechanical, EEE, CSE, CIVIL) and B.Tech (IT, CSBS, AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To understand the basics and types of consumer electronics and their components.	
2.	To explain how audio and video systems work in modern devices.	
3.	To describe the operation of home appliances and personal gadgets.	
4.	To understand smart consumer devices and basic home automation concepts.	
5.	To explain connectivity methods, safety measures, and maintenance of consumer electronics.	
	INTRODUCTION (Not for Examination)	**2**
Importance	Consumer electronics refer to electronic devices intended for personal and home use in areas such as communication, entertainment, and automation. These include smartphones, televisions, laptops, and home appliances, with rapid technological advancements driving smarter, more connected systems. •Enhance daily convenience through automation and smart features. •Facilitate communication via digital platforms and smart devices. •Provide diverse entertainment experiences via AV systems and streaming platforms. •Support remote work, online education, and digital learning.	
Real-life Example(s)	•Google Nest thermostat adjusts home temperature automatically. •Android mobile phone used for real-time Zoom video meetings. •Smart TVs stream content via Netflix. •Laptops used for online education via Google Classroom.	
UNIT–I	**INTRODUCTION TO CONSUMER ELECTRONICS**	**6+3**
	Overview and Evolution of Consumer Electronics - Classification: Entertainment, Home Appliances, Office Equipment, Personal Gadgets - Electronic Components and Power Supply Units - Overview of Sensors, Microcontrollers, and ICs in Consumer Applications - Recent Trends: Smart Devices, Green Electronics, and Sustainability ***Experiment:** Assemble and test a regulated DC power supply.	
UNIT–II	**AUDIO AND VIDEO SYSTEMS**	**6+3**

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	Analog and Digital Audio Systems: MP3, Dolby, DTS - **Television:** LED, OLED, QLED - Digital TV, HDTV, Smart TV Concepts **Video Processing:** Compression Standards (MPEG, H.264), Streaming Technology ***Experiment:** Build and test a basic audio amplifier circuit using LM386.	
UNIT – III	**HOME AND PERSONAL APPLIANCES**	**6+3**
	Role of Electronics - Refrigerators, Microwave Ovens, Air Conditioners. **Personal Gadgets:** Mobile Phones, Wearables, Bluetooth Devices - Digital Cameras - Home Theatre Systems - **Remote Controls:** Infrared and RF-based Systems ***Experiment:** Disassemble and analyze an electronic control board from a home appliance (Not for Examination)	
UNIT– IV	**SMART CONSUMER DEVICES**	**6+3**
	Smart Homes and Automation Devices - Voice Assistants (Alexa, Google Assistant), Smart Speakers, Smart Lighting, Smart Plugs, Video Door Phones - Introduction to Home Automation Controllers. ***Experiment:** Create a voice-controlled light using Google Assistant / Alexa.	
UNIT–V	**BIOMEDICAL & TELEMEDICINE**	**6+3**
	Introduction to Health Gadgets - Smartwatches, fitness bands, home health devices, Body Signal Measuring Devices- ECG, heart rate, temperature sensors, Telemedicine Systems- Online doctor consultation and mobile health apps platforms- Smart Diagnosis Using AI- Automatic health problem detection and alerts ***Experiment**: Measure Blood pressure signal using Arduino.	
	Total(LT)	**47 Periods**
	*** INTERNAL EVALUATION ONLY**	
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Understand the evolution, classification, and components used in consumer electronic systems.	**L2 - Understand**
CO2	Describe the working principles and formats of audio and video systems used in modern devices.	**L2 - Understand**
CO3	Explain the operating principles of home appliances and personal electronic gadgets.	**L2 - Understand**
CO4	Understand the functionalities and applications of smart consumer devices and automation tools.	**L2 - Understand**

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CO5	Comprehend connectivity interfaces, safety standards, and maintenance practices in home electronics.	**L2 - Understand**
	TEXTBOOKS:	
1.	Dr. B.R. Gupta, V. Singhal, "Consumer Electronics ", S K Kataria & Sons Publisher, 6th Edition 2016.	
2.	S P Bali, "Consumer Electronics", Pearson Education Asia Pvt., Ltd., 2008.	
	REFERENCE BOOKS:	
1.	Chaudhery Mustansar Hussain, Paolo Di Sia, "Handbook of Smart Materials, Technologies, and Devices", Springer 2022.	
2.	D Chattopadhyay, PC Rakshit, "Electronics: Fundamentals and Applications", New Age International Private Limited, 2022.	

	WEB REFERENCES:		
S.No.	**Publisher**	**Website link**	**Type of Content**
1.	Copenhagen Centre on Energy Efficiency UNEP DTU partnership Review (HBR)	https://c2e2.unepccc.org	Articles, Case Studies
2.	MIT Open Courseware	ocw.mit.edu	Free Online Courses
3.	Advanced Engineering Services	https://aesgs.com/	Videos, Podcasts, and Articles

	VIDEO REFERENCES:			
	Video Details	**Name of the Expert**	**Type of Content**	**Video Link**
1.	Audio System Engineering	Prof.S. Dasmandal IIT Kharagpur	Video lecture	https://avcce.digimat.in/nptel/courses/video/117105133/L02.html
2.	Consumer electronics	Dr P Ashok Professor,SVCE	Video lecture	https://www.youtube.com/watch?v=NsXjOTKGDiI

Mapping of COs with POs and PSOs

Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		1		2	1			1	1		1			
CO2	2		1		2	1			1	1		1			
CO3	2		1		2	1			1	1		1			
CO4	2		1		2	1			1	1		1			
CO5	2		1		2	1			1	1		1			
Avg.	**2**		**2**		**2**	**1**			**1**	**1**		**1**			

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BE23CE601	SMART BUILDINGS	CP	L	T	P	C
		3	2	1	0	3
Type of Course	Open Elective					
Offering Dept.	Civil Engineering					
Programme & Branch	Common to B.E.(Mechanical,ECE,EEE,CSE) and B.Tech (IT,CSBS,AI&DS) Branches	Version: 1.0				

