DEPT. OF CSE (DS)

Autonomous

Scheme and Syllabus

Third Year

V & VI Semester

2023 Scheme

SERVICE TO MANKIND IS SERVICE TO GOD

His Divine Soul Padmabhushana

Sri Sri Sri Dr. Balagangadharanath MahaSwamiji

Founder President, Sri Adichunchanagiri Shikshana Trust®

Belief in God is not ignorance or illusion. It is a belief that there is an unseen, ineffable Power that transcends all our powers of muscles, mind and lives.

His Holiness Parama Pujya

Sri Sri Sri Dr. Nirmalanandanatha MahaSwamiji

President, Sri Adichunchanagiri Shikshana Trust ®

True richness is the generosity of heart. Cultivate it and work to help the less fortunate ones in life.

Revered Sri Sri Dr. Prakashanatha Swamiji

Managing Director, BGS & SJB Group of Institutions & Hospitals

People and prosperity follow the path which the leaders take. So the elders and leaders should make sure that they give the right lead and take the right path.

Department of Computer Science and Engineering (Data Science)

Department of Computer Science & Engineering (Data Science)

Vision

To enrich the next generation of young data practitioners, accomplish academic excellence and bring forward the Data Scientists.

Mission

M1: Grooming the students equipping with advanced technical knowledge to be industry-ready and globally competent.

M2: Facilitate quality data science education, enable students to become skilled professionals to solve real-time problems through industry collaboration.

M3: Encourage ethical value based transformation to serve the society with responsibility emphasizing on innovation and research methods

Program Educational Objectives

PEO1. Apply the structured statistical and mathematical methodology to process massive amounts of data to detect underlying patterns to make predictions under realistic constraints and to visualize the data.

PEO2. Promote design, research, product implementation and services in the field of Data Science by using modern tools

Program Specific Outcomes

PSO1: Apply the skills in the multi-disciplinary area of Data Science.

PSO2: Demonstrate Engineering Practice learnt to solve real-time problems in various domains.

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Sri Adichunchanagiri Shikshana Trust (R)
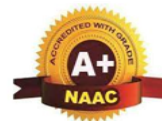
SJB Institute of Technology

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2023 Scheme – UG	
Syllabus Book for Department of Computer Science and Engineering (Data Science)	
Syllabus for 5th & 6th Semester	
The syllabus, scheme and guidelines are provided in detail. The syllabus, scheme and guidelines are subjected to changes if any needed. The updates will be done timely. Regularly access the institution website for the updated information.	
The Syllabus book is available on	www.sjbit.edu.in
For any queries, please write to	academicdean@sjbit.edu.in

UPDATES

Release / Revision	Date	Remarks
Release	29/03/2025	First release
Rev-1		

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Autonomous Scheme of Teaching & Examinations (ST&E) (Tentative) UG - BE 3rd Year -CSE(DS)

SCHEME: 2023   **SEM: V**   **Revision date:**   **29-03-2025**

S. #	Course Type	Course type Series	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Lecture (L)	Tutorial (T)	Practical (P)	PBL/ABL /SL/etc. (O)	CIE Marks	Dur.	Th.	Lab	Tot.
1	PCC	3	23CDT501	Theory of Computation	CSE(DS)	CSE(DS)	3	3	0	0		50	03	50	-	100
2	IPCC	5	23CDI502	Computer Networks	CSE(DS)	CSE(DS)	4	3	0	2		50	03	50	-	100
3	IPCC	6	23CDI503	Artificial Intelligence and Machine Learning	CSE(DS)	CSE(DS)	4	3	0	2		50	03	50	-	100
4	PCCL	3	23CDL504	Data Visualization Lab	CSE(DS)	CSE(DS)	1	0	0	2		50	03	-	50	100
5	PEC	1	23CDP51y	Professional Elective Course - 1	CSE(DS)	CSE(DS)	3	3	0	0		50	03	50	-	100
6	ETC	3	23CDE53y	Emerging Technology Course - 3	CSE(DS)	CSE(DS)	3	3	0	0	@	50	03	50	-	100
7	HSMC	6	23SFHH06/ 23UHVH07	Bioscience or UHV-Universal Human Values	any dept	any dept	1	0	2	0	@	50	02	50	-	100
8	AEC	5	23CDAE5y	Ability Enhancement Course - 5	CSE(DS)	CSE(DS)	1	1	0	0		50	02	50	-	100
								(or)								
								0	0	2		50	02	-	50	100
9	NCMC	4	23PASN01	Physical Education - Sports and Athletics	PED	PED	PP/NP	-	-	-	2	50	-	-	-	50
			23YOGN02	Yoga	PED	PED										
			23NSSN03	NSS - National Service Scheme	NSS	NSS										
			23NCCN04	NCC - National Cadet Corps	NCC	NCC										
			23IKSN05	Indian Knowledge System	HSS	HSS										
				Total			**20**	**16**	**2**	**8**	**2**	**450**		**350**	**100**	**850**

PCC: Professional Course; IPCC: Integrated Professional Core Course; PCCL: Professional Core Course Laboratory; AEC: Ability Enhancement Course; HSMC: Humanities, Social Sciences & Management Course; NCMC: Non Credit Mandatory Course;

{@ - Compulsory one activity during the semester};

{I.E.-Industry Experts}.

PBL: project Based learning; ABL: Activity Based Learning; SL: Self-Learning

ETC (Emerging Technology Course):

For ETC (L:T:P:O) can be plaanned by the depts considering practicality & possibility of conduction, same shall be indicated along with course title in the list, if altered than above. If planned altering the prescription, the same shall be approved at the department BOS & authorities. Atleast one activity is mandatory during the delivery of the course. The guidelines is applicable to all the semesters III to VI semesters (ETC-1 to ETC-4).

Bioscience & UHV-Universal Human Values:

1) Any one of the course will be offered by the departments in each semester of IV & V based on the institutional planning.

2) Both the courses shall be studied and completed by the students registering each in the two semesters. For example, if Bioscience is offered in the IV semester, UHV-Universal Human Values is offered in the V semester.

Ability Enhancement Course-5: 23CDAE5y - 1 Credit course

1) The courses and the syllabus shall be defined by the respective dept. BOS.

2) SEE will be MCQ if offered as theory course. If offered as LAB course, SEE will be practical, with two internal examiners. Handled by Controller of Examinations.

NCMC (Non Credit Mandatory Course) for course type series-4: Refer to guidelines in III SEM.

Professional Elective Course - 1		Emerging Technology Course - 3		Ability Enhancement Course - 5	
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title
23CDP511	Computer Vision	23CDE531	Java Full Stack Development	23CDAE51	Devops
23CDP512	Exploratory Data Analytics	23CDE532	Web Programming	23CDAE52	Mobile Application Development with Flutter
23CDP513	Data Warehousing 2.0	23CDE533	IOT Analytics	23CDAE53	Generative AI
23CDP514	NOSQL Databases	23CDE534	Information and Network Security	23CDAE54	React

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Autonomous Scheme of Teaching & Examinations (ST&E) (Tentative) UG - BE 3rd Year - CSE(DS)

SCHEME: 2023   **SEM: VI**   **Revision date:**   **29-03-2025**

S. #	Course Type	Course type Series	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Teaching Hrs/Week				Examinations				
								L	T	P	O		SEE (Dur. & Marks)			
								Lecture	Tutorial	Practical	PBL/ABL /SL/etc.	CIE Marks	Dur.	Th.	Lab	Tot.
1	PCC	4	23CDT601	Big Data Analytics	CSE(DS)	CSE(DS)	3	3	0	0		50	03	50	-	100
2	IPCC	7	23CDI602	Deep Learning	CSE(DS)	CSE(DS)	4	3	0	2		50	03	50	-	100
3	PCCL	4	23CDL603	Big Data Analytics Lab	CSE(DS)	CSE(DS)	1	0	0	2		50	03	-	50	100
4	PEC	2	23CDP62y	Professional Elective Course - 2	CSE(DS)	CSE(DS)	3	3	0	0		50	03	50	-	100
5	OEC	1	23CDO61y	Open Elective Course - 1	Any dept.	Any dept.	3	3	0	0		50	03	50	-	100
6	ETC	4	23CDE64y	Emerging Technology Course - 4	CSE(DS)	CSE(DS)	3	3	0	0	@	50	03	50	-	100
7	AEC	6	23RMAE61	Research Methodology & IPR	Dept.	Dept.	3	3	0	0	@	50	03	50	-	100
8	PRJ	1	23CDPRJ1	Project - Phase I	CSE(DS)	Dept.	2	0	0	4	@	50	03	-	50	100
9	HSMC	7	23SCRH08	Social Connect & Responsibility	Any dept	Any dept	1	1	0	0	@	50	-	-	-	50
10	NCMC	4	23PASN01	Physical Education - Sports and Athletics	PED	PED	PP/NP	-	-	-	2	50	-	-	-	50
			23YOGN02	Yoga	PED	PED										
			23NSSN03	NSS - National Service Scheme	NSS	NSS										
			23NCCN04	NCC - National Cadet Corps	NCC	NCC										
			23IKSN05	0	HSS	HSS										
Total							**23**	**19**	**0**	**8**	**2**	**500**		**300**	**100**	**900**

PCC: Professional Course; IPCC: Integrated Professional Core Course; PCCL: Professional Core Course Laboratory; PEC: Professional Elective Course; OEC: Open Elective Course;
HSMC: Humanities, Social Sciences & Management Course; AEC: Ability Enhancement Course; NCMC: Non Credit Mandatory Course; PRJ: Project work.
{@ - Compulsory one activity during the semester}; {I.E.-Industry Experts}; PBL: project Based learning; ABL: Activity Based Learning; SL: Self-Learning
NOTE: CIE & SEE guidelines for S. #7: AEC-23RMAE61-Reserach Methodology & IPR will be same as 3 credit courses BSC/ESC/PCC/ETC/PEC/OEC as mentioned in serial no. 1 of CIE & SEE guidelines.

Open Elective Courses (OEC):

1) Open Electives listed here are to offer for other department students.

2) Students shall select open elective courses offered from other departments, separate consolidated list of courses offered from various departments will be published time to time.

ETC (Emerging Technology Course):

For ETC (L:T:P:O) can be plaanned by the depts considering practicality & possibility of conduction, same shall be indicated along with course title in the list, if altered than above. If planned altering the prescription, the same shall be approved at the department BOS & authorities. Atleast one activity is mandatory during the delivery of the course. The guidelines is applicable to all the semesters III to VI semesters (ETC-1 to ETC-4).

NCMC (Non Credit Mandatory Course) for course type series-4: Refer to guidelines in III SEM.

Professional Elective Course - 2 (23CDP62y)		Open Elective Course - 1 (23CDO61y)		Emerging Technology Course - 4 (23CDE64y)	
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title
23CDP621	Natural Language Processing	23CDO611	Introduction to Data Structures	23CDE641	UI/UX with Flutter
23CDP622	Block Chain Technologies	23CDO612	Fundamental of Operating System	23CDE642	Parallel Programming
23CDP623	Distributed File System	23CDO613	Introduction to Data Science	23CDE643	Prompt Engineering
23CDP624	Digital Marketing	23CDO614	OOPS with Java	23CDE644	Data Security and Privacy

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Department of Computer Science and Engineering (Data Science)

Semester:	V		Course Type:	PCC	
Course Title: Theory of Computation					
Course Code:	**23CDT501**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)		3:0:0:0		**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	3

I. Course Objectives:

This course will enable students to:
- Introduce core concepts in Automata and Theory of Computation.
- Identify different Formal Language Classes and their Relationships.
- Learn concepts of Grammars and Recognizers for different formal languages
- Prove or disprove theorems in automata theory using their properties

II. Teaching-Learning Process (General Instructions):

These are sample Strategies which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Introduce Topics in manifold representations.

