

www.sjcit.ac.in

||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV), NIRF(151-300) in 2023,Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chikkaballapur - 562 101, Karnataka

Estd : 1986

I & II Semester
Scheme & Syllabus of M.Tech Programme
Computer Science & Engineering
(2024 Scheme)

Core Values

Spiritual, **J**udicious, **C**ommitment, **I**ntegrity, **T**rustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

A+ NAAC

QS I-GAUGE GOLD

INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating



Estd : 1986

||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME, CV & AE), Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chikkballapur - 562 101, Karnataka

www.sjcit.ac.in

Scheme of Teaching and Examinations

M.Tech., in CSE

(Computer Science and Engineering)

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

I SEMESTER (Core Courses related to main Engineering Stream)

Sl. No	Course Type	Course Code	Course Title	Teaching Hours per Week			Examination				
				Theory	Practical/Seminar	Tutorial/SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	PCC	MCS101	Advanced Artificial Intelligence	3	0	0	03	50	50	100	3
2	IPCC	MCS102	Advanced Internet of Things	3	2	0	03	50	50	100	4
3	PCC	MCS103	Advanced Data Structures & Algorithms	3	0	0	03	50	50	100	3
4	PEC	MCS104X	Professional Elective I	3	0	0	03	50	50	100	3
5	PEC	MCS105X	Professional Elective II	3	0	0	03	50	50	100	3
6	PCCL	MCSL106	Algorithms & AI Lab	0	4	0	03	50	50	100	2
7	NCMC	MRMC107	Research Methodology and IPR (Online)	Classes and Evaluation Procedures are as per the policy of the online course providers (online.vtu.ac.in OR nptel.ac.in)							PP
		OR									
		MCSC107	BoS Recommended online course								
Total				**15**	**6**	**0**	**18**	**300**	**300**	**600**	**18**

Professional Elective I		Professional Elective II	
MCS104A	Wireless Networks & Mobile Computing	MCS105A	Digital Image Processing
MCS104B	Mobile Application Development	MCS105B	Multimedia Communications
MCS104C	Natural Language Processing	MCS105C	Agile Technologies
MCS104D	Cyber Security and Cyber Law	MCS105D	NoSQL Database

Note: **BSC**-Basic Science Courses, **PCC**: Professional core. **IPCC**-Integrated Professional Core Courses, **PCC(PB):** Professional Core Courses (Project Based), **PCCL**-Professional Core Course lab**, NCMC**- None Credit Mandatory Course, **L-**Lecture**, P-**Practical**, T/SDA-**Tutorial **/** Skill Development Activities(Hours are for Interaction between faculty and students) **MRMC107**- Research Methodology and IPR (**Online**) for the students who have **not studied** this course in the Undergraduate level. This course is not counted for vertical progression, Students have to qualify for the award of the master's degree. **MXXC107** - BoS Recommended online course for the students who have studied Research Methodology and IPR in Undergraduate level.

M- Master program **XX – ME** for Mechanical Engineering, **CV** for Civil Engineering, **EC** for Electronics and Communication Engineering, **CS** for Computer Science and Engineering **BA**- Business Administration.

BSC: Basic Science Courses: Courses like Mathematics/ Science are the prerequisite courses that the concerned engineering stream board of Studies will decide. **PCC: Professional Core Course:** Courses related to the stream of engineering, which will have both CIE and SEE components, students have to qualify in the course for the award of the degree. **Integrated Professional Core Course (IPCC)**: Refers to a Professional Theory Core Course Integrated with practicals of the same course. The IPCC's theory part shall be evaluated by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. **Project Based Learning Course (PCC(PB):** Project Based Learning course is a professional core Course only Students have to complete a project out of learning from the course and SEE will be viva voce on project work. **PCCL: Professional Core Course Laboratory:** Practical courses whose CIE will be evaluated by the class teacher and SEE will be evaluated by the two examiners.

Skill development activities: Under Skill development activities in a concerning course, the students Should

1. Interact with industry (small, medium, and large).
2. Involve in research/testing/projects to understand their problems and help creative and innovativemethods to solve the problem.
3. Involve in case studies and field visits/ fieldwork.
4. Accustom to the use of standards/codes etc., to narrow the gap between academia and industry.
5. Handle advanced instruments to enhance technical talent.
6. Gain confidence in the modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze and authenticate the output to interpretand conclude.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.Students and the course instructor/s are to be involved either individually or in groups to interact together to enhance the learning and application skills ofthe study they have undertaken. The students with the help of the course teacher can take up relevant technical –activities that will enhance their skills. The prepared report shall be evaluated for CIE marks.

MRMC107-Research Methodology and IPR- None Credit Mandatory Course (NCMC) if students have not studied this course in their undergraduate program then he /she has to take this course at **http://online.vtu.ac.in or http://nptel.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 consideredfor vertical progression.

Semester: I						
Advanced Artificial Intelligence						
Course Code	**:**	MCS101		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Introduction to AI
Knowledge on Fundamental Concepts	Mathematics, Python Programming Language, Algorithms and data structures, Machine learning basics, Natural language processing.
Knowledge on Connected Tools (If any)	ChatGPT, Gemini

Course Learning Objectives: This course will enable the students to	
CLO1	Apply AI techniques to solve real-world problems, including search algorithms, optimization, and decision-making processes.
CLO2	Analyze the structures and algorithms of a selection of techniques related to searching, reasoning and language processing.
CLO3	Explore the Significance, Scope, ethical and societal implications of AI technologies.

Module – 1	**08Hrs**
Intelligent agents: Structure of Agents. **Problem-solving through Search:** Problem-Solving Agents, Example Problems, Search Algorithms, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions. **Test Book 1**: **Ch-2**: 2.4, **Ch-3**: 3.1 – 3.6	
Module – 2	**08Hrs**
Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems. **Knowledge Representation Issues:** Representations and Mapping, Approaches Issues to Knowledge Representation, Issues in Knowledge Representation **Test Book 1**: **Ch-5:** 5.1 – 5.5 **Test Book 2**: **Ch-4:** 4.1 – 4.3	
Module – 3	**08Hrs**
Using Predicate Logic: Representation Simple Facts in Logic, Representation Instance and ISA Relationships, Computable Functions and Predicates, Resolution, Natural Deduction. **Planning:** Definition of Classical Planning, Algorithms for Classical Planning, Heuristics for Planning. **Test Book 1**: **Ch-11:** 11.1 – 11.3 **Test Book 2**: **Ch-5:** 5.1 – 5.5	
Module – 4	**08Hrs**
Statistical Reasoning: Probability and Bayes' Theorem, Certainty Factors and Rule-Based Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. **Natural Language Processing**: Language Models, Grammar, Parsing, Augmented Grammars, Complications of Real Natural Language, Natural Language Tasks.	

Test Book 1: Ch-23: 23.1 – 23.6 **Test Book 2**: **Ch-8:** 8.1 – 8.5	
Module – 5	**08Hrs**
Robotics: Robots, Robot Hardware, What kind of problem is robotics solving? Robotic Perception, Humans and Robots, Application Domains. **Philosophical Foundations:** Limits of AI, Can Machines Really Think? The Ethics of AI. **Test Book 1**: **Ch-25:** 25.1 – 25.4, 25.8, 25.10, **Ch-27**: 27.1 – 27.3	

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate basic principles, architecture and components of intelligent agents.
CO2	Apply the different search algorithms for problem solving.
CO3	Analyze the knowledge representation and reasoning with different decision-making theory.
CO4	Describe classical planning in the context of artificial intelligence, including its goals, constraints, and applications in problem-solving.
CO5	Explore the principles and applications of natural language processing and robotics to enhance human-computer interaction.

Text Books	
1	"Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig, 4th Edition (2021).
2	Kevin Knight, Elaine Rich and B. Nair, Artificial Intelligence, Third Edition, 2017.

Reference Books	
1	FLASINSKI M, Introduction to Artificial Intelligence, SPRINGER 2017.
2	"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://nptel.ac.in/courses/106102220

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**2**	**1**		**1**
CO2	**2**	**2**	**1**	**1**		**1**
CO3	**2**		**1**			**1**
CO4	**2**		**2**			**1**
CO5	**2**	**2**				**1**

Semester: I						
Advanced Internet of Things						
Course Code	**:**	**MCS102**		**Credits**	**:**	04
Hours/Week(L:T:P)	**:**	3:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	50		**SEE**	**:**	50 Marks
Course Type	**:**	Integrated		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Organization, Data Communication and Computer Networks
Knowledge on Fundamental Concepts	IoT Network, Sensing, Connectivity, database.
Knowledge on Connected Tools (If any)	Arduino IDE, Proteus simulator

Course Learning Objectives: This course will enable the students to	
CLO1	Overview the genesis of IOT, enabling technologies and exploring various IoT applications.
CLO2	Explore object functionalities, Services of networking Protocols and Standards.
CLO3	Discuss the significance of wireless technology and IPv6 for the Internet of Things.
CLO4	Physical device and programming aspects of IoT for prototyping of complex IoT applications.
CLO5	Identify advanced topics for IoT for data analytics and tools used for IoT data processing.

Module – 1	**08 Hrs**
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples-Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad other applications. **Text Book 1: Chapter-1,2 & 3**	
Module – 2	**08 Hrs**
Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zigbee IP(ZIP), IPSO. **Text Book 1: Chapter-4 & 5**	
Module – 3	**08 Hrs**

Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity: IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6. **Text Book 1: Chapter-6**

Module – 4	**08 Hrs**
IoT Physical Devices and Endpoints – Raspberry Pi: Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi with Python, Other IoT Devices. Case Studies illustrating IoT Design:-Introduction, Home Automation, Cities, Environment, Agriculture. Applications. **Text Book 2: Chapter-7.1 to 7.7 & Chapter-9.1 to 9.5.**	
Module – 5	**08 Hrs**
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real Time Data Analysis, Structural Health Monitoring Case Study. **Text Book 2: Chapter-10.1 to 10.8.**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the genesis of IoT, enabling technologies and exploring applications.
CO2	Identify the IoT object functionalities, services of networking Protocols and standards.
CO3	Explore various wireless network connectivity technology and IPv6 for Internet of Things.
CO4	Apply programming aspects of IoT on physical devices to develop IoT applications. Case study.
CO5	Examine the need for data analytics and tools for IoT.

Text Books	
1	Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, Daniel Minoli Wiley 2013, ISBN 9788126558230.
2	Internet of Things: A Hands-on Approach, Arshdeep Bahga, Vijay Madisetti, Universities Press 2014, ISBN 9780996025515.

