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.

M.E. / M.Tech. Regulations 2023

M.E. – Computer Science and Engineering

Curriculum and Syllabi

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

Version: 1.0	**Date:** 09.09.2023

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Board of Studies
Faculty of CSE & IT
Knowledge Institute of Technology
KIOT Campus, Kakapalayam,
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	KNOWLEDGE INSTITUTE OF TECHNOLOGY(AUTONOMOUS), SALEM -637504	
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	Website: www.kiot.ac.in	Version 1.0

M.E. / M.Tech. REGULATIONS 2023 (R 2023)

CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

M.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 create globally competent software professionals with social values to cater the ever-changing industry requirements.

MISSION OF THE DEPARTMENT	
M1	To provide appropriate infrastructure to impart need-based technical education through effective teaching and research.
M2	To involve the students in collaborative projects on emerging technologies to fulfill the industrial requirements.
M3	To render value based education to students to take better engineering decision with social consciousness and to meet out the global standards.
M4	To inculcate leadership skills in students and encourage them to become a Globally competent professional.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	Develop proficiency as a computer science engineer with an ability to solve a wide range of computational problems and have sustainable development in industry or any other work environment.
PEO 2	Possess the ability to think analytically and logically to understand technical problems with computational systems for a lifelong learning which leads to pursuing research.
PEO 3	Strongly focus on design thinking and critical analysis to create innovative products and become entrepreneurs.

PROGRAM OUTCOMES (POs)	
Engineering Graduates will be able to:	
PO1	An ability to independently carry out research / investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.
PO4	Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.
PO5	Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.
PO6	Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation.

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KNOWLEDGE INSTITUTE OF TECHNOLOGY(AUTONOMOUS), SALEM – 637504												
M.E. COMPUTER SCIENCE AND ENGINEERING											Version : 1.0	
Courses of Study and Scheme of Assessment (Regulations 2023)											Date : 09.09.23	
SI. No.	Course Code	Course Title	Periods / Week						Maximum Marks			
			CAT	CP	L	T	P	C	IA	ESE	Total	
SEMESTER I												
-	-	Induction Programme	-	-	-	-	-	-	-	-	-	
	THEORY											
1.	ME23MA103	Applied Probability and Statistics for Computer Science Engineers	FC	4	3	1	0	4	40	60	100	
2.	ME23RM201	Research Methodology and IPR	RM	3	2	1	0	3	40	60	100	
3.	ME23CP301	Advanced Data Structures and Algorithms	PC	3	3	0	0	3	40	60	100	
4.	ME23CP302	Database Practices	PC	3	3	0	0	3	40	60	100	
5.	ME23CP303	Network Technologies	PC	3	3	0	0	3	40	60	100	
6.	ME23CP304	Principles of Programming Languages	PC	3	3	0	0	3	40	60	100	
7.	ME23AC7XX	Audit Course – I*	AC	2	2	0	0	NC	100	-	100	
	PRACTICALS											
8.	ME23CP305	Advanced Data Structures and Algorithms Laboratory	PC	4	0	0	4	2	60	40	100	
9.	ME23CP306	Database Practices Laboratory	PC	4	0	0	4	2	60	40	100	
	EMPLOYABILITY ENHANCEMENT											
10.	ME23PT801	Technical Seminar / Case Study Presentation	EEC	2	0	0	2	0	100	-	100	
TOTAL				31	19	2	10	23	560	440	1000	
SEMESTER II												
	THEORY											
1.	ME23CP307	Advanced Software Engineering	PC	3	3	0	0	3	40	60	100	
2.	ME23CP308	Multicore Architecture and Programming	PC	3	3	0	0	3	40	60	100	
3.	ME23MC701	Universal Human Values and Ethics	MC	3	2	1	0	3	40	60	100	
4.	ME23CP4XX	Professional Elective - I	PE	3	3	0	0	3	40	60	100	
5.	ME23CP4XX	Professional Elective - II	PE	3	3	0	0	3	40	60	100	
6.	ME23AC7XX	Audit Course – II*	AC	2	2	0	0	0	100	-	100	
7.	ME23XX5XX	Open Elective - I	OE	3	3	0	0	3	40	60	100	
	PRACTICALS											
8.	ME23CP309	Software Engineering Laboratory	PC	2	0	0	2	1	60	40	100	
	EMPLOYABILITY ENHANCEMENT											
9.	ME23PT802	Research Paper Review and Presentation	EEC	2	0	0	2	1	100	-	100	
TOTAL				24	19	1	4	20	500	400	900	

*Audit Course is Optional

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M.E. COMPUTER SCIENCE AND ENGINEERING											Version : 1.0	
Courses of Study and Scheme of Assessment (Regulations 2023)											Date : 09.09.23	
Sl. No.	Course Code	Course Title	Periods / Week						Maximum Marks			
			CAT	CP	L	T	P	C	IA	ESE	Total	
	SEMESTER III											
	THEORY											
1.	ME23CP310	Security Practices	PC	3	3	0	0	3	40	60	100	
2.	ME23CP4XX	Professional Elective - III	PE	3	3	0	0	3	40	60	100	
3.	ME23XX5XX	Open Elective - II	OE	3	3	0	0	3	40	60	100	
	THEORY CUM PRACTICAL											
4.	ME23CP4XX	Professional Elective - IV	PE	5	3	0	2	4	50	50	100	
5.	ME23CP311	Internet of Things	PC	5	3	0	2	4	50	50	100	
	PRACTICAL											
6.	ME23CP601	Project Work – Phase I	PW	12	0	0	12	6	60	40	100	
TOTAL				31	15	0	16	23	280	320	600	
SEMESTER IV												
	PRACTICAL											
1.	ME23CP602	Project Work –Phase II	PW	24	0	0	24	12	60	40	100	
TOTAL				24	0	0	24	12	60	40	100	
Total Number of Credits: 78												

PROFESSIONAL ELECTIVES

SEMESTER II
(Professional Electives - I & II)

S. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1.	ME23CP401	Cloud Computing Technologies	PE	3	3	0	0	3	40	60	100
2.	ME23CP402	Foundations of Data Science	PE	3	3	0	0	3	40	60	100
3.	ME23CP403	Agile Methodologies	PE	3	3	0	0	3	40	60	100
4.	ME23CP404	Digital Image Processing	PE	3	3	0	0	3	40	60	100
5.	ME23CP405	Machine Learning	PE	3	3	0	0	3	40	60	100
6.	ME23CP406	Software Quality Assurance	PE	3	3	0	0	3	40	60	100
7.	ME23CP407	Autonomous Systems	PE	3	3	0	0	3	40	60	100
8.	ME23CP408	Big Data Mining and Analytics	PE	3	3	0	0	3	40	60	100

SEMESTER III
(Professional Electives- III & IV)

S. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1.	ME23CP409	Web Services and API Design	PE	3	3	0	0	3	40	60	100

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2.	ME23CP410	Data Visualization Techniques	PE	3	3	0	0	3	40	60	100
3.	ME23CP411	Compiler Optimization Techniques	PE	3	3	0	0	3	40	60	100
4.	ME23CP412	Robotics	PE	3	3	0	0	3	40	60	100
5.	ME23CP413	Devops and Micro services	PE	5	3	0	2	4	50	50	100
6.	ME23CP414	Deep Learning	PE	5	3	0	2	4	50	50	100
7.	ME23CP415	Block chain Technologies	PE	5	3	0	2	4	50	50	100
8.	ME23CP416	Full Stack Web Application Development	PE	5	3	0	2	4	50	50	100