Course Objectives:		
1.	To facilitate the recent developments in smart materials.	
2.	To understand and gain knowledge about automation and foundation systems.	
3.	To gain knowledge on sustainability and urban infrastructure	
4.	To gain knowledge in smart buildings codes and standards.	
5.	To explore the evolving landscape of smart civil infrastructure by examining upcoming technologies, resilience strategies, and regulatory developments.	
	INTRODUCTION (Not for Examination)	**2**
Importance	Smart buildings enhance energy efficiency, safety, and comfort through automation and real-time data. They support sustainability, reduce operational costs, and contribute to smarter urban development. Smart buildings are crucial for sustainability, cost savings, and occupant well-being by using IoT sensors and data to automate and optimize energy use (HVAC, lighting), maintenance, and security, leading to lower operational costs, reduced carbon footprints, higher productivity, and better comfort for users.	
Real-life Example(s)	• Infosys Mysuru & Hyderabad Campuses, • TCS Olympus Centre, Mumbai, • Indira Paryavaran Bhawan, New Delhi • The Salesforce Tower in San Francisco integrates smart HVAC, lighting, and environmental controls.	
Linkages	**Previous Course :**Construction Materials and Technology **Future Course:** AI and IOT for Engineering Applications	
UNIT–I	**INTRODUCTION TO SMART BUILDINGS**	**6+3**
	Definition and Scope of Smart Buildings- Conventional and Smart Building Construction - Evolution from Traditional to Smart Infrastructure– Benefits of Energy Efficiency, Comfort, Security, Sustainability- Components of Smart Buildings using IoT, Automation, Data Systems.	
UNIT–II	**BUILDING AUTOMATION AND FOUNDATION SYSTEMS**	**6+3**
	Basics of HVAC, Lighting, Security, and Access Control Systems Sensors and Actuators in Building Systems- Communication Protocols - Control Strategies and Integration. Integration of Sensors in Structural and Geotechnical Systems- Smart Foundations: Real-Time Soil and Settlement Monitoring.	

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UNIT–III	**SUSTAINABLE DESIGN AND SMART INFRASTRUCTURE**	**6+3**
	Green Building Materials and Methods for Sustainability- Smart Water Management: Rainwater Harvesting, Greywater Systems- Integration with Urban Infrastructure: Roads, Drainage, Utilities- Civil role in Achieving LEED, IGBC, or GRIHA Standards.	
UNIT – IV	**ENERGY MANAGEMENT AND SUSTAINABILITY**	**6+3**
	Smart Metering and Energy Monitoring - Integration of Renewable Energy Sources (solar, wind) - Demand-Side Management and Load Forecasting- LEED and WELL Certification System.	
UNIT–V	**FUTURE TRENDS AND REGULATIONS IN SMART INFRASTRUCTURE**	**6+3**
	Smart Cites and the Role of Smart Buildings- Regulatory Frameworks, Standards, and Codes Relevant to Smart Construction- Resilient Infrastructure for Disaster Management- Civil Engineering Challenges in Automation and AI Integration.	
	Total(LT)	**47 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Understand the foundational concepts and importance of smart buildings.	**L2 - Understand**
CO2	Analyze and design automation systems within a building context.	**L3 - Apply**
CO3	Evaluate and implement sustainable civil engineering solutions in smart building projects.	**L3 - Apply**
CO4	Develop strategies for sustainable and energy-efficient smart buildings.	**L3 - Apply**
CO5	Interpret future trends, codes, and innovations shaping smart civil infrastructure.	**L3 - Apply**

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	TEXTBOOKS:
1.	O.V. Gnana Swathika, K. Karthikeyan, Sanjeevikumar Padmanaban,"Smart Buildings Digitalization" CRC Press,1st edition,2022
2.	V.K.Jain, "Automation Systems in Smart & Green Buildings", Khanna Publishers,2009
	REFERENCE BOOKS:
1.	Ron Bakker, "Smart Buildings: Technology and the Design of the Built Environment", RIBA Publishing;2020
2.	Chandan Swaroop Meena,Ashwani Kumar, "Sustainable Technologies for Energy Efficient Buildings (Smart Innovations and Technological Advancements in Mechanical and Materials Engineering)", CRC Press, 1st edition, 2024

WEB REFERENCES:

S.No.	Publisher	Website link	Type of Content
1.	BGRID (Building Data for all)	https://bgrid.com/smart-building-certificates/	Website (Smart Building Certificate Course)
2.	MDPI (Applied Sciences Journal)	www.mdpi.com The Smart Buildings Revolution: A Comprehensive Review of the Smart Readiness Indicator Literature	Article
3.	Springer (SN Computer Science)	www.springer.com A Reference Architecture for IoT-Enabled Smart Buildings	Article

VIDEO REFERENCES:

S.No.	Video Details	Name of the Expert	Type of Content	Video Link
1.	Sustainable Architecture	Prof.Avlokita Agarwal Dept. of Architecture and Planning ,IIT-Roorkee	Youtube	https://www.youtube.com/watch=VE2tpwGCN0U
2.	Smart Building Sensors	Prof. Ravindra Kumar Jha Assistant Professor IIT Guwahati	Youtube	https://www.youtube.com/watch=q1GOOfk8bj0

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Mapping of COs with POs and PSOs														
Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1						1	1		1	2	
CO2	3	2	1						1	1		1	2	
CO3	3	2	1						1	1		1	2	
CO4	3	2	1						1	1		1	2	
CO5	3	2	1			2			1	1		1	2	
Avg.	3	2	1			2			1	1		1	2	
1–Low, 2 –Medium, 3–High.														

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BE23PT652	Japanese Language – Level 2	CP	L	T	P	C
		3	2	1	0	3
Type of Course	Open Elective					
Offering Dept.	Centre for Career Development and Training (C-CDT)					
Programme & Branch	Common to all B.E./B.Tech. Branches	Version: 1.0				

Course Objectives:	
1.	To introduce advanced verb forms and grammatical patterns in the Japanese language, including te-form, tai-form, and present continuous usage.
2.	To develop proficiency in using casual and polite styles in the Japanese language and understanding their appropriate contexts.
3.	To enable students to express opinions, convey thoughts, and ask questions using appropriate structures in the Japanese language.
4.	To familiarize students with conditional forms, expressions of gratitude, and usage of motion-related particles in the Japanese language, along with additional Kanji characters.
5.	To enhance students' ability to construct meaningful conversations involving giving, receiving, and conditional expressions like "when" and "even if" in the Japanese language.