Reference Books	
1	Designing Connected Products, Claire Rowland, Elizabeth Goodman et.al O'Reilly First Edition, 2015, ISBN: 9781449372569.
2	The Internet of Things, Michael Miller, Pearson 2015 First Edition, ISBN 9780789754004.

Web links and Video Lectures (e – Resources)	
1	https://www.tutorialspoint.com/internet_of_things/index.htm#:~:text=IoT%20(Internet%20of%20Things)%20%20is,to%20any%20industry%20or%20system
2	https://www.javatpoint.com/iot-internet-of-things
3	https://www.google.com/search?q=iot+nptel+videos+for+pg+students&oq=iot+nptel+videos+for+pg&gs_lcrp=EgZjaHJvbWUqBwgBECEYoAEyBggAEEUYOTIHCAEQIRigATIHCAIQIRigATIHCAMQIRigATIHCAQQIRiPAjIHCAUQIRiPAtIBCTE1MTk1ajBqN6gCCLACAQ&sourceid=chrome&ie=UTF-8

Possible list of practical experiments:	
1	Transmit a string using UART.
2	Study on Arduino board usage and installing Arduino IDE.
3	Point-to-Point communication of two Motes over the radio frequency.
4	Multi-point to single point communication of Motes over the radio frequency. LAN (Sub-netting).
5	I2C protocol study.
6	Reading Temperature and Relative Humidity value from the sensor on serial monitor (or) LCD display.

Semester: I						
Advanced Data structure & Algorithms						
Course Code	**:**	MCS103		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Introduction to Algorithms and Data Structures
Knowledge on Fundamental Concepts	Basic mathematical concepts, Fundamental data structures, searching & sorting algorithms, Recursion.
Knowledge on Connected Tools (If any)	Integrated Development Environments (IDEs), Algorithm Visualizers, Profiling and Optimization Tools

Course Learning Objectives: This course will enable the students to	
CLO1	Apply search trees & balanced search trees to solve real-world problems
CLO2	Describe the concept of intervals as mathematical entities, and explain how intervals are represented in computer science.
CL03	Explore real-world applications of heaps.
CL04	Understand the real-world applications of graph algorithms in diverse fields.
CL05	Analyze time complexity and space requirements for approximate string matching in various scenarios.

Module – 1	**08 Hrs**
Search Trees: Two Models of Search Trees, General Properties and Transformations, Height of a Search Tree, Basic Find, Insert, and Delete, Returning from Leaf to Root, Dealing with Non unique Keys, Queries for the Keys in an Interval, Building Optimal Search Trees, Converting Trees into Lists and Removing a Tree. **Balanced Search Trees:** Height-Balanced Trees, Weight-Balanced Trees, (a, b)- and B-Trees, Red-Black Trees and Trees of Almost Optimal Height, Top-Down Rebalancing for Red-Black Trees **Text Book 1: Chapter 2, Chapter 3.1 – 3.6**	
Module – 2	**08 Hrs**
Tree Structures for Sets of Intervals: Interval Trees, Segment Trees, Trees for the Union of Intervals, Trees for Sums of Weighted Interval, Trees for Interval-Restricted Maximum Sum Queries, Orthogonal Range Trees, Higher-Dimensional Segment Trees, Other Systems of Building Blocks, Range-Counting and the Semigroup Model, Kd-Trees and Related Structures. **Text Book 1: Chapter 4**	
Module – 3	**08 Hrs**
Heaps: Balanced Search Trees as Heaps, Array-Based Heaps, Heap-Ordered Trees and Half Ordered Trees, Leftist Heaps, Skew Heaps, Binomial Heaps, Changing Keys in Heaps, Fibonacci Heaps, Heaps of Optimal Complexity, Double-Ended Heap Structures and Multidimensional Heaps and Heap-Related Structures with Constant-Time Updates. **Text Book 1: Chapter 5**	
Module – 4	**08 Hrs**

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 (FFT Circuits). **Text Book 2: Chapter 22.1-22.2, Chapter 24, Chapter 26.1-26.3, Chapter 30**

Module – 5	**08 Hrs**
String-Matching Algorithms: Naïve string Matching, Rabin - Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm and **Boyer – Moore algorithms.** **Text Book 2: Chapter 32**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Implement advanced operations like finding successors, predecessors, and performing range queries on search trees.
CO2	Analyze and apply fundamental data structures and algorithms to solve complex computational problems effectively.
CO3	Evaluate and implement various searching, sorting to optimize algorithm performance.
CO4	Design and analyze advanced tree and graph algorithms, including balanced search trees and graph traversal methods, to address real-world applications.
CO5	Apply string matching algorithms to real-world problems such as text search, bioinformatics, and data mining.

Text Books	
1	Advanced Data Structures, Peter Brass, Cambridge University Press, 2008, ISBN:9780521880374.
2	T. H Cormen, C E Leiserson, R L Rivest and C Stein. Introduction to Algorithms. PHI, 4th Edition, 2022 , ISBN:9780262046305.

Reference Books	
1	Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson, 4th Edition, 2013, ISBN:9780133404180
2	Data structures with Java, Ford and Topp, Pearson,2005 Education, ISBN:9780131293373
3	Ellis Horowitz, Sartaj Sahni, S. Rajasekharan. Fundamentals of Computer Algorithms. Universities press. 2nd Edition, 2007,ISBN: 0-7167-8316
4	Data structures and Algorithms in Java, M.T. Goodrich, R. Tomassia, 4th edition, Wiley India Edition. ISBN:0-471-73884-0

Web links and Video Lectures (e – Resources)	
1	https://www.coursera.org/learn/advanced-data-structures
2	https://nptel.ac.in/courses/106106133
3	https://pages.cs.wisc.edu/~shuchi/courses/787-F07/about.html

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1						
CO2						
CO3						
CO4						
CO5						

Semester: I						
Wireless Networks & Mobile Computing						
Course Code	**:**	**MCS104A**		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Networks, Fundamentals of Mobile Computing, IOT
Knowledge on Fundamental Concepts	
Knowledge on Connected Tools (If any)	NS2

Course Learning Objectives: This course will enable the students to	
CLO1	To develop the concept of systems thinking in the context of mobile and wireless systems
CLO2	Obtain the knowledge of the interplay of concepts.
CLO3	Describe multiple sub-disciplines in mobile and wireless systems
CLO4	Design algorithms as a part of software Development
CLO5	Applying in gain knowledge and experience in various computation methods.

Module – 1	**08 Hrs**
Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Emerging Technologies: Wireless broadband (WiMAX), Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6. Wireless Networks: Global Systems for Mobile Communication (GSM): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Short Service Messages (SMS): Introduction to SMS, SMS Architecture, SMMT, SMMO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS. **Chapter 1,2**	
Module – 2	**08 Hrs**
Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. **Chapter 3**	
Module – 3	**08 Hrs**
Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators **Chapter 4,5.1 to 5.4**	
Module – 4	**08 Hrs**

Building Wireless Internet Applications: Thin client overview: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML **Chapter 6**
Module – 5 **08 Hrs**
J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP. **Chapter 7**

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate state of art techniques in wireless communication.
CO2	Discover CDMA, GSM. Mobile IP, WiMAX.
CO3	Demonstrate program for CLDC, MIDP let model and security concerns
CO4	Develop multiple sub-disciplines in mobile and wireless systems
CO5	Gain knowledge and experience in applying various computation methods.

Text Books	
1	Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing Technology, Applications and Service Creation", 2nd ed, Tata McGraw Hill, 2010, ISBN:9780070588073, 0070588074

Reference Books	
1	*Mobile Computing.* Raj kamal. Oxford University Press. 2007.
2	*Wireless Communications and Networks, 3G and Beyond.* ItiSahaMisra. Tata McGraw Hill.2009

Web links and Video Lectures (e – Resources)	
1	https://www.javatpoint.com/mobile-computing
2	https://tinyurl.com/2zk9sdp7

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**2**			
CO2				**2**		**1**
CO3		**2**				**1**
CO4						**1**
CO5	**2**					

Semester: I						
Mobile Application Development						
Course Code	:	MCS104B		**Credits**	:	3
Hours/Week(L:T:P)	:	3:0:0		**CIE**	:	50 Marks
Total Hours	:	40		**SEE**	:	50 Marks
Course Type	:	PEC		**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	
Knowledge on Fundamental Concepts	
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Explore the fundamentals of mobile communication and computing, including GSM architecture, protocols, security, and smartphone operating systems and applications.
CLO2	Develop foundational skills in Android development, covering Android SDK setup, the software stack, virtual devices, project creation, and emulator usage.
CLO3	To explore Android development fundamentals, including key components, application design, UI layouts, and graphics and animation techniques
CLO4	Developing and enhancing Android applications
CLO5	To develop and integrate functionalities for displaying web pages and maps

Module – 1	**08 Hrs**
Introduction to mobile communication and computing: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications.	
Module – 2	**08 Hrs**
Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.	
Module – 3	**08 Hrs**
The Intent of Android Development, Four kinds of Android Components: Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android's Graphics API.	
Module – 4	**08 Hrs**
Creating the Activity, working with views: Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services.	
Module – 5	**08 Hrs**

Displaying web pages and maps, communicating with SMS and emails. Creating and using content providers: Creating and consuming services, publishing android applications.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the requirements for mobile applications
CO2	Explain the challenges in mobile application design and development
CO3	Develop design for mobile applications for specific requirements
CO4	Implement the design using Android SDK, Objective C and iOS
CO5	Deploy mobile applications in Android and iPone marketplace for distribution

Text Books	
1	*Mobile Computing: (technologies and Applications.* N. N. Jani. S chand
2	*Android programming.* B.M.Hirwani. Pearson publications. 2013.
3.	*Android in Action.* W. Frank Ableson, RobiSen and C. E. Ortiz. DreamTech Publisher. Third Edition-2012.

Reference Books	
1	*Android Application development.* James C. Sheusi. Cengage learning. 2017.