OPEN ELECTIVES											
S. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
Except M.E. Computer Science and Engineering											
1.	ME23CP501/ ME23CP310	Security Practices	OE	3	3	0	0	3	40	60	100
2.	ME23CP502/ ME23CP401	Cloud Computing Technologies	OE	3	3	0	0	3	40	60	100
3.	ME23CP503/ ME23CP415	Block chain Technologies	OE	3	3	0	0	3	40	60	100
4.	ME23CP504/ ME23CP414	Deep Learning	OE	3	3	0	0	3	40	60	100
5.	ME23CP505	Design Thinking	OE	3	3	0	0	3	40	60	100
6.	ME23CP506	Principles of Multimedia	OE	3	3	0	0	3	40	60	100
Except M.E. Industrial Safety Engineering											
7.	ME23IS501/ ME23IS302	Environmental Safety	OE	3	3	0	0	3	40	60	100
8.	ME23IS502/ ME23IS309	Electrical safety	OE	3	3	0	0	3	40	60	100
9.	ME23IS503/ ME23IS413	Safety in Engineering Industry	OE	3	3	0	0	3	40	60	100
10.	ME23IS504	Design of Experiments	OE	3	3	0	0	3	40	60	100
11.	ME23IS505	Circular Economy	OE	3	3	0	0	3	40	60	100
Except M.E. Embedded System Technologies											
12.	ME23ET501/ ME23ET310	IoT for Smart Systems	OE	3	3	0	0	3	40	60	100
13.	ME23ET502/ ME23ET408	Machine Learning and Deep Learning	OE	3	3	0	0	3	40	60	100
14.	ME23ET503	Renewable Energy Technology	OE	3	3	0	0	3	40	60	100
15.	ME23ET504/ ME23ET423	Smart Grid	OE	3	3	0	0	3	40	60	100
Except M.E. VLSI Design											
16.	ME23VL501	Big Data Analytics	OE	3	3	0	0	3	40	60	100
17.	ME23VL502	Internet of Things and Cloud	OE	3	3	0	0	3	40	60	100
18.	ME23VL503	Medical Robotics	OE	3	3	0	0	3	40	60	100
19.	ME23VL504	Embedded Automation	OE	3	3	0	0	3	40	60	100

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FOUNDATION COURSES (FC)											
Sl. No.	Course Code	Course title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1.	ME23MA103	Applied Probability and Statistics for Computer Science Engineers	FC	4	3	1	0	4	40	60	100

AUDIT COURSES / MANDATORY COURSE											
AUDIT COURSES (Optional Courses)											
Sl. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1.	ME23AC701	English for Research Paper Writing	AC	2	2	0	0	0	100	-	100
2.	ME23AC702	Disaster Management	AC	2	2	0	0	0	100	-	100
3.	ME23AC703	Constitution of India	AC	2	2	0	0	0	100	-	100
4.	ME23AC704	ew;wkpo; ,yf;fpak;/ Classical Tamil Literature	AC	2	2	0	0	0	100	-	100
MANDATORY COURSES											
1.	ME23MC701	Universal Human Values and Ethics	MC	3	2	1	0	3	40	60	100

SEMESTER-WISE CREDITS DISTRIBUTION

SUMMARY							
Sl. No.	Course Category	Credits per Semester				Credits	Credit %
		I	II	III	IV		
1.	FC	4	-	-	-	4	5
2.	RM	3	-	-	-	3	4
3.	PC	16	7	8	-	31	40
4	PE	-	6	6	-	12	15
5.	OE	-	3	3	-	6	8
6.	PW	-	-	6	12	18	23
7.	MC/AC	-	3	-	-	3	4
8.	EEC	-	1	-	-	1	1
	Total	**23**	**20**	**23**	**12**	**78**	**100**

AT	Category of Course	FC	Foundation Courses	MC	Mandatory Courses
CP	Contact Period	PC	Professional Core Courses	AC	Audit Courses
L	Lecture Period	PE	Professional Elective Courses	IA	Internal Assessment
T	Tutorial Period	OE	Open Elective Courses	ESE	End Semester Examination
P	Laboratory Period	PW	Project Work Courses		
C	Credits	EEC	Employability Enhancement Courses		

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ME23CP311	INTERNET OF THINGS	Version: 1.0				
Programme & Branch	M.E. – Computer Science and Engineering	CP	L	T	P	C
		5	3	0	2	4

Course Objectives: Upon completion of the course, students will be able:

1.	To learn the architectural overview of IoT.
2.	To understand the IoT reference architecture and real world design constraints.
3.	To understand the various IoT levels.
4.	To explore the basics of cloud architecture.
5.	To gain experience in Raspberry PI and experiment simple IoT application on it.

UNIT–I	INTRODUCTION	9

Internet of Things (L2) - Domain Specific IoTs (L2) - IoT and M2M - Sensors for IoT Applications (L2) – Structure of IoT (L2) – IoT Map Device (L2) - IoT System Management with NETCONF (L2) - YANG(L2).

UNIT–II	IoT ARCHITECTURE, GENERATIONS AND PROTOCOLS	9

IETF architecture for IoT (L2) - IoT reference architecture (L2) - First Generation (L2) – Description & Characteristics (L2) –Advanced Generation (L2) – Description & Characteristics (L2) – Integrated IoT Sensors (L3) – Description & Characteristics (L2).

UNIT– III	IoT PROTOCOLS AND TECHNOLOGY	9

SCADA and RFID Protocols (L3) - BACnet Protocol (L3) -Zigbee Architecture (L2)- 6LowPAN (L2)- CoAP - Wireless Sensor Structure (L2)–Energy Storage Module (L2)–Power Management Module (L2) – RF Module (L3) – Sensing Module(L2).

UNIT – IV	CLOUD ARCHITECTURE BASICS	9

The Cloud types; IaaS, PaaS, SaaS(L2)- Development environments for service development; Amazon, Azure, Google Appcloud platform in industry(L2).

UNIT–V	IOT PROJECTS ON RASPBERRY PI	9

Building IOT with RASPBERRY PI (L3) - Creating the sensor project (L3)- Preparing Raspberry Pi (L3) - Clayster libraries (L2) – Hardware Interacting with the hardware (L3) - Interfacing the hardware (L3) - Internal representation of sensor values (L2) - Persisting data (L2)- External representation of sensor values (L2)- Exporting sensor data (L3).

TOTAL : 45 PERIODS

LIST OF EXPERIMENTS/EXERCISES:	
1.	Develop an application for LED Blink and Pattern using Arduino or Raspberry Pi
2.	Develop an application for LED Pattern with Push Button Control using Arduino or Raspberry Pi
3.	Develop an application for LM35 Temperature Sensor to display temperature values using arduino or Raspberry Pi
4.	Develop an application for Forest fire detection end node using Raspberry Pi device and sensor
5.	Develop an application for home intrusion detection web application
6.	Develop an application for Smart parking application using python and Django for web application
	TOTAL : 30 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course Specific Open Ended Problems will be solved during teaching. Such problems can be given as Assignments and evaluated as IA only and not for the End Semester Examinations.