7. Show the different ways to solve the same problem with different approaches and encourage the students to come up with their own creative ways to solve them.

8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding

III. COURSE CONTENT

Module-1:	08 Hrs

Introduction to Finite Automata: Introduction to Finite Automata**,** Structural Representations, Automata and Complexity. The Central Concepts of Automata Theory. Deterministic Finite Automata, Nondeterministic Finite Automata, An Application: Text Search, Finite Automata with Epsilon-Transitions .**Text Book1:Chapter:Section Ch :1-1.1,1.5, 2- 2.2, 2.3, 2.4, 2.5**

RBT Levels: L1, L2 & L3

Module-2:	08 Hrs

Regular Expressions: Regular Expressions, Finite Automata and Regular Expressions, Proving Languages not to be Regular. Closure Properties of Regular Languages, Equivalence and Minimization of Automata, Applications of Regular Expressions

Text Book1: Chapter: Section Ch 3-3.1, 3.2 (Except 3.2.1), 3.3, 4-4.1, 4.2, 4.4.

RBT Levels: L1, L2 & L3

Module-3:	08 Hrs

Context-Free Grammars: Context-Free Grammars, Parse Trees, Ambiguity in Grammars and Languages, Ambiguity in Grammars and Languages, Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.
Text Book1: Chapter: Section 5-5.1, 5.2, 5.4. 6- 6.1, 6.2, 6.3.1, 6.4.

RBT Levels: L1, L2 & L3

Module-4:	08 Hrs

Normal Forms for Context-Free Grammars: Normal Forms for Context-Free Grammars, The Pumping Lemma for Context-Free Languages, Closure Properties of Context-Free Languages.
Text Book1: Chapter: Section 7-7.1, 7.2, 7.3

RBT Levels: L1, L2 & L3

Module-5:	08 Hrs

Turing Machines: Introduction to Turing Machines: Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine.
Text Book1: Chapter: Section 8-8.1, 8.2, 8.3, 8.4. 9- 9.1, 9.2

RBT Levels: L1, L2 & L3

IV. COURSE OUTCOMES

CO1	Apply the fundamentals of automata theory to write DFA, NFA, Epsilon-NFA and conversion between them.
CO2	Prove the properties of regular languages using regular expressions.
CO3	Design context-free grammars (CFGs) and pushdown automata (PDAs) for formal languages..
CO4	Design Turing machines to solve the computational problems.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	2	2		3						1		2	1
CO2	2	2	2		2						1		2	1
CO3	3	2	3		2						1		2	1

CO4	3	3	2		3					1		2	1

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII (a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Publication	Edition
1	Introduction to Automata Theory, Languages and Computation",	John E Hopcroft,	Pearson	3rd Edition

VII (b): Reference Books:

2	Automata,Comput ability and complexity	Elain Rich	Pearson Education,2018	1st Edition,
3	Theory of Computer Science	K.L.P Mishra, N Chandrashekaran	PHI,2012	3rd Edition
4	An introduction to Formal Languages and Automata	Peter Linz	Narosa Publishers,1998.	3rd Edition

VII (c): Web links and Video Lectures (e-Resources):

WebLinks:
- https://archive.nptel.ac.in/courses/106/105/106105196/
- https://archive.nptel.ac.in/courses/106/106/106106049/
- https://nptelvideos.com/course.php?id=717

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Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	IPCC		
Course Title: Computer Networks					
Course Code:		**23CDI502**		**Credits:**	4
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }			3:0:2:0	**Total Hours:**	40 + 8-10 Lab slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I. Course Objectives:

This course will enable students to,

- Study the TCP/IP protocol suite, switching criteria and Medium Access Control protocols for reliable and noisy channels.

- Learn network layer services and IP versions.

- Discuss transport layer services and understand UDP and TCP protocols.

- Demonstrate the working of different concepts of networking layers and protocols.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

6. Use any of these methods: Chalk and board, Active Learning, Case Studies.

III. COURSE CONTENT	
III(a).Theory PART	
Module-1	**08 Hrs**
Introduction: Data Communications, Networks, Network Types, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, **Introduction to Physical Layer:** Transmission media, Guided Media, Unguided Media: Wireless. **Switching:** Packet Switching and its types. **Textbook: Chapter: sections Ch-1: 1-1.3, Ch-2: 2.1 -2.3, Ch-7: 7.1–7.3, 8.3.**	
RBT Levels: L1, L2 & L3	
Module-2	**8 Hrs**
Data Link Layer: Error Detection and Correction: Introduction, Block Coding, Cyclic Codes. **Data link control:** DLC Services: Framing, Flow Control, Error Control, Connectionless and Connection Oriented, Data link layer protocols, High Level Data Link Control. **Media Access Control:** Random Access, Controlled Access. Check Sum and Point to Point Protocol **Textbook: Chapter: sections Ch-10: 10.1-10.4, Ch-11: 11.1-11.4, Ch-12: 12.1-12.2**	
RBT Levels: L1, L2 & L3	
Module-3	**08 Hrs**
Network Layer: Network layer Services, Packet Switching, IPv4 Address, IPv4 Datagram, IPv6 Datagram, Introduction to Routing Algorithms, Unicast Routing Protocols: DVR, LSR, PVR, Unicast Routing protocols: RIP, OSPF, BGP, Multicasting Routing-MOSPF **Textbook: Chapter: sections Ch-18: 18.1,18.2,18.4 , Ch-20: 20.1-20.3, Ch-21: 21.3.2, Ch-22: 22.2**	
RBT Levels: L1,L2 & L3	
Module-4	**08 Hrs**
Introduction to Transport Layer: Introduction, Transport-Layer Protocols: Introduction, User Datagram Protocol, Transmission Control Protocol: services, features, segments, TCP connections, flow control, Error control, Congestion control. **Textbook: Chapter: sections Ch-23: 23.1-23.2, Ch-24: 24.1-24.3.4,24.3.6-24.3.9**	
RBT Levels:L1,L2 & L3	
Module-5	**08 Hrs**
Introduction to Application Layer: Introduction, Client-Server Programming, Standard Client- Server Protocols: World Wide Web and HTTP, FTP, Electronic Mail, Domain Name System (DNS), TELNET, Secure Shell (SSH). **Textbook**: **Chapter: sections Ch-25: 25: 25.1-25.2, Ch-26: 26: 26.1-26.6**	
RBT Levels: L1,L2,L3	

III(b). PRACTICAL PART	
Sl. No.	**Experiments**
1	Implement three nodes point–to–point network with duplex links between them. Set the queue size; vary the bandwidth, and find the number of packets dropped.
2	Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3	Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source/destination.
4	Develop a program for error detecting code using CRC-CCITT (16- bits).
5	Develop a program to implement a sliding window protocol in the data link layer.
6	Using TCP/IP sockets or Datagram socket, write a client–server program to make the clients end the file name and to make the servers end back the contents of the requested file if present.
7	Develop a program for a simple RSA algorithm to encrypt and decrypt the data.
8	Develop a program for congestion control using a leaky bucket algorithm.

Instructions for conduction of practical part:

- For the Simulation experiments modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude using NS2 or NS3.
- Installation procedure of the required software must be demonstrated, carried out in groups, and documented in the report. Non simulation programs can be implemented using Java.

IV. COURSE OUTCOMES

CO1	**Explain** the fundamentals of computer networks.
CO2	**Apply** the concepts of computer networks to demonstrate the working of various layers and protocols in communication network.
CO3	**Analyze** the principles of protocol layering in modern communication systems.
CO4	**Demonstrate** various Routing protocols and their services using tools such as Cisco packet tracer.

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2			1								1	
CO2	2	2	2		2								2	2
CO3	2	2	3		3						2		1	2
CO4		3		3	3					2			2	2

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 2

Semester End Examination (SEE): Refer Annexure Section 2

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Data Communications and Networking	Behrouz A.Forouzan	5th Edition, 2013	Tata McGraw-Hill

VII(b): Reference Books:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Computer Networks–A Systems Approach	Larry L. Peterson and Bruce S.Davie	4th Edition, 2019	Elsevier
2.	Computer and Communication Networks	Nader F.Mir	2ndEdition, 2015	Pearson Education
3.	Data and Computer Communication	William Stallings	10thEdition, 2014	Pearson Education,Inc

VII(c): Web links and Video Lectures (e-Resources):

- https://www.digimat.in/nptel/courses/video/106105183/L01.html
- http://www.digimat.in/nptel/courses/video/106105081/L25.html
- https://nptel.ac.in/courses/10610

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Implementation of various protocols using open source simulation tools.
- Simulation of Personal area network, Home area network, achieves QoSetc.

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Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	IPCC		
Course Title:		**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**			
Course Code:		**23CDI503**		**Credits:**	04
Teaching Hours/Week (L:T:P:O)			3:0:2:0	**Total Hours:**	40+8-10 Lab Slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	3 Hours

I.	**Course Objectives:**

- Gain a historical perspective of AI and its foundations.

- Become familiar with basic principles of AI toward problem solving.

- To familiarize the basics of machine learning and its algorithms such as decision trees.

- Understand the working of Artificial Neural Networks models and basic concepts of Classification Algorithms.

- To explore advanced concept like Bayesian models, clustering, Reinforcement learning and provide practical insight into its applications.

II. Teaching-Learning Process (General Instructions):

Mention the planned/proposed sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

III. COURSE CONTENT	
III(a). Theory PART	

Module-1	8 Hrs
Artificial Intelligence: What is artificial intelligence? Foundations and History of AI Intelligent Agents: Agents and Environments, Good Behaviour: The concept of rationality, the nature of Environments, the structure of Agents. **Textbook1:Chapter:Sections: Ch:1, 2**	
RBT Levels: L1 – Remembering, L2 – Understanding, L3 – Applying	

Module-2	8 Hrs
Problem solving by searching: Problem solving agents, Example problems, Searching for solutions, Uniformed search strategies, Informed search strategies, Heuristic functions **Textbook1:Chapter:Sections : Ch:3**	
RBT Levels: L1 – Remembering, L2 – Understanding, L3 – Applying	

Module-3	8 Hrs
Introduction: Need for Machine Learning, Machine Learning Explained, Types of Machine Learning. **Concept Learning**: Concept learning task, Concept learning as search, Find-S algorithm,Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm. **Decision Tree Learning:** Introduction to Decision Tree Learning Model, Decision Tree Induction Algorithms. **Textbook 2:Chapter:Sections: Ch:2, 3**	
RBT Levels: L1 – Remembering, L2 – Understanding, L3 – Applying,	

Module-4	8 Hrs
Artificial Neural Networks: Introduction, Neural Networks representation, Appropriate Problems, perceptrons, Back propagation algorithm. **Regression Analysis:** Introduction to Regression, Introduction to Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression. **Textbook 2:Chapter:Sections: Ch:4-4.1, 4.2, 4.3, 4.4, 4.5**	
RBT Levels: L1 – Remembering, L2 – Understanding, L3 – Applying	

Module-5	8 Hrs
Clustering Algorithms: Introduction to Clustering Approaches, Proximity Measures, Hierarchical Clustering Algorithms, Partitional Clustering Algorithm, Density-based Methods, Grid-based Approach. **Bayesian Learning:** Introduction, Bayes Theorem, Naïve Bayes Algorithm. **Reinforcement Learning:** Introduction, The learning task, Q-Learning. **Textbook 2:Chapter:Sections Ch:8-8.1, 8.2, 8.3, 13-13.1, 13.2, 13.3**	
RBT Levels: L1 – Remembering, L2 – Understanding, L3 – Applying	

III(b). PRACTICAL PART.	
SL.No	**Experiments**
1	Implement A* Search algorithm.
2	Implement AO* Search algorithm.
3	Develop a program to Compute the correlation matrix to understand the relationships between pairs of features. Visualize the correlation matrix using a heatmap to know which variables have strong positive/negative correlations. Create a pair plot to visualize pair wise relationships between features. Use California Housing dataset.