Web links and Video Lectures (e – Resources)	
1	https://tinyurl.com/5du53uam
2	https://www.ibm.com/cloud/learn/mobile-application-development-explained
3	https://tinyurl.com/mscezade

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**3**				
CO2		**3**		**3**		
CO3			**3**		**3**	
CO4						
CO5						

Semester: I						
Natural Language Processing						
Course Code	**:**	MCS105C		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Introduction to artificial intelligence
Knowledge on Fundamental Concepts	• Familiarity with data structures such as arrays, linked lists, stacks, and queues, and algorithms such as sorting, searching, and graph traversal. • Basic knowledge of linguistics, including phonetics, phonology, morphology, syntax, and semantics. • Knowledge of mathematical concepts such as probability, statistics, linear algebra, and calculus.
Knowledge on Connected Tools (If any)	• Python (e.g., NLTK, spaCy, scikit-learn) • Java (e.g., Stanford CoreNLP, OpenNLP) • R (e.g., caret, dplyr, ggplot2)

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamentals of NLP
CLO2	Analyze language structures and grammar
CLO3	Process Indian languages using NLP techniques
CLO4	Identify NLP applications in real-world scenarios
CLO5	Develop statistical language models and information retrieval systems

Module – 1	**08 Hrs**
Overview and Language Modeling: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.	
Module – 2	**08 Hrs**
Word Level and Syntactic Analysis: Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Wordsand Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar - Constituency- Parsing-Probabilistic Parsing.	
Module – 3	**08 Hrs**
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language	

Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.
Module – 4 **08 Hrs**
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analysing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modelling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically Based Text Mining: Related Work, A Semantically Guided Model for Effective TextMining.
Module – 5 **08 Hrs**
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net-Stemmers-POS Tagger- Research Corpora.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the structure of language and grammar and Identify NLP applications in real-world scenarios.
CO2	Perform morphological parsing by analyzing words into their constituent parts, such as stems, prefixes, and suffixes.
CO3	Extract relations from text and Evaluate the performance of relation extraction systems.
CO4	Evolve and Apply explanatory novel patterns based semantically guided model for effective text mining.
CO5	Analyze the strengths & weaknesses and evaluate the performance of different information retrieval models.

Text Books	
1	Natural Language Processing and Information Retrieval, TanveerSiddiqui, U.S. Tiwary, Oxford University Press, 2008.
2	Natural Language Processing andText Mining. Anne Kao and Stephen R. Potee, Springer-Verlag London Limited. 2007.

Reference Books	
1	Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition. Daniel Jurafsky and James H Martin. Prentice Hall, 2008 2nd Edition
2	Natural Language Understandin.James Allen. Benjamin/Cumming spublishing company, 2nd edition, 1995.
3	Information Storage and Retrieval systems. Gerald J. Kowalski and Mark.T. Maybury. Kluwer academic Publishers, 2000.
4	Natural Language Processing with Python.Steven Bird, Ewan Klein, Edward Loper. O'Reilly Media, 2009.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=fM4qTMfCoak&list=PLZoTAELRMXVMdJ5sqbCK2LiM0HhQVWNzm This course focuses on learning key concepts, tools and methodologies for natural

	language processing with an emphasis on hands-on learning through guided tutorials and real-world examples.

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**2**	**3**	**3**			**3**
CO2	**2**	**3**	**3**	**2**		**2**
CO3	**2**		**2**	**2**	**2**	**1**
CO4	**2**		**1**	**1**	**2**	
CO5		**2**		**2**	**2**	**2**

Semester:I						
CYBER SECURITY AND CYBER LAW						
Course Code	**:**	**MCS106D**		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	2:2:0		**CIE**	**:**	50Marks
TotalHours	**:**	40		**SEE**	**:**	50Marks
Course Type	**:**	PEC		**SEEDuration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Cyber Security and Network Security.Cryptography
Knowledge on Fundamental Concepts	Cyber Security concepts
Knowledge on Connected Tools (If any)	Security tools: Antivirus, firewalls, network scanners, and IDS/IPS

CourseLearning Objectives: This course will enable the students to	
CLO1	**Outline**the basic principles of cyber security, including the concepts of confidentiality, integrity, and availability
CLO2	**Infer**the process of risk management in cyber security, including risk assessment, risk mitigation strategies, and the role of cyber security policies.
CLO3	**Analyze** legal frameworks and international laws related to cybercrime, including relevant cybersecurity regulations.
CLO4	**Demonstrate** tools and methods used in cybercrime and security.
CLO5	**Illustrate** evidence collection and legal challenges.

Module – 1	**08Hrs**
Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyberoffenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing. **Text Book 1:Ch 1, Ch 2: 2.1 – 2.8**	
Module – 2	**08Hrs**
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops **Text Book 1:Ch 3**	
Module – 3	**08 Hrs**

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

Text Book 1:Ch 4,Ch 5:5.1-5.3

Module – 4	**08 Hrs**

Understanding Computer Forensics: Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics.

Text Book 1:Ch 7

Module – 5	**08 Hrs**

Introduction to Security Policies and Cyber Laws: Need for An Information Security Policy, Information Security Standards – Iso, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the it Act, 2000, Intellectual Property Issues, Overview of Intellectual - Property - Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License

Text Book 2:Ch 4

CourseOutcomes:Aftercompletingthe course,thestudentswillbe ableto	
CO1	**Relate** cyber security, cyber law and their roles
CO2	**Identify and analyze** cybercrime activities, and perform digital forensics investigations to protect, detect, and respond to security incidents.
CO3	**Infer** legal issues in cybercrime,
CO4	**Demonstrate** proficiency in using cybersecurity tools and techniques to prevent, detect, and respond to cyber threats, as well as identify methods employed by cybercriminals to exploit vulnerabilities and commit cybercrime.
CO5	**Illustrate** the processes involved in digital evidence collection, emphasizing proper techniques for acquiring, preserving, and documenting evidence.

TextBooks	
1	Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives Sunit Belapure and Nina Godbole Wiley India Pvt Ltd 2013
2	Introduction to information security and cyber laws Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla Dreamtech Press 2015

ReferenceBooks	
1	Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions Thomas J. Mowbray John Wiley & Sons,
2	Cyber Security Essentials James Graham, Ryan Olson, Rick Howard CRC Press 2010

Web links and Video Lectures (e – Resources)	
1	https://onlinecourses.nptel.ac.in/noc23_cs127/preview

2	https://onlinecourses.nptel.ac.in/noc23_cs44/preview
3	https://onlinecourses.swayam2.ac.in/nou19_cs08/preview

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		1			2
CO2	1	1	2		1	1
CO3	2	2				
CO4	1				1	
CO5	1	1			1	1

Semester: I						
Digital Image Processing						
Course Code	**:**	MCS105A		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Mathematics, Basic Coding techniques.
Knowledge on Fundamental Concepts	Image, Filters, color image, etc.
Knowledge on Connected Tools (If any)	--

Course Learning Objectives: This course will enable the students to	
CLO1	Become familiar with digital image fundamentals.
CLO2	Get exposed to simple image enhancement techniques in Spatial and Frequency domain.
CLO3	Learn concepts of degradation function and restoration techniques.
CLO4	Study the image segmentation and representation techniques
CLO5	Become familiar with image compression and recognition methods

Module – 1	**08 Hrs**
DIGITAL IMAGE FUNDAMENTALS: Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, **TB: 1, Ch: 1.4,1.5, Ch: 2.1, 2.3 to 2.5, Ch: 6.1, 6.2.1, 6.2.3**	
Module – 2	**08 Hrs**
IMAGE ENHANCEMENT: Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, **TB: 1, Ch: 3.3 to 3.6, 4.8,4.9(Except: 4.8.4, 4.9.4, 4.9.5)**	
Module – 3	**08 Hrs**
IMAGE RESTORATION: Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering. **TB: 1, Ch: 5.1 to 5.4, 5.8**	
Module – 4	**08 Hrs**
IMAGE SEGMENTATION: Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm. **TB: , Ch: 10.2 to 10.4, 10.5.1 to 10.5.3 Ch: 9.2.1, 9.2.2**	
Module – 5	**08 Hrs**
IMAGE COMPRESSION AND RECOGNITION: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Patterns and Pattern classes - Recognition based on matching. **TB: , Ch: 8.2.1, 8.2.3, 8,2,5, Ch: 12.1, 12.2.1 TB: 2 Ch: 9.6,**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Infer basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
CO2	Choose different image processing techniques for smoothing, sharpening and enhancement.
CO3	Interpret the basics of image restoration techniques.
CO4	Elucidate the basics of image segmentation techniques.
CO5	Inspect the working of image compression and recognition algorithms.

Text Books	
1	*Digital Image Processing*, Rafael C. Gonzalez, Richard E. Woods, Pearson, Third Edition, 2010. (Fourth Edition, 2022, ISBN-13: 9780137848560)
2	*Fundamentals of Digital Image Processing*, Anil K. Jain, Pearson, 2002 (First Edition, 2015, ISBN-13: 978-9332551916)

Reference Books	
1	*Digital Image Processing*, Kenneth R. Castleman, Pearson, First Edition 2007. ISBN-13: 978-8131712863
2	*Digital Image Processing using MATLAB*, Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Pearson Education, Inc., 2011.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=sa7vO6YXBik&list=PL3rE2jS8zxAykFjinlf6EsucLv5EA03_m
2	https://www.youtube.com/watch?v=DSGHkvQBMbs&list=PLuv3GM6-gsE08DuaC6pFUvFaDZ7EnWGX8 **OR** https://onlinecourses.nptel.ac.in/noc24_ee133/preview

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**1**	**1**		**1**		
CO2	**3**	**2**	**1**		**2**	
CO3	**3**	**2**	**1**		**2**	**1**
CO4	**3**	**2**	**1**	**1**	**2**	**1**
CO5	**2**	**1**		**1**	**2**	**1**

Semester: I						
MULTIMEDIA COMMUNICATIONS						
Course Code	**:**	**MCS105B**		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Networks, Fundamentals of Image Processing Techniques
Knowledge on Fundamental Concepts	
Knowledge on Connected Tools (If any)	NS2

Course Learning Objectives: This course will enable the students to	
CLO1	Improve your reading, speaking, writing and listening skills in English in a technical context.
CLO2	Build up your knowledge of technical language in English.
CLO3	Demonstrate learner autonomy by maximizing use of learning resources
CLO4	Describe the producing quality work
CLO5	Applying in gain knowledge and experience in various computation methods.

