GLOBAL ACADEMY OF TECHNOLOGY

(Autonomous Institution Affiliated to VTU, Belagavi)
Accredited by NAAC with 'A' Grade,
NBA Accredited - CSE, ISE, ECE, EEE, ME, CV
Ideal Homes Township, Raja Rajeshwari Nagar, Bengaluru-560098

Scheme and Syllabus of I to IV Semester

(Autonomous System of 2024 Scheme)

Master of Technology (M.Tech)

in

COMPUTER SCIENCE AND ENGINEERING

H.V. Rajashekar Swamy
Dean Academic
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Skshwamy
Head of Department
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Department of Computer Science and Engineering

Vision

To achieve academic excellence and strengthen the skills to meet emergingchallenges of computer science and engineering.

Mission

- To impart strong theoretical foundation in the field of ComputerScience and Engineering accompanied with extensive practical skills.
- To inculcate research and innovation spirit through interaction withindustry and carry out projects that address societal needs.
- Instill professional ethics and values with a concern for environment.

Program Outcomes (POs)

Computer Science and Engineering Post Graduates inculcate

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:

An ability to demonstrate a degree of mastery over Computer Science and Engineering.

PO4:

An ability to acquire a sense of ethical and moral integrity in Applications of Computer Science and Engineering with concern to Environment and sustainability.

PO5:

An ability to inculcate a personality trait to be open to learn, unlearn and relearn concepts and skills for the life time.

I SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			Credits
					L	T	P	CIE	SEE	Total	
1	MCS101	Advances in Computer Networks	PCC	CSE	03	00	00	50	50	100	3
2	MCS102	Cloud Computing and Big Data Analytics	IPCC		03	00	02	50	50	100	4
3	MCS103	Artificial Intelligence	PCC		03	00	00	50	50	100	3
4	MCS104	Computational Algorithms	PCC		03	00	00	50	50	100	3
5	MCS105	Data Science	PCC		03	00	00	50	50	100	3
6	MCSL106	Algorithms and AI Lab	PCCL		00	00	02	50	50	100	2
7	MRM1107	Research Methodology and IPR	NCMC		Online courses(online.vtu.ac.in)						PP
Total								**300**	**300**	**600**	**18**

Note:

PCC	Professional Core Course
IPCC	Integrated Professional Core Course
PCCL	Professional Core Course lab
NCMC	None Credit Mandatory Course
PEC	Professional Elective Course
AEC	Ability Enhance Course

NCMC: If the students have not studies this Course in their Under Graduate program, then he/she has to take this Course at http://online.vtu.ac.in and to qualify for this course is compulsory before completion of the minimum duration of the Program (Two years). However, this course will not be considered for vertical progression.

AEC:
This course is prescribed to help students to enhance their skills in fields connected to the specialization as well as allied fields that leads to employable skills. The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50% mandatory for the award of the degree.

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II SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			Credits
					L	T	P	CIE	SEE	Total	
1	MCS201	Block Chain Technology	PCC	CSE	03	00	00	50	50	100	3
2	MCS202	Deep Learning	IPCC		03	00	02	50	50	100	4
3	MCS203X	Professional Elective 1	PEC		03	00	00	50	50	100	3
4	MCS204X	Professional Elective 2	PEC		03	00	00	50	50	100	3
5	MCS205	Large Language Models	PCC		03	00	00	50	50	100	3
6	MCS206	Cyber security and Digital Forensics	PCC		03	00	00	50	50	100	3
7	MCSL207	Data Analytics using Tableau Laboratory	PCCL		00	00	02	50	50	100	2
8	AEC208	Full Stack Development	AEC		00	00	02	50	50	100	1
Total								**400**	**400**	**800**	**22**

Professional Elective 1		Professional Elective 2	
MCS203A	Pattern Recognition	**MCS204A**	Human Computer Interaction
MCS203B	Wireless Networks and Mobile Computing	**MCS204B**	Edge and Fog Computing
MCS203C	Agile Technology	**MCS204C**	Augmented and Virtual Reality

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III and IV SEMESTER

For the students who are willing to take up a two-semester duration Industry/Research Internship Leading to Project work /start-up												
III Semester (A)												
				Teaching Hours/Week			**Examination**					
Sl. No.	**Course**	**Course Code**	**Course Title**	**Theory**	**Practical/Mini Project/Internship**	**Tutorial/Skill Development Activities**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**
				L	**P**	**SDA**					
1	PEC/ MDC	MCS311	Online Courses 12 weeks duration	-	-	-	-	-	-	100	3
2		MCS312	Online Courses 12 weeks duration	-	-	-	-	-	-	100	3
3		MCS313	Online Courses 12 weeks duration	-	-	-	-	-	-	100	3
4	INT	MINT384	Research Internship /Industry-Internship leading to project work/ Startup	Two-semester duration, SEE in the IV semester which leads to project work /start-up			03	100	-	100	3
Total										**400**	**12**

IV Semester (A)										
				Teaching Hours/Week		**Examination**				
Sl. No.	**Course**	**Course Code**	**Course Title**	**Theory**	**Practical/Field Work**	**Duration in hours**	**CIE Marks**	**SEE Marks Viva Voce**	**Total Marks**	**Credits**
				L	**P**					
1	INT	MINT481	Research Internship / Industry Internship Leading to Project Work/Start-up	Two-semester duration		03	100	100	200	12
2	PROJ	MPRJ482	Project			03	100	100	200	16
Total						**06**	**200**	**200**	**400**	**28**

INT: Industry/ Research Internship leading to the project work /startup

PROJ: Project work outcome of Internship (Project Phase-II is Viva voce SEE)

Taking up a two-semester Industry/Research Internship that leads to project work or a start-up can be a highly rewarding experience for students. It allows them to apply theoretical knowledge in practical settings, gain valuable industry or research experience, and potentially develop innovative solutions or business ideas. Here are some key steps and considerations for students pursuing such an internship:

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Industry Internship: The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gain practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

Research Internship: A research internship is an opportunity for students or early career professionals to gain hands-on experience in conducting research under the guidance of a mentor or within a research team. These internships can take place in academic institutions, research organizations, government agencies, or private companies

Research /Industry Internship: In the third-semester Students have to be in touch with a guide/mentor/coordinator and regularly submit the report referred to the progress internship. Based on the progress report the Guide/Mentor/coordinator has to enter the CIE marks at the end of the 3rd semester. At the beginning of the 4th semester, students have to define the project topic out of the learning due to the Internship, upon completion of the project work he/she has to attend the SEE at the parent Institute.

Internship Leading to Start-up: An internship that leads to a startup is an exciting pathway, blending real-world experience with entrepreneurial ambition. Here's a comprehensive guide to transitioning an internship experience into launching your startup: 1) Maximize your internship experience, 2) Identifying Viable Business Ideas, 3) Research and Validation 4) Building a Business Plan 5) Networking and Mentorship 6) Securing Funding 7) Establishing Startup 8) Launching and Marketing. By following these steps, you can effectively transition from an internship to launching a successful startup. This journey requires dedication, resilience, and a willingness to learn and adapt.

Mxxx301/401 to 303/403:MOOC courses of 12 weeks duration are the courses suggested by the Board of Studies of the University and will be displayed on www.online.vtu.ac.in. The online courses selected should not be the same as those studied in the first and second semesters of the program. The student will not be eligible to get their degree if they unintentionally select online courses that match previously finished courses. These courses are not considered for the vertical progression; however, qualifying for these courses and earning the credits is a must for the award of the degree. It is permitted to complete these online MOOC courses either in
3rd semester or in 4th semester.

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For the students who are willing to take an Industry Internship for one-semester duration and independent project work next semester												
III Semester (B)												
Sl. No.	**Course**	**Course Code**	**Course Title**	**Teaching Hours/Week**			**Examination**				
				Theory	**Practical/Mini Project/Internship**	**Tutorial/Skill Development Activities**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**
				L	**P**	**SDA**					
1	PEC/ MDC	MCS311	Online Courses 12 weeks duration	-	-	-	-	-	-	100	3
2		MCS312	Online Courses 12 weeks duration	-	-	-	-	-	-	100	3
3		MCS313	Online Courses 12 weeks duration	-	-	-	-	-	-	100	3
4	INT	2MINT384	Industry-Internship	One semester Duration			03	100	100	200	11
Total										**500**	**20**

IV Semester (B)										
Sl. No.	**Course**	**Course Code**	**Course Title**	**Teaching Hours/Week**		**Examination**				
				Theory	**Practical/Field Work**	**Duration in hours**	**CIE Marks**	**SEE Marks Viva Voce**	**Total Marks**	**Credits**
				L	**P**					
1	Project	MPRJ481	Project work	-	**08**	03	100	100	200	20
Total						**03**	**100**	**100**	**200**	**20**

Industry Internship: The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gains practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned. The students who take up a one-semester Internship in the Industry have to appear SEE at the institute at the end of the semester as per the examination calendar.

Project Work: Students in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare a synopsis, and narrate the methodology to carry out the project work. Each student, under the guidance of a Faculty, is required to

Present the seminar on the selected project orally and/or through Power Point slides.
Answer the queries and be involved in debate/discussion.
Submit two copies of the typed report with a list of references.