	INTRODUCTION (Not for Examination)	**2**
Importance	Learning Japanese at the N5 level is a valuable starting point for beginners. It builds a strong foundation in basic grammar, vocabulary, and kanji, enabling simple conversations and sentence formation. N5 also helps learners better understand Japanese culture through everyday expressions. It is useful for travel, study, or work opportunities in Japan. Additionally, it enhances cognitive skills like memory and focus.	
Real-life Example(s)	• In a Japanese factory, engineers can understand signboards and communicate with the workers to improve the productivity. • Certification in Japanese Language Opens doors for onsite roles or Japanese companies.	
Linkages	Japanese Language - Level 1 Japanese Language - Level 3	
UNIT–I	**Groups of Verbs**	**6+3**
	Tai form - Verb groups - te form - Give and ask permission to do an action - Present continuous form-Restrict other person from doing an action – nouns - Basic Questions	
UNIT–II	**Casual Form**	**6+3**
	Nai form - Dictionary form - ta form - Polite style and Casual style differences - Conversation in plain style - Place of usage of Polite style and Casual style	

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UNIT–III	**Express Opinions and Thoughts**	**6+3**
	Introduction to new particle - Express someone one's thought -Convey the message of one person to another - Ask someone if something is right - Noun modifications	
UNIT – IV	**If Clause and Remaining Kanjis**	**6+3**
	If clause tara form - Express gratitude for an action done by other person - Hypothetical situation - Particles to use in case of Motion verbs - 120 Kanjis	
UNIT–V	**Giving and Receiving**	**6+3**
	Introduction to giving and receiving with te form and "when, even if" usages: Providing to and getting from differences - Understanding of situations and framing sentences using when and even if etc.	
	Total	**47 Periods**
	Assessment Method: Internal Examinations Only	
	Bloom's Taxonomy Levels: Remember (L1), Understanding (L2), Apply (L3), Analyze (L4), Evaluate (L5), Create (L6).	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Understand and use various verb forms such as te-form, tai-form, nai-form, and present continuous to express actions and permissions in the Japanese language.	L2-Understand
CO2	Differentiate between casual and polite styles and engage in conversations appropriately using both forms in the Japanese language.	L2-Understand
CO3	Express personal thoughts and opinions, report others' statements, and ask questions using new particles and sentence structures in the Japanese language.	L2-Understand
CO4	Apply conditional sentences (tara form), express gratitude, and use motion-related particles accurately while understanding 120 new Kanji characters in the Japanese language.	L2-Understand
CO5	Construct complex sentences using expressions like "when" and "even if," and appropriately use giving and receiving verbs in the Japanese language.	L3-Apply
	TEXTBOOKS:	
1.	Takuji Kobayashi "MINNA NO NIHONGO –Japanese for Everyone", 2nd edition GOYAL Publishers & distributors Pvt. Ltd, New Delhi, 2017	
	REFERENCE BOOKS:	
1.	Collect if (Group of contributor) "Speed Master N5" J Research Publishing, 2016	
2.	Genki N5 "An Integrated Course in Elementary Japanese", 3rd edition, The Japan Times Publishing, 2020	

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	WEB REFERENCES:		
S.No.	**Publisher**	**Website link**	**Type of Content**
1.	Tofugu	https://www.tofugu.com/japanese/jlpt-n5/	Study material
2.	JLPT Sensei	https://jlptsensei.com/jlpt-n5/	Grammar, Vocabulary Lists
3.	WaniKani Community	https://community.wanikani.com/t/resources-for-jlpt-n5-especially-listening/18603	Online Course
4.	Japan Society NYC	https://www.japansociety.org/language_center	Online Course

	VIDEO REFERENCES:			
	Video Details	**Name of the Expert**	**Type of Content**	**Video Link**
1.	YouTube	Japanese Ammo with Misa	Lecture	https://www.youtube.com/watch?v=G7 NtwtdAqJU
2.	YouTube	Nihongo no Mori	Lecture	https://www.youtube.com/channel/UCVx6RFaEAg46xfAsD2zz16w
3.	NPTEL	Prof. Rajalakshmi (IITM)	Academic Course	https://nptel.ac.in/courses/109/104/109104072/
4.	YouTube	Learn Japanese with JapanesePod101	Lecture	https://www.youtube.com/watch?v=EaE9QnZ_gZQ

Mapping of COs with POs and PSOs

Cos	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1									1	3					
CO2										2					
CO3										3					
CO4									2	3					
CO5									2	3					
Avg.									**1.6**	**2.8**					

1–Low, 2 –Medium, 3–High.

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BE23EC612	IoT SYSTEM DEVELOPMENT AND INTEGRATION	CP	L	T	P	C
		3	2	1	0	3
Type of Course	Open Elective(EmTV)					
Offering Dept.	Electronics and Communication engineering					
Programme & Branch	Common to B.E. (Mechanical, CSE, CIVIL) and B.Tech (IT, CSBS, AIDS) Branches	Version: 1.0				

Course Objectives:

1	To introduce the components and working of embedded platforms used in IoT.
2	To help learners understand sensor interfacing and basic signal processing.
3	To provide knowledge of IoT communication protocols and data transfer mechanisms.
4	To explain the use of cloud platforms for storing and visualizing IoT data.
5	To understand system-level integration, security, and deployment aspects in IoT.

Introduction (Not for examination)		**02**
Importance	The Internet of Things (IoT) enables the connection of physical objects to the digital world through embedded systems, communication protocols, and cloud computing. It provides a platform to sense, process, and act upon data in real time. This course focuses on the development and integration of IoT systems using microcontrollers, sensors, communication technologies, and cloud platforms. Learners will understand how to collect data from the environment, transfer it securely, and visualize or control systems remotely. Emphasis is placed on system-level understanding of how IoT components work together for practical applications.	
Real-Life Examples	1.Smart Agriculture 2.Smart Home Automation 3.Industrial Safety Monitoring	
UNIT–I	**EMBEDDED PLATFORMS FOR IoT**	**6+3**
	Overview: Arduino, ESP32, Raspberry Pi - Digital and Analog pin usage PWM, Timers - On-board peripherals (L2): Wi-Fi, GPIO, ADC. ***Experiment:** Controlling LEDs, Relays, and Motors.	
UNIT–II	**SENSOR INTERFACING AND SIGNAL PROCESSING**	**6+3**
	Interfacing DHT11, LDR, Gas sensor, IR sensor - Signal filtering and conversion - Data calibration and threshold setting. ***Experiment:** Display sensor readings on serial monitor and LCD .	