Module – 1	**08 Hrs**
Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles,.Text, images, audio and video. **Chapter: 1**	
Module – 2	**08 Hrs**
Text and image compression, compression principles, text compression- Runlength, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression- GIF, TIFF and JPEG. **Chapter 2**	
Module – 3	**08 Hrs**
Audio and video compression, audio compression – principles, DPCM, ADPCM, Adaptive and Linear predictive coding, Code-Excited LPC, Perceptual coding, MPEG and Dolby coders video compression, video compression principles **Chapter 3,4**	
Module – 4	**08 Hrs**
Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework **Chapter 5**	
Module – 5	**08 Hrs**
Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques **Text Book :Chapter 2,3**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Deploy the right multimedia communication models.
CO2	Apply QoS to multimedia network applications with efficient routing techniques.
CO3	Solve the security threats in the multimedia networks
CO4	Work on real-time multimedia network applications

Text Books	
1	*Multimedia Communications.* Fred Halsall. Pearson education.1st edition 2001. ISBN:9780070588073, 0070588074
2	*Multimedia: Computing, Communications and Applications.* Raif Steinmetz, KlaraNahrstedt. Pearson education. 2002 4th edition ISBN:9780070588073, 0070599079

Reference Books	
1	*Multimedia Communication Systems.* K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic. Pearson education. 2004.
2	*Multimedia: An Introduction.* John Billamil, Louis Molina. PHI. 2002

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=NPQW-UwR6vQ&list=PL6wr_B29b3UR5weQ80W8aYMkxEAz92IIC
2	https://tinyurl.com/2zk9sdp7

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2		2			
CO2	2	3		2		
CO3	2					
CO4	2					1

Semester: I						
AGILE TECHNOLOGIES						
Course Code	**:**	MCS105C		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	
Knowledge on Fundamental Concepts	
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	To interpret the fundamental principles and practices associated with each of the agile development methods.
CLO2	To apply the principles and practices of agile software development on a project of interest.
CLO3	To interpret how agile methods reduce risk via incremental learning and delivery.

Module – 1	**08 Hrs**
Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor	
Module – 2	**08 Hrs**
Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility	
Module – 3	**08 Hrs**
Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, Releasing: "Done Done", No Bugs, Version Control, Ten- Minute Build, Continuous Integration, Collective Code Ownership, Documentation. Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. Developing: Incremental requirements, Customer Tests, Test Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing	
Module – 4	**08 Hrs**
Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules, Rely on People :Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, Eliminate Waste :Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput	
Module – 5	**08 Hrs**
Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence :Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery	

Course Outcomes: After completing the course, the students will be able to	
CO1	Define XP Lifecycle, XP Concepts, Adopting XP L1
CO2	Examine on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
CO3	Incremental Requirements, Customer Tests

Text Books	
1	*The Art of Agile Development*, James shore, Chromatic, O'Reilly 2007

Reference Books	
1	Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin Prentice Hall 1st edition, 2002
2	Agile and Iterative Development A Manger's Guide, Craig Larman Pearson Education First Edition, India, 2004
3	Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin Prentice Hall 1st edition, 2002

Web links and Video Lectures (e – Resources)	
1	https://www.tutorialspoint.com/agile/index.htm
2	https://www.javatpoint.com/agile
3	https://www.udemy.com/topic/agile/free/

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**					
CO2		**3**				**2**
CO3			**3**		**2**	
CO4						
CO5						

Semester: I						
NoSQL Database						
Course Code	:	MCS105D		**Credits**	:	03
Hours/Week(L:T:P)	:	3:0:0		**CIE**	:	50 Marks
Total Hours	:	40		**SEE**	:	50 Marks
Course Type	:	PCC		**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Fundamental of NoSQL Database
Knowledge on Fundamental Concepts	It provides a flexible schema where each set of documents/row-column/key-value pairs can contain different types of data.
Knowledge on Connected Tools (If any)	MongoDB Charts, MongoDB Compass, Studio 3T, and Knowi. MongoDB Charts

Course Learning Objectives: This course will enable the students to	
CLO1	Recognize and Describe the four types of NoSQL Databases, the Document-oriented, KeyValue
CLO2	Apply performance tuning on Column-oriented NoSQL databases and Document-oriented NoSQL Databases.
CLO3	To build projects that use NoSQL databases
CLO4	Differentiate the detailed architecture of column oriented NoSQL database, Document database and Graph Database and relate usage of processor, memory, storage and file system commands.
CLO5	Evaluate several applications for location based service and recommendation services. Devise an application using the components of NoSQL.

Module – 1	**8 Hrs**
Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.	
Module – 2	**8 Hrs**
Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment,Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.	
Module – 3	**8 Hrs**
NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features,Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications,Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.	
Module – 4	**8 Hrs**
Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra,Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features,Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.	

Module – 5	**8 Hrs**
NoSQL Key/Value databases using Riak, Key-Value Databases,Key-Value Store, Key-Value Store Features,Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information,User Profiles, Preferences, Shopping Cart Data,Relationships among Data, Multi operation Transactions, Query by Data,Operations by Sets. Graph NoSQL databases using Neo4,NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Demonstrate an understanding of the detailed architecture of Column Oriented NoSQL databases, Document databases, Graph databases.
CO2	Use the concepts pertaining to all the types of databases.
CO3	Analyze the structural Models of NoSQL.
CO4	Apply Nosql Development tools with suitable usecase.
CO5	Develop various applications using NoSQL databases.

Text Books	
1	1. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Sadalage, P. & Fowler, Wiley Publications,1st Edition ,2019.

Reference Books	
1	" 1. Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement (1st Ed.). Redmond,E. & Wilson, J. (2012). Raleigh, NC: The Pragmatic Programmers, LLC. ISBN-13: 978-1934356920 ISBN-10:1934356921

Web links and Video Lectures (e – Resources)	
1	https://www.geeksforgeeks.org/introduction-to-nosql/
2	https://www.javatpoint.com/nosql-databases

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**2**		**2**		
CO2		**2**		**2**		
CO3		**2**			**2**	
CO4	**2**					**2**
CO5	**1**		**2**			

Semester:I						
Algorithms & AI Lab						
Course Code	**:**	MCSL106		**Credits**	**:**	02
Hours/Week(L:T:P)	**:**	0:0:4		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PCCL		**SEE Duration**	**:**	3 Hours

Prerequisites: Discrete Mathematics, Mathematics for AI, Machine Learning and Artificial Intelligence Concepts	
Courses	Data Structures, Algorithms, Big Data , Introduction to Artificial Intelligence, Machine Learning / Deep Learning Concepts
Knowledge on Fundamental Concepts	Mathematics for Algorithms and AI, Artificial Intelligence Fundamentals
Knowledge on Connected Tools (If any)	NumPy, SciPy, and Matplotlib

Course Learning Objectives: This course will enable the students to	
CLO1	Implement and optimize algorithms like sorting, searching, dynamic programming, and graph algorithms.
CLO2	Build, train, and evaluate machine learning models using frameworks like Scikit-learn, TensorFlow, and PyTorch.
CLO3	Visualize and interpret algorithm performance, both in terms of execution time and model effectiveness.
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 Back propagation 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: After completing the course, the students will be able to	
CO1	Implement and demonstrate AI algorithms.
CO2	Apply and compare the performance of different algorithms in practice, considering both time and space efficiency.
CO3	Implement basic search algorithms such as Breadth-First Search (BFS), Depth-First Search (DFS), *A search**, and Greedy algorithms to solve path finding and optimization problems.
C04	Apply algorithms and AI models to solve industry-relevant problems in fields like healthcare, finance, and technology.

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**X**			**X**		
CO2			**X**		**X**	
CO3		**X**				
CO4						



Estd : 1986

||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME, CV & AE), Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chikkballapur - 562 101, Karnataka

www.sjcit.ac.in



Scheme of Teaching and Examinations

M.Tech., in CSE

(Computer Science and Engineering)

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

II SEMESTER (Core Courses related to main Engineering Stream)

Sl. No	Course Type	Course Code	Course Title	Teaching Hours per Week			Examination				
				Theory	Practical/Seminar	Tutorial/SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	PCC	MCS201	Advanced Operating System	3	0	0	03	50	50	100	3
2	IPCC	MCS202	Data Science and Management	3	2	0	03	50	50	100	4
3	PCC	MCS203	Network Programming	3	0	0	03	50	50	100	3
4	PEC	MCS204X	Professional Elective I	3	0	0	03	50	50	100	3
5	PEC	MCS205X	Professional Elective II	3	0	0	03	50	50	100	3
6	PBLC	MCS206	Mini Project with Seminar	3	0	0	03	50	50	100	3
7	PCCL	MCSL207	Network Programming Lab	1	2	0	03	50	50	100	2
8	SEC	MCS208	SKILL ENHANCEMENT FOR RESEARCH EXCELLENCE-1	0	2	0	03	50	50	100	1
Total				**19**	**6**	**0**	**24**	**400**	**400**	**800**	**22**

Professional Elective I		Professional Elective II	
MCS204A	Blockchain Technology	MCS205A	Computer Vision
MCS204B	Information and Network Security	MCS205B	Advances in Software Engineering
MCS204C	Deep Learning	MCS205C	Prompt Engineering
MCS204D	Decision Support Systems	MCS205D	Business Intelligence and its Applications

Note: PCC: Professional core. IPCC-Integrated Professional Core Courses, PCC(PB): Professional Core Courses (Project Based), PCCL-Professional Core Course lab, PEC- Professional Elective Courses, MDC- Multi-Disciplinary Courses , L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities (Hours are for Interaction between faculty and students) L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities (Hours are for Interaction between faculty and students) PBLC: Project Based Learning course

M- Master program **XX** – **ME** for Mechanical Engineering, **CV** for Civil Engineering, **EC** for Electronics and Communication Engineering, **CS** for Computer Science and Engineering **BA**- Business Administration.

Ability Enhancement Courses (AEC):.These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights, and the law. Skill Enhancement Course (SEC): Skill Enhancement Course means a course designed to provide value-based or skill-based knowledge and should contain both theory and lab/hands-on/training/fieldwork. The main purpose of these courses is to provide students with life skills in the hands-on mode to increase their employability. If AEC/SEC courses are ONLINE (MOOCs) courses, suggested by the concerned board of studies. These courses will be made available on www. online.vtu.ac.in

Semester: II						
Advances in Operating Systems						
Course Code	**:**	MCS201		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Operating system, Data structures, Computer Organization and Microprocessors
Knowledge on Fundamental Concepts	A solid foundation in fundamental operating system concepts such as process management, memory management, and concurrency control
Knowledge on Connected Tools (If any)	Prior experience with programming languages (like C/C++) and data structures is also highly recommended

Course Learning Objectives: This course will enable the students to	
CLO1	Analyze the characteristics of operating systems for multiprocessor and multicomputer architectures.
CLO2	Understand and address the challenges related to designing operating systems.
CLO3	Explore the latest trends in developing mobile operating systems.
CLO4	Evaluate the implications of these trends on performance and user experience.