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The participants shall take part in discussions to foster a friendly and stimulating environment in which the students are motivated toreach high standards and become self-confident

CIE marks for the project report (20 marks), seminar (20 marks) and question and answer (10 marks) shall be awarded (based on the quality ofreport and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Principal. The committee shall consist of internal guide and a faculty from the department with the senior most acting as the Chairperson.

Semester End Examination SEE marks for the project report (30 marks), seminar (10 marks) and question and answer session (10 marks) shallbe awarded (based on the quality of the report and presentation skill, participation in the question and answer session) by the examiners appointed by the University.

Mxxx301/401 to 303/403:MOOC courses of 12 weeks duration are the courses suggested by the Board of Studies of the University and will be displayed on www.online.vtu.ac.in. The online courses selected should not be the same as those studied in the first and second semesters of the program. The student will not be eligible to get their degree if they unintentionally select online courses that match previously finished courses.These courses are not considered for the vertical progression; however, qualifying for these courses and earning the credits is a must for the award of the degree. It is permitted to complete these online MOOC courses either in 3rd semester or in 4th semester.

For the students who are willing to take a research-leading paper publication in Q1/Q2/Q3 Journals and to a PhD Registration												
III Semester (C)												
				Teaching Hours/Week			**Examination**					
Sl. No.	**Course**	**Course Code**	**Course Title**	**Theory**	**Practical/Mini Project/Internship**	**Tutorial/Skill Development Activities**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**
				L	**P**	**SDA**					
1	PCC/ IPCC/ MDC/ PEC	MCS311	Online Courses 12 weeks duration	-	-	-	-	-	-	100	3
2		MCS312	Online Courses 12 weeks duration	-	-	-	-	-	-	100	3
3		MCS313	Online Courses 12 weeks duration	-	-	-	-	-	-	100	3
4		MCS314	Online Courses 12 weeks duration	-	-	-	-	-	-	100	3
5	PROJ	MPRJ385	Project Phase-I	One semester Duration			03	100	-	100	6
Total										**500**	**18**

IV Semester (C)										
				Teaching Hours/Week		**Examination**				
Sl. No.	**Course**	**Course Code**	**Course Title**	**Theory**	**Practical/Field Work**	**Duration in hours**	**CIE Marks**	**SEE Marks Viva Voce**	**Total Marks**	**Credits**
				L	**P**					
1	Project	MPRJ481	Project work	-	**08**	03	100	100	200	22
Total						**03**	**100**	**100**	**200**	**22**

Only full-time research work will be permitted in the department. Based on seat availability, the students are permitted to register for project work leading to the publication of papers in Q1/Q2/Q3 journals and admission to research (PhD) in their 3rd semester of the M.Tech., program

Project Phase-1 Project Phase-I, typically the initial phase in any project, is crucial as it lays the foundation for the entire project. This phase involves defining the project's scope, objectives, and initial planning. Here's a structured approach to effectively carry out Project Phase-I:

Project Charter: Outlines the project's purpose, objectives, and stakeholders.

Scope Statement: Defines the project boundaries and deliverables.

Requirements Document: Captures all project requirements.

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Project Plan: Details the approach, timeline, and resource allocation.

Risk Management Plan: Identifies and plans for potential risks.

Feasibility Study Report: Assesses technical, economic, and operational feasibility.

Students in consultation with the guide shall carry out literature survey/visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare a synopsis, and narrate the methodology to carry out the project work. Each student, under the guidance of a faculty, is required to

Present the seminar on the selected project or ally and/or through power point slides.

Answer the queries and be involved in debate/discussion.

Submit two copies of the typed report with a list of references.

The participants shall take part in discussions to fostera friendly and stimulating environment in which the students are motivated to reach high standards and beco MCS lf-confident.

Continuous Internal Evaluation (100 Marks).

CIE marks for the project report (60 marks), seminar (20 marks) and question and answer(20marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Principal. The committee shall consist of an internal guide and a faculty from the department with

The senior most acting as the Chairperson.

Project Work Phase-II: Each student shall be involved in carrying out the project workjointly in constant consultation with internal guide and external guide and prepare the project report as per the norms of the university to avoid plagiarism. Phase II of a project typically involves the detailed execution of the planned activities, continuous monitoring and control of the project's progress, and making necessary adjustments to ensure the project stays on track. Keep detailed records of all project activities,

decisions, and changes. Ensure all project documentation is organized and accessible. Conduct a final project review to evaluate overall performance, achievements, and lessons learned. Document best practices and areas for improvement for future projects.

Paper Publication Process: Publishing a research paper based on your project in a Q1/Q2/Q3 journal involves several key steps, from writing

the manuscript to navigating the peer review process. Here's a comprehensive guide:

Writing the Manuscript: Choose a clear and concise title that accurately reflects the content. Write an abstract summarizing the research question, methods, results, and conclusions.

Literature Review: Review relevant existing research to establish the foundation of your study. Identify gaps that your research aims to fill. **Methodology:** Describe the research design, methods, and procedures in detail. Include information on data collection, analysis, and any toolsor software used.

Results: Present the findings of your research clearly and logically. Use tables, figures, and charts to illustrate key results.

Discussion: Interpret the results and explain their implications. Compare your findings with existing research and discuss any discrepancies or new insights.

Conclusion: Summarize the main findings and their significance. Suggest potential future research directions.

References: Cite all sources used in your research following the journal's citation style.

Journal Selection: Choose a journal that aligns with the scope and focus of your research. Consider the journal's impact factor (Q1, Q2, Q3) and

audience.

Review Journal Guidelines: Carefully read the journal's submission guidelines and ensure your manuscript adheres to them.

Prepare Your Manuscript: Format your manuscript according to the journal's guidelines. Include all required sections and supplementary materials.

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Cover Letter: Write a cover letter to the journal editor highlighting the significance of your research and why it fits the journal. **Submit the Manuscript:** Use the journal's online submission system to submit your manuscript. Ensure all required information and documents are included.

Semester End Examination SEE marks for the project report (60 marks), seminar (20marks) and question and answer session (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the
examiners appointed by the University.

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ASSESSMENT DETAILS

IPCC/ PCC/PEC Courses Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

CIE

1. Three Tests each of 20 Marks
2. Two assignments each of 20 Marks/One Skill Development Activity of 40 marks to attain the Cos and POs
3. The sum of three tests and two assignments/one Skill Development Activity added will be scaled down to 50 marks.
   CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

SEE

1. Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours).
2. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

PCCL Courses Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

CIE Component

1. The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

SEE Component

1. SEE marks for the practical course is 50 Marks.
2. All laboratory experiments are to be included for practical examination.
3. General rubrics suggested for SEE are: writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks.
4. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero. The duration of SEE is 03 hours.

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ADVANCES IN COMPUTER NETWORKS

Course Code:	MCS101	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Discuss with the basics of Computer Networks and Internet addressing
CLO2	Demonstrate various Routing-update algorithms
CLO3	Analyze network traffic, congestion, controlling and resource allocation
CLO4	Discuss Cellular Networks and LTE Technology
CLO5	Explain fundamentals of Network management

CONTENTS	# of Hours
MODULE 1 **Foundation:** Building a Network, Applications, Requirements, Architecture, Software Performance, Packets: Packet Delay, Variability, Packet Size, Error Detection. IP Version 4- The IPv4 Header, Special Addresses, IPv4 Subnets, Dynamic Host Configuration Protocol (DHCP), IP version 6-IPv6 Header, IPv6 addresses, IPv6 Host Address Assignment, ICMPv6.	**08**
MODULE 2 **Routing-Update Algorithms:** Distance-Vector Routing-Update Algorithm, Distance-Vector Slow-Convergence Problem, Loop-Free Distance Vector Algorithms: DSDV, AODV, Link-State Routing-Update Algorithm: Shortest- Path-First Algorithm, Classless Internet Domain Routing: CIDR, Hierarchical routing, Provider- Based Routing	**08**
MODULE 3 **Congestion Control and Resource Allocation:** Issues in resource allocation – network model, taxonomy, evaluation criteria; Queuing discipline – FIFO, Fair Queuing; TCP congestion control – additive increase/multiplicative decrease, slow start, fast retransmit and fast Recovery, Congestion-avoidance mechanisms– DECbit, Random Early Detection (RED), Source-based congestion control.	**08**
MODULE 4 **Cellular Networks and LTE Technology**: The Cellular Concept – System Design Fundamentals: Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Long-Term Evolution (LTE) Introduction: Architectural Review of UMTS and GSM, The Need for LTE, From UMTS to LTE, From LTE to LTE-Advanced, System Architecture Evolution: High-Level Architecture of LTE, User Equipment.	**08**

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MODULE 5	
Network Management: Goals, Organization, and Functions, Architecture and Organization, Perspectives **Basic Foundations: Standards, Models and Language:** Standards, Models (Organizational, Information, Communicational, Functional), ASN.1, Encoding Structure, Macros.	08

Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Develop the fundamental concepts in networks and addressing mechanism using IPv4 and IPv6
CO2	Apply the different routing techniques for a network to find shortest path.
CO3	Model various congestion control mechanism and bottlenecks in TCP.
CO4	Identify Cellular networks and LTE technology.
CO5	Discuss fundamentals of Network management.