TOTAL: 75 PERIODS

Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Understand the various concept of the IoT and their technologies.	**L2 – Understand**
CO2	Develop the IoT application using different hardware platforms.	**L3 - Apply**
CO3	Implement the various IoT Protocols.	**L3 – Apply**
CO4	Understand the basic principles of cloud computing.	**L2 – Understand**
CO5	Develop and deploy the IoT application into cloud environment.	**L3 – Apply**

REFERENCE BOOKS:	
1.	Arshdeep Bahga, Vijay Madisetti, Internet of Things: A hands-on approach, Universities Press, 2015
2.	Dieter Uckelmann, Mark Harrison, Florian Michahelles (Eds), Architecting the Internet of Things, Springer, 2011
3.	Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
4.	Ovidiu Vermesan Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
5.	N. Ida, Sensors, Actuators and Their Interfaces: A Multidisciplinary Introduction, 2nd Edition Scitech Publishers, 202014
6.	Reese, G. (2009). Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. Sebastopol, CA: O'Reilly Media, Inc. (2009)
VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=WUYAjxnwjU4&list=PLJ5C_6qdAvBG7SHg5mLOQq6bzF-sOPu3k
2.	https://www.youtube.com/watch?v=h0gWfVCSGQQ
3.	https://www.youtube.com/watch?v=GkD0NjUubWM
WEB REFERENCES:	
1.	https://www.ibm.com/topics/internet-of-things
2.	https://freeeway.com/16-types-of-sensors-used-in-iot/
3.	https://www.guvi.in/blog/best-iot-project-ideas/
ONLINE COURSES:	
1.	https://online.stanford.edu/courses/xee100-introduction-internet-things

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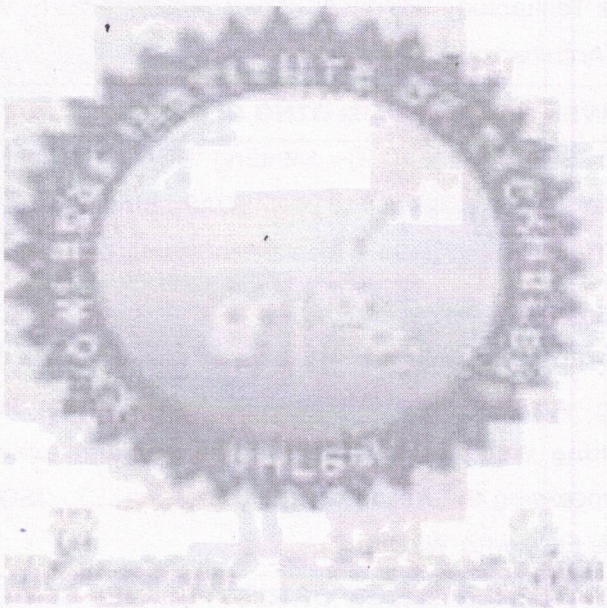
2.	https://onlinecourses.nptel.ac.in/noc22_cs53/preview
3.	https://www.coursera.org/specializations/iot

Mapping of COs with Pos						
COs	**Pos**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	1	2	1	1	3
CO2	3	2	1	2	3	2
CO3	1	1	2	1	3	3
CO4	2	3	2	1	2	2
CO5	1	2	1	2	1	1
Average	1.60	1.80	1.60	1.40	2.00	2.20
1–Low, 2 –Medium, 3–High						



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ME23CP409	WEB SERVICES AND API DESIGN	Version: 1.0				
Programme & Branch	M.E. – Computer Science and Engineering	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To learn the basics of web service.
2.	To become familiar with the web services building blocks.
3.	To learn to work with RESTful web services.
4.	To implement the RESTful web services.
5.	To understand resource oriented architecture.

UNIT–I	INTRODUCTION TO WEB SERVICE	9

Overview – Web service - Architecture(L1) – Service-Oriented Architecture (SOA)(L1), Architecting Web Services: Web Services Technology Stack(L1), Logical Architectural View(L2), Deployment Architectural View(L2), and Process Architectural View(L2).

UNIT–II	WEB SERVICE BUILDING BLOCKS	9

Introduction to SOAP: SOAP Syntax(L2)- Sending SOAP Messages(L2) - SOAP Implementations - Introduction to WSDL: WSDL Syntax(L2) - SOAP Binding (L2)- WSDL Implementations (L3)- Introduction to UDDI: The UDDI API(L1) – Implementations(L2) - The Future of UDDI (L2).

UNIT– III	RESTFUL WEB SERVICES	9

Programmable Web - HTTP: Documents in Envelopes (L2)- Method Information - Scoping Information (L2)- The Competing Architectures - Technologies on the Programmable Web(L1) -Leftover Terminology(L1) - Writing Web Service Clients: The Sample Application(L2) - Making the Request: HTTP Libraries (L2)- Processing the Response: XML Parsers(L2) - JSON Parsers(L2): Handling Serialized Data (L2)- Clients Made Easy with WADL(L2).

UNIT – IV	IMPLEMENTATION OF RESTFUL WEB SERVICES	9

Introducing the Simple Storage Service (L1)- Object-Oriented Design of S3(L2) - Resources - HTTP Response Codes Resource(L2)- URIs – Addressability(L2) - Statelessness - Representations (L3)- Links and Connectedness - The Uniform Interface(L2) – Spring Web Services(L2) – Spring MVC Components (L3)- Spring Web Flow - A Service Implementation using Spring Data REST(L3).

UNIT–V	RESOURCE ORIENTED ARCHITECTURE	9

Resource(L1)- URIs - Addressability (L2)- Statelessness - Representations (L2)- Links and Connectedness - The Uniform Interface(L2)- Designing Read-Only Resource-Oriented Services: Resource Design (L2)- Turning Requirements Into Read-Only Resources (L2)- Figure Out the Data Set(L2)- Split the Data Set into Resources- Name the Resources (L2)- Design Representation(L2)- Link the Resources to Each Other- The HTTP Response (L2).

TOTAL : 45 PERIODS

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OPEN ENDED PROBLEMS / QUESTIONS		
Course Specific Open Ended Problems will be solved during teaching. Such problems can be given as Assignments and evaluated as 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 how to write XML documents.	**L2 – Understand**
CO2	Apply the web service building blocks such as SOAP, WSDL and UDDI.	**L3 – Apply**
CO3	Describe the RESTful web services.	**L2 – Understand**
CO4	Implement the RESTful web service with Spring Boot MVC.	**L3 – Apply**
CO5	Discuss Resource-oriented Architecture.	**L2 – Understand**
REFERENCE BOOKS:		
1.	Leonard Richardson and Sam Ruby, RESTful Web Services, O'Reilly Media, 2007	
2.	McGovern, et al., "Java Web Services Architecture", Morgan Kaufmann Publishers,2005.	
3.	Lindsay Bassett, Introduction to JavaScript Object Notation, O'Reilly Media, 2015	
4.	Craig Walls, "Spring in Action, Fifth Edition", Manning Publications, 2018	
5.	Raja CSP Raman, Ludovic Dewailly, "Building A RESTful Web Service with Spring 5", Packt Publishing, 2018.	
6.	Bogunuva Mohanram Balachandar, "Restful Java Web Services, Third Edition: A pragmatic guide to designing and building RESTful APIs using Java", Ingram short title, 3rd Edition, 2017.	
7.	Mario-Leander Reimer, "Building RESTful Web Services with Java EE 8: Create modern RESTful web services with the Java EE 8 API", Packt publishing, 2018	
VIDEO REFERENCES:		
1.	https://www.youtube.com/watch?v=0CSyIBHQy9g	
2.	https://www.youtube.com/watch?v=BZi44GOD8kY	
3.	https://www.youtube.com/channel/UCSJbGtTlrDami-tDGPUV9-w	
WEB REFERENCES:		
1.	https://restfulapi.net/	
2.	https://learn.microsoft.com/en-us/azure/architecture/best-practices/api-design	
3.	https://apiblueprint.org/	
ONLINE COURSES:		
1.	https://www.coursera.org/learn/api-design-google-cloud-apigee	
2.	https://www.udemy.com/course/rest-api-design-the-complete-guide/	