Module – 1	**08 Hrs**
Multiprocessor Operating Systems: System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation- Memory Management. **Teaching- Learning Process :** Chalk and board and PPT	
Module – 2	**08 Hrs**
Distributed Operating Systems: System Architectures- Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms- Distributed Deadlock detection. **Teaching- Learning Process :** Chalk and board and PPT	
Module – 3	**08 Hrs**
Distributed scheduling - Distributed shared memory - Distributed File system – Multimedia file systems – File placement – Caching. **Teaching- Learning Process :** Chalk and board and PPT	
Module – 4	**08 Hrs**
Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms. **Teaching- Learning Process :** Chalk and board and PPT	
Module – 5	**08 Hrs**

Mobile Operating Systems: ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming - Runtime issues- Approaches to power management.

Teaching- Learning Process : Chalk and board and PPT

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze the characteristics of operating systems for multiprocessor and multicomputer architectures.
CO2	Understand and address the challenges related to designing operating systems and their implications.
CO3	Explore the latest trends in developing mobile operating systems and evaluate their impact on performance.

Text Books	
1	M Singhal and NG Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Inc, 2001

Reference Books	
1	A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001
2	Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/playlist?list=PLAwxTw4SYaPkKfusBLVfklgfdcB3BNpwX
2	https://youtu.be/QqGRJU-2Xoc?feature=shared
3	https://techworldthink.github.io/MCA/Download/S2/El%20-%20OS/FULL/OS_MD_1.pdf

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**X**		**X**			
CO2	**X**	**X**		**X**	**X**	
CO3	**X**		**X**	**X**		
CO4	**X**		**X**			
CO5	**X**		**X**	**X**		

Semester: II						
Data Science and Management						
Course Code	**:**	MCS202		**Credits**	**:**	04
Hours/Week(L:T:P)	**:**	3 : 2 : 0		**CIE**	**:**	50 Marks
Total Hours	**:**	50		**SEE**	**:**	50 Marks
Course Type	**:**	IPCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Fundamental of Data Science
Knowledge on Fundamental Concepts	Math skills, Programming skills, Communication skills and Programming skills
Knowledge on Connected Tools (If any)	Power BI, Tableau

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the foundational concepts of data science, including its history, significance, and the data science process.
CLO2	Apply statistical methods and data analysis techniques to interpret and draw insights from complex datasets.
CLO3	Implement various machine learning algorithms and assess their performance using appropriate evaluation metrics in real-world scenarios.
CLO4	Utilize data visualization tools and techniques to effectively communicate findings and insights to diverse audiences.
CLO5	Indicate proficiency with statistical analysis of data to derive insight from results and interpret the data findings visually

Module – 1	**08 Hrs**

Introduction to Data Science

What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference: Populations and samples, Statistical modelling, probability distributions, fitting a model.

Exploratory Data Analysis and the Data Science Process

Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: Real Direct (online real estate firm). Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbours (k- NN), k-means.

Textbook 1: Chapter 1, Chapter 2, Chapter 3

Module – 2	**08 Hrs**

Feature Generation and Feature Selection

Extracting Meaning from Data: Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system.

A Deep Dive into Matplotlib

Introduction, Overview of Plots in Matplotlib, Pyplot Basics: Creating Figures, Closing Figures, Format Strings, Plotting, Plotting Using pandas DataFrames, Displaying Figures, Saving Figures; Basic Text and Legend Functions: Labels, Titles, Text, Annotations, Legends; Basic Plots:Bar Chart, Pie Chart, Stacked Bar Chart, Stacked Area Chart, Histogram, Box Plot, Scatter Plot, Bubble Plot; Layouts: Subplots, Tight Layout, Radar Charts, GridSpec; Images:

Basic Image Operations, Writing Mathematical Expressions
Textbook 1: Chapter 6
Textbook 2: Chapter 3

Module – 3	**08 Hrs**

Meet Hadoop: Data Storage and Analysis, Querying All Your Data, Beyond Batch, Comparison with Other Systems: Relational Database Management Systems, Grid Computing, Volunteer Computing Hadoop Fundamentals.
MapReduce: A Weather Dataset: Data Format, Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop:Map and Reduce, Java MapReduce, Scaling Out: Data Flow, Combiner Functions, Running a Distributed MapReduce Job, Hadoop Streaming **The Hadoop Distributed File system:**The Design of HDFS, HDFS Concepts: Blocks, Namenodes and Datanodes, HDFS Federation, HDFS High-Availability, The Command-Line Interface, Basic Filesystem Operations, HadoopFilesystems Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the FileSystem API, Writing Data, Directories, Querying the Filesystem, Deleting Data, Data Flow:Anatomy of a File Read, Anatomy of a File Write.

Textbook 3: Chapter 1,2,3.

Module – 4	**08 Hrs**

YARN Anatomy of a YARN Application Run: Resource Requests, Application Lifespan, Building YARN, Applications, YARN Compared to MapReduce, Scheduling in YARN: The FIFO Scheduler, The Capacity Scheduler, The Fair Scheduler, Delay Scheduling, Dominant Resource Fairness. Hadoop I/O Data Integrity, Data Integrity in HDFS, Local FileSystem, Checksum File System, Compression, Codecs, Compression and Input Splits, Using Compression in MapReduce, Serialization, The Writable Interface, Writable Classes, Implementing a Custom Writable, Serialization Frameworks, File-Based Data Structures: SequenceFile

Textbook 3: Chapter 4,5.

Module – 5	**08 Hrs**

MapReduce Types and Formats: MapReduce Types, Input Formats: Input Splits and Records, Text Input, Binary Input, Multiple Inputs, Database Input (and Output) Output Formats: Text Output, Binary Output, Multiple Outputs, Lazy Output, Database Output, **Flume :**Flume Installing Flume, An Example, Transactions and Reliability, Batching, The HDFS Sink, Partitioning and Interceptors, File Formats, Fan Out, Delivery Guarantees, Replicating and Multiplexing Selectors, Distribution: Agent Tiers, Delivery Guarantees, Sink Groups, Integrating Flume with Applications, Component Catalog.

Textbook 3: Chapter 8,14.

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the foundational concepts of data science, history, significance, and process.
CO2	Apply statistical methods and data analysis techniques to interpret and draw insights from complex datasets.
CO3	Implement various machine learning algorithms and assess their performance using appropriate evaluation metrics in real-world scenarios.
CO4	Utilize data visualization tools and techniques to effectively communicate findings and insights to diverse audiences.
CO5	Examine, visualize, curate, and prepare data and recognize how the quality of the data and the means of data collection may affect interpretation.

Text Books	
1	Doing Data Science, Cathy O'Neil and Rachel Schutt, O'Reilly Media, Inc O'Reilly Media, Inc, 2013

2	Data Visualization workshop, Tim Grobmann and Mario Dobler, Packet Publishing, ISBN 9781800568112
3	Hadoop: The Definitive Guide, Tom White, Fourth Edition, O'Reilly, 2015.

Reference Books	
1	"An Introduction to Statistical Learning" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Toshigami, 2nd Edition (2021)
2	"The Elements of Statistical Learning" by Trevor Hastie, Robert Toshigami, and Jerome Friedman, 2nd Edition (2009)
3	"Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett, 2nd Edition (2013)

Web links and Video Lectures (e – Resources)	
1	https://www.coursera.org/specializations/jhu-data-science
2	https://www.kaggle.com/learn/data-science
3	https://www.youtube.com/playlist?list=PL4cUxeGkcC9g1s4L6G8p8Fq5XK6Pq7b1k

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	X		X	X		
CO2			X		X	X
CO3		X				
CO4	X					
CO5	X		X			

Lab Programs	
1	Install VMWare to setup the Hadoop environment and its ecosystems
2	Implement the following file management tasks in Hadoop: i. Adding files and directories ii. Retrieving files iii. Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities
3	Run a basic word count Map Reduce program to understand Map Reduce Paradigm.
4	MapReduce program to find the grades of student's
5	Implement matrix multiplication with Hadoop Map Reduce

Semester: II						
Network Programming						
Course Code	**:**	MCS203		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3 : 0 : 0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Networks, Operating Systems, Data Structures and Algorithms, Programming Fundamentals.
Knowledge on Fundamental Concepts	Networking Basics, Processes and threads, Socket APIs.
Knowledge on Connected Tools (If any)	Visual Studio Code, Eclipse.

Course Learning Objectives: This course will enable the students to	
CLO1	Define the key protocols which support the Internet
CLO2	Explore working of the TCP/UDP Sockets
CLO3	Illustrate working of Daemon Processes
CLO4	Illustrate working of Daemon Processes

Module – 1	**08 Hrs**
Introduction to network application, client/server communication, OSI Model, BSD Networking history, Test Networks and Hosts, Unix Standards, 64-bit architectures, Transport Layer: TCP, UDP and SCTP	
Module – 2	**08 Hrs**
Sockets Introduction – socket address structures, value-result arguments, byte ordering and manipulation functions, address conversion functions, Elementary TCP Sockets – socket, connect, bind, listen, accept , fork and concurrent server design, getcsockname and getpeername functions and TCP Client/Server Example.	
Module – 3	**08 Hrs**
I/O Multiplexing and Socket Options – I/O Modules, select function, str_cli function, batch input and buffering, shutdown function, TCP Echo Server, pselect function, poll function.	
Module – 4	**08 Hrs**

Advanced I/O functions – Socket timeouts, recv and send functions, readv, writev, sendmsg and recvmsg. Unix domain protocols - socket address structure, socketpair functions, socket functions Unix domain stream client/server , Unix domain Datagram client/server.	
Module – 5	**08 Hrs**
Client/Server Design Alternatives – TCP Client Alternatives, TCP Test Client, TCP Iterative server, TCP Concurrent server, TCP preforked server, no locking around accept, TCP preforked server, file locking around accept, TCP preforked server, thread locking around accept, TCP preforked server, descriptor passing, TCP concurrent server, one thread per client.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the concept of Networking and Transport Layer: TCP, UDP and SCTP.
CO2	Illustrate the working of Sockets
CO3	Demonstrate the Daemon Processes and No blocking I/O
CO4	Explain the io ctl operations- socket SAD

Text Books	
1	UNIX Network Programming W. Richard Stevens, Bill Fenner, Andrew M. Rudoff Pearson Volume 1, Third Edition, 2004

Reference Books	
1	Network Programming in C Barry Nance PHI 2002
2	Windows Socket Network Programming Bob Quinn, Dave Shute Pearson 2003
3	UNIX Network Programming Richard Stevens Second Edition.