Reference Books:

1. Peter L Dordal, "An Introduction to Computer Networks", Open Access Book, 2016.
2. Larry L. Peterson, Bruce S Davie," Computer Networks: A Systems Approach", Elsevier, 2007.
3. Network Management Principles and Practice, Mani Subramanian, Pearson, 2010.
4. Theodore S Rappaport, Wireless Communications Principles and Practice, Pearson, 2nd Edition, 2010.
5. Christopher Cox, An Introduction to LTE, Wiley, 2nd Edition, 2014.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	1	1
CO2	2	2	2	1	1
CO3	2	2	2	1	1
CO4	2	2	2	1	1
CO5	2	2	2	1	1
Average	**2**	**2**	**2**	**1**	**1**

Low-1: Medium-2: High-3

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CLOUD COMPUTING AND BIG DATA ANALYTICS

Course Code:	MCS102	CIE Marks:	50
Hours/Week (L: T: P):	3:0:2	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	4		

Course Learning Objectives:

The course will enable students to:

CLO1	Demonstrate cloud Infrastructure computing and Cloud Resource Virtualization
CLO2	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
CLO3	Explore Hadoop Distributed File system and MapReduce programming model to process Big data

CONTENTS	# of Hours
MODULE 1 **Cloud Computing and Big Data** Introduction: Defining cloud computing, cloud types, examining the Characteristics of cloud Computing Historical Developments, Virtualization, introduction, characteristics of virtuarized Environments, Virtualization, Taxonomy of Techniques, Execution Virtualization, Other Types of Virtualization, virtualization and cloud computing, pros and Cons of virtualization, Technology Examples: VMware: Full virtualization	08
MODULE 2 **Cloud Computing Architecture**: Introduction, cloud reference model, architecture infrastructure/ Hardware as a service, platform as a service, software as a service, Types of Clouds, public Clouds, private Clouds, Hybrid clouds, community clouds, Economics of the cloud, open challenges, Cloud Definition, cloud interoperability and standards scalability and Fault Tolerance, security, Trust, and privacy organizational Aspects, Aneka application framework overview.	08
MODULE 3 **Case Study on Open Source & Commercial Clouds**: Amazon AWS, Google Cloud, Microsoft Azure Using Amazon Web Services, Amazon Web Service Components and Services, Working with the Elastic Compute Cloud (EC2), Working with Amazon Storage Systems, Understanding Amazon Database services, Google App Engine, Architecture and core concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance, CRM and ERP.	08
MODULE 4 **Introduction to Big Data Analytics:** Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing,	08

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Introduction to Hadoop: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, Map Reduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools.	
MODULE 5 **NoSQL Big Data Management, MongoDB and Cassandra:** Introduction, NoSQL Data Store, NoSQL to Manage Big Data, MongoDB, Databases, Cassandra Databases. **Map Reduce, Hive and Pig:** Introduction, Map Reduce Map Tasks, Reduce Tasks and Map Reduce Execution, Composing Map Reduce for Calculations and Algorithms, Hive, HiveQL	08

Laboratory Component

List of exercises for which student should develop programs and execute in theLaboratory

1. Implement a map reduce for word count from a given input text file.
2. Execute a Map reduce python program for printing maximum salary for a given input file.
3. Execute a python program to implement map reduce concepts for printing year wise sales from a given csv file.
4. Execute a python program to implement map reduce for inverted index of a given data set.
5. Execute a python program to implement word count using spark cell
6. Implement NoSQL Database Operations: CRUD operations, Arrays using MongoDB.
7. Implement Functions: Count – Sort – Limit – Skip – Aggregate Using MongoDB.
8. Installation of open source hypervisors such as VMWare Player.

Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Describe the Delivery models, Services and Applications of Cloud Computing
CO2	Discuss Cloud Resource Virtualization, Resource Management & Scheduling and Cloud Security
CO3	Explain Big Data Concepts and NoSQL Data Management with respect to Cloud
CO4	Describe the role of Hadoop in various MapReduce Applications
CO5	Explain the Big Data using Hadoop Ecosystem and Spark Programming model

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education.
2. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018.

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Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	1	1	2	2	2
CO2	1	1	2	2	2
CO3	1	1	2	2	2
CO4	1	1	2	2	2
CO5	1	1	2	2	2
Average	**1**	**1**	**2**	**2**	**2**

Low-1: Medium-2: High-3

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ARTIFICIAL INTELLIGENCE

Course Code	MCS103	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3 Hours
No. of Credits	3		

Course Objectives:

CLO1	Define the foundational concepts of artificial intelligence and key problem-solving techniques.
CLO2	Explain the knowledge representation and reasoning techniques to solve complex problems in AI systems.
CLO3	Use machine learning algorithms to evaluate their performance in real-world applications.
CLO4	Build the applications of natural language processing and robotics to enhance human-computer interaction.
CLO5	Explore the ethical considerations and societal implications of AI technologies.
CLO6	Define the foundational concepts of artificial intelligence and key problem-solving techniques.

CONTENTS	# of Hours
MODULE 1 **Introduction to Artificial Intelligence and Problem Solving**, Definition and scope of AI, History and evolution of AI, Types of AI: Narrow AI vs. General AI, Problem formulation and problem-solving techniques, Search algorithms: Uninformed and informed search strategies, Heuristic search and constraint satisfaction problems.	**08**
MODULE 2 **Knowledge Representation and Reasoning**, Types of knowledge representation, Propositional logic and first-order logic ,Semantic networks and frames, Ontologies and their applications, Deductive and inductive reasoning, Rule-based systems and non-monotonic reasoning, Probabilistic reasoning and Bayesian networks.	**08**
MODULE 3 **Machine Learning,** Introduction to machine learning, Supervised, unsupervised, and reinforcement learning, Common algorithms: Decision trees, SVM, neural networks Evaluation metrics for machine learning models ,Practical applications of machine learning in AI systems.	**08**
MODULE 4 **Natural Language Processing** and Robotics, Basics of natural language processing (NLP), Text processing and language models, Sentiment analysis and language generation, Robotics fundamentals and sensor technologies, Robot kinematics, control, and applications of AI in robotics.	**08**
MODULE 5 **Ethical and Societal Implications of AI,** Ethical considerations in AI development ,AI and job displacement ,Privacy concerns and data security, Bias and fairness in AI algorithms, Accountability and transparency in AI systems, The role of government and regulation in AI, Public perception and trust in AI technologies, Future of AI and its impact on society.	**08**

Reference Books:

1. Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig, 4th Edition (2021)
2. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville third Edition.
3. Pattern Recognition and Machine Learning by Christopher M. Bishop Edition: fourth Edition (2020)
4. Artificial Intelligence: Foundations of Computational Agents by David L. Poole and Alan K. Mackworth Edition: third Edition (2021).

Web links and Video Lectures (e-Resources):

1. https://cs221.stanford.edu
2. https://www.kaggle.com/learn/machine-learning
3. https://www.youtube.com/playlist?list=PLkDaE6sXhPqQ5s2cW2g1iGgC4eD9W6xZ2
4. https://www.youtube.com/playlist?list=PLD6B6F0A3B1D4D3D8A7E3C5E8A7B2E0C

Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Explain the foundational concepts of artificial intelligence, including its history, types, and key problem-solving techniques.
CO2	Apply knowledge representation and reasoning techniques to solve complex problems in AI systems.
CO3	Implement machine learning algorithms and evaluate their performance in real-world applications.
CO4	Explore the principles and applications of natural language processing and robotics to enhance human-computer interaction.

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

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COMPUTATIONAL ALGORITHMS

Course Code:	MCS104	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Analyze the asymptotic performance of algorithms.
CLO2	Demonstrate a familiarity with major algorithms
CLO3	Apply important algorithmic design paradigms and methods of analysis.