4	Develop a program to create histograms for all numerical features and analyze the distribution of each feature. Generate box plots for all numerical features and identify any outliers. Use California Housing dataset.
5	Develop a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of the Iris dataset from 4 features to 2.
6	Implement and demonstrate the Find-S algorithm
7	Implement and demonstrate the Candidate Elimination algorithm
8	Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
9	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
10	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

IV. COURSE OUTCOMES

CO1	Appraise the theory of Artificial intelligence and Illustrate the working of AI.
CO2	Apply problem-solving agents and various search strategies to solve a given problem.
CO3	Describe the machine learning techniques and Apply the knowledge of Decision Tree algorithms.
CO4	Analyze ANN learning and Apply the knowledge of classification algorithms on various dataset and compare results.
CO5	Utilize clustering algorithms to identify patterns in data and implement reinforcement learning techniques.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	1		2								3	1
CO2	3	3	2	2	2								3	1
CO3	3	2	2		2								3	2
CO4	3	3	2	3	2								3	2
CO5	3	3	2	2	2								3	2

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure section 2

Semester End Examination (SEE): Refer Annexure section 2

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
01	Artificial Intelligence	Stuart J. Russell and Peter Norvig	3rd Edition, 2015	Pearson
02	Machine Learning	Tom M Mitchell	2021, First Edition	OXFORD University Press

VII(b): Reference Books:

01	Machine Learning	S Sridhar, M Vijayalakshmi,	1st Edition, 2017	McGraw Hill
02	Machine Learning: Theory and Practice	Murty, M. N., and V. S. Ananthanarayana	2024.	Universities Press

VII(c): Web links and Video Lectures (e-Resources):

- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
- https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
- https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
- https://nptel.ac.in/courses/106/105/106105077/
- https://www.universitiespress.com/resources?id=9789393330697
- https://www.drssridhar.com/?page_id=1053
- Machine Learning Tutorials: https://www.geeksforgeeks.org/machine-learning/
- Machine Learning Tutorials: https://www.tutorialspoint.com/machine_learning/index.htm
- Python for Machine Learning: https://www.w3schools.com/python/python_ml_getting_started.asp
- Introduction to Machine Learning: https://onlinecourses.nptel.ac.in/noc22_cs29/preview

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- AI Chatbot Development.
- Hands-on Projects with Kaggle Competitions.

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Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	PCCL		
Course Title: Data Visualization Lab					
Course Code:	**23CDL504**			**Credits:**	01
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }		0:0:2:0		**Total Hours:**	24
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Practical		**Exam Hours:**	03

I.	Course Objectives:

This course will enable students to:

● Understand the Importance of data Visualization for business intelligence and decision making.

● Learn different approaches to understand the importance of visual perception.

● Learn different data visualization techniques and tools.

● Gain knowledge of effective data visuals to solve workplace problems.

Sl.No	Experiments
1	Getting Started - Tableau Workspace, Tableau terminologies, basic functionalities.
2	Connecting to Data Source – Connecting to Database, Different types of Tableau Joins.
3	Creating a View - formatting charts, adding filters, creating calculated fields and defining parameters.
4	Dashboard Design and Storytelling – Components of Dashboard, Understanding how to place worksheets in Containers, Action filters and its types.
5	Introducing Power BI –Components and the flow of work. Power BI Desktop Interface-The Report has five main areas.
6	Querying Data from CSV - Query Editor, Connecting the data from the Excel Source, Clean, Transform the data.
7	Creating Reports & Visualizations - Different types of charts, Formatting charts with Title, Colors.
8	Dashboards - Filters in Power BI, Formatting dashboards.
9	Analysis of revenue in sales dataset: i) Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue. ii) Create a line chart to show the revenue based on the month of the year. iii) Create a bin of size 10 for the age measure to create a new dimension to show the revenue. iv) Create a donut chart view to show the percentage of revenue per region by creating zero access in the calculated field.

	v) Create a butterfly chart by reversing the bar chart to compare female & male revenue based on product category.
	vi) Create a calculated field to show the average revenue per state & display profitable & non-profitable state.
	vii)vii) Build a dashboard.
10	**Analysis of GDP dataset:**
	Visualize the countries data given in the dataset with respect to latitude and longitude along with country name using symbol maps.
	Create a bar graph to compare GDP of Belgium between 2006 – 2026.
	Using pie chart, visualize the GDP of India, Nepal, Romania, South Asia, and Singapore by the year 2010.
	Visualize the countries Bhutan & Costa Rica competing in terms of GDP.
	Create a scatter plot or circle views of GDP of Mexico, Algeria, Fiji, Estonia from 2004 to 2006.
	Build an interactive dashboard.
11	**Analysis of HR Dataset:**
	i) Create KPI to show employee count, attrition count, attrition rate, attrition count, active employees, and average age.
	ii) Create a Lollipop Chart to show the attrition rate based on gender category.
	iii) Create a pie chart to show the attrition percentage based on Department Category- Drag department into colours and change automatic to pie. Entire view, Drag attrition count to angle. Label attrition count, change to percent, add total also, edit label.
	iv) Create a bar chart to display the number of employees by Age group,
	v) Create a highlight table to show the Job Satisfaction Rating for each job role based on employee count.
	vi) Create a horizontal bar chart to show the attrition count for each Education field Education field wise attrition – drag education field to rows, sum attrition count to col,
	vii) Create multiple donut chart to show the Attrition Rate by Gender for different Age group.
12	**Analysis of Amazon Prime Dataset:**
	Create a Donut chart to show the percentage of movie and tv shows
	Create a area chart to shows by release year and type
	Create a horizontal bar chart to show Top 10 genre
	Create a map to display total shows by country
	Create a text sheet to show the description of any movie/movies. vi) Build an interactive Dashboard.

Instructions for conduction of practical part:

LAB Activities: Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.

Experiential Learning: Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

II. COURSE OUTCOMES	
CO1	Design the experiment to create basic charts and graphs using Tableau and Power BI.
CO2	Develop the solution for the given real world problem.
CO3	Analyze the results and produce substantial written documentation.

III. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2	3	1	3				2				2	
CO2	2	2	3	1	3				2				2	
CO3	2	2	3	1	3				2				2	

IV. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 4

Semester End Examination (SEE): Refer Annexure Section 4

V.   Learning Resources

V (a) Suggested Learning Resources:

1. Microsoft Power BI Dashboards Step by Step by Errin O'Connor, 2019 Pearson Education, Inc

2. Information Dashboard Design: Displaying Data for At-a-glance Monitoring" by Stephen Few

3. The DATA VISUALIZATION WORKSHOP –Mario Dobber and Tim GroBmann, Pkt publishing ltd.

V(b): Web links and Video Lectures (e-Resources):

1 https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial- home.htm

2. https://www.tutorialspoint.com/tableau/index.htm

3. https://www.simplilearn.com/tutorials/power-bi-tutorial/power-bi-vs-tableau

VI: Activity Based Learning / Practical Based Learning/Experiential learning:

Practical Based Learning

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science& Engineering (Data Science)

Semester:	V		Course Type:	PEC	
Course Title: Computer Vision					
Course Code:		**23CDP511**		**Credits:**	03
Teaching Hours/Week (L: T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	3

I. Course Objectives:	

- To understand the fundamentals of computer vision and digital image processing.
- To introduce the processes involved in image enhancement and restoration.
- To facilitate the students to gain understanding of colour image processing and morphology.
- To impart the knowledge of image segmentation and object recognition techniques.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

l. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4.Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5.Use animations/videos to help the students to understand the concepts.

6.Demonstrate the concepts using a suitable programming language.

III. COURSE CONTENT	
Module-1	**08 Hrs**
Heading: Introduction: Definition and history of computer vision. Photometric image formation. Digital camera. Image Processing: Point operators, linear filtering **Textbook:**Text Book 1: Chapter: sections Ch-1(1.1, 1.2), Ch-2(2.2, 2.3), Ch-3(3.1, 3.2)	
RBT Levels: L1, L2& L3	
Module-2	**08 Hrs**

Heading: Image Processing: More neighborhood operators, Fourier Transforms, Pyramids and wavelets, Geometric transformations.		

Textbook:Text Book 1:Chapter: sections Ch-3 (3.3 – 3.6)

RBT Levels: L1, L2 & L3

Module-3	**08 Hrs**

Heading: Image Restoration and Reconstruction:Model of Image degradation / restoration process, restoration in the presence of noise only, periodic noise reduction by frequency domain filtering.
Image Segmentation: Fundamentals, Point, Line and Edge detection, thresholding(foundation and basic thresholding), segmentation by region growing, region splitting and merging.

Textbook:textbook 2:Chapter: sections Ch-5 (5.1 to 5.4), Ch-10 (10. 1 to 10.3.2, 10.4)

RBT Levels: L1, L2 & L3

Module-4	**08 Hrs**

Heading: Color Image Processing: Color fundamentals, color models, pseudo color image processing, full color image processing, color transformations, color image smoothing and sharpening, using color in image segmentation, noise in color images.

Textbook:Text Book 2:Chapter: sections Ch-6 (6.1 – 6.8)

RBT Levels: L1, L2, L3

Module-5	**08 Hrs**

Heading: Morphological Image Processing: Preliminaries, Erosion and Dilation, opening and closing, Hit-or-miss transform, basic morphological algorithms.
Feature Extraction: Background, boundary processing(boundary following and chain codes only).
Image Pattern Classification: Background, Patterns and Classes, Pattern classification by prototype matching (minimum distance classifier)

Textbook: Text Book 2:Chapter: sections Ch-(9. 1 – 9.5), Ch-11 (11.1 to 11.2.2), Ch-12 (12. 1 to 12. 3.1)

RBT Levels: L1, L2 & L3

IV. COURSE OUTCOMES

CO1	Explain the fundamentals of computer vision and its applications.
CO2	Apply the image enhancement techniques for smoothing and sharpening of images
CO3	Compare the different image restoration and segmentation techniques.
CO4	Demonstrate the smoothing and sharpening techniques for color images.
CO5	Explain morphological, feature extraction, and pattern classification techniques for object recognition.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2			2							1	1	
CO2	2	2			2							1	1	
CO3	2	2			2							1	1	
CO4	2	2			2							1	1	
CO5	2	2			2							1	1	

	VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Computer Vision: Algorithms and Applications	Richard Szeliski	2nd Edition, 2022	Springer
2.	Multiple View Geometry in Computer Vision	Richard Hartley and Andrew Zisserman	2nd Edition, 2004 3	Cambridge University Press
3.	Computer Vision: A Modern Approach	David A. Forsyth and Jean Ponce	2nd Edition, 2011	Prentice Hall

VII(b): Reference Books:

1.	Computer Vision: A Modern Approach	David Forsyth and Jean Ponce	2nd edition ,2015.	Pearson
2.	Concise Computer Vision – An Introduction into Theory and Algorithms	Reinhard Klette,	2014	Springer

VII(c): Web links and Video Lectures (e-Resources):

- Virtual Labs: https://cse 19
- https://cse19-iiith.ylabs.ac.in/
- https://_Qnlinecourses.nptel.ac:in/noc21 ee78/preview

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Programming Assignment-I: Implementation of important concepts of Image enhancement (point & filters) and restoration techniques with C++/Java/Python

Programming Assignment-2: Implementation of segmentation, Morphological and colour image processing techniques with C++/Java/Python

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	PEC		
Course Title: Exploratory Data Analysis					
Course Code:	**23CDP512**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I.   Course Objectives:

- To equip students with the necessary skills in Python, IPython, and Jupyter for performing data analysis tasks.