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UNIT–III	**IoT PROTOCOLS AND NETWORKING**	**6+3**
	IoT Protocol Stack Overview - Application Layer: MQTT, HTTP, CoAP - Transport Layer : TCP/UDP - Network and Physical Layers: Wi-Fi, Bluetooth, Zigbee (overview), send real-time data to cloud and visualize (Not for examination)- MQTT publish/subscribe implementation using ESP32 and broker. ***Experiment: Send sensor data to MQTT broker.**	
UNIT–IV	**CLOUD PLATFORMS AND VISUALIZATION TOOLS**	**6+3**
	Introduction to IoT cloud platforms: ThingSpeak, Firebase, Ubidots - Data logging, visualization with charts/gauges - Event-driven alert systems using IFTTT - Storing and retrieving data from cloud. ***Experiment**: Send real-time data to cloud and visualize.	
UNIT–V	**SYSTEM INTEGRATION AND DEPLOYMENT CONCEPTS**	**6+3**
	IoT System Integration - Power Management in IoT Devices - Edge vs Cloud Computing - Data Storage and Retrieval - Security and Privacy in IoT. ***Experiment:** Measure delay between sensor reading and cloud update.	
		TOTAL: 47 Hours

*** INTERNAL EVALUATION ONLY**

	OPEN ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as Internal Assessment (IA) only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**Bloom's Taxonomy**
CO1	Explain the architecture and functionality of microcontroller platforms used in IoT systems.	**L2–Understand**
CO2	Describe the methods of interfacing various sensors and actuators with embedded devices.	**L2–Understand**
CO3	Summarize the working principles of IoT communication protocols such as MQTT and HTTP.	**L2–Understand**
CO4	Interpret the steps for data logging, visualization, and control using cloud-based IoT platforms.	**L2–Understand**
CO5	Discuss the principles of IoT system integration, including edge computing, power management, and basic security.	**L2–Understand**

	TEXTBOOKS:
1.	Shriram K. Vasudevan, "Internet of Things", Wiley Publications, 2nd Edition 2020.
2.	Raj Kamal, "Internet of Things (IOT): Architecture and Design Principles" McGraw Hill, 2022.
	REFERENCE BOOKS:
1.	Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, John Wiley & Sons Ltd, 1st Edition,2012.
2.	Mayur Ramgir, Internet – of – Things, Architecture, Implementation and Security, Pearson Education, First Edition, 2020.

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	WEB REFERENCES:		
S.NO.	Publisher	Website link	Type of Content
1	Wikipedia / Espressif Systems	https://en.wikipedia.org/wiki/ESP32	Technical content
2	Instructables tutorial	https://www.instructables.com/Build-Your-First-IOT-with-a-Raspberry-Pi-DHT11-sen/	Article content
3.	Platform MathWorks (ThingSpeak)	https://thingspeak.mathworks.com	Real Time Project content

	VIDEO REFERENCES:			
	Video Details	Name of the Expert	Type of Content	Video link
1	Introduction to Internet of Things	Prof. Sudip Misra Dept. of Computer Science & Engineering, IIT Kharagpur	Lecture series	https://onlinecourses.nptel.ac.in/noc22_cs53/preview?utm_source=chatgpt.com
2	Design of IOT	Prof. T. V. Prabhakar — Principal Research Scientist, Department of Electronic Systems Engineering, IISc Bangalore	Lecture series	https://www.youtube.com/playlist?list=PLsAtoG7tyROM_MOp9W1vY_O_Aw6LkJjdk

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	2		1		2	1			1	1		1			
CO2	2		1		2	1			1	1		1			
CO3	2		1		2	1			1	1		1			
CO4	2		1		2	1			1	1		1			
CO5	2		1		2	1			1	1		1			
Average	**2**		**1**		**2**	**1**			**1**	**1**		**1**			

1–Low, 2 –Medium, 3–High.

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BE23ME612	BIOMASS AND HYDRO ENERGY SYSTEMS	CP	L	T	P	C
		3	2	1	0	3
Type of Course	Open Elective (EmTV)					
Offering Dept.	Mechanical Engineering					
Programme & Branch	Common to B.E. (CSE, ECE, CIVIL) and B.Tech. (IT,CSBS and AI&DS) Branches	Version:1.0				

Course Objectives:		
1.	To understand the core principles and technologies of biomass energy.	
2.	To impart knowledge on bio-fuel energy systems.	
3.	To familiarize students with hydro energy systems.	
4.	To develop understanding of geothermal energy systems.	
5.	To enable students to comprehend government policies, incentives, and international agreements.	
	INTRODUCTION(Not for Examination)	**2**
Importance:	Introduces key renewable energy sources - Explains storage and hybrid systems - Covers smart grid basics - Highlights energy policies and trends - Prepares for green energy careers -Supports climate action awareness.	
Real-life Examples:	Biomass and Bio-energy: Biogas Plant converts agricultural waste into biogas and Ethanol Plant supports sustainable bio fuels.	
Linkages:	Engineering Chemistry, Environmental Science and Sustainability and Renewable Energy system.	
UNIT–I	**BIOMASS**	**6+3**
	Introduction – System Description and Working principles - Various types of Bio gas power plant – Efficiency of conversion – Resource Potential and level of usage / Implementation – Advantages and Constraints-Applications – Recent developments. ***Case study:** Punjab generates large amounts of paddy straw, often burned by farmers, causing air pollution and wasting a valuable resource. Analyze the causes and impacts of this practice, and suggest sustainable methods or technologies for biomass management.	
UNIT–II	**BIO - FUEL**	**6+3**
	Introduction – System Description and Working principles - Various types of Bio fuel Process – Efficiency of conversion– Resource Potential and level of usage / Implementation– Advantages and constraints - Applications – Recent developments. ***Case study:** Analyze the current scenario of biofuel usage in India. What are the key challenges and opportunities in expanding biofuel production and consumption, and how do government policies impact its growth?	