Web links and Video Lectures (e – Resources)	
1	https://archive.nptel.ac.in/courses/106/105/106105183/

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1			**X**			**X**
CO2						
CO3			**X**			**X**
CO4	**X**	**X**			**X**	

Semester: II						
Blockchain Technology						
Course Code	**:**	MCS204A		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Networks, Crypotography
Knowledge on Fundamental Concepts	Hash Functions, Blocks and Chains, Digital Signatures
Knowledge on Connected Tools (If any)	Solidity (Smart Contracts), Remix IDE, Truffle Suite

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the strong technical knowledge of Blockchain technologies.
CLO2	Analyzing the blockchain decentralization and cryptography concepts.
CLO3	Explore the driving force behind the cryptocurrency Bitcoin, along with the Decentralization.
CLO4	Develop Ethereum Network, Wallets, Nodes, Smart contract and DApps.
CLO5	Make use of Hyperledger in Blockchain Based Application Architecture

Module – 1	**08 Hrs**
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. **Teaching- Learning Process:** Chalk and talk/PPT/case study/web content	
Module – 2	**08 Hrs**
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys	

Teaching- Learning Process: Chalk and talk/PPT/case study/web content

Module – 3	**08 Hrs**
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash **Teaching- Learning Process:** Chalk and talk/PPT/case study/web content	

Module – 4	**08 Hrs**
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101:Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts. **Teaching- Learning Process:** Chalk and talk/PPT/case study/web content	

Module – 5	**08 Hrs**
Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media **Teaching- Learning Process:** Chalk and talk/PPT/case study/web content	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the emerging abstract models for Blockchain Technology and to familiarize
CO2	With the functional/operational concepts.
CO3	Analyze the various consensus mechanisms, applications, research challenges and future directions.

Text Books	
1	Mastering BlockChain, Imran Bashir, 2nd Edition, Packt – 2018

Reference Books	
1	Mastering Bitcoin: Programming the Open Blockchain, Andreas M, O'Rielly – 2017

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/106105184
2	https://ocw.mit.edu/courses/15-s12-blockchain-and-money-fall-2018/video_galleries/video-lectures/

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**X**		**X**		
CO2	**X**			**X**		
CO3		**X**				
CO4	**X**		**X**	**X**		
CO5	**X**		**X**			

Semester: II						
Information and Network Security						
Course Code	**:**	MCS204B		**Credits**	**:**	03
Hours/Week (L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Networks, Introduction to Cybersecurity
Knowledge on Fundamental Concepts	Networking, Cybersecurity, Cyber laws, Information processing
Knowledge on Connected Tools (If any)	Wireshark

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the basics of Cryptography and Network Security.
CLO2	Secure a message over insecure channel by various means.
CLO3	Maintain the Confidentiality, Integrity, Reliability and Availability of a data.

Module – 1	**08 Hrs**
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and BruteForce Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the Feistel Cipher structure, the Feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm	

Teaching- Learning Process: Chalk and Talk/ PPT

Text Book-1: Chapter - 3,4

Module – 2	**08 Hrs**

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffie-Hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real.

Teaching- Learning Process : Chalk and Talk/ PPT

Text Book-1: Chapter – 9,10

Module – 3	**08 Hrs**

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

Teaching- Learning Process : Chalk and Talk/ PPT

Text Book: Chapter – 14,15

Module – 4	**08 Hrs**

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function. Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. Transport Layer Security: Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. HTTPS Connection Initiation, Connection Closure. Secure Shell (SSH).

Teaching- Learning Process : Chalk and Talk/ PPT

Text Book: Chapter – 17,18

Module – 5	**08 Hrs**

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.

Teaching- Learning Process : Chalk and Talk/ PPT

Text Book: Chapter – 19,20

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the vulnerabilities in any computing system and hence be able to design a security solution.
CO2	Identify the security issues in the network and resolve it.
CO3	Analyze security mechanisms using rigorous approaches, including theoretical.
CO4	Apply various protocols for network security to protect against the threats in the networks

Text Book	
1	Cryptography and Network Security,William Stallings, Pearson, 6thEdition

Reference Books	
1	Cryptography and Information Security,V K Pachghare, PHI, 2nd Edition
2	A Course in Number Theory and Cryptology, Neal Koblitz ,Springer, 1987
3	Cryptography and Network Security, Behrouz A Forouzan, Debdeep Mukhopadh yay, McGrawHill, 3rd Edition, 2015

Web links and Video Lectures (e – Resources)	
1	https://www.coursera.org/specializations/computer-network-security

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**X**		**X**		
CO2		**X**				**X**
CO3		**X**		**X**		
CO4			**X**			

Semester: II						
Deep Learning						
Course Code	**:**	MCS204C		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	4		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Deep Learning – by Prof. Pabitra Mitra (IIT Kharagpur)-NPTEL
Knowledge on Fundamental Concepts	Python Programming, Mathematics for ML/DL, Machine Learning Basics
Knowledge on Connected Tools (If any)	TensorFlow, PyTorch, Keras, NumPy

Course Learning Objectives: This course will enable the students to	
CLO1	Discuss the context of neural networks and deep learning
CLO2	Have a working knowledge of neural networks and deep learning
CLO3	Explore the parameters for neural networks

Module – 1	**08 Hrs**
Machine Learning Basics: Learning Algorithms, Capacity, Over fitting and Under fitting, Hyper parameters and Validation Sets, Estimator, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, building a Machine Learning Algorithm, Challenges	

Motivating Deep Learning.

Teaching- Learning Process: Chalk and talk/PPT/case study/web content

Textbook 1: Chapter 5(5.1 to 5.11)

Module – 2	**08 Hrs**

Deep Feed forward Networks: Gradient-Based Learning, Hidden Units, Architecture Design, Back Propagation. Regularization: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under- Constrained Problems, Dataset Augmentation, Noise Robustness, Semi Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging, Dropout.

Teaching- Learning Process: Chalk and talk/PPT/case study/web content

Textbook 1: Chapter 6(6.2 to 6), Chapter 7(7.1 to 7.12)

Module – 3	**08 Hrs**

Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates. Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features.

Teaching- Learning Process: Chalk and talk/PPT/case study/web content

Textbook 1: Chapter 8(8.1 to 8.5), Chapter 7(9.1 to 9.9)

Module – 4	**08 Hrs**

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Long short-term memory

Teaching- Learning Process: Chalk and talk/PPT/case study/web content

Textbook 1: Chapter 10(10.1 to 10.6,10.10)

Module – 5	**08 Hrs**

Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyper parameters, Debugging Strategies, Example: Multi-Digit Number Recognition. Applications: Vision, NLP, Speech.

Teaching- Learning Process: Chalk and talk/PPT/case study/web content

Textbook 1: Chapter 11(11.1 to 11.6), Chapter 12(12.2 to 12.4)

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
CO2	Implement deep learning algorithms and solve real-world problems.
CO3	Execute performance metrics of deep learning techniques.
CO4	Compare modeling aspects of various neural network architectures.

Text Books	
1	Deep Learning, Lan Good fellow and Yoshua Bengio, MIT Press https://www.deeplearningbook.org/ 2016.

Reference Books

1	Neural Networks: systematic Introduction, Raúl Rojas, 1996.
2	Pattern Recognition and machine Learning, Chirstopher Bishop, 2007.

Web links and Video Lectures (e – Resources)	
1	https://www.simplilearn.com/tutorials/deep-learning-tutorial
2	https://www.kaggle.com/learn/intro-to-deep-learning
3	https://www.javatpoint.com/deep-learning

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**X**				**X**
CO2	**X**					
CO3			**X**		**X**	
CO4		**X**				**X**

Semester: II						
Decision Support Systems						
Course Code	**:**	MCS204D		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	DBMS, Basic Programming (Python, Java, or R)
Knowledge on Fundamental Concepts	Decision-Making Process, Modeling Techniques User Interface Design
Knowledge on Connected Tools (If any)	Excel, BI Tools, SQL

Course Learning Objectives: This course will enable the students to	
CLO1	Recognize the relationship between business information needs and decision making
CLO2	Select appropriate modeling techniques
CLO3	Able to Analyze, design and implement a DSS

Module – 1	**08 Hrs**

Introduction to decision support systems: DSS Defined, History of decision support systems, Ingredients of a DSS, Data and model management, DSS Knowledge base, User interfaces, User interfaces, The DSS user, Categories and classes of DSSs, Chapter Summary. Decisions and decision makers Decision makers: who are they, Decision styles, Decision effectiveness, How can a DSS help?, A Typology of decisions, Decision theory and Simon's model of problem solving, Bounded decision making, The process of choice, Cognitive processes, Biases and heuristics in decision making.

Teaching- Learning Process: Chalk and Talk PPT

Text Book 1: Ch 1, Ch 2

Module – 2	**08 Hrs**

Decisions in the organization: Understanding the organization, Organizational culture. Modeling decision processes: Defining the problem and its structures, Decision models, Types of probability, Techniques for forecasting probabilities, Calibration and sensitivity

Teaching- Learning Process: Chalk and Talk PPT

Text Book 1: Ch 3, Ch 4

Module – 3	**08 Hrs**

Group decision support and groupware technologies: Group Decision making, the problem with groups, MDM support technologies, Managing MDM activities, the virtual workspace, chapter summary. Executive information systems: What exactly is an EIS, Some EIS history, Why area top executives so different?, EIS components, Making the EIS work, The future of executive decision making and the EIS.

Teaching- Learning Process: Chalk and Talk PPT

Text Book 2: Ch 5, Ch 6

Module – 4	**08 Hrs**

Designing and building decision support systems: Strategies for DSS analysis and design, The DSS developer, DSS user interface issues, chapter summary. Implementing and integrating decision support systems: DSS implementation, System evaluation, The importance of integration, chapter summary.

Teaching- Learning Process: Chalk and Talk PPT

Text Book 1: Ch 14, Ch 15

Module – 5	**08 Hrs**

Creative decision making and problem solving What is creativity?, Creativity defined, The occurrence of creativity, Creative problem solving techniques, Creativity and the role of technology, chapter summary.

Teaching- Learning Process: Chalk and Talk PPT

Text Book 1: Ch 16

Course Outcomes: After completing the course, the students will be able to	
CO1	Appraise issues related to the development of DSS
CO2	Select appropriate modeling techniques
CO3	Analyze and implement a DSS

CO4	Demonstrate qualitative and quantitative skills and critical thinking to

Text Books	
1	Decision support system, George M.Marakas, PHI, 2011.
2	Decision Support Systems, Marakas, 2nd Edition, Pearson India, 2015.