- To provide students with an in-depth understanding of NumPy for effective scientific computation.

- To introduce both basic and advanced techniques for data manipulation using Pandas.

- To develop proficiency in data visualization through Matplotlib and Seaborn.

- To introduce the concepts of Machine Learning with hands-on applications using Scikit-Learn.

- To encourage the practical use of data analysis tools and techniques on real-world datasets.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The lecturer's approach (L) should not be limited to traditional lectures; alternative and effective teaching methods should be considered to achieve the desired outcomes.

2. Utilize videos, animations, and demonstrations to illustrate the functioning of various concepts.

3. Foster collaborative learning (group learning) within the classroom environment.

4. Pose at least three higher-order thinking (HOT) questions during class to encourage critical thinking.

5. Implement Problem-Based Learning (PBL) to enhance students' analytical skills and promote design thinking, focusing on abilities like design, evaluation, generalization, and analysis, rather than mere memorization.

6. Leverage animations and videos to aid students in comprehending complex concepts.

7. Demonstrate key concepts using Python and its associated libraries.

III. COURSE CONTENT	
Module-1	**08 Hrs**
Heading: Introduction to Python and NumPy: The Basics of NumPy Arrays, Sorted Arrays, Structured Data: NumPy's Structured Arrays **Textbook-1:Chapter: sections: Ch-2, Ch-5, Ch-11, Ch-12**	
RBT Levels: L1, L2 & L3	
Module-2	**08 Hrs**
Heading: Introducing Pandas Objects, Handling Missing Data, Hierarchical Indexing, Pivot Tables. **Textbook-1: Chapter: sections Ch-13, Ch-16, Ch-17, Ch-21**	
RBT Levels:L1, L2 & L3	
Module-3	**08 Hrs**
Heading: Vectorized String Operations, Working with Time Series, High Performance Pandas: eval and query. **Textbook-1:Chapter: sections Ch-22, Ch-23, Ch-24**	
RBT Levels:L1, L2 & L3	
Module-4	**08 Hrs**
Heading: General Matplotlib Tips, Simple Line Plots, Simple Scatter Plots, Visualization with Seaborn. **Textbook-1: Chapter: sections Ch-25, Ch-26, Ch-27, Ch-36**	
RBT Levels:L1, L2 & L3	
Module-5	**08 Hrs**
Heading: Machine Learning, Introducing Scikit-Learn, Hyperparameters and Model Validation. **Textbook-1: Chapter: sections Ch-37, Ch-38, Ch-39**	
RBT Levels:L1, L2 & L3	

IV. COURSE OUTCOMES

CO1	Demonstrate the application of the NumPy for performing data analysis tasks.
CO2	Make use of Pandas for various data manipulation tasks.
CO3	Apply advanced data manipulation techniques to real-world datasets.
CO4	Develop data visualizations using Matplotlib and Seaborn to effectively communicate data insights.
CO5	Explain the fundamental concepts of machine learning and validation models using Scikit-Learn.

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3				2				1				3	
CO2	3	2			2				1				3	
CO3	3	3	2		2									3
CO4	3					2				3			3	
CO5	3	3	2	2	2									3

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Python Data Science Handbook: Essential Tools for Working with Data,	Jake VanderPlas	2nd Edition, 2022.	Oreilly

VII(b): Reference Books:

1	Python Data Analytics	Fabio Nelli	3rd Edition, 2023	Apress

VII(c): Web links and Video Lectures (e-Resources):

● Numpy Tutorial - https://www.w3schools.com/python/numpy/default.asp
● Pandas Tutorial - https://www.w3schools.com/python/pandas/default.asp
● Matplotlib Tutorial - https://www.w3schools.com/python/matplotlib_intro.asp
● Introduction to ML with Scikit Learn - https://scikit-learn.org/1.4/tutorial/basic/tutorial.html

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

● Programming Assignment-1: Implementation of important concepts of data manipulation using NumPy and Pandas (Python) - 10 Marks
● Programming Assignment-2: Implementation of simple Machine Learning models with Visualization using Python (MatPlotlib, Scikitlearn) - 15 Marks

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	PEC		
Course Title: Data Warehousing 2.0					
Course Code:	**23CDP513**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }		3:0:0:0		**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I. Course Objectives:	

To understand the need of data warehousing.

● To understand the planning a data warehouse based on business requirements

● To understand the architectural components of Data warehouse

● To understand the data modeling approaches in Data Warehousing

● To understand OLAP operations and use them effectively to improve data quality

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking. 5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it. 6. Introduce Topics in manifold representations.

7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.

8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

III. COURSE CONTENT	
Module-1:	**08 Hrs**

Escalating Need for Strategic Information, Failures Of Past Decision-Support Systems, Operational Versus Decision-Support Systems, Data warehousing—The Only Viable Solution, Data Warehouse Defined. **Data Warehouse:** The Building Blocks: Defining Features, Data Warehouses and Data Marts, Architectural Data Warehouse: Types, Components: Source Data Component, Data Staging Component, Data Storage Component, Information Delivery Component, Metadata Component, Management and Control Component, Metadata In The Data Warehouse.

Textbook:Chapter:sections Ch:1,2

RBT Levels: L1, L2 & L3

Module-2:	08 Hrs

Planning And Project Management: Planning Your Data Warehouse, The Data Warehouse Project, The Development Phases, The Project Team, Project Management Considerations Defining

The Business Requirements: Dimensional Analysis, Information Packages: Requirements Not Fully Determinate, Business Dimensions, Dimension Hierarchies and Categories, Key Business Metrics Or Facts, Requirements Gathering Methods, Data Sources, Data Transformation, Data Storage, Information Delivery, Information Package Diagrams.

Requirements As The Driving Force For Data warehousing : Data Design , The Architectural Plan , Data Storage Specifications , Information Delivery Strategy.

Textbook:Chapter:sections Ch: 4,5,6

RBT Levels: L1, L2 & L3

Module-3:	**08 Hrs**

Architectural Components: Understanding Data Warehouse Architecture, Distinguishing Characteristics, Architectural Framework, Technical Architecture.

Infrastructure As The Foundation For Data warehousing: Infrastructure Supporting Architecture, , Database Software , Collection Of Tools , Data Warehouse Appliances .

The Significant Role of Metadata: Metadata Defined, , Metadata Repository, Metadata Management,

Textbook 1:Chapter:sections CH: 7,8,9
Textbook 2:Chapter:sections CH: 11

RBT Levels: L1, L2 & L3

Module-4:	**08 Hrs**

Principles Of Dimensional Modeling: From Requirements To Data Design , E-R Modeling Versus Dimensional Modeling, The Star Schema , Star Schema Keys , Advantages Of The Star Schema , Star Schema: Examples .

Dimensional Modeling Advanced Topics: Updates To The Dimension Tables, The Snowflake Schema, Aggregate Fact Tables.

Data Extraction, Transformation, And Loading: ETL Overview, ETL Requirements And Steps, Data Extraction, Data Transformation, Data Loading, ETL Tool Options, Reemphasizing ETL Metadata.

Textbook:Chapter:sections Ch: 10,11,12

RBT Levels: L1, L2 & L3	
Module-5	**08 Hrs**

Data Quality: A Key To Success: Why Is Data Quality Critical? Data Quality Challenges, Data Quality Tools, Data Quality Initiative,. **Matching Information To The Classes Of Users**: Information From The Data Warehouse, Who Will Use The Information? Information Delivery framework, **On-Line Analytical Processing(OLAP)**: Need of OLAP, Multidimensional Data Model, OLAP Guidelines, Multidimensional versus Multirelational OLAP, OLAP Models: MOLAP Modele, ROLAP Model.

MLops – what is MLop, Key components of MLops,

Textbook1 :Chapter: sections Ch:13,14,15,16
Textbook2 :Chapter: sections Ch:13

RBT Levels: L1, L2 & L3

IV. COURSE OUTCOMES

CO1	Explain the need for strategic information and data warehousing.
CO2	Describe necessary skills to plan, manage, and execute data warehouse projects effectively.
CO3	Identify the role of metadata in data warehousing.
CO4	Analyse multi-dimensional modeling techniques for effective data organization in data warehouses.
CO5	Explain the importance of data quality and master data management in data warehousing.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	1	1	-	-						1		2	-
CO2	2	2	2	2	2						2		2	1
CO3	2	2	1	1	-						-		2	1
CO4	2	2	2	2	2						2		2	1
CO5	2	1	1	-	1						1		2	1

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:(Insert or delete rows as per requirement)

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Data Warehousing Fundamentals for IT Professionals,	PAULRAJ PONNIAH,	Second Edition, 2010.	Wiley
2	Data Warehousing. Data Mining & OLAP	Alex Berson Stephen J. Smith	Edition 2004	TATA McGRAW HILL

VII(b): Reference Books:				
1.	Data Warehousing in the Real World	Sam Anahory Dennis Murray	2020	Pearson

VII(c): Web links and Video Lectures (e-Resources):

https://archive.nptel.ac.in/courses/106/105/106105191/

● https://www.youtube.com/watch?v=m-aKj5ovDfg

● https://onlinecourses.swayam2.ac.in/cec19_cs01/preview

● http://nptel.ac.in/video.php?subjectId=106106093

● http://textofvideo.nptel.iitm.ac.in/video.php?courseId=106106093&p=4

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Presentation / Group Discussion/ Assignments.

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	PEC		
Course Title: NOSQL Databases					
Course Code:	**23CDP514**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I.	Course Objectives:

This course will enable students to: • Understand the importance and need of NoSQL • Exposure to Map-reduce and Key-Value databases • Understand fundamentals of Document Databases • Identify different usecases where graph databases are advantageous

II. Teaching-Learning Process (General Instructions):

Mention the planned/proposed sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

III. CO URSE CONTENT	
Module-1:	08 Hrs
Why NoSQL : The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL Aggregate Data Models: Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Summarizing Aggregate-Oriented Databases. More Details on Data Models: Relationships, Graph Databases, Schema less Databases, Materialized Views, **Textbook1:Chapter:sections Ch:1,2,3**	
RBT Levels: L1, L2 & L3	
Module-2:	**08 Hrs**
Distribution Models: Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. **Consistency:** Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem. Version Stamps: Business and System Transactions, Version Stamps on Multiple Nodes. **Textbook1:Chapter:sections 4,5,6**	
RBT Levels: L1, L2 & L3	
Module-3:	**08 Hrs**
Map-Reduce: Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce Key-Value Databases: What Is a Key-Value Store, Key-Value Store Features: Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases: Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use: Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets. **Textbook1:Chapter:sectionsCh: 7,8**	
RBT Levels: L1, L2 & L3	
Module-4:	**08 Hrs**
Document Databases: What Is a Document Database? Features: Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases: Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, ECommerce Applications, When Not to Use: Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure. **Textbook1:Chapter:sections Ch:9**	
RBT Levels: L1, L2 & L3	
Module-5:	**08 Hrs**
Graph Databases: What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases: Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use. **Textbook 1:Chapter:sections Ch:11**	
RBT Levels: L1, L2 & L3	
IV. COURSE OUTCOMES	
CO1	Differentiate between NoSQL and traditional databases.