Mapping of COs with POs

COs	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	3	3	-	-	-
CO2	1	-	3	3	1	2
CO3	-	3	3	-	-	-
CO4	1	-	2	3	1	2
CO5	1	-	1	-	1	-
Average	1	3	2.4	3	1	2
1–Low, 2 –Medium, 3–High						

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ME23CP410	DATA VISUALIZATION TECHNIQUES	Version: 1.0				
Programme & Branch	M.E. – Computer Science and Engineering	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To develop skills to both design and critique visualizations.
2.	To introduce visual perception and core skills for visual analysis.
3.	To understand technological advancements of data visualization.
4.	To understand various data visualization techniques.
5.	To understand the methodologies used to visualize large data sets.

UNIT–I	INTRODUCTION AND DATA FOUNDATION	9

Basics - Relationship between Visualization and Other Fields(L1) -The Visualization Process (L2)- Pseudo code Conventions(L3) - The Scatter plot(L3). Data Foundation (L2)- Types of Data - Structure within and between Records (L2)- Data Pre-processing(L2) - Data Sets(L3).

UNIT–II	FOUNDATIONS FOR VISUALIZATION	9

Visualization stages(L2) - Semiology of Graphical Symbols (L2)- The Eight Visual Variables (L2)– Historical Perspective – Taxonomies(L2) - Experimental Semiotics based on Perception Gibson's Affordance theory(L3) – A Model of Perceptual Processing(L2).

UNIT– III	VISUALIZATION TECHNIQUES	9

Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three Dimensional Data - Dynamic Data - Combining Techniques(L2). Geospatial Data : Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data (L3)- Visualization of Area Data – Other Issues in Geospatial Data Visualization Multivariate Data : Point-Based Techniques – Line Based Techniques(L3) - Region-Based Techniques(L3) - Combinations of Techniques – Trees Displaying Hierarchical Structures(L2) – Graphics and Networks- Displaying Arbitrary Graphs/Networks(L2).

UNIT – IV	INTERACTION CONCEPTS AND TECHNIQUES	9

Text and Document Visualization: Introduction - Levels of Text Representations(L1) - The Vector Space Model - Single Document Visualizations(L2) -Document Collection Visualizations – Extended Text Visualizations Interaction Concepts: Interaction Operators(L2) - Interaction Operands and Spaces (L2) - A Unified Framework. Interaction Techniques: Screen Space(L3) - Object-Space –Data Space (L3)- Attribute Space- Data Structure Space (L2)- Visualization Structure (L2)– Animating Transformations (L3)- Interaction Control(L2).

UNIT–V	RESEARCH DIRECTIONS IN VISUALIZATIONS	9

Steps in designing Visualizations (L1)– Problems in designing effective Visualizations(L2)- Issues of Data. Issues of Cognition, Perception, and Reasoning(L2). Issues of System Design Evaluation, Hardware and Applications(L2).

TOTAL : 45 PERIODS

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OPEN ENDED PROBLEMS / QUESTIONS		
Course Specific Open Ended Problems will be solved during teaching. Such problems can be given as Assignments and evaluated as 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	Visualize the objects in different dimensions.	**L3 – Apply**
CO2	Design and process the data for Visualization.	**L3 – Apply**
CO3	Apply the visualization techniques in physical sciences, computer science, applied mathematics and medical sciences.	**L3 – Apply**
CO4	Apply the virtualization techniques for research projects.	**L3 – Apply**
CO5	Identify appropriate data visualization techniques given particular requirements imposed by the data.	**L2 – Understand**
REFERENCE BOOKS:		
1.	Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010.	
2.	Colin Ware, "Information Visualization Perception for Design", 4th edition, Morgan Kaufmann Publishers, 2021.	
3.	Robert Spence "Information visualization – Design for interaction", Pearson Education, 2nd Edition, 2007	
4.	Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008.	
VIDEO REFERENCES:		
1.	https://www.youtube.com/user/tableausoftware	
2.	https://www.youtube.com/user/currankelleher	
3.	https://www.youtube.com/user/GoogleDevelopers	
WEB REFERENCES:		
1.	https://www.datavisualizationsociety.org/	
2.	https://www.data-to-viz.com/	
3.	https://www.datavisualizationsociety.org/	
ONLINE COURSES:		
1.	https://www.storytellingwithdata.com/	
2.	https://visualisingdata.com/	
3.	https://github.com/hal9ai/awesome-dataviz	

Mapping of COs with POs

COs	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1	2	2	1	2
CO2	2	1	2	3	2	2
CO3	1	-	2	2	1	1
CO4	3	1	3	3	2	2
CO5	2	1	3	2	2	2
Average	2.20	1	2.40	2.40	1.40	1.60
1–Low, 2 –Medium, 3–High						

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ME23CP411	COMPILER OPTIMIZATION TECHNIQUES	Version: 1.0				
Programme & Branch	M.E. – Computer Science and Engineering	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To understand the optimization techniques used in compiler design.
2.	To be aware of the various computer architectures that support parallelism.
3.	To become familiar with the theoretical background needed for code optimization.
4.	To understand the techniques used for identifying parallelism in a sequential program.
5.	To learn the various optimization algorithms.

UNIT–I	INTRODUCTION	9

Language Processors (L2) - The Structure of a Compiler(L2) – The Evolution of Programming Languages (L2)- The Science of Building a Compiler(L2) – Applications of Compiler Technology Programming Language Basics(L2) - The Lexical Analyser Generator(L3) -Parser Generator(L3) - Overview of Basic Blocks and Flow Graphs(L2) - Optimization of Basic Blocks(L2) - Principle Sources of Optimization(L2).

UNIT–II	INSTRUCTION-LEVEL PARALLELISM	9

Processor Architectures(L1) – Code-Scheduling Constraints(L2) – Basic-Block Scheduling (L2)–Global Code Scheduling (L2)– Advanced code motion techniques(L3) – Interaction with Dynamic Schedulers(L1)- Software Pipelining(L1).

UNIT– III	OPTIMISING FOR PARALLELISM AND LOCALITY-THEORY	9

Basic Concepts (L2)– Matrix-Multiply: An Example - Iteration Spaces(L2) - Affine Array Indexes (L3)– Data Reuse(L2)- Array data dependence Analysis(L3).

UNIT – IV	OPTIMISING FOR PARALLELISM AND LOCALITY – APPLICATION	9

Finding Synchronisation(L2) - Free Parallelism (L2)– Synchronisation Between Parallel Loops(L2) – Pipelining – Locality Optimizations(L3) – Other Uses of Affine Transforms(L3).