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UNIT–III	**HYDRO ENERGY**	**6+3**
	Introduction– System Description and Working principles - Various types – Efficiency of conversion – Resource Potential and level of usage / Implementation– Advantages and constraints - Applications – Recent developments. ***Case study:** Analyze the wide-ranging social consequences experienced by local communities as a result of dam construction, including forced displacement, disruption of traditional livelihoods, loss of cultural heritage, and challenges in resettlement and social integration.	
UNIT–IV	**GEOTHERMAL ENERGY**	**6+3**
	Introduction – System Description and Working principles - Various Types of geothermal power plants – Efficiency of conversion– Resource potential and level of usage / Implementation– Advantages and constraints- Applications – Recent developments. ***Case study:** How would you design a geothermal energy project for a developing country with limited infrastructure, ensuring sustainability and community involvement?.	
UNIT–V	**POLICIES AND FUTURE TRENDS**	**6+3**
	Government policies and incentives, Global agreements (e.g., Paris Agreement), Emerging technologies in renewable energy, Future trends and career opportunities. ***Case Study:** How are current renewable energy policies shaping future trends in India, and what strategic measures can be implemented to accelerate the adoption of renewable energy across sectors and regions?.	
	Total(LT)	**47 Periods**
	• **INTERNAL EVALUATION ONLY**	
	OPEN-ENDEDPROBLEMS/QUESTIONS	
	Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End Semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Explain the types, sources, technologies, and applications of biomass energy.	L2- Understand
CO2	Describe the types, sources, production processes, and applications of biofuel energy.	L2- Understand
CO3	Explain and analyze the working principles, system configurations, and technologies of hydro energy systems.	L2- Understand
CO4	Describe the basic concepts, working principles, and technologies of geothermal energy systems.	L2- Understand
CO5	Apply the knowledge of government policies, incentives, and international agreements.	L3 – Apply

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	TEXTBOOKS:
1.	D. P. Kothari, K. C. Singal, and R. Ranjan, Renewable Energy Sources and Emerging Technologies. New Delhi, India: PHI Learning Pvt. Ltd., 3rd Edition, 2022.
2.	B. H. Khan, Non-Conventional Energy Resources. New Delhi, India: McGraw-Hill Education, 3rd Edition, 2020.

	REFERENCE BOOKS:
1.	V. V. N. Kishore, Ed., Renewable Energy Engineering and Technology: Principles and Practice. New Delhi, India: TERI Press, 3rd Edition, 2019.
2.	R. A. Huggins, Energy Storage: A Vital Element in the Energy Transition. Cham, Switzerland: Springer, 2016.
3.	V. C. Nelson, Ed., Introduction to Renewable Energy. Boca Raton, FL: CRC Press, 2011.

WEB REFERENCES:

S.No.	Publisher	Website link	Type of Content
1.	Science direct	https://www.sciencedirect.com/journal/renewable-energy	Reading Material
2.	Wiley Online Library	https://onlinelibrary.wiley.com/journal/2974	Reading Material

VIDEO REFERENCES:

	Video Details	Name of the Expert	Type of Content	Video Link
1.	NPTEL	Prof.Pankaj Kalita, IIT Guwahati	Lecture	https://youtu.be/KSN9whMIlAk
2.	NPTEL	Prof.Sayakbanerjee, IIT Bombay	Lecture	https://youtu.be/_iiAcuOO-Ds

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1		2	1					1			
CO2	2	2	1	1		2	1			2		1			
CO3	2	2	1	1		2	1		1			1			
CO4	2	2	1	1		2	1			2		1			
CO5	2	2	1	1		2	1		2			1			
Avg.	**2**	**2**	**1**	**1**		**2**	**1**		**1**	**1**		**1**			

1–Low,2–Medium,3–High.

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BE23EC543M	WIRELESS COMMUNICATION FOR IoT	CP	L	T	P	C
		3	2	1	0	3
Type of course	Minor Degree					
Offering Dept.	ELECTRONICS AND COMMUNICATION ENGINEERING/ELECTRICAL AND ELECTORNICS ENGINEERING					
Programme & Branch	Common to B.E. (Mechanical, CSE, CIVIL) and B.Tech (IT, CSBS and AI&DS) Branches	Version:1.0				

Course Objectives:		
1.	To understand the basic concepts of wireless communication required for IoT systems.	
2.	To explain the operation of personal and short-range wireless technologies used in IoT	
3.	To interpret LPWAN technologies and their suitability for large-scale IoT deployments.	
4.	To understand the role of 4G/5G and satellite communication in enhancing IoT connectivity.	
5.	To summarize network integration, security, and performance requirements in wireless IoT systems.	
	INTRODUCTION (Not for Examination)	**2**
Importance	Wireless communication is the backbone of IoT solutions enabling seamless connectivity between billions of devices. Understanding wireless technologies helps engineers build low-power, scalable, and secure IoT systems for real-world deployment. The course prepares students for emerging technologies like LPWAN, 5G, and satellite IoT. It enhances industry-relevant skills essential for smart city, healthcare, and industrial automation sectors.	
Real-life Example(s)	• **Smart Energy Meters –** LoRaWAN/NB-IoT enables automated electricity usage monitoring and billing. • **Wearable Health Devices** – BLE supports continuous heart rate and fitness tracking • **Home Automation Systems** – Wi-Fi/ZigBee connect lights, appliances, and security controls.	
UNIT–I	**WIRELESS FUNDAMENTALS FOR IoT**	**6+3**
	Basics of Wireless Communication – Spectrum, Modulation, Bandwidth, Radio Propagation Models – Path Loss, Fading, Interference, Multiple Access Techniques, Antennas and RF Front-End for IoT Devices, Power Constraints & Range Considerations in IoT Systems, QoS Parameters – Latency, Reliability, Throughput, Regulatory Standards & ISM Bands for IoT, Wireless Channel Performance Metrics	
UNIT–II	**SHORT-RANGE IoT WIRELESS TECHNOLOGIES**	**6+3**
	Bluetooth & BLE – Architecture, Pairing & Low Energy Features, ZigBee – IEEE 802.15.4, Network Layers & Cluster Tree Topology, 6LoWPAN – IPv6 over Low-Power WPAN, RFID & NFC – Principles, Protocols, and	