CONTENTS	# of Hours
MODULE 1 **Review of Analysis Techniques:** Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods	08
MODULE 2 **Number -Theoretic Algorithms:** Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.	08
MODULE 3 **Graph Algorithms:** Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. Polynomials and the FFT: Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.	08
MODULE 4 **String-Matching Algorithms:** Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms	08
MODULE 5 **Probabilistic and Randomized Algorithms:** Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms	08

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Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Design and apply iterative and recursive algorithms and Analyze the running time complexities of algorithms
CO2	Apply the concept of Number -Theoretic Algorithms
CO3	Identify the application scenario for graph algorithms
CO4	Illustrate string matching algorithm.
CO5	Apply the concept of Probabilistic and Randomized Algorithms

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, PHI, India, 2nd Edition.
2. Horowitz, Sahani and Rajsekaran, Fundamentals of Computer Algorithms.
3. Rajeev Motwani, Prabhakar Raghavan, Randomized Algorithm, Cambridge University Press.
4. Aho, Hopcroft, Ullman: The Design and Analysis of Algorithms, Pearson Education.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	1	1	2	1	2
CO2	1	1	2	1	2
CO3	1	1	2	1	2
CO4	1	1	2	1	2
CO5	1	1	2	1	2
Average	**1**	**1**	**2**	**1**	**2**

Low-1: Medium-2: High-3

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DATA SCIENCE

Course Code:	MCS105	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Provide with the knowledge and expertise to become a proficient data scientist
CLO2	Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
CLO3	Understand the basic and advanced statistics for data science
CLO4	Understand the optimization techniques for design

CONTENTS	# of Hours
MODULE 1 **Introduction to Data Science:** Introduction, Benefits and uses, Facets of data, Data science process, Big data ecosystem and data science, The Data science process, Overview, research goals retrieving data transformation, Exploratory Data Analysis Model building.	08
MODULE 2 **Machine Learning:** Introduction Machine learning algorithms, Modeling process, Types–Supervised, Unsupervised, Semi-supervised, Handling larger data on a single computer.	08
MODULE 3 **Statistics:** Introduction, sampling of data - probability Sampling, random Sampling, Unequal probability sampling, measures of centre, measures of variation, coefficient of variation, measure of relative standing, z-score, correlation in data, Empirical rule, examples.	08
MODULE 4 **Advanced Statistics:** Point estimates, sampling distribution, confidence intervals hypothesis tests, conducting a hypothesis test, One Sample t-test, type I and type II errors, hypothesis tests for categorical variables, chi-square test, chi square Independence test and examples.	08
MODULE 5 **Optimization:** Optimization: Components of Optimization, Objective Function, Constraints, Bounded and unbounded problem, Monotonic Functions, Convex functions, Unimodal functions, Multimodal function, Classification of Optimization problems, Classification of Optimization techniques, multi-objective Optimization, Saddle point for single objective function, Linear programming, Non-linear programming	08

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Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Understand the preliminaries of data science.
CO2	Interpret the concept of machine learning and apply it to real time applications.
CO3	Explain the statistical methods and its applications for data science.
CO4	Explain the advanced statistical methods and its applications for data science.
CO5	Apply and analyze the optimization techniques of a model.

Reference Books:

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", Manning Publications 2016.
2. Kalyanmoy Deb, "Optimization for Engineering Design: Algorithm and Example", New Delhi PHI Learning Private Limited 2012.
3. Ozdemir, Sinan, "Principles of data science", Packt Publishing Ltd, 2016.
4. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.
5. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison Wesley Data & Analytics Series, 2013.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	2	2
CO2	2	2	1	2	2
CO3	2	2	1	2	2
CO4	2	2	1	2	2
CO5	2	2	1	2	2
Average	**2**	**2**	1	**2**	**2**

Low-1: Medium-2: High-3

ALGORITHMS & AI LABORATORY

Course Code	**MCSL106**	**CIE Marks**	50
Number of Contact Hours/Week	**0:0:2**	**SEE Marks**	50
Total Number of Lab Contact Hours	36	**Exam Hours**	03

Credits – 2

Course Learning Objectives: This course MCSL106 will enable students to:

CLO1: Implement and evaluate Algorithm and AI in Python programming language.

Descriptions (if any):

Installation procedure of the required software must be demonstrated, carried out in groups. and documented in the journal.

Programs List:

1.	Implement a simple linear regression algorithm to predict a continuous target variable based on a given dataset.
2.	Develop a program to implement a Support Vector Machine for binary classification. Use a sample dataset and visualize the decision boundary.
3.	Develop a simple case-based reasoning system that stores instances of past cases. Implement a retrieval method to find the most similar cases and make predictions based on them.
4.	Write a program to demonstrate the ID3 decision tree algorithm using an appropriate dataset for classification.
5.	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test it with suitable datasets.
6.	Implement a KNN algorithm for regression tasks instead of classification. Use a small dataset, and predict continuous values based on the average of the nearest neighbors.
7.	Create a program that calculates different distance metrics (Euclidean and Manhattan) between two points in a dataset. Allow the user to input two points and display the calculated distances.
8.	Implement the k-Nearest Neighbor algorithm to classify the Iris dataset, printing both correct and incorrect predictions.
9.	Develop a program to implement the non-parametric Locally Weighted Regression algorithm, fitting data points and visualizing results.
10.	Implement a Q-learning algorithm to navigate a simple grid environment, defining the reward structure and analyzing agent performance.

Laboratory Outcomes: The student should be able to:

CO1: Implement and demonstrate AI algorithms.
CO2: Evaluate different algorithms.

Conduct of Practical Examination:

Experiment distribution.

For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.

For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.

Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.

Marks Distribution

For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks

For laboratories having PART A and PART B

Part A – Procedure + Execution + Viva = 6 + 38 + 6 = 50 Marks

Part B – Procedure + Execution + Viva = 9 + 32 + 9 = 50 Marks

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SEMESTER – II

BLOCK CHAIN TECHNOLOGY

Subject Code	MCS201	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the basic terminologies of cryptography and Hash functions.
CLO2	Understand how Block chain systems such as Bitcoin and Ethereum work.
CLO3	Explain the role of Consensus mechanisms & Smart contracts in Block Chain.
CLO4	Understand various applications of Block chain.

CONTENTS	# of Hours
MODULE-1 **Basics of Block Chain**: Defining Block Chain, Generic elements of a Block chain, How Block chain works, Features of Block chain, Types of Block chain, CAP theorem and Block chain. Distributed Ledger Technologies, Forks in Block Chain. **Decentralization:** Decentralization using Block Chain, Requirements of a Decentralized Applications (DApps), DApp examples, Platforms for Decentralization.	08
MODULE-2 **Cryptography and Technical Foundations:** Cryptographic services & primitives, Symmetric cryptography: Stream and Block Ciphers, Elliptic Curve Cryptography. **Hash Functions:** Basics, Message Authentication Code & its properties, Design of SHA-256, SHA-3(Keccak) algorithms, Merkle & Petricia trees, Distributed Hash Tables, Digital Signatures: RSA Digital Signature Algorithm, Elliptic Curve Digital Signature Algorithm.	08
MODULE-3 **Bitcoin:** Bitcoin, Digital keys and addresses, Private and Public keys in Bitcoin, Addresses in Bitcoin, Transactions, Block Chain: Structure of Block, Bitcoin Network, Bitcoin Wallets, Bitcoin Installation & Programming, Bitcoin limitations. **Consensus Algorithms:** Mining: Tasks of Miners, Mining Algorithm, Nakamoto Consensus, Proof of Work, Proof of Stake, Proof of Burn	08
MODULE-4 **Ethreum:** Introduction, EVM, Working of Ethereum, Components of Ethreum Ecosystem, Ether cryptocurrency, EVM, Smart Contracts: Basics, Recardian Contracts **Development tools and Frameworks:** Remix, MetaMask, Ganache, Solidity language.	08
MODULE-5 **Alternative Blockchains:** Kadena, Ripple, Stellar, Quorum **Blockchain-Outside of Currencies:** Internet of Things, Government, Health, Financial Crime Prevention.	08

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Explain the terminologies and types of Block Chain.
CO2	Describe various cryptographic algorithms and Hash concepts in Block Chain.
CO3	Explain the Bitcoin features and the importance of Consensus in Block chain.
CO4	Explain Ethereum Block Chain using Smart Contracts, various tools and frameworks learnt.
CO5	Discuss about alternative block chains available and various applications of Block Chain outside the currencies..

Reference Books:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, 2018.
2. Blockchain Technology Concepts and Applications, Kumar Saurabh,Ashuthosh Saxena,Wiley emerging technology series,2020.
3. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016 Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
4. DR. Gavin Wood, ``ETHEREUM: A Secure Decentralized Transaction Ledger, "Yellow paper.2014.
5. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", VPT, 2017

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	-	-	1	-	1
CO2	2	2	3	-	1
CO3	-	-	3	2	3
CO4	2	2	3	2	3
CO5	-	-	2	2	1
Average	**2**	**2**	**3**	**2**	**1**

Low-1: Medium-2: High-3

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DEEP LEARNING

Course Code:	MCS202	CIE Marks:	50
Hours/Week (L: T: P):	3:0:2	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	4		

Course Learning Objectives:

The course will enable students to:

CLO1	Introduce the idea of Artificial Neural Networks and their applications.
CLO2	Study and implement different architectures of Artificial Neural Networks.
CLO3	Study and implement various optimization techniques on Artificial Neural Networks
CLO4	Enable design and deployment of deep learning models for machine learning problems.