UNIT–V	INTERPROCEDURAL ANALYSIS	9

Basic Concepts(L2) – Need for Interprocedural Analysis (L2)– A Logical Representation of Data Flow (L1)– A Simple Pointer-Analysis Algorithm(L4) – Context Insensitive Interprocedural Analysis (L4)- Context- Sensitive Pointer-Analysis(L2) - Datalog Implementation by Binary Decision Diagrams(L3).

TOTAL : 45 PERIODS

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OPEN ENDED PROBLEMS / QUESTIONS		
Course Specific Open Ended Problems will be solved during teaching. Such problems can be given as Assignments and evaluated as 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	Design and implement techniques used for optimization by a compiler.	**L3 – Apply**
CO2	Modify the existing architecture that supports parallelism.	**L3 – Apply**
CO3	Modify the existing data structures of an open source optimising compiler.	**L3 – Apply**
CO4	Design and implement new data structures and algorithms for code optimization.	**L3 – Apply**
CO5	Critically analyse different data structures and algorithms used in the building of an optimising compiler.	**L4 - Analyze**
REFERENCE BOOKS:		
1.	Charles N, Ron K Cytron, Richard J LeBlanc Jr., "Crafting a Compiler", Pearson Education, 2010.	
2.	Torbengidius Mogensen, "Basics of Compiler Design", Springer, 2011.	
3.	Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, " Compilers - Principles, Techniques and Tools", Second Edition, Pearson Education 2007.	
4.	Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures, First Edition ,2001.	
5.	Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, 2007	
6.	John Hopcroft, Rajeev Motwani, Jeffrey Ullman, "Introduction to Automata Theory Languages, and Computation", Third Edition, Pearson Education, 2007.	
VIDEO REFERENCES:		
1.	https://godbolt.org/	
2.	https://learn.microsoft.com/en-us/cpp/build/reference/optimization-compiler	
WEB REFERENCES:		
1.	https://compileroptimizations.com/	
2.	https://community.st.com/t5/stm32-mcus-products/compiler-optimization-problems/td-p/542634	
ONLINE COURSES:		
1.	https://nptelvideos.com/course.php?id=439	
2.	https://www.quora.com/Where-can-I-find-a-free-online-compiler-for-C-language	

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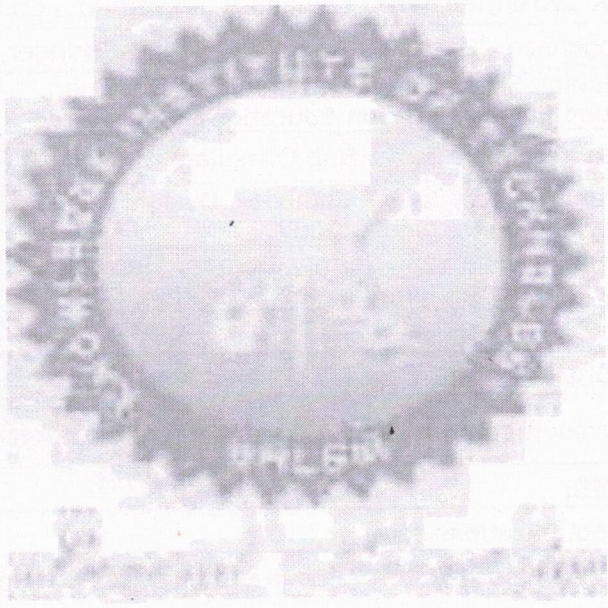
Mapping of COs with POs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	3	2	2
CO2	-	-	3	3	-	3
CO3	3	-	3	3	-	3
CO4	3	3	3	3	-	-
CO5	-	3	3	3	3	-
Average	2.6	2.6	2.8	3	2.5	2.6
1–Low, 2 –Medium, 3–High						



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ME23CP412	ROBOTICS	Version:1.0				
Programme & Branch	M.E. – Computer Science and Engineering	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To introduce the concepts of robotic systems.
2.	To understand the concepts of instrumentation and control related to robotics.
3.	To understand the kinematics and dynamics of robotics.
4.	To learn the artificial intelligence techniques and task planning for robotics.
5.	To explore robotics in industrial applications.

UNIT–I	INTRODUCTION TO ROBOTICS	9

Robotics(L1) –History(L1) - Classification and Structure of Robotic Systems(L2) - Basic components(L2) -Degrees of freedom(L1) - Robot joints coordinates(L2)- Reference frames(L2) – workspace(L2)- Robot languages(L2)- Robotic sensors(L2)- proximity and range sensors(L2), ultrasonic sensor(L2), touch and slip sensor(L2).

UNIT–II	ROBOT KINEMATICS AND DYNAMICS	9

Kinematic Modelling: Translation and Rotation Representation(L2), Coordinate transformation(L2), DH parameters(L2), Forward and inverse kinematics(L2), Jacobian(L2), Dynamic Modelling: Forward and inverse dynamics(L2), Equations of motion using Euler-Lagrange formulation(L2), Newton Euler formulation(L2).

UNIT–III	ROBOTICS CONTROL	9

Control of robot manipulator(L2) - state equations(L2) - constant solutions (L2)-linear feedback systems(L2), single-axis PID control (L2)- PD gravity control(L2) -computed torque control, variable structure control and impedance control(L2).

UNIT–IV	ROBOT INTELLIGENCE AND TASK PLANNING	9

Artificial Intelligence (L1)- techniques (L2)- search problem reduction (L2)- predicate logic means and end analysis(L2) -problem solving(L2) -robot learning - task planning (L2)- basic problems in task planning - AI in robotics and Knowledge Based Expert System in robotics(L2)

UNIT–V	INDUSTRIAL ROBOTICS	9

Robot cell design and control (L2)- cell layouts - multiple robots and machine interference(L2) - work cell design(L2) - work cell control – interlocks(L2) – error detection deduction and recovery(L2) - work cell controller - robot cycle time analysis(L2). Safety in robotics, Applications of robot and future scope(L2)

TOTAL:45 PERIODS

OPEN ENDED PROBLEMS/QUESTIONS	
Course Specific Open Ended Problems will be solved during teaching. Such problems can be given as Assignments and evaluated as IA only and not for the End Semester Examinations.	
	TOTAL:45 PERIODS

Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Describe the fundamentals of robotics.	**L2 - Understand**
CO2	Understand the concept of kinematics and dynamics in robotics.	**L2 - Understand**
CO3	Discuss the robot control techniques.	**L2 - Understand**
CO4	Explain the basis of intelligence in robotics and task planning.	**L2 - Understand**
CO5	Discuss the industrial applications of robotics.	**L2 - Understand**

REFERENCE BOOKS:

1.	Mikell. P. Groover, Michell Weis, Roger. N. Nagel, Nicolous G.Odrey, 'Industrial Robotics Technology, Programming and Applications ', McGraw Hill, Int 2012.
2.	Reza N.Jazar, 'Theory of Applied Robotics Kinematics, Dynamics and Control', Springer, 1st Indian Reprint, 2010.
3.	K.S.Fu, R.C.Gonzalez and C.S.G.Lee, 'Robotics Control, Sensing, Vision and Intelligence', Tata McGraw Hill, 2nd Reprint,2008
4.	Richard D. Klafter, Thomas A. Chmielewski, Michael Negin, 'Robotics Engineering: An Integrated Approach', PHI Learning, New Delhi, 2009.
5.	John J. Craig, 'Introduction to Robotics (Mechanics and Control)', Addison-Wesley, 2nd Edition, 2004.