CO2	Analyze the need of NoSQL in handling huge databases.
CO3	Use of Map-Reduce concepts for concurrent processing of larger datasets.
CO4	Apply the concepts document databases for different real time use cases.
CO5	Analyse the impact of Graph databases in discovering complex relationships and hidden patterns in data.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2	1	1	1							1	2	
CO2	2	2	2	2	3							1	2	1
CO3	2	2	2	2	3							1	2	1
CO4	2	2	2	2	3							1	2	1
CO5	2	2	2	2	3							1	2	1

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence,	Pramod J.Sadalage, P. & Fowler,	2012	Pearson Addison Wesley

VII(b): Reference Books:

1	"NoSQL For Mere Mortals",	Dan Sullivan,	1st Edition,2015.(ISBN13: 978-9332557338)	Pearson Education India,
2	"Making Sense of NoSQL: A guide for Managers and the Rest of us",	Dan McCreary and Ann Kelly,	1st Edition, 2013. (ISBN-13: 978-9351192022)	Manning Publication/Dreamtech Press,

VII(c): Web links and Video Lectures (e-Resources):

1. https://www. neo4j.com/docs/cypher-manual/current/introduction/
2. https://www.mongodb.com

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Presentation / Group Discussion/ Assignments.

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Sri Adichunchanagiri Shikshana Trust (R)

SJB Institute of Technology

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Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	ETC		
Course Title: Java Full Stack Development					
Course Code:	**23CDE531**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03 hrs

I. Course Objectives:

- Gain a solid understanding of Enumerations and Annotations.
- Utilize Generic classes effectively in Java programs.
- Explore and implement fundamental String operations.
- Develop dynamic web applications using Java Servlets and JSP.
- Integrate database interactions using Java Database Connectivity (JDBC).

II. Teaching-Learning Process (General Instructions):

The following are some of the strategies that teachers can employ to facilitate the achievement of various course outcomes:

1. Diverse Teaching Methods: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.

2. Visual Aids: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.

3. Collaborative Learning: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.

4. Higher Order Thinking (HOT) Questions: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.

5. Problem-Based Learning (PBL): Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.

6. Multiple Representations: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.

7. Creative Problem Solving: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.

8. Real-World Application: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehensionand retention.

- Chalk & Talk
- Stud. Assignment
- Web Resources
- LCD/Smart Boards
- Stud. Seminars

III. COURSE CONTENT	

Module-1	08 Hrs

Java Fundamentals: Describe the use of main in a Java application, perform basic input and output using standard packages, Evaluate the scope of a variable, Comment and document programs.

Data Types, Variables: Declare and use primitive data type variables, Construct and evaluate code that manipulates strings, Construct and evaluate code that creates, iterates, and manipulates arrays and array lists, Construct and evaluate code that performs parsing, casting, and conversion, Construct and evaluate arithmetic expressions.

Textbook:1 Chapter 2: sections Ch-2: 2.3-2.6, Ch-3: 3.1-3.5

Pre-requisites (Self Learning)

Basic understanding of what programming is and familiarity with concepts like algorithms and flowcharts. Basic knowledge of at least one other programming language (optional but helpful).
Basic arithmetic operations (addition, subtraction, multiplication, division).Understanding of mathematical expressions and operator precedence.

RBT Levels: L1, L2, L5, L6

Module-2	08 Hrs

Flow Control Implementation: Construct and evaluate code that uses branching statements and loops, logical operators and constructs.

Object-Oriented Programming: Construct and evaluate class definitions, Declare, implement, and access data members in classes, Implement code on oops (Encapsulation, Inheritance, Polymorphism, Abstraction, Interface).

Textbook:1 Chapter 5: sections Ch-5: 5.4-5.6, Ch-6: 6.1-6.4

Pre-requisites (Self Learning)

Basic knowledge of logical operators and constructs. Ability to trace and understand simple flowcharts and pseudo code. Understanding the concepts of classes and objects. Familiarity with terms like inheritance, polymorphism, and encapsulation (basic level).

RBT Levels: L5, L6

Module-3	08 Hrs

Declare, implement, and access methods,Instantiate and use class objects in programs Troubleshoot syntax errors, logic errors, and runtime errors, Implement exception handling.

Enumerations: Enumerations, Enumeration fundamentals, the values() and valueOf() methods, Java enumerations are class types, enumerations inherits Enum, example, type wrappers.

Generics: What are Generics, A Generic Class with Two Type Parameters, The General Form of a Generic Class, Bounded Types, Using Wildcard Arguments, Creating a Generic Method, Generic Interfaces, Raw types and Legacy code, Generic Class Hierarchies,Ambiguity errors, Some Generic Restrictions

Textbook:1 Chapter 6: sections Ch-6: 6.8-6.10, Ch-12, Ch-14

Pre-requisites (Self Learning)	
Understanding of method overloading and overriding. Familiarity with the concept of constructors and destructors in any programming language. Basic Knowledge on Enumerations and Generics in Java.	
RBT Levels: L1,L2, L3	
Module-4:	**08 Hrs**
String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf (), Changing the case of characters within a String, String Buffer, String Builder. **The life cycle of a servlet:** A simple servlet; the servlet API; The javax.servlet package Reading servlet parameter; the javax.servlet.http package; Handling HTTP Requests and Responses; using Cookies; Session Tracking.	
Textbook:1:Chapter: sections Ch-5, Ch-31	
Pre-requisites (Self Learning)	
Understanding of string handling and the life cycle of a servlet by knowing the basic knowledge on API, servlet, cookies and handling HTTP requests and responses.	
RBT Levels: L1, L2 & L3	
Module-5	**08 Hrs**
Java Server Pages (JSP): JSP tags, Variables and Objects, Methods, Control statements, Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects. **The concept of JDBC:** JDBC Driver Types; JDBC packages; A brief overview of the JDBC Process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; Result Set; Transaction Processing; Metadata, Data Types; Exceptions.	
Textbook:2: Chapter: sections Ch-11, Ch-6	
Pre-requisites (Self Learning)	
Understanding the Java server pages and the JDBC drivers and its components.	
RBT Levels: L1, L2 & L3	

IV. COURSE OUTCOMES

CO1	Proficiently write and execute Java programs with proper structure and documentation.
CO2	Effectively perform data manipulation and conversion using primitive types, strings, arrays, and array lists.
CO3	Utilize control flow statements to create logical and efficient program execution.
CO4	Design and implement classes with appropriate data members and methods, applying object-oriented principles.
CO5	Debug, troubleshoot, and handle exceptions to maintain robust and error-free code.
CO6	Develop comprehensive Java applications that integrate all learned concepts and techniques.

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	1	3	3	2						1	2	2	2
CO2	1	2	2	2	2						2	1	2	1

CO3	2	2	2	2	2					1	2	1	1
CO4	2	2	2	2	1					1	2	2	2
CO5	2	2	3	2	1					2	1	2	1
CO6	2	2	2	2	1					2	1	2	1

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations

Continuous Internal Evaluation (CIE): Refer Annexure Section 1.

Semester End Examination (SEE): Refer Annexure Section 1.

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	JAVA the Complete	Herbert Schildt	Reference 9 th Edition	Tata McGraw-Hill 2
2	The Complete Reference J2EE	Jim Keogh	7 th Edition	Tata McGraw-Hill

VII(b): Reference Books:

1	Introduction to JAVA Programming	Y. Daniel Liang	7th Edition, 2007	Pearson Education

VII(c): Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106/105/106105191/
- https://nptel.ac.in/courses/106/105/106105225/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes and Seminar.

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Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	ETC		
Course Title: Web Programming					
Course Code:	**23CDE532**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }		3:0:0:@		**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03 hrs

I.   Course Objectives:

- To develop dynamic website using JavaScript, JDBC
- To get expertise of Java Server Pages and Servlets for server-side programming.
- To become familiar with the data operations carried out by XML-based web applications.

II. Teaching-Learning Process (General Instructions):

1. To achieve expertise in developing dynamic websites using JavaScript and JDBC, mastering Java Server Pages (JSP) and Servlets for server-side programming, and understanding data operations in XML-based web applications, a structured teaching-learning approach is essential.

2. The learning process should begin with foundational concepts through theoretical lessons, followed by hands-on practical exercises.

3. Interactive coding sessions, real-world projects, and case studies should be incorporated to enhance problem-solving skills.

4. Tutorials, online resources, and guided assignments can help reinforce key concepts. Regular coding challenges and debugging exercises will improve logical thinking and practical application.

5. Collaborative learning through peer discussions, group projects, and code reviews will encourage knowledge sharing. Additionally, integrating XML processing with real-time applications will strengthen the understanding of data operations.

6. Evaluations through quizzes, mini-projects, and assessments will track progress, ensuring a comprehensive learning experience that builds both theoretical knowledge and practical expertise.

III. COURSE CONTENT	
Module-1	**08 Hrs**
Introduction to WEB Programming: Internet, WWW, Web Browsers, and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox. **Textbook: Chapter: sections Ch-1: 1.1 to 1.9**	
RBT Levels: L1 & L2	
Module-2	**08 Hrs**
HTML and XHTML: Origins of HTML and XHTML, Basic syntax, Standard XHTML document structure, Basic text markup, Images, Hypertext Links, Lists, Tables. Forms, Frames in HTML and XHTML, Syntactic differences between HTML and XHTML **Textbook: Chapter: sections Ch-2: 2.1 to 2.9**	
RBT Levels: L1, L2 & L3	
Module-3	**08 Hrs**
CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, Background images, tags. **Textbook 1: Chapter: sections Ch-3: 3.1 to 3.12**	
RBT Levels: L1, L2 & L3	
Module-4	**08 Hrs**
Java Script – I: Object orientation and JavaScript; General syntactic characteristics; Primitives, Operations, and expressions; Screen output and keyboard input. **Textbook 1: Chapter: sections Ch-4 : 4.1 to 4.5**	
RBT Levels: L1, L2 & L3	
Module-5	**08 Hrs**
Java Script – II: Control statements, Object creation and Modification; Arrays; Functions; Constructor; Pattern matching using expressions; Errors, Element access in JavaScript. **Textbook 1: Chapter: sections Ch- 4: 4.6 to 4.14**	
RBT Levels: L1, L2 & L3	
IV. COURSE OUTCOMES	
CO1	Describe the fundamentals of web and concept of HTML.
CO2	Use the concepts of HTML, XHTML to construct the web pages.
CO3	Interpret CSS for dynamic documents.
CO4	Evaluate different concepts of JavaScript & Construct dynamic documents.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3				2							1	2	
CO2			3		2				1					3
CO3			3		2					1				3
CO4			3	2	1									3

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks: (Insert or delete rows as per requirement)

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the Publisher
1	Programming the World Wide Web	Robert W Sebesta	6th Edition, 2008.	Pearson Education

VII(b): Reference Books: (Insert or delete rows as per requirement)

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the Publisher
1	Internet & World Wide Web How to program	M.Deitel, P.J.Deitel, A.B.Goldberg	3rd Edition, 2004.	Pearson Education / PHI
2	Web Programming Building Internet Applications	Chris Bates	3rd Edition, 2006.	Wiley India

VII(c): Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=HcOc7P5BMi4&list=PLfqMhTWNBTe0PY9xunOzsP5kmYIz2Hu7i

2. https://www.youtube.com/watch?v=l1EssrLxt7E&list=PLfqMhTWNBTe3H6c9OGXb5_6wcc1Mca52n

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quiz, Case Studies, Mini Projects

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science Engineering (Data Science)

Semester:	V			Course Type:	ETC	
Course Title: IOT Analytics						
Course Code:		**23CDE533**		**Credits:**		03
Teaching Hours/Week (L: T:P:O) {O – Other pedagogies, mention @}			3:0:0:@	**Total Hours:**		40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**		100
SEE Type:		Theory		**Exam Hours:**		03

I. Course Objectives:

- Understand the recent application domains of IoT in everyday life.
- Understand the protocols and standards designed for IoT and the current research on it.
- Understand the other associated technologies like cloud and fog computing in the domain of IoT.
- Improve knowledge about the various cutting-edge technologies in the field IoT and machine learning applications.
- Gain insights about the current trends of machine learning and AI techniques used in IoT to orient towards the present industrial scenario.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Use of PowerPoint presentation
2. Think -pair and share techniques
3. Workshop on Arduino and Raspberry Pi
4. Usage of Tinker Cad tool
5. Overview of the real-world applications of IoT from the published papers.