CONTENTS	# of Hours
MODULE 1 **Introduction:** Artificial Intelligence and Deep Learning-a historical perspective, Artificial neural networks, Shallow neural networks, Deep neural networks, gradient descent, forward and backpropagation, computational graphs, linear and non-linear activation functions.	08
MODULE 2 **Optimization Techniques:** Regularization, Dropout, Batch Normalization, Vanishing/Exploding gradients, Mini-batch gradient, Gradient descent with momentum, RMSprop, Adam optimization, Learning rate decay, Local optima, Global optima. Hyperparameter tuning.	08
MODULE 3 **Convolutional Neural Networks:** Basic operations: padding, stride, pooling; Classic convolutional models: LeNet-5, AlexNet, VGG, Modern Deep Convolutional models: ResNet, GoogleNet; Inception Network, 1-D convolutions, Object detection and Face Recognition with CNN.	08
MODULE 4 **Recurrent Neural Networks:** Sequence modelling, Types of Recurrent Neural Networks, Backpropagation through time, Language modelling and sequence generation, Word Embeddings, vanishing gradients with RNNs, Long-Short Term Memory (LSTM), Gated Recurrent MODULEs (GRU), Bidirectional LSTMs, Sequence-to-Sequence model, Attention Mechanism, Transformer Network.	08
MODULE 5 **Advanced Topics:** Deep Reinforcement Learning, Generative Adversarial Networks, Generative vs. Discriminative models, Deep Convolution GANS, Autoencoders, NLP Applications.	08

Laboratory Component

List of exercises for which student should develop programs and execute in theLaboratory

1. Basic image processing operations: Histogram equalization, Thresholding, edge detection, data augmentation, morphological operations
2. Implement SVM/Softmax classifier for CIFAR-10 dataset: (i) using KNN, (ii) using 3 layer neural network
3. Study the effect of batch normalization and dropout in neural network classifier
4. Familiarization of image labelling tools for object detection, segmentation
5. Image segmentation using Mask RCNN, UNet, SegNet
6. Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.)
7. Image Captioning with Vanilla RNNs
8. Image Captioning with LSTMs

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the functioning of Mathematics and Science in ANN
CO2	Apply the optimization techniques in Parameter tuning of Deep Learning Models
CO3	Apply CNN with its basic building blocks.
CO4	Design and deploy deep learning solutions for real-world applications with popular deep learning tools.

Reference Books:

1. Charu C. Aggarwal, "Neural Networks and Deep Learning- A textbook", 2018, Springer.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning (Adaptive Computation and Machine Learning series", MIT Press.
3. Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms", O'Reilly Media.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	-	1	1	1	2
CO2	2	2	1	1	2
CO3	2	2	1	1	2
CO4	2	2	1	1	2
Average	**2**	**2**	**1**	**1**	**2**

Low-1: Medium-2: High-3

PATTERN RECOGNITION

Course Code:	MCS203A	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the Different paradigms for Pattern Recognition and fundamentals of probability
CLO2	Explain the Feature extraction, Feature selection
CLO3	Explain the Nearest Neighbor based classifiers & Bayes classifier
CLO4	Discuss Naive Bayes classifier, Bayesian belief network, Decision Trees
CLO5	Discuss Clustering techniques

CONTENTS	# of Hours
MODULE 1 **Introduction:** Definition of Pattern Recognition, Applications, Datasets for Pattern Recognition, Different paradigms for Pattern Recognition, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.	**08**
MODULE 2 **Representation:** Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.	**08**
MODULE 3 **Nearest Neighbor based classifiers & Bayes classifier:** Nearest neighbor algorithm, variants of algorithms, use of for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network.	**08**
MODULE 4 **Naive Bayes classifier**: Bayesian belief network, Decision Trees: Introduction, DT for PR, Construction of DT, splitting at the nodes, over fitting & Pruning, Examples, Hidden Markov models: Markov models for classification, Hidden Markov models and classification using HMM.	**08**
MODULE 5 **Clustering:** Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means,Isodata),clustering large datasets, examples, An application: Handwritten Digit recognition.	**08**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Identify the different paradigms and statistical foundations of Pattern Recognition
CO2	Analyze the data structures and data abstraction techniques for Pattern Recognition
CO3	Examine the different classifiers and implement the algorithms
CO4	Evaluate the use of Bayesian belief networks, decision trees and hidden Markov models for classification tasks
CO5	Illustrate the hierarchical and partitional clustering techniques and its application in Pattern Recognition.

Reference Books:

1. V Susheela Devi, M Narasimha Murthy, Pattern Recognition (An Introduction), Universities Press, 2011.
2. Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, PHI, 1996.
3. Duda R. O., P.E. Hart, D.G. Stork, Pattern Classification, John Wiley and sons, 2000.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	1	-	-	-	-
CO2	2	1	-	1	-
CO3	2	1	1	1	-
CO4	2	1	1	1	-
CO5	2	1	1	-	-
Average	**2**	**1**	**1**	1	-

Low-1: Medium-2: High-3

WIRELESS NETWORKS AND MOBILE COMPUTING

Course Code:	MCS203B	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the basics of wireless networks and connectivity issues.
CLO2	Understand the Wireless Local Area Network technology with its protocols and applications.
CLO3	Understand the Wireless Personal Area Network technology with its protocols and applications.
CLO4	Understand the Wireless Wide Area Network technology with its protocols and applications.
CLO5	Understand Wireless Ad Hoc Networks and its technologies.

CONTENTS	# of Hours
MODULE 1 **Fundamentals of Wireless Communication:** Advantages, Limitations and Applications, Wireless Media, Infrared Modulation Techniques, Spread spectrum: DSSS and FHSS, Diversity techniques, MIMO, Channel specifications- Duplexing, Multiple access technique: FDMA, TDMA, CDMA, CSMA, OFDMA fundamentals,Frequency Spectrum, Radio and Infrared Frequency Spectrum. **Basics of wireless networks:** Wireless networks, wireless switching technology, wireless communication problem, wireless network reference model.	08
MODULE 2 **Wireless Local Area Network (WLAN):** Network components, Design requirements, WLAN architecture, Standards, WLAN Protocols- Physical Layer and MAC Layer, IEEE 802.11p, Security (WPA), Latest developments of IEEE 802.11 standards	08
MODULE 3 **Wireless Personal Area Network (WPAN)**: Network architecture and components, WPAN technologies and protocols, Application software; ZigBee (802.15.4): Stack architecture, Components, Topologies, Applications; Bluetooth (802.15.1): Protocol stack, Link types, security aspects, Network connection establishment, error correction and topology; LR-WPAN (IEEE 802.15.4)	08
MODULE 4 **Wireless Wide Area Network (WPAN):** Cellular networks, satellite networks, LAN versus WWAN, Interworking of WLAN and WWAN, WWAN applications.	08
MODULE 5 **Wireless Ad Hoc Networks:** Wireless Ad Hoc Networks, Mobile ad hoc networks, wireless sensor networks, wireless Mesh networks, Vehicular Ad Hoc Networks(VANETs)	08

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the existing wireless networks and connectivity issues
CO2	Describe the Wireless Local Area Network technology with its protocols and applications
CO3	Discuss the Wireless Personal Area Network technology with its protocols and applications
CO4	Describe the Wireless Wide Area Network technology with its protocols and applications
CO5	Understand Wireless Ad Hoc Networks and its technologies

Reference Books:

1. Dr. Sunil Kumar S. Manvi & Mahabaleshwar S. Kakkasageri, "Wireless and Mobile Network conceptsand protocols", John Wiley India Pvt. Ltd, 1st edition, 2010
2. Vijay K.Garg, "Wireless Communications and Networking", Morgan Kaufmann, Publishers, 2009.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	-	1	1	-	-
CO2	1	1	1	1	-
CO3	1	1	1	1	-
CO4	1	1	1	1	-
CO5	1	1	1	-	1
Average	**1**	**1**	**1**	**1**	**1**

Low-1: Medium-2: High-3

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AGILE TECHNOLOGY

Course Code:	MCS203C	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the fundamental principles of software project management.
CLO2	Have a good knowledge of responsibilities of project manager.
CLO3	Be familiar with the different methods and techniques used for project management.

CONTENTS	# of Hours
MODULE 1 **Selecting Software Development Life Cycle:** A generic process framework, Boehm's software engineering goal structure, waterfall model, Prototype Model, rapid Application Development (RAD), and Spiral Model, Selecting a software development model based on Characteristics of: requirements, Project team, User community, Project type and Risk.	08
MODULE 2 **Software Project Management:** Software project management process; Project Management skills, People management skills, P-CMM adaptation with CMM, Personality Models: The Myers-Briggs Type indicator(MBTI), Fundamental Interpersonal Relations Orientation-Behavior (FIRO-B), Common Software Quality Metrics.	08
MODULE 3 **Selecting a Project Team, Building WBS and Managing Project Risks:** Project office, project team, Building WBS for Software Project and developing Project Staffing Management Plan; Essential competencies of Project Manager, Managing Risks in Project: Risk assessment, Risk control and Risk mitigation.	08
MODULE 4 **Agile Project Management:** Values, Principles, Manifesto of Agile; Methodologies of Agile, Agile Governance, Understanding Critical Success Factors to Implement Agile PM: Resolving Risks, Myths, Challenges and benefits of APM.	08
MODULE 5 **Scrum Methodology and Implementation of SPRINT:** Roles and Responsibilities in Scrum, implementing Scrum process, estimating a Scrum Project, Tracking Scrum Projects, Communication in Scrum Projects; Sprints, how to Plan and Run an Effective Scrum - Sprint; Case Study of APM using Scrum for an Indian E-Governance project.	08