VIDEO REFERENCES:

1.	https://www.youtube.com/playlist?list=PLGs0VKk2DiYxkoe2XNxDvVHqL5XG4dMWi
2.	https://www .TED Talks on Robotics/

WEB REFERENCES:

1.	https://openai.com/
2.	https://www.therobotreport.com/
3.	https://www.ieee-ras.org/

ONLINE COURSES:

1.	https://github.com/topics/robotics
2.	https://www.coursera.org/courses?query=robotics

Mapping of COs with POs

COs	POs					
	PO 1	PO2	PO3	PO4	PO 5	PO 6
CO1	1	3	3	-	2	-
CO2	1	2	3	2	1	1
CO3	1	2	-	3	3	2
CO4	2	-	3	-	2	-
CO5	1	-	-	3	3	3
Average	1.2	2.3	3	2.7	2.2	2

1–Low, 2 –Medium, 3–High

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ME23CP413	DEVOPS AND MICRO SERVICES	Version: 1.0				
Programme & Branch	M.E. – Computer Science and Engineering	CP	L	T	P	C
		5	3	0	2	4

Course Objectives:

1.	To learn the basic concepts and terminology of DevOps.
2.	To gain knowledge on Devops platform.
3.	To understand building and deployment of code.
4.	To be familiar with DevOps automation tools.
5.	To learn basics of MLOps.

UNIT – I	INTRODUCTION	9

Software Engineering(L1) - traditional and Agile process models(L2) - DevOps –Definition(L1) – Practices(L3) - DevOps life cycle process(L2) - need for DevOps(L2) –Barriers (L1).

UNIT – II	DEVOPS PLATFORM AND SERVICES	9

Cloud as a platform - IaaS, PaaS, SaaS (L2)- Virtualization(L3) - Containers (L2)–Supporting Multiple Data Centres(L1) - Operation Services(L2) - Hardware provisioning- software Provisioning (L2)- IT services - SLA - capacity planning(L3) - security - Service Transition(L2) - Service Operation Concepts(L2).

UNIT – III	BUILDING, TESTING AND DEPLOYMENT	9

Microservices architecture(L2) - coordination model (L2)- building and testing (L3)- Deployment pipeline(L2) - Development and Pre-commit Testing (L2)-Build and Integration Testing(L3) - continuous integration - monitoring (L2)- security - Resources to be Protected(L2) - Identity Management (L2).

UNIT – IV	DEVOPS AUTOMATION TOOLS	9

Infrastructure Automation(L2)- Configuration Management(L2) - Deployment Automation (L2)- Performance Management(L2) - Log Management (L2)-Monitoring(L2).

UNIT – V	MLOPS	9

MLOps(L2) – Definition(L1) - Challenges (L1) - Developing Models(L2) – Deploying to production(L2) - Model Governance(L2) - Real world examples (L3).

TOTAL : 45 PERIODS

LIST OF EXPERIMENTS/EXERCISES:

1.	Creating a new Git repository, cloning existing repository, Checking changes into a Git repository, Pushing changes to a Git remote, Creating a Git branch.
2.	Installing Docker container on windows/Linux, issuing docker commands.
3.	Building Docker Images for Python Application.
4.	Setting up Docker and Maven in Jenkins and First Pipeline Run.
5.	Running Unit Tests and Integration Tests in Jenkins Pipelines.

TOTAL: 30 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course Specific Open Ended Problems will be solved during teaching. Such problems can be given as

Assignments and evaluated as IA only and not for the End Semester Examinations.		
		TOTAL: 75 PERIODS
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Implement modern software Engineering process.	**L3 – Apply**
CO2	Work with DevOps platform.	**L3 – Apply**
CO3	Build, test and deploy code.	**L3 – Apply**
CO4	Explore DevOps tools.	**L2 – Understand**
CO5	Correlate MLOps concepts with real time examples.	**L3 – Apply**
REFERENCE BOOKS:		
1.	Len Bass, Ingo Weber and Liming Zhu, — "DevOps: A Software Architect's Perspective", Pearson Education, 2016	
2.	Joakim Verona - "Practical DevOps" - Packet Publishing, 2016	
3.	Viktor Farcic - "The DevOps 2.1 Toolkit: Docker Swarm" - Packet Publishing, 2017	
4.	Mark Treveil and the Dataiku Team - "Introducing MLOps" - O'Reilly Media- 2020	
VIDEO REFERENCES:		
1.	https://youtu.be/7kX3fs0pWwc?si=YfRG3Cu4KCTtZPPd	
2.	https://youtu.be/rX4mQHpWuUY?si=6n00iwT50da7MJIE	
3.	https://youtu.be/XL4KGeQsN3c?si=QncAf6DcwQ_4-Q5	
WEB REFERENCES:		
1.	https://www.stackify.com	
2.	http://docs.oracle.com	
3.	https://microservice.io	
ONLINE COURSES:		
1.	https://www.udemy.com/topic/microservices	
2.	https://staragile.com/in/devops	
3.	https://aws.amazon.com/training/learn-about/devops/?trk=d5f5086e-2756-4df0-af53-d57b79eb28a9	

Mapping of COs with POs

COs	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	1	2	3	-
CO2	3	2	-	-	3	-
CO3	3	2	2	3	2	3
CO4	3	2	1	2	3	-
CO5	3	2	2	1	2	3
Average	3	2	1.5	2	2.6	3
1–Low, 2 –Medium, 3–High						

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ME23CP414	DEEP LEARNING	Version: 1.0				
Programme & Branch	M.E. – Computer Science and Engineering	CP	L	T	P	C
		5	3	0	2	4

Course Objectives:

1.	To develop and Train Deep Neural Networks.
2.	To develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition.
3.	To build and train RNNs, work with NLP and Word Embedding.
4.	To understand the internal structure of LSTM and GRU and the differences between them.
5.	To learn the Auto Encoders for Image Processing.

UNIT–I	DEEP LEARNING CONCEPTS	9

Fundamentals about Deep Learning(L1) - Perception Learning Algorithms(L1) - Probabilistic modelling(L1). Early Neural Networks - How Deep Learning different from Machine Learning(L2) - Scalars. Vectors. Matrixes, Higher Dimensional Tensors(L2) - Manipulating Tensors. Vector Data(L2) - Time Series Data. Image Data. Video Data(L2).

UNIT–II	NEURAL NETWORKS	9

About Neural Network(L1) - Building Blocks of Neural Network(L1) - Optimizers. Activation Functions. Loss Functions(L3) - Data Pre-processing for neural networks(L3) - Feature Engineering - Overfitting and Underfitting(L3) - Hyper parameters(L2).