III. COURSE CONTENT

Module-1	08 Hrs

Introduction to Internet of Things:
Introduction, Physical design of IOT, Logical Design of IOT, IOT enabling technologies, IOT Levels & Deployment Templates.

Textbook 1:Chapter: sections Ch-1

RBT Levels:L1, L2&L3

Module-2	08 Hrs
IoT Platforms Design Methodology	
Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring, loT Systems - Logical Design using Python: Introduction, Installing Python, Python Data Types and Data structures, Control flow, Functions, Modules, Packages, File Handling, Operations, Classes, Python Packages of Interest for IoT. **Textbook 1:Chapter: sections Ch- 5 5.1-5.3,6.2-6.11**	
RBT Levels: L1, L2 & L3	
Module-3:	08 Hrs
IoT Physical Devices & End points:	
What is a IoT Device, Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Case Studies illustrating IoT design – Home Automation, Cities, Agriculture. **Textbook 1:Chapter: sections Ch-7 7.1-7.6,9.2,9.3,9.5**	
RBT Levels: L1, L2 & L3	
Module-4:	08 Hrs
Data and Analytics for IoT	
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment. **Textbook 2Chapter: sections Ch-5, Ch-6 (6.1 – 6.6), Ch-7 (7.1 – 7.9), Ch-10**	
RBT Levels: L1, L2 & L3	
Module-5:	08 Hrs
IoT Physical Devices and Endpoints - Arduino UNO	
Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples. **Textbook 2Chapter: sections Ch-3, Ch-4 (4.1 – 4.9), Ch-9 (9.1 – 9.5)**	
RBT Levels: L1, L2 & L3	
IV. COURSE OUTCOMES	

CO1	Explain the evolution of IoT, IoT networking components, and addressing strategies in IoT.
CO2	Analyze various sensing devices and actuator types.
CO3	Demonstrate the processing in IoT.
CO4	Apply different connectivity technologies.
CO5	Elaborate the need for Data Analytics and Security in IoT.

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2			2							1	1	
CO2	2	2			2							1	1	
CO3	2	2			2							1	1	
CO4	2	2			2							1	1	
CO5	2	2			2							1	1	

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Internet of Things- A Hands On Approach	Arshdeep Bahga, Vijay Madisetti	2014	Universities press
2.	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry		

VII(b): Reference Books:

1.	Internet of Things	Srinivasa K G	2017	CENGAGE Leaning India

VII(c): Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
- https://docs.arduino.cc/
- https://www.arduino.cc/education/certification
- https://www.udemy.com/topic/arduino/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Mini projects by the students (2 to 4) using Arduino board and Raspberry Pi boards
- Demonstration of projects using Tinker Cad tool.

SJB Institute of Technology

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:		Emerging Technology Course(ETC)	
Course Title:	**Information and Network Security**				
Course Code:	**23CDE534**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}				**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I. Course Objectives:

- Analyze Digital Security Lapses
- Illustrate the Need for Key Management
- Evaluate Cryptographic Hash Functions and Their Applications
- Examine Authentication Mechanisms in Cyber security
- Demonstrate the Role of Cryptography in Network Security

II. Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

6. Use any of these methods: Chalk and board, Active Learning, Case Studies.

III. COURSE CONTENT

Module-1	08 Hrs

Introduction to Cryptography, How to Speak Crypto. Classic Crypto. Simple Substitution Cipher. Cryptanalysis of a Simple Substitution. Definition of Secure. Modern Crypto History. Taxonomy of Cryptography, Taxonomy of Cryptanalysis

TextBook1: Chapter: sections Ch- 2

RBT Levels: L1, L2

Module-2													08 Hrs	

What is a Hash Function? The Birthday Problem, Non-cryptographic Hashes. Tiger Hash. HMAC. Uses of Hash Functions. (Online Bids. Spam Reduction), Other Crypto-Related Topics. Random Numbers. Generating Random Bits. Information Hiding.

TextBook1: Chapter: sections Ch-5: 5.1-5.3, 5.5-5.9

RBT Levels: L1, L2 &L3

Module-3													08 Hrs	

Random number generation, Providing freshness, Fundamentals of entity authentication, Passwords, Dynamic password schemes, Zero-knowledge mechanisms, Cryptographic Protocols, Protocol basics, Analysing a simple protocol, Authentication and key establishment protocols

TextBook2: Chapter: sections Ch-8: 8.1-8.6, Ch-9: 9.1-9.4

RBT Levels: L1 & L2

Module-4													08 Hrs	

Key management fundamentals, Key generation Key establishment, Key storage Key usage Governing key management, Public-Key Management, Certification of public keys, Public-key management models.

TextBook2: Chapter: sections Ch-10, Ch-11

RBT Levels: L1, L2 & L3

Module-5													08 Hrs	

Cryptographic Applications Cryptography on the Internet, Cryptography for wireless local area networks, Cryptography for mobile telecommunications, Cryptography for secure payment card transactions, Cryptography for identity cards, Cryptography for home users

TextBook2: Chapter: sections Ch-12

RBT Levels: L1, L2

IV. COURSE OUTCOMES	
CO1	Explain fundamental concepts of cryptography, classical encryption techniques, cryptanalysis, and security principles.
CO2	Demonstrate the working of hash functions, HMAC, and their applications in data integrity and security.
CO3	Analyze entity authentication mechanisms, password-based schemes, zero-knowledge proofs, and cryptographic protocols.
CO4	Evaluate key management techniques, public-key infrastructure, and key establishment mechanisms.
CO5	Apply cryptographic techniques in various real-world applications, including networks, mobile communications, and secure transactions.

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)														
PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	1									2	

CO2	3	3	3	2	2								2	1
CO3	3	2	2	3	2								2	1
CO4	3	3	3	3	2	2							1	
CO5	3	3	2	3	3								1	1

VI.   Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII.   Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Information Security: Principles and Practice	Mark Stamp	2nd Edition	Wiley
2.	Everyday Cryptography: Fundamental Principles and Applications	Keith M. Martin	December 2013	Oxford Scholarship Online

VII(b): Reference Books:

1.	Applied Cryptography Protocols, Algorithms, and Source Code in C	Bruce Schneier	January, 1996	John Wiley & Sons, Inc

VII(c): Web links and Video Lectures (e-Resources):

- https://gchq.github.io/CyberChef/
- https://cryptopals.com/
- https://play.google.com/store/apps/details?id=com.northcrypt.quiz
- https://play.google.com/store/apps/details?id=com.softwarriors.cryptochallenge

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Implementation of various protocols using open source simulation tools.
- Quiz/Presentation

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Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	AEC			
Course Title: DEVOPS						
Course Code:		**23CDAE51**			**Credits:**	01
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }			0:0:2:0	**Total Hours:**		10 - 12 lab Slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**		100
SEE Type:		Practical		**Exam Hours:**		2

I.   Course Objectives:

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

II.   COURSE CONTENT

Sl. No.	Experiments
1.	**Introduction to Maven and Gradle:** Overview of Build Automation Tools, Key Differences Between Maven and Gradle, Installation and Setup
2.	**Working with Maven:** Creating a Maven Project, Understanding the POM File, Dependency Management and Plugins
3	**Working with Gradle:** Setting Up a Gradle Project, Understanding Build Scripts (Groovy and Kotlin DSL), Dependency Management and Task Automation
4.	**Practical Exercise:** Build and Run a Java Application with Maven, Migrate the Same Application to Gradle
5.	**Introduction to Jenkins:** What is Jenkins?, Installing Jenkins on Local or Cloud Environment, Configuring Jenkins for First Use
6.	**Continuous Integration with Jenkins:** Setting Up a CI Pipeline, Integrating Jenkins with Maven/Gradle, Running Automated Builds and Tests
7.	**Configuration Management with Ansible:** Basics of Ansible: Inventory, Playbooks, and Modules, Automating Server Configurations with Playbooks, Hands-On: Writing and Running a Basic Playbook
8.	**Practical Exercise:** Set Up a Jenkins CI Pipeline for a Maven Project, Use Ansible to Deploy Artifacts Generated by Jenkins

9.	**Introduction to Azure DevOps:** Overview of Azure DevOps Services, Setting Up an Azure DevOps Account and Project
10.	**Creating Build Pipelines:** Building a Maven/Gradle Project with Azure Pipelines, Integrating Code Repositories (e.g., GitHub, Azure Repos), Running Unit Tests and Generating Reports
11	**Creating Release Pipelines:** Deploying Applications to Azure App Services, Managing Secrets and Configuration with Azure Key Vault, Hands-On: Continuous Deployment with Azure Pipelines
12	**Practical Exercise and Wrap-Up:** Build and Deploy a Complete DevOps Pipeline, Discussion on Best Practices and Q&A

Instructions for conduction of practical part:

● **LAB Activities:** Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.

●**Experiential Learning:** Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

III. COURSE OUTCOMES

CO1	Demonstrate different actions performed through Version control tools like Git.
CO2	Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
CO3	Experiment with configuration management using Ansible.
CO4	Demonstrate Cloud-based DevOps tools using Azure DevOps.

IV. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	2							2	2	1
CO2	2	2	2	2	2							2	2	1
CO3	2	2	2	2	2							2	2	1
CO4	2	2	2	2	2							2	2	

V. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations

Continuous Internal Evaluation (CIE): Refer Annexure Section 4

Semester End Examination (SEE): Refer Annexure Section 4

VI. Learning Resources

Suggested Learning Resources:
● https://www.geeksforgeeks.org/devops-tutorial/
● https://www.javatpoint.com/devops
● https://www.youtube.com/watch?v=2N-59wUIPVI
● https://www.youtube.com/watch?v=87ZqwoFeO88

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Practical Based Learning.