Course Outcomes:

Upon successful completion of this course, students will be able to

CO1	Explain Selecting Software Development Life Cycle
CO2	Explain Software Project Management
CO3	Discuss Selecting a Project Team, Building WBS and Managing Project Risks
CO4	Explain Agile Project Management concepts
CO5	Interpret Scrum Methodology and Implementation of SPRINT

Reference Books:

1. Quality Software Project Management by Robert. T.Futrell, Donald.F. Shafer & Linda.I. Shafer; Pearson Education-Prentice Hall.
2. Agile Project Management with Scrum (Developer Best Practices), by Ken Schwaber, Microsoft Press Publication, 2019

Mapping of CO-PO:

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	-	-	2	-	1
CO2	-	1	2	-	1
CO3	1	1	2	2	1
CO4	1	1	2	2	1
CO5	1	1	2	2	1
Average	**1**	**1**	**2**	**2**	**1**

Low-1: Medium-2: High-3

HUMAN COMPUTER INTERACTION

Course Code:	MCS204A	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Discuss the surveying the literatures of Human Computer Interaction
CLO2	Learn the knowledge through analysis and critical thinking to decide the interactions in HCI systems
CLO3	Analyze the Organizational issues and stake holder requirements by using Cognitive models, communication and collaboration models
CLO4	Design and Develop Web Interfaces by using Direct Selection, Contextual Tools, Overlays

CONTENTS	# of Hours
MODULE 1 **Introduction:** Importance of user Interface – definition, importance of good design, Benefits of good design. A brief history of Screen design. **The Graphical User Interface:** popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.	08
MODULE 2 **Design Process:** Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.	08
MODULE 3 **Screen Designing: Design goals** – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.	08
MODULE 4 **Windows:** New and Navigation schemes selection of window, selection of devices based and screen based controls.	08
MODULE 5 **Components**: Text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors. Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.	08

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	discuss the basic components that which interact devices with computers.
CO2	Explain the window, device and screen based control navigation schemes
CO3	Describe the elements of good user interface design and effective GUI
CO4	Explain screen design principles for making good decisions based on technological constraints in interface design.
CO5	Describe the importance of human characteristics and understanding business functions

Reference Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, Pearson Education, 3rd Edition, 2004.
2. Bill Scott and Theresa Neil, Designing Web Interfaces, OReilly, First Edition, 2008.
3. Jenny Preece, Helen Sharp, Yvonne Rogers, Interaction Design: Beyond Human-Computer Interaction, 4th Edition, 2015.
4. Jenifer Tidwell, Designing Interfaces: Patterns for Effective Interaction Design, O'Reilly, 2nd Edition, 2011.
5. Wilbert O Galitz, The Essential Guide to User Interface Design, 3rd Edition. Wiley DreamaTech., India.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	-	1	2	-	2
CO2	-	1	2	-	2
CO3	-	1	2	-	2
CO4	2	1	2	2	2
CO5	2	1	2	2	2
Average	**2**	**1**	**2**	**2**	**2**

Low-1: Medium-2: High-3

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EDGE AND FOG COMPUTING

Course Code:	MCS204B	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the basics of fog and edge computing.
CLO2	Have a basic understanding of the design and architecture of fog computing
CLO3	Design new services with fog computing.
CLO4	Gain knowledge on different real time applications in fog computing environment.
CLO5	Gain knowledge of how to design and implement mobile fog applications with 5Gnetwork

CONTENTS	# of Hours
MODULE 1 **Internet of Things (IoT) and New Computing Paradigms:** Introduction, Relevant Technologies, Fog and Edge Computing Completing the Cloud, Hierarchy of Fog and Edge Computing, Business Models, Opportunities and Challenges. **Addressing the Challenges in Federating Edge Resources:** The Networking Challenges, The Management Challenge	08
MODULE 2 **Integrating IoT, Fog and Cloud Infrastructures:** Introduction, Methodology, Integrated C2F2T Literature by Modeling Technique, Integrated C2F2T Literature by Use-Case Scenarios, Integrated C2F2T Literature by Metrics. **Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds:** Introduction, Background, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog	08
MODULE 3 **Optimization Problems in Fog and Edge Computing:** Introduction ,Background / Related Work , Preliminaries , The Case for Optimization in Fog Computing , Formal Modeling Framework for Fog Computing , Metrics, Optimization Opportunities along the Fog Architecture , Optimization Opportunities along the Service Life Cycle, Toward a Taxonomy of Optimization Problems in Fog Computing , Optimization Techniques . **Middleware for Fog and Edge Computing:** Introduction , Need for Fog and Edge Computing Middleware , Design Goal ,State-of-the-Art Middleware Infrastructures , System Model , Proposed Architecture.	08
MODULE 4 **A Lightweight Container Middleware for Edge Cloud Architectures:** Introduction, Background/Related Work, Clusters for Lightweight Edge Clouds, Architecture	08

Management – Storage and Orchestration, IoT Integration, Security Management for Edge Cloud, Fog Data Management.	
MODULE 5 **Predictive Analysis to Support Fog Application Deployment:** Motivating Example: Smart Building , Predictive Analysis with FogTorchΠ, Examples of Security and Privacy Issues in IoT , Security Concerns at Different Layers in IoT, Privacy Concerns in IoT Devices, IoT Security Breach Deep-Dive: Distributed Denial of Service (DDoS) Attacks on IoT Devices. **Fog Computing Realization for Big Data Analytics:** Introduction , Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation, Case Studies.	**08**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Explore the fundamentals and management in fog computing
CO2	Understand the design of fog architecture and networks slices.
CO3	Discuss about Optimization Problems in Fog and Edge Computing and its middleware.
CO4	Understand Lightweight Container Middleware for Edge Cloud Architectures and its security techniques.
CO5	Discuss about Predictive Analysis to Support Fog Application Deployment and big data analysis using different case studies.

Reference Books:

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama.
2. Amir M. Rahmani, PasiLiljeberg, Jürgo-SörenPreden, Axel Jantsch, —Fog Computing inThe Internet of Things: Intelligence at the Edgel, Springer, 2018.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	1	1	1	-	1
CO2	1	1	1	-	1
CO3	1	1	1	2	1
CO4	2	1	1	2	1
CO5	2	1	1	2	1
Average	**2**	**1**	**1**	**2**	**1**

Low-1: Medium-2: High-3

AUGMENTED AND VIRTUAL REALITY

Course Code:	MCS204C	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Explain the Fundamentals of Virtual Reality
CLO2	Discuss the Various Interfaces - Input and output devices
CLO3	Illustrate the Augmented reality methods and mixed reality.
CLO4	Outline and Utilize various modeling techniques.
CLO5	Select simple AR/VR applications using the frameworks.

CONTENTS	# of Hours
MODULE 1 **Introduction:** The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. **Virtual Reality and Virtual Environment:** Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.	08
MODULE 2 **Input Devices:** (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. **Output Devices:** Graphics displays, sound displays & haptic feedback.	08
MODULE 3 **Augmented and Mixed Reality:** Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality. wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	08
MODULE 4 **Modeling:** Geometric modeling, kinematics modeling, physical modeling, behavior modeling, model management	08
MODULE 5 **Human Factors:** Methodology and terminology, user performance studies, VR health and safety issues. **Applications:** Medical applications, military applications, robotics applications, Engineering, Entertainment, Science, Training.	08

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Explain various principles and concepts of virtual reality and its application.
CO2	Discuss input and output interfaces.
CO3	Discuss VR/AR technology differences
CO4	Apply appropriate method of geometric modelling
CO5	Implement Virtual Reality and Augmented Reality applications

Reference Books:

1. Virtual Reality Technology, Gregory C. Burdea& Philippe Coiffet, John, 2nd Edition, 2013 Wiley & Sons, Inc.
2. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Interscience, 2nd Edition, 2006.
3. Alan B. Craig, "Understanding Augmented Reality", Concepts and Applications, Morgan Kaufmann,1st Edition, 2013
4. Oliver Bimber and Ramesh Raskar, Spatial Augmented Reality: Merging Real and Virtual Worlds, 2005.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	1	1	-	-	1
CO2	1	1	2	-	1
CO3	1	1	2	-	1
CO4	1	1	2	1	1
CO5	1	1	2	1	1
Average	**1**	**1**	**2**	**1**	**1**

Low-1: Medium-2: High-3

LARGE LANGUAGE MODELS

Course Code:	MCS205	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Know and learn large language models and its applications.
CLO2	Study different components used to design large language models.
CLO3	Improvise the performance of large language model by fine tuning methods.
CLO4	Evaluate the performance of large language models.