UNIT– III	CONVOLUTIONAL NEURAL NETWORK	9

About CNN(L1)- Linear Time Invariant(L1)-Image Processing Filtering(L1)-Building a convolutional neural network(L1)-Input Layers, Convolution Layers, Pooling Layers, Dense Layers(L2)-Backpropagation Through the Convolutional Layer(L1)- Filters and Feature Maps(L2)-Backpropagation Through the Pooling Layers(L2)- Dropout Layers and Regularization(L2)- Batch Normalization(L1)-Various Activation Functions(L1)-Various Optimizers(L2)-LeNet, AlexNet, VGG16, ResNet(L3)- Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, Microsoft ResNet Model-R-CNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO(L3).

UNIT – IV	NATURAL LANGUAGE PROCESSING USING RNN	9

About NLP & its Toolkits. Language Modelling(L2)- Vector Space Model (VSM)(L2)- Continuous Bag of Words (CBOW)-Skip-Gram Model for Word Embedding(L2)-Part of Speech (PoS) Global Co-occurrence Statistics(L2)–based Word Vectors(L2)- Transfer Learning(L2)-Word2Vec Global Vectors for Word Representation GloVe(L2)- Backpropagation Through Time(L2)- Bidirectional RNNs (BRNN) (L4)-Long Short Term Memory LSTM(L2)-Bi-directional LSTM-Sequence-to-Sequence Models (Seq2Seq)- Gated recurrent unit GRU (L4).

UNIT–V	DEEP REINFORCEMENT & UNSUPERVISED LEARNING	9

About Deep Reinforcement Learning(L1)- Q - Learning(L2) Deep Q - Network (DQN)(L2) - Policy Gradient Methods(L2) – Actor - Critic Algorithm(L2) - About Auto encoding(L2) - Convolutional Auto Encoding(L2) - Variational Auto Encoding(L2) - Generative Adversarial Networks(L2) - Autoencoders for Feature Extraction(L3). Auto Encoders for Classification(L2) - Denoising Autoencoders(L3) - Sparse Autoencoders(L3).

TOTAL : 45 PERIODS

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LIST OF EXPERIMENTS/EXERCISES:	
1.	Feature Selection from Video and Image Data
2.	Image and video recognition
3.	Image Colorization
4.	Aspect Oriented Topic Detection & Sentiment Analysis
5.	Object Detection using Autoencoder
	TOTAL: 30 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS
Course Specific Open Ended Problems will be solved during teaching. Such problems can be given as Assignments and evaluated as IA only and not for the End Semester Examinations.
TOTAL: 75 PERIODS

Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Understand Feature Extraction from Image and Video Data.	**L2 - Understand**
CO2	Implement Image Segmentation and Instance Segmentation in Images.	**L3 – Apply**
CO3	Implement image recognition and image classification using a pretrained network (Transfer Learning).	**L3 – Apply**
CO4	Analyse Traffic Information using Twitter Data.	**L4 – Analyze**
CO5	Apply Autoencoder for Classification & Feature Extraction.	**L3 – Apply**

REFERENCE BOOKS:	
1.	Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
2.	Deep Learning A Practitioner's Approach Josh Patterson and Adam Gibson O'Reilly Media, Inc.2017
3.	Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
4.	Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
5.	Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017

VIDEO REFERENCES:	
1.	https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2.	https://onlinecourses.nptel.ac.in/noc20_cs50/preview

WEB REFERENCES:	
1.	https://www.kaggle.com/learn/intro-to-deep-learning
2.	https://www.datacamp.com/tutorial/tutorial-deep-learning-tutorial

ONLINE COURSES:	
1.	https://www.udemy.com/course/deeplearning
2.	https://in.mathworks.com/solutions/deep-learning

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Mapping of COs with Pos						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2		3	3	3
CO2	2	2	2	3	3	2
CO3	2	2	2	3	2	3
CO4	2	2	1	3	3	3
CO5	2	2		3	2	2
Average	2	2	1.6	3	2.6	2.6
1–Low, 2 –Medium, 3–High						

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ME23CP415	BLOCK CHAIN TECHNOLOGIES	Version: 1.0				
Programme & Branch	M.E. – Computer Science and Engineering	CP	L	T	P	C
		5	3	0	2	4

Course Objectives:

1.	To understand cryptographic fundamentals and blockchain technology.
2.	To learn the crypto currency mechanics and impacts of block chain technology on it.
3.	To gain comprehensive understanding of ethereum.
4.	To explore the understanding of both private and public Blockchain and smart contract.
5.	To learn various aspects of block chain technology like applications in various domains.

UNIT–I	INTRODUCTION OF CRYPTOGRAPHY AND BLOCKCHAIN	9

Introduction to Blockchain(L1), Blockchain Technology Mechanisms & Networks(L2), Blockchain Origins, Objective of Blockchain(L1), Blockchain Challenges(L1), Transactions and Blocks(L2), P2P Systems(L2), Keys as Identity(L2), Digital Signatures(L2), Hashing(L2), and public key cryptosystems(L2), private vs. public Blockchain(L2).

UNIT–II	BITCOIN AND CRYPTOCURRENCY	9

Introduction to Bitcoin(L1), The Bitcoin Network(L2), The Bitcoin Mining Process(L2), Mining Developments, Bitcoin Wallets(L2), Decentralization and Hard Forks(L2), Ethereum Virtual Machine (EVM)(L3), Merkle Tree, Double-Spend Problem(L3), Blockchain and Digital Currency(L2), Transactional Blocks(L2), Impact of Blockchain Technology on Cryptocurrency(L4).

UNIT– III	INTRODUCTION TO ETHEREUM	9

Introduction to Ethereum(L2), Consensus Mechanisms(L2), Metamask Setup(L2), Ethereum Accounts, Transactions(L2), Receiving Ethers(L2), Smart Contracts(L2).

UNIT – IV	INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING	9

Introduction to Hyperledger(L1), Distributed Ledger Technology & its Challenges(L2), Hyperledger & Distributed Ledger Technology(L2), Hyperledger Fabric, Hyperledger Composer(L3). Solidity - Language of Smart Contracts(L3), Installing Solidity & Ethereum Wallet(L3), Basics of Solidity(L2), Layout of a Solidity Source File & Structure of Smart Contracts(L3), General Value Types(L3)

UNIT–V	BLOCKCHAIN APPLICATIONS	9

Internet of Things(L4), Medical Record Management System(L4), Domain Name Service and Future of Blockchain(L4), Alt Coins(L4).

TOTAL : 45 PERIODS

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LIST OF EXPERIMENTS/EXERCISES:	
1.	Create a Simple Blockchain in any suitable programming language.
2.	Use Geth to Implement Private Ethereum Block Chain.
3.	Build Hyperledger Fabric Client Application.
4.	Build Hyperledger Fabric with Smart Contract.
5.	Create Case study of Block Chain being used in illegal activities in real world.
6.	Using Python Libraries to develop Block Chain Application.
	TOTAL: 30 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS
Course Specific Open Ended Problems will be solved during teaching. Such problems can be given as Assignments and evaluated as IA only and not for the End Semester Examinations.
TOTAL: 75 PERIODS

Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Understand and explore the working of Blockchain technology.	**L2 – Understand**
CO2	Analyze the working of Smart Contracts.	**L4 – Analyze**
CO3	Understand and analyze the working of Hyperledger.	**L2 – Understand**
CO4	Apply the learning of solidity to build de-centralized apps on Ethereum.	**L3 - Apply**
CO5	Analyze and develop applications on Blockchain.	**L4 - Analyze**