SJB Institute of Technology

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	AEC		
Course Title: Mobile Application Development with Flutter					
Course Code:	**23CDAE52**			**Credits:**	01
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}		0:0:2:0	**Total Hours:**		10-12 Lab slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Practical		**Exam Hours:**	2

I. Course Objectives:

This course will enable students to:

- To introduce basics of Flutter platform for progressive app development
- To gain knowledge on user interface support in Flutter.
- To learn various programming elements required for app development.
- To develop progressive applications with flutter.

II. Teaching-Learning Process (General Instructions):

Note: The following programs should be implemented using flutter framework.

III. COURSE CONTENT

Sl. No.	Experiments
1.	Develop an application using Flutter to print "Hello world and Hello Flutter".
2.	Develop an application using Flutter to Increment and Decrement Numbers (Counter App).
3	Develop Login Screen Application.
4.	Develop a "To-do List" Application.
5.	Develop Calculator Application.
6.	Develop an application to Check the Weather in Countries Across the world (Weather app).
7.	Develop a "Stopwatch" application using Flutter.
8.	Develop an application that Navigate from one Screen to another (Seamless navigation).
9.	Develop Basic E-commerce UI Application.
10.	Develop an application to implement Animates Logo.
11	Develop an application that tracks our daily Expenses and get a report chart.
12	Develop an application to Play Quiz and get the Score Board.

Instructions for conduction of practical part:

● **LAB Activities:** Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.

●**Experiential Learning:** Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

IV. COURSE OUTCOMES

CO1	Demonstrate basics elements Flutter platform for progressive app development.
CO2	Develop user interface designs for applications.
CO3	Experiment with different programming elements of app development.
CO4	Develop progressive applications for real-world problems.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	2							2	2	1
CO2	2	2	2	2	2							2	2	1
CO3	2	2	2	2	2							2	2	1
CO4	2	2	2	2	2							2	2	

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations

Continuous Internal Evaluation (CIE): Refer Annexure Section 4

Semester End Examination (SEE): Refer Annexure Section 4

VII. Learning Resources

Suggested Learning Resources:

● https://flutter.dev/

● https://developers.google.com/learn/pathways/intro-to-flutter

● https://github.com/flutter/flutter

● https://www.geeksforgeeks.org/flutter-tutorial/

● https://www.tutorialspoint.com/flutter/index.htm

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Practical Based Learning.

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Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	AEC		
Course Title: Generative AI					
Course Code:	**23CDAE53**			**Credits:**	01
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }		0:0:2:0		**Total Hours:**	10-12 Lab slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Practical		**Exam Hours:**	2

I. Course Objectives:

This course will enable students to:

- Understand the principles and concepts behind generative AI models
- Explain the knowledge gained to implement generative models using Prompt design frameworks.
- Apply various Generative AI applications for increasing productivity.
- Develop Large Language Model-based Apps.

II. Teaching-Learning Process (General Instructions):

Note: The following programs should be implemented in python language.

III. COURSE CONTENT

Sl. No.	Experiments / Programs / Problems
1.	Explore pre-trained word vectors. Explore word relationships using vector arithmetic. Perform arithmetic operations and analyze results.
2.	Use dimensionality reduction (e.g., PCA or t-SNE) to visualize word embeddings for Q 1. Select 10 words from a specific domain (e.g., sports, technology) and visualize their embeddings. Analyze clusters and relationships. Generate contextually rich outputs using embeddings. Write a program to generate 5 semantically similar words for a given input.
3	Train a custom Word2Vec model on a small dataset. Train embeddings on a domain-specific corpus (e.g., legal, medical) and analyze how embeddings capture domain-specific semantics.
4.	Use word embeddings to improve prompts for Generative AI model. Retrieve similar words using word embeddings. Use the similar words to enrich a GenAI prompt. Use the AI model to generate responses for the original and enriched prompts. Compare the outputs in terms of detail and relevance.
5.	Use word embeddings to create meaningful sentences for creative tasks. Retrieve similar words for a seed word. Create a sentence or story using these words as a starting point.

	Write a program that: Takes a seed word. Generates similar words. Constructs a short paragraph using these words.
6.	Use a pre-trained Hugging Face model to analyze sentiment in text. Assume a real-world application, Load the sentiment analysis pipeline. Analyze the sentiment by giving sentences to input.
7.	Summarize long texts using a pre-trained summarization model using Hugging face model. Load the summarization pipeline. Take a passage as input and obtain the summarized text.
8.	Install langchain, cohere (for key), langchain-community. Get the apikey(By logging into Cohere and obtaining the cohere key). Load a text document from your googledrive . Create a prompt template to display the output in a particular manner.
9.	Take the Institution name as input. Use Pydantic to define the schema for the desired output and create a custom output parser. Invoke the Chain and Fetch Results. Extract the below Institution related details from Wikipedia: The founder of the Institution. When it was founded. The current branches in the institution . How many employees are working in it. A brief 4-line summary of the institution.
10.	Build a chatbot for the Indian Penal Code. We'll start by downloading the official Indian Penal Code document, and then we'll create a chatbot that can interact with it. Users will be able to ask questions about the Indian Penal Code and have a conversation with it.

Instructions for conduction of practical part:

• **LAB Activities:** Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.

•**Experiential Learning:** Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

IV. COURSE OUTCOMES

CO1	Develop the ability to explore and analyze word embeddings, perform vector arithmetic to investigate word relationships, visualize embeddings using dimensionality reduction techniques
CO2	Apply prompt engineering skills to real-world scenarios, such as information retrieval, text generation
CO3	Utilize pre-trained Hugging Face models for real-world applications, including sentiment analysis and text summarization
CO4	Apply different architectures used in large language models, such as transformers, and understand their advantages and limitations.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	2							2	2	1
CO2	2	2	2	2	2							2	2	1
CO3	2	2	2	2	2							2	2	1
CO4	2	2	2	2	2							2	2	

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations

Continuous Internal Evaluation (CIE): Refer Annexure Section 4

Semester End Examination (SEE): Refer Annexure Section 4

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Modern Generative AI with ChatGPT and OpenAI Models: Leverage the Capabilities of OpenAI's LLM for Productivity and Innovation with GPT3 and GPT4	Valentina Alto	2023	Packt Publishing Ltd

VII(b): Reference Books:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Generative AI for Cloud Solutions: Architect modern AI LLMs in secure, scalable, and ethical cloud environment	Paul Singh, AnuragKaruparti	2024	Packt Publishing Ltd

VII(c): Web links and Video Lectures (e-Resources):

- https://youtu.be/eTPiL3DF27U
- https://youtu.be/je6AlVeGOV0
- https://youtu.be/RLVqsA8ns6k
- https://youtu.be/0SAKM7wiC-A
- https://youtu.be/28_9xMyrdjg
- https://youtu.be/8iuiz-c-EBw
- https://youtu.be/7oQ8VtEKcgE
- https://youtu.be/seXp0VWWZV0

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

1. Assignments, Quizzes and Seminar
2. Real world problem solving and puzzles using group discussion. E.g., AI-Generated Fake News Detection, AI Bias & Fairness Puzzleetc

|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	AEC		

Course Title:	React				

Course Code:	23CDAE54			Credits:	01
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }			0:0:2:0	**Total Hours:**	10-12 Lab slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Practical		**Exam Hours:**	2

I.   Course Objectives:

● Enable students to develop React applications utilizing functional and class-based components, effectively managing state with hooks and lifecycle methods .

● Introduce, how to pass data dynamically between parent and child components using props, ensuring modular and reusable component design.

● Create dynamic and responsive applications, integrating forms, validation, task management systems, and styled components.

● Use React Router for navigation, external API integration for dynamic data handling, and CSS styling techniques for modern UI/UX design.

II. Teaching-Learning Process (General Instructions):

Note: The following programs should be implemented in python language.

III. COURSE CONTENT

Sl. No.	Experiments / Programs / Problems
1.	Use create-react-app to set up a new project. Edit the App.js file to include a stateful component with useState. Add an input field and a <h1>element that displays text based on the input. Dynamically update the content as the user types.
2.	Develop a React application that demonstrates the use of props to pass data from a parent component to child components. The application should include the parent component named App that serves as the central container for the application. Create two separate child components, Header: Displays the application title or heading. Footer: Displays additional information, such as copyright details or a tagline. Pass data (e.g., title, tagline, or copyright information) from the App component to the Header and Footer components

	using props. Ensure that the content displayed in the Header and Footer components is dynamically updated based on the data received from the parent component.
3	Create a Counter Application using React that demonstrates state management with the useState hook. Display the current value of the counter prominently on the screen. Add buttons to increase and decrease the counter value. Ensure the counter updates dynamically when the buttons are clicked. Use the useState hook to manage the counter's state within the component. Prevent the counter from going below a specified minimum value (e.g., 0). Add a "Reset" button to set the counter back to its initial value. Include functionality to specify a custom increment or decrement step value.
4.	Develop a To-Do List Application using React functional components that demonstrates the use of the useState hook for state management. Create a functional component named ToDoFunction to manage and display the to do list. Maintain a list of tasks using state. Provide an input field for users to add new tasks. Dynamically render the list of tasks below the input field. Ensure each task is displayed in a user-friendly manner. Allow users to delete tasks from the list. Mark tasks as completed or pending, and visually differentiate them.
5.	Develop a React application that demonstrates component composition and the use of props to pass data. Create two components: FigureList: A parent component responsible for rendering multiple child components. BasicFigure: A child component designed to display an image and its associated caption. Use the FigureList component to dynamically render multiple BasicFigure components. Pass image URLs and captions as props from the FigureList component to each BasicFigure component. Style the BasicFigure components to display the image and caption in an aesthetically pleasing manner. Arrange the BasicFigure components within the FigureList in a grid or list format. Allow users to add or remove images dynamically. Add hover effects or animations to the images for an interactive experience.
6.	Design and implement a React Form that collects user input for name, email, and password. Form Fields are Name, Email, Password. Ensure all fields are filled before allowing form submission.Validate the email field to ensure it follows the correct email format (e.g., example@domain.com). Optionally enforce a minimum password length or complexity. Display error messages for invalid or missing inputs. Provide visual cues (e.g., red borders) to highlight invalid fields. Prevent form submission until all fields pass validation. Log or display the entered data upon successful submission (optional). Add a "Show Password" toggle for the password field. Implement client side sanitization to ensure clean input.
7.	Develop a React Application featuring a ProfileCard component to display a user's profile information, including their name, profile picture, and bio. The component should demonstrate flexibility by utilizing both external CSS and inline styling for its design. Display the following information: Profile picture, User's name, A short bio or description Use an external CSS file for overall structure and primary styles, such as layout, colors, and typography. Apply inline styles for dynamic or specific styling elements, such as background colors or alignment. Design the ProfileCard to be visually appealing and responsive. Ensure the profile picture is displayed as a circle, and the name and bio are appropriately styled. Add hover effects or animations to enhance interactivity. Allow the background color of the card to change dynamically based on a prop or state.