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	Applications, UWB & Wi-Fi HaLow for IoT Applications, Comparative Analysis – Power, Range & Data Rate	
UNIT–III	**LPWAN COMMUNICATION TECHNOLOGIES**	**6+3**
	Introduction to LPWAN for IoT – Need & Characteristics, LoRa & LoRaWAN Protocol Architecture, NB-IoT – 3GPP Standards, Deployment Modes & Use Cases, Weightless & DASH7 Overview, Cellular IoT Evolution – LTE-M, Cat-M1, Industrial IoT Connectivity Scenarios	
UNIT – IV	**4G/5G AND SATELLITE WIRELESS FOR IOT**	**6+3**
	Role of Cellular Networks in IoT Communication, MTC & mMTC Models for Massive IoT Deployment, 5G NR & Ultra-Reliable Low Latency Communication (URLLC), Network Slicing & Edge Computing in IoT, IPv6 Integration & Mobility Management, IoT over Satellite – LEO/MEO, Narrowband Satellite IoT.	
UNIT–V	**IOT NETWORK INTEGRATION, SECURITY & TESTING**	**6+3**
	IoT Network Architecture – Device, Gateway, Cloud, Routing Protocols for IoT – RPL, Mesh, DSR, Interoperability & Standards – IEEE, IETF, 3GPP, Wireless Security – WPA3, Encryption, Key Management, Threats: Jamming, Spoofing, Eavesdropping in IoT, Testing Wireless Performance – Range, Reliability, QoS.	
	Total (LT)	**47 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	
CO1	Explain the principles of wireless communication applied in IoT devices.	**L2 - Understand**
CO2	Describe different short-range wireless technologies and their use cases in IoT applications.	**L2 - Understand**
CO3	Interpret LPWAN standards and their communication characteristics in IoT networks.	**L2 - Understand**
CO4	Discuss the significance of 4G/5G and satellite networks for massive IoT connectivity.	**L2 - Understand**
CO5	Understand security mechanisms, interoperability needs, and performance parameters of wireless IoT systems.	**L2 - Understand**
	TEXTBOOKS:	
1	Olivier Hersent, David Boswarthick, and Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Wiley Publications, 2012.	
2	Theodore S. Rappaport, Wireless Communications: "Principles and Practice", Pearson Education, 2nd Edition, 2010.	

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	REFERENCE BOOKS:	
1	William Stallings," Wireless Communications and Networks", Pearson Education, 2nd Edition, 2005.	
2	Boris Adryan, Dominik Obermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech House Publishers, 2017.	

	WEB REFERENCES:		
S.No.	**Publisher**	**Website link**	**Type of Content**
1.	Internet Encyclopedia / Wikimedia Foundation	https://en.wikipedia.org/wiki/Internet_of_things?utm_source=chatgpt.com	Article Material
2.	TechTarget	https://www.emqx.com/en/blog/iot-protocols-mqtt-coap-lwm2m	Technical content

	VIDEO REFERENCES:			
	Video Details	**Name of the Expert**	**Type of Content**	**Video Link**
1.	YouTube	Prof.T.Prabhu	Lecture content	https://www.youtube.com/watch?v=rOfzo65XCHw
2.	Nptel video	Prof.Anand Srivastava - Department of Electronics and Communication Engineering ,IIID	Video Lecture	https://www.youtube.com/watch?v=EymhRKG6IzM

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2			1										
CO2	3	2			1										
CO3	3	2			1										
CO4	3	2			1	1									
CO5	3	2			1	1									
Avg.	**3**	**2**			**1**	**1**									

1–Low, 2 –Medium, 3–High.

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BE23EE543M	EMBEDDED SYSTEMS DESIGN	CP	L	T	P	C
		3	2	1	0	3
Type of Course	Minor Degree					
Offering Dept.	Electronics and Communication Engineering / Electrical and Electronics Engineering					
Programme & Branch	Common to B.E. (Mechanical, EEE, CSE, CIVIL) and B.Tech (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:

1.	To introduce the basics of embedded systems, architecture, and memory elements.
2.	To explain embedded C programming, drivers, and development tools
3.	To understand the fundamentals and features of real-time operating systems.
4.	To explore communication devices, protocols, and bus standards used in automotive systems.
5.	To study real-world automotive applications through relevant case studies and simulations.

	INTRODUCTION (Not for Examination)	**2**
Importance	The course helps understand how hardware and software work together in small, efficient systems that must meet timing and performance needs. applications used in many areas like automobiles, healthcare devices, household electronics, IoT products, aerospace systems, and industrial machines.	
Real-life Examples	Domestic Appliances, smart watches, medical devices, Digital cameras and drones.	
Linkages	Digital Electronics	
UNIT–I	**INTRODUCTION**	**6+3**
	Basic Terminologies – Characteristics of Embedded Computing Applications– Embedded Software Development Process – Challenges in Embedded System Design – Embedded System Architecture – Memory Devices	
UNIT–II	**SOFTWARE DEVELOPMENT**	**6+3**
	Embedded C programming - Device drivers - Cross-compiler - Debugging and simulation tools - Hardware-in-the-loop (HIL) concept - MISRA-C guidelines.	
UNIT–III	**RTOS**	**6+3**
	Concept of OS-based Software Development – Real-Time Operating Systems: Definition, Characteristics and Structure – Task Management: Classification, Structure, States, and Scheduling – Concept of Pseudo Multitasking and True Multitasking – Task Synchronization – Inter-task Communication – Features of Free RTOS.	

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UNIT – IV	**COMMUNICATION DEVICES AND BUS STANDARDS**	**6+3**
	I/O Devices: Types and Examples of I/O devices - Synchronous, Iso-synchronous and Asynchronous Communications - Internal Serial - Communication: SPI, UART - Timer and Counting Devices – Serial Communication using: I2C – CAN - Advanced I/O Serial high speed buses. ***Experiential Learning**: CAN bus simulation.	
UNIT–V	**CASE STUDIES**	**6+3**
	Autonomous Vehicle control system - Drone - smart Wearables – smart Automations System - Vehicle Diagnostics ECU.	
	Total(LT)	**47 Periods**
	*** INTERNAL EVALUATION ONLY**	
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Understand key concepts and components of embedded systems used in vehicles.	**L2 – Understand**
CO2	Develop embedded software using C, device drivers, and debugging tools.	**L3 – Apply**
CO3	Apply RTOS concepts for managing real-time tasks and inter-task communication.	**L3 – Apply**
CO4	Explain serial communication protocols like UART, SPI, I2C, and CAN in embedded applications.	**L2 – Understand**
CO5	Explain embedded control through case studies such as ADAS.	**L2 – Understand**
	TEXTBOOKS:	
1.	Nicolas Navet and Francoise Simonot-Lion, "Automotive Embedded Systems Handbook", CRC Press, 2009.	
2.	Ronald K. Jurgen, "Distributed Automotive Embedded Systems", SAE International, 2007.	
	REFERENCE BOOKS:	
1.	Miroslaw Staron, "Automotive Software Architectures: An Introduction", Springer, 2017.	
2.	Tom Weather Jr. &Cland c. Ilunter, "Automotive computers and control system" Prentice Hall Inc., New Jersey	