CONTENTS	# of Hours
MODULE 1 **Introduction:** Introduction to Language model, Advantages and disadvantage of language models, what is a large Language Model? Building Blocks of Language Models, Decoding Strategies, Language Model Architectures, Advantages of large language models.	08
MODULE 2 **Large Language Model Training:** Transformers, Components of a Generic Attention Mechanism, The Encoder Step-by-Step, The Decoder Step-by-Step. Pretraining Data: Simple Tokenization, Sub word Tokenization, Batching, scaling up pretraining data, Obtaining Web Pages, Scrape Texts, Clean Texts.	08
MODULE 3 **Emergent Behaviors of Large Language Models:** Emergent Behaviors of Pre-Trained Language models, Finetuning: Alignment, Dialog, Instruction Following, Zero-Shot Learning (Sentiment Classification), Zero-Shot Learning (Summarization), Few-Shot Learning (Machine Translation), prompt selection, Multi-Step Reasoning.	08
MODULE 4 **Automatic Evaluation of Large Language Models:** What is evaluation, Intrinsic vs extrinsic evaluation, automatic evaluation, General form of an evaluation metric, Sequences: Exact match, Word error rate, Perplexity, BLEU, ROUGE, addressing semantically similar words, character n-gram precision, character n-gram F-score, Bert-based similarity, BERT Score.	08
MODULE 5 **Parameter Efficient Tuning:** Parameter efficient tuning: Auto Prompt, Prompt tuning, Low Rank Adaption, adapters, compacters, Advantages of Adapter-Based Methods, Layer Freezing, Bias-terms Fine-tuning, Infused Adapter by Inhibiting and Amplifying Inner Activations, LLMs for Search Engines, LLMs for Music Generation.	08

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the preliminaries of language model and large language models.
CO2	Understand the training principles of Large Language Models
CO3	Interpret the concept of fine tuning of large language models.
CO4	Demonstrate the performance of large language models
CO5	Explain the parameter tuning of large language models and its applications

Reference Books:

1. Daniel Jurafsky & James H. Martin, Transformers and Large Language Models, Speech and Language Processing. Copyright © 2023
2. Alec Radford et al., "Improving Language Understanding by Generative Pre-Training, 2023.
3. Alec Radford et al., "Language Models are Unsupervised Multitask Learners", 2023.
4. Sebastian Gehrmann et al, "The GEM Benchmark: Natural Language Generation, its Evaluation and Metrics", 2023.
5. Brian Lester et al., "The Power of Scale for Parameter-Efficient Prompt Tuning"

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	1	1	1	-	1
CO2	1	1	1	-	1
CO3	2	1	1	2	1
CO4	2	1	1	2	1
CO5	1	1	1	-	1
Average	**2**	**1**	**1**	**2**	**1**

Low-1: Medium-2: High-3

CYBER SECURITY AND DIGITAL FORENSICS

Course Code:	MCS206	CIE Marks:	50
Hours/Week (L: T: P):	3:0:0	SEE Marks:	50
Total Hours:	40	Examination Hours:	3
No. of Credits:	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Provide the basic knowledge on Computer Forensics.
CLO2	Understand cybercrime and the laws governing cybercrime.
CLO3	Comprehend the contextual need of cybercrime investigations.
CLO4	Investigate the use of tools used in cyber forensics.

CONTENTS	# of Hours
MODULE 1 **Understanding Cyber Crime:** Indian IT Act 2008 and amendments, Computer Forensics and Investigation as a profession, Understanding computer forensics, Preparing a computer investigation, Taking a systematic approach, Procedures for corporate high tech investigations, Understanding data recovery workstations and software	08
MODULE 2 **Cyber Crime in Devices:** Introduction, Proliferation of mobile and wireless devices, Credit card fraud in the mobility era, Challenges posed by mobile devices, Registry settings, Attacks on mobile/cell phones, Security implications and Measures for organizations in handling mobile devices, Organizational security policies and measures in mobile computing era, Laptops	08
MODULE 3 **Data Acquisition:** Understanding storage formats for digital evidence, Determining the best acquisition method, Contingency planning for Image acquisitions, Using acquisition tools, validating Data acquisition, Using remote network acquisition tools, Computer forensics Analysis and Validation –Determining what data to collect and analyze, Validating forensic data, Addressing Data Hiding Techniques, Performing remote acquisitions.	08
MODULE 4 **Computer Forensics Tools:** Evaluating Computer Forensic tool needs, Computer Forensics software tools, Computer Forensics Hardware tools, Validating and testing Forensic software, Recognizing a graphics file, Understanding data compression, locating and recovering graphics files, Identifying unknown file formats, Understanding copyright issues with graphics.	08

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MODULE 5	
Tools and Methods: Introduction, proxy servers and Anonymizers, Phishing, Password cracking, Keyloggers and spywares, virus and worms, Trojan Horses and back doors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer overflow, Identity Theft	08

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Discuss the Indian IT Act 2008 and its Amendments.
CO2	Describe the organizational methods and policies for cyber crime handling in mobile and wireless devices..
CO3	Explain the Data storage and acquisition methods for digital evidence.
CO4	Describe the computer forensic tools and their usage.
CO5	Discuss the different tools and techniques used in cyber crime

Reference Books:

1. Dr.Surya Praksh Tripathi,Ritendra Goyal Praveen Kumar Shukla, Introduction to Information Security and cyber laws, Dream tech Press, 2015.
2. I.A.Dhotre, Cyber Forensics, Technical Publications 1st Edition, 2016.
3. Sunith Belapure and Nina Godbole, Cyber Security: Understanding Cyber Crime, computer forensics and legal perspectives, Wiley India, 2013.
4. Thomas J Moubray, John, Cyber Security:Managing Systems,Conducting Testing,and Investigating Inrusions, Wiley, 2014.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	-	-	1	3	1
CO2	-	-	1	3	1
CO3	2	1	1	2	1
CO4	2	1	1	2	1
CO5	2	1	1	3	1
Average	**2**	**1**	**1**	**3**	**1**

Low-1: Medium-2: High-3

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DATA ANALYTICS USING TABLEAU LABORATORY

Course Code:	MCSL207	CIE Marks:	50
Hours/Week (L: T: P):	0:0:2	SEE Marks:	50
No. of Credits:	2	Examination Hours:	3

Course Learning Objectives:

The course will enable students to:

CLO1	Become familiar with components and fields available in Tableau desktop.
CLO2	Get exposed to access data and connect data.
CLO3	Learn concepts of charts, plots, maps and mathematical functions to analyze real time data.
CLO4	Become familiar to build dashboard in Tableau.

CONTENTS

MODULE 1

Data Analytics: Introduction, types of Data Analysis, Real-world Data Analytics examples, tools and techniques for data Analytics.

Tableau: What is Tableau? History of Tableau, Advantages and disadvantages of Tableau, Tableau architecture, Tableau Public and Tableau Desktop, Workspace, Connecting to data source, Files and folders, Tableau navigation, Terminologies, Data types, Data roles, Data aggregation, File types.

MODULE 2

Data Connection: Extracting data, Joining, Blending, Splits, Sorting, Fields operations.

Tableau calculations: Operators, Functions, Numeric, string, date, table calculations, Level of Details expressions.

MODULE 3

Sort and Filter: Basic filters, Filter operations, Extract filters, Quick filters, Context filters, Condition filters, Data source filters, Top filters, Build groups, hierarchy, sets.

MODULE 4

Charts: Bar, Line, Pie, Crosstab, Bubble, Bullet, Area, Pareto, Bump chart, Gantt chart, Histogram, Motion charts, Waterfall charts.

Plots: Scatter, Boxplot.

Maps: Heat map, Tree map.

MODULE 5

Advanced Tableau: Dashboard, Formatting, Forecasting, Trend Lines.

List of Programs

Program 1

1. Create Calculated Fields on the dataset Sample-Superstores using Tableau.
   a) Display Absolute value of Profit for each Region and Sub-Category.
   b) Find sum of Maximum and Minimum Profit for each Region.
   c) Display the sum of Sales amount for each state. Label each State as 'Super Sales' if the Sales amount is greater than $100000, 'Good Sales' if the Sales amount is greater than $50000, 'Average Sales' if the Sales amount is greater than $10000, else as 'Bad Sales'.
   d) Demonstrate all types of Level of Details.
   e) Display the data for the Order_Date less than 2021 and Sales between 5000 and 10000.
   f) Convert the first 5 characters of State to Uppercase and plot it against Profit.
   g) Replace '-' with '(' and add ')' at the end of Customer ID and plot it against Sales.
   h) Display the Order Date in the format mm/dd/yyyy hh:mm:ss AM/PM.
2. Create a Dashboard considering atleast 4 charts from the above Calculated Fields.

Program 2

1. Create Calculated Fields on the dataset Amazon using Tableau.
   a) Round-off the Rating to zero decimal places and plot it against User Name.
   b) Obtain the plot of Rating versus first 4 characters of the Product Name.
   c) Capitalize only first letter of the Product Name and plot it against any measure.
   d) Determine if there are null values in the Rating and replace it with zero.
   e) Find the average Sales Price.
   f) Capitalize first character of every word under the Product Name and plot it against Discounted Price.
   g) Round-off the Actual Price to the nearest lowest integer and plot it against Product Names starting with 'AG'.
   h) Draw a stacked bar plot depicting the Product Id with series B07 against Rating.
2. Create a Dashboard considering atleast 4 charts from the above Calculated Fields.