REFERENCE BOOKS:	
1.	Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.
2.	Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016
3.	Antonopoulos, Mastering Bitcoin, O'Reilly Publishing, 2014.
4.	Antonopoulos and G. Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", O'Reilly Publishing, 2018.
5.	D. Drescher, Blockchain Basics. Apress, 2017.
VIDEO REFERENCES:	
1.	https://vidico.com/news/blockchain-animation/
2.	https://www.youtube.com/watch?v=qOVAbKKSH10
3.	https://www.youtube.com/watch?v=a4xgVqZdd6M

WEB REFERENCES:	
1.	https://www.geeksforgeeks.org/solidity/
2.	https://www.tutorialspoint.com/ethereum/index.htm
3.	https://docs.aws.amazon.com/managed-blockchain/latest/hyperledger-fabric-dev/managed-blockchain-get-started-tutorial.html
ONLINE COURSES:	
1.	https://nptel.ac.in/courses/106/104/106104220/#
2.	https://www.udemy.com/course/build-your-blockchain-az/
3.	https://eduxlabs.com/courses/blockchain-technologytraining/?tab=tab-curriculum

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Mapping of COs with POs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	3	2	2	3
CO2	2	1	2	3	2	2
CO3	2	1	3	1	2	1
CO4	2	1	2	3	2	2
CO5	-	-	-	-	-	-
Average	2	1	2.5	2.25	2	2
1–Low, 2 –Medium, 3–High						

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ME23CP416	FULL STACK WEB APPLICATION DEVELOPMENT	Version: 1.0				
Programme & Branch	M.E. – Computer Science and Engineering	CP	L	T	P	C
		5	3	0	2	4

Course Objectives:

1.	To develop Type Script Application.
2.	To develop Single Page Application (SPA).
3.	To understand the communication with a server over the HTTP protocol.
4.	To learn all the tools need to start building applications with Node.js.
5.	To implement the Full Stack Development using MEAN Stack.

UNIT–I	FUNDAMENTALS & TYPESCRIPT LANGUAGE	10

Server-Side Web Applications(L2)- Client-Side Web Applications- Single Page Application(L1)- About Type Script- Creating TypeScript Projects(L3)- TypeScript Data Types- Variables-Expression and Operators- Functions(L1)- OOP in Typescript(L1)- Interfaces(L1) Generics Modules(L2) Enums- Decorators(L2). Enums- Iterators- Generators(L2).

UNIT–II	ANGULAR	10

About Angular, Angular CLI(L2) Creating an Angular Project(L2)- Components(L3)- Components Interaction- Dynamic Components- Angular Elements- Angular Forms(L2)- Template Driven Forms. Property, Style, Class and Event Binding(L2)- Two way Bindings- Reactive Forms(L2)-Form Group- Form Controls(L2) About Angular Router- Router Configuration-Router State(L3)- Navigation Pages- Router Link- Query Parameters- URL matching(L2)- Matching Strategies- Services(L3)- Dependency Injection(L2)- HttpClient- Read Data from the Server- CRUD Operations- Http Header Operations- Intercepting requests and responses.

UNIT– III	NODE.js	10

About Node.js- Configuring Node.js environment(L2- Node Package Manager NPM(L2)- Modules- Asynchronous Programming(L2)- Call Stack and Event Loop(L2)- Callback functions- Callback errors- Abstracting callbacks(L2)- Chaining callbacks-File System- Synchronous vs. asynchronous I/O(L2)- Path and directory operations- File Handle(L2)- File Synchronous API- File Asynchronous API(L2)- File Callback API. Timers(L2)- Scheduling Timers- Timers Promises API(L2)- Node.js Events- Event Emitter(L2)- Event Target and Event API(L2)- Buffers- Buffers and Typed Arrays(L3)- Buffers and iteration- Using buffers for binary data - Flowing vs non-flowing streams(L3)- JSON(L2).

UNIT – IV	EXPRESS.Js	7

Express.js- How Express.js Works(L1). Configuring Express.js App Settings(L2) - Defining Routes. Starting the App. Express.js Application Structure(L3)- Configuration, Settings- Middleware- body-parse- cookie-parser- express-session(L2)- response-time- Template Engine(L2)- Jade. EJ- Parameters(L2)-

Routing(L3)- router-route(path)- Router Class- Request Object- Response Object(L3)- Error Handling- RESTful(L2).		
UNIT–V	**MONGODB**	**8**
Introduction to MongoDB(L2)- Documents- Collections- Subcollections(L2)- Database- Data Type- Dates- Arrays(L2)- Embedded Documents(L2)- CRUD Operations- Batch Insert- Insert Validation(L2)- Querying the Documents(L2)- Cursors- Indexing- Unique Indexes(L2)- Sparse Indexes- Special Index and Collection Types(L2)- Full-Text Indexes- Geospatial Indexing(L2)- Aggregation framework(L2).		
		TOTAL : 45 PERIODS

LIST OF EXPERIMENTS/EXERCISES:

1.	Accessing the Weather API from Angular
2.	Accessing the Stock Market API from Angular
3.	Call the Web Services of Express.js From Angular
4.	Read the data in Node.js from MongoDB
5.	CRUD operation in MongoDB using Angular

TOTAL: 30 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course Specific Open Ended Problems will be solved during teaching. Such problems can be given as Assignments and evaluated as IA only and not for the End Semester Examinations.

TOTAL: 75 PERIODS

Course Outcomes: Upon completion of this course the students will be able to:		**BLOOM'S Taxonomy**
CO1	Develop basic programming skills using Java script.	**L3 – Apply**
CO2	Implement a front-end web application using Angular.	**L3 – Apply**
CO3	Create modules to organize the server.	**L3 – Apply**
CO4	Build RESTful APIs with Node, Express and MongoDB with confidence.	**L3 – Apply**
CO5	Interpret to Store complex, relational data in MongoDB using Mongoose.	**L2 – Understand**

REFERENCE BOOKS:

1.	Adam Freeman, Essential TypeScript, Apress, 2019
2.	Mark Clow, Angular Projects, Apress, 2018
3.	Alex R. Young, Marc Harter,Node.js in Practice, Manning Publication, 2014
4.	Pro Express.js, Azat Mardan, Apress, 2015
5.	MongoDB in Action, Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett, Tim Hawkins, Manning Publication, Second edition, 2016

VIDEO REFERENCES:

1.	https://www.youtube.com/watch?v=R6RX2Zx96fE
2.	https://youtu.be/Gzk4cc8LTQs?si=472Z7JzgfXUwX-Or

3.	https://youtu.be/8KaJRw-rfn8?si=sRg9HINKIBgaeNvj
WEB REFERENCES:	
1.	https://www.mongodb.com
2.	https://www.simplilearn.com/what-is-full-stack-development-article
3.	https://ifact.iitk.ac.in/product/full-stack-web-developer-angular-react-and-mongo-db-advance
ONLINE COURSES:	
1.	https://www.classcentral.com/course/full-stack-mobile-app-development-35062
2.	https://www.udemy.com/course/full-stack-development-using-angular-10-web-api-sql
3.	https://ifacet.iitk.ac.in/product/full-stack-web-developer-mongodb-express-react-and-node-js-advance

Mapping of COs with POs

COs	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
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CO3	2	-	1	-	3	3
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CO5	3	3	-	-	3	3
Average	2.33	3	1.75	3	3	3
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