Reference Books	
1	https://www.coursera.org/lecture/business-intelligence-tools/decision-support-systems-videolecture-E8P9x

Web links and Video Lectures (e – Resources)	
1	https://www.coursera.org/lecture/business-intelligence-tools/decision-support-systems-videolecture-E8P9x

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**X**				
CO2			**X**		**X**	
CO3				**X**	**X**	
CO4		**X**	**X**			

Semester: II						
Computer Vision						
Course Code	**:**	MCS205A		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Linear Algebra, Calculus, Digital Image Processing, Machine Learning / Deep Learning.
Knowledge on Fundamental Concepts	Image Fundamentals, Matrix Multiplication, Convolution vs Correlation, Fourier Transforms (for filtering)
Knowledge on Connected Tools (If any)	Jupyter Notebooks, Visual Studio Code, Google Colab

Course Learning Objectives: This course will enable the students to	
CLO1	Explore the fundamentals of image formation.

CLO2	Discuss the major ideas, methods, and techniques of computer vision and pattern recognition.
CLO3	Able to implement algorithms and techniques to analyze and interpret the visible world around us.

Module – 1	**08 Hrs**
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color. **Teaching-Learning Process**: Chalk and talk PPT	
Module – 2	**08 Hrs**
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture. **Teaching-Learning Process**: Chalk and talk PPT	
Module – 3	**08 Hrs**
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering. **Teaching-Learning Process**: Chalk and talk PPT	
Module – 4	**08 Hrs**
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples. **Teaching-Learning Process**: Chalk and talk PPT	
Module – 5	**08 Hrs**
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment. **Teaching-Learning Process**: Chalk and talk PPT	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamentals of image formation.
CO2	Discuss the major ideas, methods, and techniques of computer vision and pattern

	recognition.
CO3	implement algorithms and techniques to analyze and interpret the visible world around us.
CO4	Implement boundary tracking techniques.

Text Books	
1	Computer Vision – A Modern Approach, David A. Forsyth and Jean Ponce, PHI Learning, 2009.
2	Computer and Machine Vision – Theory, Algorithms and Practicalities, E. R. Davies, Elsevier 4th Edition, 2013.

Reference Books	
1	Computer Vision: Algorithms and Applications by Richard Szeliski, and "Multiple View Geometry in Computer Vision" by Richard Hartley and Andrew Zisserman.
2	Fundamentals of Digital Image Processing by Anil K. Jain, and "The Image Processing Handbook" by John C. Russ

Web links and Video Lectures (e – Resources)	
1	https://www.digimat.in/nptel/courses/video/108103174/L19.html

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**X**		**X**		
CO2			**X**			
CO3	**X**				**X**	
CO4		**X**				

Semester: II						
Advances in Software Engineering						
Course Code	**:**	MCS205B		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Data Structures and Algorithms, Object Oriented Programming concepts, Software Development.
Knowledge on Fundamental Concepts	Software Development Fundamentals, UML or Design Patterns.
Knowledge on Connected Tools (If any)	IntelliJ IDEA, VS Code, Eclipse, Maven, Gradle, JUnit, PyTest, Mocha etc.

Course Learning Objectives: This course will enable the students to	
CLO1	Reduce the development time, and resources required to maintain existing applications.
CLO2	Increase code reuse, and provide a competitive advantage to organizations that uses it.

Module – 1	**08 Hrs**
Introduction: What is software engineering? Software Engineering Concepts, Development Activities, Managing Software Development, Modeling with UML, Project Organization and Communication. **Teaching- Learning Process:** Chalk and talk/PPT/case study/web content **Text Book 1: Ch-01 :** 1.2 -1.5, **Ch-02, Ch-03**	
Module – 2	**08 Hrs**
Requirement Elicitation And Analysis: Requirements Elicitation: Requirements Elicitation Concepts, Requirements Elicitation Activities, Managing Requirements Elicitation, Analysis: Analysis Concepts, Analysis Activities, Managing Analysis. **Teaching-Learning Process:** Chalk and talk/PPT/case study/web content **Text Book 1: Ch-04 :** 4.3 – 4.4, **Ch-05 :** 5.2,5.5	
Module – 3	**08 Hrs**
System Design: System design-Decomposing the system: Overview of System Design, System Design Concepts, System Design Activities: Objects to Subsystems, System Design – Addressing design goals: Activities: An overview of system design actives, UML deployment diagrams, Addressing Design Goals, Managing System Design. **Teaching-Learning Process:** Chalk and talk/PPT/case study/web content **Text Book 1: Ch-06 :** 6.1 – 6.4, **Ch-07 :** 7.3 – 7.5	
Module – 4	**08 Hrs**
Object Design, Implementation And Testing : Object design-Reusing pattern solutions: An Overview of Object Design, Reuse Concepts: Design Patterns, Reuse Activities, Managing Reuse, Object design-Specifying interface: An overview of interface specification, Interfaces Specification Concepts, Interfaces Specification Activities, Managing Object Design, Mapping model to code: Mapping Models to Code Overview, Mapping Concepts, Mapping Activities, Managing Implementation, Testing: An overview of testing, Testing concepts, Managing testing. **Teaching-Learning Process:** Chalk and talk/PPT/case study/web content **Text Book 1: Ch-08 :** 8.1 – 8.5, **Ch-09 :** 9.1 – 9.5, **Ch-10 :** 10.1 – 10.5, **Ch-11 :** 11.1 – 1.3,11.4	
Module – 5	**08 Hrs**
Software Maintenance And Software Configuration Management: Software maintenance: What is Software Maintenance?, Factors that Mandate Change, Lehman's Laws of system evolution, Types of software maintenance, Software maintenance process and actives, Reverse Engineering, Software Re-engineering, Patterns for Software Maintenance, Tool support for Software Maintenance. Software Configuration Management: The baseline of Software Life Cycle, What is Software Configuration Management, Why Software Configuration Management, Software Configuration Management Functions, Software Configuration Management Tools.	

Teaching-Learning Process: Chalk and talk/PPT/case study/web content **Text Book 2: Ch-21 :** 21.1 – 21.8, 21.12 , **Ch-22 :** 22.1 – 21.4, 22.6

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply Object Oriented Software Engineering approach in every aspect of software
CO2	Adapt appropriate object oriented design aspects in the development process
CO3	Adapt the concepts and tools related to software configuration management

Text Books	
1	Object-Oriented Software Engineering, Bernd Bruegge, Alan H Dutoit, Pearson Education, 3rd edition, 2014.
2	Object Oriented Software Engineering, David C. Kung, Tata McGraw Hill 2015.

Reference Books	
1	Object Oriented Software Engineering, Stephan R. Schach, Tata McGraw Hill 2008.
2	Applying UML and Patterns, Craig Larman, Pearson Education 3rd edition, 2005

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=BqVqjJq7_vI
2	https://medium.com/javarevisited/my-favorite-courses-to-learn-object-oriented-programming-and- designin-2019-197bab351733

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**X**					**X**
CO2		**X**	**X**			
CO3			**X**		**X**	

Semester: II						
Prompt-Engineering						
Course Code	**:**	MCS205C		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Artificial Intelligence
Knowledge on Fundamental Concepts	Basic Programming Knowledge

Knowledge on Connected Tools (If any)	Basic Knowledge on LLMs

Course Learning Objectives: This course will enable the students to	
CLO1	learn how to develop and optimizing prompts
CLO2	Learn how to apply effective prompting techniques with best practices
CLO3	Learn from common use cases how to best apply prompt engineering techniques

Module – 1	**08 Hrs**
Introduction: LLM Settings, Basics of Prompting, Elements of a Prompt, General Tips for Designing Prompts, Examples of Prompts. **Teaching- Learning Process:** Chalk and board and PPT	
Module – 2	**08 Hrs**
Prompting Techniques-1: Zero-Shot Prompting, Few-Shot Prompting, Chain-of-Thought Prompting, Meta Prompting, Self-Consistency, Generated Knowledge Prompting **Teaching- Learning Process:** Chalk and board and PPT	
Module – 3	**08 Hrs**
Prompting Techniques-2: Prompt Chaining, Tree of Thoughts (ToT), Retrieval Augmented Generation (RAG), Automatic Reasoning and Tool-use (ART), Automatic Prompt Engineer (APE), Active-Prompt, **Teaching- Learning Process**: Chalk and board and PPT	
Module – 4	**08 Hrs**
Prompting Techniques-3: Directional Stimulus Prompting, PAL (Program-Aided Language Models), ReAct Prompting, Reflexion, Multimodal CoT Prompting, **Teaching- Learning Process**: Chalk and board and PPT	
Module – 5	**08 Hrs**
Agents and Guides: Introduction to AI Agents, Agent Components, Crafting Effective Prompts for LLMs. Risks & Misuses: Adversarial Prompting in LLMs, Factuality, Biases **Teaching- Learning Process**: Chalk and board and PPT	

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpretation of the basics of prompting for Large Language Models (LLMs)
CO2	Proficiently apply various prompting techniques
CO3	Gain knowledge of AI Agents and the associated risks and misuses of LLMs .

Text Books	
1	https://www.promptingguide.ai/

Reference Books	
1	https://www.edx.org/learn/artificial-intelligence/ibm-introduction-to-prompt-engineering?utm_source=chatgpt.com
2	https://www.cse.iitd.ac.in/~mausam/courses/col772/spring2023/lectures/22-promptengg.pdf

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/@elvissaravia/playlists
2	https://www.youtube.com/watch?v=aD7pcm1TfRo&list=PLTZYG7bZ1u6puy4VGgQXYVycNL16xDTeO
3	https://www.youtube.com/watch?v=1afc2cAz2Tg&list=PL9ooVrP1hQOE5dmqWrYQqQTX-FFyfYdLf

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1						**X**
CO2				**X**	**X**	
CO3				**X**		

Semester: II						
Business Intelligence and its Applications						
Course Code	**:**	MCS205D		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks

Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Data Structures and Algorithm, Introduction to Artificial Intelligence, Computer Applications
Knowledge on Fundamental Concepts	Understanding of basic Information Systems and their roles in organizations, database management systems.
Knowledge on Connected Tools (If any)	Power BI, Tableau

Course Learning Objectives: This course will enable the students to	
CLO1	The concepts of Business Intelligence and Analytics in the context of Decision Support Systems.
CLO2	Identify and list various technologies used for decision making, including Automated Decision Systems.
CLO3	Describe the techniques and applications of Sentiment Analysis.
CLO4	Illustrate Multi-Criteria Decision Making systems with relevant examples.
CLO5	Predictive modelling techniques used in business analytics and decision support.