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	WEB REFERENCES:		
S.No.	**Publisher**	**Website link**	**Type of Content**
1.	ARM Developer Documentation	https://developer.arm.com	Embedded processors, architecture, Cortex-M documentation
2.	NXP – Embedded Systems & Automotive MCUs	https://www.nxp.com/applications/en/embedded	Embedded platforms, safety MCUs, communication buses
3.	IEEE Embedded Systems Letters (ESL)	https://ieeexplore.ieee.org/xpl/RecentIssue.jsp	Research articles on embedded computing

	VIDEO REFERENCES:			
S.No.	**Video Details**	**Name of the Expert**	**Type of Content**	**Video Link**
1.	Embedded Systems & Real-Time Applications	MIT OpenCourseWare	Youtube Video	https://www.youtube.com/watch?v=Q7W3G9J53Ls
2.	Introduction to RTOS	FreeRTOS	Youtube Video	https://www.youtube.com/watch?v=jB2nEy5NnZI

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2									1			
CO2	3	2	2									1			
CO3	3	2	2									1			
CO4	3	2	2									1			
CO5	3	2	2									1			
Avg.	**3**	**2**	**2**									**1**			

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BE23EC544M	IoT EDGE COMPUTING AND DEVICE PROGRAMMING	CP	L	T	P	C
		3	2	1	0	3
Type of course	Minor Degree					
Offering Dept.	ELECTRONICS AND COMMUNICATION ENGINEERING/ELECTRICAL AND ELECTORNICS ENGINEERING					
Programme & Branch	Common to B.E. (Mechanical, CSE, CIVIL) and B.Tech (IT, CSBS and AI&DS) Branches	Version:1.0				

Course Objectives:		
1.	To understand the fundamentals and architectural concepts of IoT Edge Computing.	
2.	To explain the hardware platforms and operating systems used for edge IoT devices.	
3.	To interpret device programming models and middleware required for edge communication.	
4.	To understand data processing, edge AI techniques, and cloud integration approaches.	
5.	To summarize security needs, deployment strategies, and challenges in real-time edge applications.	
	INTRODUCTION (Not for Examination)	**2**
Importance	IoT Edge Computing and Device Programming is essential for enabling faster, secure, and intelligent data processing closer to IoT devices. It helps reduce dependency on cloud connectivity and enhances real-time decision-making in critical applications. The subject prepares students to develop scalable and efficient edge-based solutions used in modern industries. It equips learners with skills required for Industry 4.0, smart cities, healthcare automation, and autonomous systems.	
Real-life Example(s)	**Smart Traffic Monitoring Systems** – Edge devices process live traffic data locally to reduce congestion and improve signal control. **Industrial Predictive Maintenance** – Machines use edge analytics to detect faults early and prevent equipment downtime **Remote Healthcare Monitoring** – Wearable sensors analyze patient vitals at the edge for faster emergency response.	
UNIT–I	**INTRODUCTION TO IOT EDGE COMPUTING**	**6+3**
	Evolution from Cloud to Edge and Fog Computing- Edge Computing Architecture and Key Components- Edge vs Cloud Trade-offs: Latency, Bandwidth, Security- Applications of Edge Computing in IoT- Real-time Processing and Local Intelligence- Edge Device Constraints – Power, Memory, and Connectivity	
UNIT–II	**EDGE HARDWARE PLATFORMS AND OPERATING SYSTEMS**	**6+3**
	Overview of Microcontrollers (ESP32, ARM Cortex, STM32)- Embedded Linux Platforms (Raspberry Pi, Jetson Nano)- Peripheral Interfaces: GPIO, UART, SPI, I2C, ADC- Sensors and Actuators Interfacing- Real-Time Operating Systems (FreeRTOS Basics). Device Booting, Firmware, and Power Management.	

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UNIT–III	**DEVICE PROGRAMMING AND MIDDLEWARE**	**6+3**
	Embedded Programming (Arduino, MicroPython, C/C++)- Event-Driven and Interrupt-Driven Programming- Communication Protocols: MQTT, CoAP, WebSockets, HTTP-Edge Middleware and Local Brokers- Over-the-Air (OTA) Updates and Firmware Security- Edge Device Debugging and Performance Optimization.	
UNIT – IV	**EDGE AI, DATA HANDLING & CLOUD COMMUNICATION**	**6+3**
	Data Acquisition, Filtering & Local Pre-processing- Edge AI Concepts – TinyML and TensorFlow Lite- Edge-Cloud Synchronization and Digital Twins- Cloud Integration: AWS IoT Greengrass, Azure IoT Edge- Device Management Platforms & Telemetry- Visualization Tools (Node-RED / Grafana Dashboards).	
UNIT–V	**SECURITY, DEPLOYMENT & REAL-WORLD USE CASES**	**6+3**
	Edge Device Security: Secure Boot, Encryption & Identity- Threats & Vulnerability Management in Edge IoT- Edge Orchestration and Containerization (Docker on Edge)-Testing Metrics: Latency, Accuracy, Power Consumption- Deployment Models for Edge Applications- Case Studies: Smart City, Industry 4.0, Autonomous Systems.	
	Total (LT)	**47 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	
CO1	Explain the importance of edge computing in reducing latency and improving IoT performance.	**L2 - Understand**
CO2	Explain the importance of edge computing in reducing latency and improving IoT performance.	**L2 - Understand**
CO3	Understand programming techniques and communication protocols for edge system development.	**L2 - Understand**
CO4	Discuss the role of edge AI, data handling, and cloud connectivity in modern IoT systems.	**L2 - Understand**
CO5	Explain security requirements, operational testing, and deployment considerations for edge applications.	**L2 - Understand**
	TEXTBOOKS:	
1	Janakiram V., "Fundamentals of Edge Computing", Wiley India Pvt. Ltd., 1st Edition, 2021.	
2	Ravi Ramakrishnan and Brooke Wenig, "TinyML and Edge Computing *for IoT*", Pearson Education, 1st Edition, 2022.	
	REFERENCE BOOKS:	

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1	Yun Liu and Arpan Pal, "Edge Computing: Models, Technologies and Applications", Elsevier, 1st Edition, 2020.	
2	Amol Bandal, "Hands-On Edge Analytics with Azure IoT", Packt Publishing, 1st Edition, 2022.	
3	Ozan Tonguz and Gianluca Rizzo, "Edge Computing: From Hype to Reality", Springer Publications, 1st Edition, 2023.	