Program 3

1. Demonstrate Data Extraction and different types of Joins on the dataset Sample-Superstores using Tableau.
2. Demonstrate the following charts using the dataset Sample-Superstores
   a) Dual Axis chart
   b) Motion chart
   c) Gantt chart
   d) Bullet chart
   e) Bubble chart
   f) Area chart
   g) Tree Map
   h) Heat Map
3. Create a Dashboard considering atleast 4 charts from the above Charts.

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Program 4

1. Create Filters and analyze the data for the given dataset Coffee Chain using Tableau.
   a) What is the number of Sales in the state Nevada for the product Decaf Espresso?
   b) In California, which is the product with the highest and lowest profit?
   c) What is the contribution of sales in the East market for Decaf?
   d) In 2012, what is the contribution of sales in the East market for Decaf?
   e) What is the average profit for all the products starting with C?
   f) In 2013, identify the state with the highest profit in the West market.
   g) Identify the total expenses to sales ratio of the state with the lowest profit.
   h) In 2013, what is the percentage of total profit for Caffe Mocha falling under Major Market?
2. Create a Dashboard considering atleast 4 charts from the above Charts.

Program 5

1. Analyze the data for the given queries by creating charts for the dataset Coffee Chain.
   a) Create a Heat map for Product Type, State, and Profit. Identify which state has the lowest profit for Espresso.
   b) Using boxplot, identify which of the Espresso product has the highest distribution of sales.
   c) Create a bar chart with Product Type, Product, and Profit. Find the product and product type with the highest profit and the lowest profit.
   d) Create a scatter plot with State, Sales, and Profit. Draw your conclusion.
   e) Identify the state with the highest and the lowest profit in the market.
   f) What is the contribution of tea (in percentage) to the overall Profit?
   g) Identify through side-by-side circles, the minimum marketing for the Coffee Beans Colombian product.
   h) Using tree maps, identify the market with its size having maximum budget sales.
2. Create a Dashboard considering atleast 4 charts from the above Charts.

Program 6

1. Analyze the data for the given queries by creating charts for the dataset Office Supplies.
   a) Find the average units offered by the representative Richard.
   b) Find the total units offered by the representative Richard.
   c) What is the unit price of all items starting with P?
   d) Find the unit price of Binders in the West region.
   e) What is the average unit price of Pen Set in the East Region?
   f) Create a scatter plot depicting the relation between any 3 variables.
   g) Create a highlight table depicting the relation between any 3 variables.
   h) Create a stacked bar chart depicting the relation between region, item and units.
2. Create a Dashboard considering atleast 4 charts from the above Charts.

Course Outcomes:
Upon successful completion of this course, student will be able to

CO1	Apply design principles for Tableau visualization.
CO2	Use various functions and Filters in Calculations to design Charts in Tableau.
CO3	Design Dashboards to develop a strong, powerful data story.
CO4	Familiarize themselves well with current trends in Data Visualization through relevant case studies.

Reference Books:

1. Tableau 10 Business Intelligence Cookbook Book – Donabel Santos, Packt Publishing, 2016.
2. The Wall Street Journal Guide to Information Graphics: The Dos and Don'ts of Presenting Data, Facts, and Figures, Dona M. Wong, W. W. Norton & Company.
3. Information Dashboard Design: Displaying Data for At-a-Glance Monitoring, Stephen Few, O'Reilly Media, 2013.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	-	2	1	1
CO2	2	-	2	1	1
CO3	2	-	2	1	1
CO4	2	-	2	1	1
Average	**2**	**-**	**2**	**1**	**1**

Low-1: Medium-2: High-3

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FULL STACK DEVELOPMENT

Course Code:	AEC208	CIE Marks:	50
Hours/Week (L: T: P):	0:0:2	SEE Marks:	50
No. of Credits:	2	Examination Hours:	3

List of exercises for which student should develop programs and execute in theLaboratory

CONTENTS
MODULE 1 **Introduction to React JS:** Why React? What is React? Features of React, setting up a React Project, Hello React, React Component, React JSX, styling react components.
MODULE 2 **State and Props:** Why Props and State? How to work with state?, useState, how to use props, passing methods as Props, Accessing Child Nodes.
MODULE 3 **React Forms and Router** Why Forms? React Form Elements, React refs, Routing in React styling forms, Form Validation, Routing in React: Why Router? Router Configuration.
MODULE 4 **Node.js and Express.js:** What is node.js? Getting started with Node.js, create web server in Node.js, Node package Manager (NPM), Express Development Environment, Routing, Middleware.
MODULE 5 **Connecting to MongoDB:** Introduction, Schema, Validation and defaults, Models. CRUD Operations - Create, Read, Update and Delete.

Reference Books:

1. FullStack React: The Complete Book on ReactJS and Friends by Anthony Accomazzo, Nate Murray, Ari Lerner, Clay Allsopp, David Gutman, and Tyler McGinnis
2. Get Programming with Node.js by Jonathan Wexler
3. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB by Azat Mardan
4. Full-Stack JavaScript Development by Eric Bush.
5. Mastering Full Stack React Web Development Paperback – April 28, 2017 by TomaszDyl , Kamil Przeorski, Maciej Czarnecki

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Lab Programs

Program 1

a) Create a component called Profile in a file named Profile.js. This component should return name of the person as heading, image of a person and description of the person. Also, export the component as the default export.
b) Create another component called Gallery in a file named Gallery.js. This Gallery component should import the Profile component and export itself as a named export.
c) Inside App component render Gallery component

Program 2

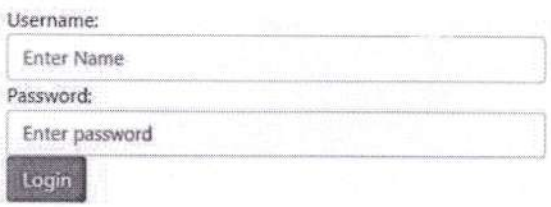
a) Create a JavaScript object named scientist1 that contains details about the first scientist (e.g., id, name, image, profession, and description). Create a second JavaScript object named scientist2 with details about a second scientist
b) Create a component called Profile in a file named Profile.js. This Profile component should take the scientist's details as props and render them (e.g., name, image, profession, and description).
c) Create a component called Card in a file named Card.js. The Card component should access the Profile component using the children prop.
d) Inside the App component, render two Card components. Each Card component should wrap a Profile component, and you should pass the scientist1 object as props to the first Profile component and the scientist2 object as props to the second Profile component

Program 3

a) Create a JavaScript object named productsData that contains an array of product objects. Each product object should include details such as id, name, price, description, and available (a boolean indicating whether the product is in stock or not)
b) Create a component named ProductList in a file named ProductList.js. The ProductList component should map through the productsData array and render a Product component for each product. Pass the product object as props to each Product component.
c) Create a component named Product in a file named Product.js. The Product component should receive the product object as props and conditionally render different content based on the available property. If the product is available (available : true), display its name, price, and description. If the product is not available (available : false), display a message saying "Out of stock".
d) Inside the App component, render the ProductList component

Program 4

Develop a Login component utilizing form elements as outlined below:



Additionally, implement form validation. If the user attempts to submit without entering a username or password, the system should display an error indicating empty fields. Otherwise, upon successful completion, the login should be acknowledged as successful.

Program 5

Create a registration form like the one shown below and make sure each part of the form has validation

Program 6

Create a student management system using React. Implement routing to manage different views such as a student list and individual student profiles. Develop functionalities within the admin panel for adding, editing, and removing students, ensure seamless navigation between these views while displaying relevant information on each page

Program 7

Develop an Express.js application that efficiently handles routes for various shopping sections such as '/products', '/cart', and '/checkout'. Implement custom middleware in Express.js to log essential information from incoming requests, including request method, URL, timestamp, and client's IP address

Program 8

Create Node.js application with the appropriate MongoDB driver, that handles the following CRUD operations for the employee database:

a) Implement an endpoint to add new employee to the employee collection. Each employee should have fields such as employeeID, name and designation.
b) Develop an endpoint to retrieve employees from the collection based on various search criteria employeeID.
c) Provide an endpoint that allows users to update specific details of an employee (e.g., change name, update designation).
d) Create an endpoint to remove employee from the collection based on emplyeeID.

Course Outcomes:
Upon successful completion of this course, student will be able to

CO1	Design, and style React applications, incorporating components, JSX, and basic project structure for effective user interface development
CO2	Demonstrate proficiency in managing component state, passing and utilizing props, and implementing parent-child component communication within React applications.
CO3	Design and implement dynamic forms, handle form data and events, apply form validation techniques, and configure routing for multi-page React applications.
CO4	Demonstrate proficiency in applying Node.js to set up a web server, utilizing NPM for package management, implementing routing and middleware in Express.js
CO5	Design MongoDB schemas, performing CRUD operations, and effectively connecting and interacting with MongoDB databases in web applications.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	-	2	1	1
CO2	2	-	2	1	1
CO3	2	-	2	1	1
CO4	2	-	2	1	1
CO5	2	-	2	1	1
Average	**2**	**-**	**2**	**1**	**1**

Low-1: Medium-2: High-3

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