Module – 1	**08 Hrs**
An Overview of Business Intelligence, Analytics, and Decision Support Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics,	
Module – 2	**08 Hrs**
Decision Making Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.	
Module – 3	**08 Hrs**
Neural Networks and Sentiment Analysis Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process,, Sentiment Analysis, Speech Analytics.	
Module – 4	**08 Hrs**
Model-Based Decision Making Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets, Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pairwise Comparisons.	
Module – 5	**08 Hrs**
Automated Decision Systems and Expert Systems Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.	

Course Outcomes: After completing the course, the students will be able to

CO1	Able to analyze Business Intelligence, Analytics, and their role in Decision Support Systems.
CO2	The various technologies used in decision making, including automated decision systems.
CO3	Apply sentiment analysis techniques to extract insights from unstructured data.
CO4	Analyze and illustrate Multi-Criteria Decision Making (MCDM) approaches for complex decision scenarios.
CO5	The predictive modelling techniques in solving real-world business problems.

Text Books	
1	Ramesh Sharda, Dursun Delen, Efraim Turban, J.E. Aronson, Ting-Peng Liang, David King, "Business Intelligence and Analytics: System for Decision Support", 10th Edition, Pearson Global Edition, 2013

Reference Books	
1	Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November 2017by Edward Mize.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=zbcCdoHeS4w

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1					**X**	
CO2	**X**					**X**
CO3						**X**
CO4		**X**		**X**		

Semester: II						
MINI PROJECT WITH SEMINAR						
Course Code	**:**	MCS206		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PBLC		**SEE Duration**	**:**	3 Hours

Course Learning Objectives: This course will enable the students to	
CLO1	To support independent learning and innovative attitude.
CLO2	To guide to select and utilize adequate information from varied resources upholding ethics.
CLO3	To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
CLO4	To develop interactive, communication, organization, time management, and presentation skills.
CLO5	To impart flexibility and adaptability.
CLO6	To inspire independent and team working.
CLO7	To expand intellectual capacity, credibility, judgments, intuition.
CLO8	To adhere to punctuality, setting and meeting deadlines.
CLO9	To instill responsibilities to oneself and others.
CLO10	To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Mini-Project	
1	Each student shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: After completing the course, the students will be able to	
CO1	Present the mini-project and be able to defend it.
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas an d information so as to apply these skills to the project task.
CO3	Habituated to critical thinking and use problem solving skills.
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.

Semester: II						
NETWORK PROGRAMMING LABORATORY						
Course Code	**:**	MCSL207		**Credits**	**:**	02
Hours/Week(L:T:P)	**:**	1:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	13		**SEE**	**:**	50 Marks
Course Type	**:**	PCCL		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Networks, Operating Systems, Programming in C / C++ / Java / Python, Data Structures and Algorithms.
Knowledge on Fundamental Concepts	OSI & TCP/IP models, Socket creation and communication, IP addressing, ports, DNS, MAC vs IP, TCP vs UDP, Multithreading or asynchronous programming.
Knowledge on Connected Tools (If any)	VS Code, Eclipse, Wireshark, NS2/NS3

Course Learning Objectives: This course will enable the students to	
CLO1	Create client and server applications using the "Sockets" API and the implementation of Data link layer protocol and TCP layer
CLO2	Ability to conduct computer communication network simulations. Development of computer network simulation and modeling techniques using OPNET simulation software

Experiments	
1	Write a C program to implement daytime client/server program using TCP sockets
2	Write a TCP client/server program in which client sends three numbers to the server in a single message. Server returns sum, difference and product as a result single message. Client program should print the results appropriately
3	Write a C program that prints the IP layer and TCP layer socket options in a separate file
4	Exercises on Socket Programming using C and Java
5	Exercises using OPNET Network Simulator • Setting up of various network topologies • Implementation of various MAC protocols • Measurement of routing protocols • Analysis of TCP/IP protocol under various mechanisms • Setting up of network that carries various application protocols and analyzing the performances
6	Comparison of TCP/IP, Socket, Pipes. Analyse which is the best

Course Outcomes: After completing the course, the students will be able to	
CO1	Understanding of the working principle of Socket programming
CO2	Familiarization with the OPNET toolkit

Reference Books	
1	UNIX Network Programming – Networking APIs: Sockets and XTI , W. Richard Stevens Computer Networks: A Systems Approach – Network Simulation Experiments in OPNET L. Peterson and S. Davie

Web links and Video Lectures (e – Resources)	
1	https://www.nsnam.org/
2	https://www.wireshark.org/
3	https://docs.oracle.com/javase/tutorial/networking/

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**X**		**X**	**X**	
CO2	**X**					**X**

Semester: II						
SKILL ENHANCEMENT FOR RESEARCH EXCELLENCE-1						
Course Code	**:**	MCS208		**Credits**	**:**	01
Hours/Week(L:T:P)	**:**	0:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	26		**SEE**	**:**	50 Marks
Course Type	**:**	SEC		**SEE Duration**	**:**	3 Hours

Course Learning Objectives: This course will enable the students to	
CLO1	To produce high-quality research papers that meet the standards of international conferences or peer-reviewed journals.
CLO2	To effectively identify suitable journals for publication based on the scope and impact of research findings.
CLO3	To demonstrate proficiency in writing and structuring research papers according to academic conventions.
CLO4	To engage in the peer review process, providing and receiving constructive feedback to enhance research quality.
CLO5	To develop skills for presenting research at conferences, including crafting effective abstracts and posters.
CLO6	To cultivate a strong understanding of ethical considerations in research and publication practices.
CLO7	To utilize citation management tools to organize references and ensure proper attribution in publications.
CLO8	To enhance collaboration skills for co-authoring papers and working within research teams.
CLO9	To stay informed about current trends and advancements in the field to ensure relevance in publications.
CLO10	To refine the ability to respond to reviewer comments and revise manuscripts effectively.
CLO11	To understand the importance of open access and alternative publication models in disseminating research.
CLO12	To build a professional network that supports research collaborations and publication opportunities.

1. **Understanding Research Fundamentals**
   - Definition of Research: Understand what constitutes research and its significance in technology and engineering.
   - Types of Research:
     Basic Research: Focused on gaining comprehensive knowledge without immediate applications.
     Applied Research: Aimed at solving specific problems.

   Literature Review
   - Conducting a Literature Survey: Identify relevant academic papers, journals, and conference proceedings. Summarize key findings and methodologies from existing literature.
   - Critical Analysis: Evaluate the strengths and weaknesses of existing research. Identify gaps in the literature that your research can address.

2. **Research Methodology**
   - Selecting a Research Topic:
     Choose a topic that aligns with your interests and current trends in technology.
   - Research Design:
     Decide on qualitative, quantitative, or mixed methods based on your research objectives.
   - Data Collection Techniques:
     Surveys, interviews, experiments, and simulations.

3. **Writing Research Proposals**
   - Structure of a Proposal:
     Introduction, Literature Review, Methodology, Expected Outcomes, and References.
   - Proposal Presentation:
     Practice presenting your proposal to peers and faculty for feedback.

4. **Data Analysis**
   - Statistical Tools:
     Familiarize yourself with tools like MATLAB, R, or Python for data analysis.
   - Interpreting Results:
     Learn to draw meaningful conclusions from your data and relate them back to your research questions.

5. **Writing Research Papers**
   - Structure of a Research Paper:
     Abstract, Introduction, Methodology, Results, Discussion, Conclusion, and References.
   - Academic Writing Skills:
     Focus on clarity, coherence, and proper citation of sources.
   - Peer Review Process:
     Understand the importance of peer review and how to respond to reviewers' comments.

6. **Presentation Skills**
   - Effective Communication:
     Develop skills to present your research findings clearly and confidently.
   - Use of Visual Aids:
     Incorporate slides, charts, and graphs to enhance your presentations.

7. **Ethical Considerations in Research**
   - Understanding Ethics:
     Familiarize yourself with ethical guidelines related to research involving human subjects, data privacy, and plagiarism.
   - Responsible Conduct of Research:
     Promote integrity and accountability in your research practices.

Submitting Manuscripts to Scopus-Indexed Conferences or Web of Science or Proceedings /Book Chapters

1. Identify Relevant Conferences

- Research Scopus-Indexed Conferences:
  Use platforms like Conference Alerts, IEEE Xplore, or the Scopus website to find conferences in your field.
- Check Conference Indexing:
  Ensure that the conference is indexed in Scopus by checking its official website or the Scopus database.

2. Prepare Your Manuscript

- Follow Conference Guidelines:
  Each conference has specific formatting and submission guidelines. Adhere to these requirements.
- Structure of the Manuscript:
  Title, Abstract, Introduction, Methodology, Results, Discussion, Conclusion, and References.
- Language and Clarity:
  Use clear and concise language. Consider having your manuscript proofread by peers or professionals.
- Submission of manuscript, Registration and Presentation finally Publication

Course Outcomes: After completing the course, the students will be able to	
CO1	At the end of the course the student will be able to:
CO2	Produce High-Quality Research Papers: Create research papers that meet international conference and peer-reviewed journal standards.
CO3	Identify Suitable Journals: Effectively select appropriate journals for publication based on research scope and impact.
CO4	Proficiency in Writing: Demonstrate skill in writing and structuring research papers according to academic conventions.
CO5	Engage in Peer Review: Actively participate in the peer review process by providing and receiving constructive feedback.
CO6	Develop Presentation Skills: Acquire skills for presenting research at conferences, including crafting effective abstracts and posters.
CO7	Understand Ethical Considerations: Cultivate a strong understanding of ethical issues in research and publication practices.
CO8	Utilize Citation Management Tools: Use citation management tools to organize references and ensure proper attribution.
CO9	Respond to Reviewer Comments: Refine the ability to address reviewer comments and revise manuscripts effectively.

Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

- Providing Students with a Sound Knowledge in Fundamentals of their branch of Study.
- Promoting Excellence in Teaching, Training, Research and Consultancy.
- Exposing Students to Emerging Frontiers in various domains enabling Continuous Learning.
- Developing Entrepreneurial acumen to venture into Innovative areas.
- Imparting Value based Professional Education with a sense of Social Responsibility.

Department Vision

Building Technically Competent Engineers to Serve the Society

Department Mission

- Imparting strong fundamental knowledge in Mechanical Engineering and allied fields.
- Fostering a culture of collaboration and propagating Industry institute interactions to enhance advances in latest technologies.
- Creating State-of-Art facilities benefitting students and faculty to carryout Research, Innovation and Consultancy.
- Providing conducive environment for both students and faculty to engage in lifelong learning activities.
- Inculcating Professional ethics, Leadership qualities and Entrepreneurial skills among students.

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

P.B. No.20, B.B Road,

Chikkaballapur - 562 101, Karnataka