	WEB REFERENCES:		
S.No.	**Publisher**	**Website link**	**Type of Content**
1.	www.particle.io	https://www.particle.io/iot-guides-and-resources/the-comprehensive-guide-to-edge-ai-in-iot/?	Technical Content
2.	MDPI Publisher	https://www.mdpi.com/2227-9709/11/4/71	Journal Article

	VIDEO REFERENCES:			
	Video Details	**Name of the Expert**	**Type of Content**	**Video Link**
1.	NPTEL Video	Dr.Rajiv Misra Department of Computer science Engineering, IIT Patna.	Lecture content	https://www.youtube.com/watch?v=hmBe8WrG0LA
2.	Youtube	Julian Chesterfield (CTO) & host	Technical content	https://www.youtube.com/watch?v=d5vKFyBnNcA

Mapping of COs with POs and PSOs

COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2			1										
CO2	3	2			1										
CO3	3	2			1										
CO4	3	2			1	1									
CO5	3	2			1	1									
Avg.	**3**	**2**			**1**	**1**									

1–Low, 2 –Medium, 3–High.

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BE23EE544M	AUTOMOTIVE INFOTRONICS	CP	L	T	P	C
		3	2	1	0	3
Type of Course	Minor Degree					
Offering Dept.	Electronics and Communication Engineering / Electrical and Electronics Engineering					
Programme & Branch	Common to B.E. (Mechanical, EEE, CSE, CIVIL) and B.Tech (IT, CSBS and AI&DS) Branches	Version: 1.0				

Course Objectives:

1.	To introduce various driver support and diagnostic systems in modern vehicles.
2.	To explain the role and working of automotive telematics and tracking systems.
3.	To describe advanced automotive safety technologies and their functions.
4.	To explore systems that enhance comfort and driving experience in vehicles.
5.	To provide knowledge on vehicle security features and anti-theft technologies.

	INTRODUCTION (Not for Examination)	**2**
Importance	This course helps understand how modern vehicles use electronics, sensors, communication systems, and intelligent control to improve safety, comfort, security, and driving experience. It gives a foundation in technologies used in connected vehicles, ADAS features, telematics, diagnostics, and automation.	
Real-life Examples	reverse parking camera, Maps navigation, airbags, ABS and Comfort Systems.	
Linkages	Embedded Systems, Sensors, Microcontrollers and communication networks	
UNIT–I	**VEHICLE SUPPORT SYSTEMS**	**6+3**
	Driver information - Real-time traffic - electronic mirror - Parking and reversing aid - driver vigilance monitoring Driver health monitoring - pedestrian detection - Intersection collision warning - vehicle diagnostics.	
UNIT–II	**AUTOMOTIVE TELEMATICS**	**6+3**
	Global positioning system – Basics and working, Geographical information systems - Applications: navigation system - Fleet Tracking system - Voice based Turn-by-Turn system - Automotive Collision Notification system - Integrated theft recovery system - calling system.	
UNIT–III	**AUTOMOTIVE SAFETY SYSTEMS**	**6+3**
	Airbag System - Anti-lock braking system - Electronic Brake force Distribution system - Electronic Stability Control - Adaptive cruise control - Tyre pressure monitoring system - Lane keep assist - Blind spot monitoring system - Traction control.	

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UNIT – IV	**AUTOMOTIVE COMFORT SYSTEMS**	**6+3**
	Active suspension system - Electrical Power assisted steering - Adaptive lighting system - Automatic Connected Mobility assistance - Intelligent windshield wipers - Adaptive climate control.	
UNIT–V	**AUTOMOTIVE SECURITY SYSTEMS**	**6+3**
	Anti-theft technologies - Alarm and warning system - Remote keyless entry - Security antenna and transponders - Fingerprint vehicle unlock - Speed governing system.	
	Total(LT)	**47 Periods**
	OPEN-ENDED PROBLEMS / QUESTIONS	
	Course specific Open-Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.	
	Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Describe different vehicle support systems including driver monitoring and diagnostics.	**L2 – Understand**
CO2	Explain telematics applications in navigation and fleet tracking.	**L2 – Understand**
CO3	Explain the operation of automotive safety systems like airbags, ABS, and ESC.	**L2 – Understand**
CO4	Identify comfort systems such as adaptive lighting, suspension, and climate control.	**L3 – Apply**
CO5	Explain modern vehicle security features and anti-theft systems.	**L2 – Understand**
	TEXTBOOKS:	
1.	LjuboVlacic, Michel Parent and Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth-Heinemann Publications, Oxford, 2001.	
2.	Robert Bosch, "Automotive Hand Book", SAE, 2000	
	REFERENCE BOOKS:	
1.	Ronald K Jurgen, "Navigation and Intelligent Transportation Systems – Progress in Technology", Automotive Electronics Series, SAE, USA, 1998.	
2.	William B R, "Understanding Automotive Electronics", Butter worth Heinemann Inc., USA, 1998	
3.	William M B, "Automotive Computer Controlled Systems", Elsevier Butterworth-Heinemann, 2011	

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	WEB REFERENCES:		
S.No.	**Publisher**	**Website link**	**Type of Content**
1.	Bosch Mobility	https://www.bosch-mobility.com/en/mobility-topics/safety-for-all-road-users	Overview of vehicle safety systems
2.	Geotab	https://www.geotab.com/blog/what-is-telematics/	article about telematics, GPS tracking,

	VIDEO REFERENCES:			
S.No.	**Video Details**	**Name of the Expert**	**Type of Content**	**Video Link**
1.	How ABS, ESC, and Traction Control Work	Jason Fenske – Automotive Engineer	Youtube Video	https://www.youtube.com/watch?v=vBrnIhPD0f0
2.	Adaptive Cruise Control Working Principle	Bosch Mobility	Youtube Video	https://www.youtube.com/watch?v=8X6rKu6rV7w

Mapping of COs with POs and PSOs

COs	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1											2		
CO2	2	1											2		
CO3	2	1											2		
CO4	2	1											2		
CO5	2	1	2	1	1							1	2		
Avg.	**2**	**1**	**2**	**1**	**1**							**1**	**2**		

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