8.	Develop a React Application featuring a ProfileCard component to display a user's profile information, including their name, profile picture, and bio. The component should demonstrate flexibility by utilizing both external CSS and inline styling for its design. Display the following information: Profile picture, User's name, A short bio or description Use an external CSS file for overall structure and primary styles, such as layout, colors, and typography. Apply inline styles for dynamic or specific styling elements, such as background colors or alignment. Design the ProfileCard to be visually appealing and responsive. Ensure the profile picture is displayed as a circle, and the name and bio are appropriately styled. Add hover effects or animations to enhance interactivity. Allow the background color of the card to change dynamically based on a prop or state.
9.	9Design a React application that demonstrates the implementation of routing using the react-router-dom library. The application should include the Navigation Menu: Create a navigation bar with links to three distinct pages, Home, About, Contact. Develop separate components for each page (Home, About, and Contact) with appropriate content to differentiate them. Configure routes using react-router-dom to render the corresponding page component based on the selected link. Use BrowserRouter and Route components for routing. Highlight the active link in the navigation menu to indicate the current page
10.	Design a React application featuring a class-based component that demonstrates the use of lifecycle methods to interact with an external API. The component should fetch and update data dynamically based on user interactions or state changes. Use the componentDidMount lifecycle method to fetch data from an API when the component is initially rendered. Display the fetched data in a structured format, such as a table or list. Use the componentDidUpdate lifecycle method to detect changes in the component's state or props. Trigger additional API calls to update the displayed data based on user input or actions (e.g., filtering, searching, or pagination). Implement error handling to manage issues such as failed API requests or empty data responses. Display appropriate error messages to the user when necessary. Allow users to perform actions like filtering, searching, or refreshing the data. Reflect changes in the displayed data based on these interactions.

Instructions for conduction of practical part:

● **LAB Activities:** Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.

●**Experiential Learning:** Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

IV. COURSE OUTCOMES	
CO1	Illustrate React basics and state components.
CO2	Develop React applications that utilize component composition, passing data through props.
CO3	Use dynamic state updates, event handling, and custom logic to increment, decrement, and reset state values.

| CO4 | Implement forms in React that collect and validate user input. |
| CO5 | Implement forms in React that collect and validate user input. |

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	2							2	2	1
CO2	2	2	2	2	2							2	2	1
CO3	2	2	2	2	2							2	2	1
CO4	2	2	2	2	2							2	2	
CO5	2	2	2	2	2							2	2	

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations

Continuous Internal Evaluation (CIE): Refer Annexure Section 4

Semester End Examination (SEE): Refer Annexure Section 4

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Beginning React JS Foundations Building User Interfaces with ReactJS: An Approachable Guide,	Chris Minnick,	2022.	Wiley publications
2	Learning React Functional Web Development with React and Redux ,	Alex Banks, Eve Porcello ·	2017	

VII(c): Web links and Video Lectures (e-Resources):

Web links and Video Lectures (e-Resources):

● https://www.youtube.com/watch?v=V9i3cGD-mts

● https://youtu.be/PHaECbrKgs0

● https://youtu.be/uvEAvxWvwOs

● https://www.geeksforgeeks.org/state-management-with-usestate-hook-in-react/

● https://youtu.be/KU-I2M9Jm68

● https://youtu.be/H63Pd_lXkeQ

● https://youtu.be/oTIJunBa6MA

● https://youtu.be/3EbYJrAOpU

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Practical Based Learning

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Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	PCC		
Course Title: Big Data Analytics					
Course Code:	**23CDT601**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	3 hrs

I. Course Objectives:

- To implement MapReduce programs for processing big data.
- To realize storage and processing of big data using MongoDB, Pig, Hive and Spark.
- To analyze big data using machine learning techniques.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

6. Use any of these methods: Chalk and board, Active Learning, Case Studies.

III. COURSE CONTENT

Module-1	08 Hrs

Classification of data, Characteristics, Evolution and definition of Big data, What is Big data, Why Big data, Traditional Business Intelligence Vs Big Data, Typical data warehouse and Hadoop environment. Big Data Analytics: What is Big data Analytics, Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools, NoSQL, and Hadoop.
TextBook1: **Chapter: sections Ch-1: 1.1, Ch-2: 2.1-2.5,2.7,2.9-2.11, Ch-3: 3.2,3.5,3.8,3.12, Ch-4: 4.1,4.2**

RBT Levels: L1, L2 & L3

Module-2	08 Hrs

Introduction to Hadoop: Introducing hadoop, Why hadoop, Why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System),Processing data with Hadoop, Managing resources and applications with Hadoop YARN(Yet Another Resource Negotiator). **Introduction to Map Reduce Programming:** Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.

TextBook1: Chapter: sections Ch-5: 5.1-,5.8, 5.10-5.12, Ch-8: 8.1 - 8.8

RBT Levels: L1, L2 & L3

Module-3	08 Hrs

Introduction to MongoDB: What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.

TextBook1: Chapter: sections Ch-6: 6.1-6.5

RBT Levels: L1, L2 & L3

Module-4	08 Hrs

Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF). **Introduction to Pig:** What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Oaperators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.

TextBook1: Chapter: sections Ch-9: 9.1-9.6,9.8, Ch-10: 10.1 - 10.15, 10.22

RBT Levels: L1, L2 & L3

Module-5	08 Hrs

Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark. **Text, Web Content and LinkAnalytics:** Introduction, Text Mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph.

TextBook2: Chapter: sections Ch-5: 5.2,5.3, Ch-9: 9.1-9.4

RBT Levels: L1, L2 & L3

IV. COURSE OUTCOMES	
CO1	Identify and list various Big Data concepts, tools and applications.
CO2	Develop programs using HADOOP framework.
CO3	Make use of Hadoop Cluster to deploy MapReduce jobs, PIG, HIVE and Spark programs.
CO4	Analyze the given data set and identify deep insights from the dataset.
CO5	Demonstrate Text, Web Content and Link Analytics.

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			2								1	
CO2	2	2	2		2								2	2
CO3	2	2	3		3						2		1	2
CO4		3		3	3					2			2	2
CO5		2		2	3					2			2	2

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Big data and Analytics	Seema Acharya and Subhashini Chellappan	2nd Edition, 2019	Wiley India Publishers
2	Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning	Raj kamal and Preeti Saxena	2019	McGraw Hill Publication

VII(b): Reference Books:

1	MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems	Adam Shook and Donald Mine	2012	O'Reilly
2	Hadoop: The Definitive Guide	Tom White	4th Edition, 2015	O'reilly Media
3	Big Data Fundamentals: Concepts, Drivers & Techniques	Thomas Erl, Wajid Khattak, and Paul Buhler	1st Edition, 2016	Pearson India Education Service Pvt. Ltd

4	Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples	John D. Kelleher, Brian Mac Namee, Aoife D'Arcy	2nd Edition, 2020	MIT Press

VII(c): Web links and Video Lectures (e-Resources):

- https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset
- https://www.youtube.com/watch?v=bAyrObl7TYE&list=PLEiEAq2VkUUJqp1k-g5W1mo37urJQOdCZ
- https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ&in dex=4
- https://www.youtube.com/watch?v=GG-VRm6XnNk
- https://www.youtube.com/watch?v=JglO2Nv_92A

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Implement MongoDB based application to store big data for data processing and analyzing the results [10 marks]

(OR)

Implement Hive based application to store big data for data processing and analyzing the results.

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	IPCC		
Course Title: Deep Learning					
Course Code:	**23CDI602**			**Credits:**	4
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:2:0	**Total Hours:**	**40** + 8-10 Lab slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I. Course Objectives:

- Understand the fundamentals of deep learning.
- Understanding the working of Convolution Neural Networks and RNN in decision making.
- Illustrate the strength and weaknesses of many popular deep learning approaches.
- Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Introduce Topics in manifold representations.

7. Show the different ways to solve the same problem with different logic and encourage the students to come up with their own creative ways to solve them.

8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

III. COURSE CONTENT		
III(a).Theory PART		
Module-1		**08 Hrs**
Introduction: What is a Neural Network?, The Human Brain, Models of a Neuron, Neural Networks Viewed As Directed Graphs, Feedback, Network Architectures, **Rosenblatt"s Perceptron:** Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment.		
RBT Levels: L1, L2 & L3		
Module-2		**8 Hrs**
Multilayer Perceptrons: Introduction, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem, Heuristics for Making the Back- Propagation Algorithm Perform Better, Back Propagation and Differentiation.		
RBT Levels: L1, L2 & L3		
Module-3		**08 Hrs**
Regularization for Deep Learning: Parameter Norm Penalties - L2 Parameter Regularization, Dataset Augmentation, Semi-Supervised Learning. Optimization for Training Deep Models: Challenges in Neural Network Optimization – Ill Conditioning, Local Minima, Plateaus, Saddle Points and Other Flat Regions.		
RBT Levels: L1,L2 & L3		
Module-4		**08 Hrs**
Convolution neural 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, Convolutional Networks and the History of Deep Learning.		
RBT Levels:L1,L2 & L3		
Module-5		**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, The Long Short-Term Memory and Other Gated RNNs.		
RBT Levels: L1,L2,L3		
III(b). PRACTICAL PART		
Sl. No.	**Experiments**	
1	Design and implement a neural based network for generating word embedding for words in a document corpus.	
2	Write a program to demonstrate the working of a deep neural network for classification task.	
3	Design and implement a Convolutional Neural Network (CNN) for classification of image dataset	
4	Build and demonstrate an auto encoder network using neural layers for data compression on image dataset.	

5	Build and demonstrate an auto encoder network using neural layers for data compression on image dataset.
6	Design and implement a deep learning network for forecasting time series data.
7	Write a program to enable pre-train models to classify a given image dataset.
8	Write a program to read a dataset of text reviews. Classify the reviews as positive or negative.

Instructions for conduction of practical part:

- For the Simulation experiments modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude using NS2 or NS3.
- Installation procedure of the required software must be demonstrated, carried out in groups, and documented in the report. Non simulation programs can be implemented using Java.

IV. COURSE OUTCOMES

CO1	Analyze and interpret the concepts of neural networks relating to artificial intelligence.
CO2	Illustrate the learning processes and their statistical properties.
CO3	Design deep learning models using regularization and convolutional operations.
CO4	Analyze sequential data to build recurrent and recursive models
CO5	Develop and analyze the applications using Autoencoders.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2			1								1	
CO2	2	2	2		2								2	1
CO3	2	2	3		3						2		1	1
CO4	2	3		3	3					2			2	1
CO5	2	3	2	3	2					2	2		2	1

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 2

Semester End Examination (SEE): Refer Annexure Section 2

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Neural networks and Learning Machines,	Simon Haykin,	Third Edition, 2016	Pearson,
2	Deep Learning,	Ian Good fellow, Yoshua Bengio and Aaron Courville,	2016.	MIT Press,

VII(c): Web links and Video Lectures (e-Resources):
https://www.youtube.com/watch?v=VyWAvY2CF9c https://www.youtube.com/watch?v=7sB052Pz0sQ https://www.youtube.com/watch?v=Mubj_fqiAv8 https://www.coursera.org/learn/neural-networks-deep-learning https://onlinecourses.nptel.ac.in/noc20_cs62/preview.
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:
• Mini projects (2 to 4 students) using Deep Learning concepts - 10 marks

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	PCCL		
Course Title: Big Data Analytics Lab					
Course Code:	**23CDL603**			**Credits:**	1
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }		0:0:2:0		**Total Hours:**	10-12 Lab slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Practical			**Exam Hours:**	3 hrs

I.   Course Objectives:

- Understand the fundamentals of Big Data processing and its frameworks.
- Learn to work with Hadoop, MapReduce, and NoSQL databases for large-scale data handling.
- Gain hands-on experience with Pig, Hive, and Spark for data processing and querying.
- Apply Big Data tools and techniques to solve real-world data analytics challenges.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

6. Use any of these methods: Chalk and board, Active Learning, Case Studies.

III. PRACTICAL

Sl. No.	Experiments
1.	Install Hadoop and Implement the following file management tasks in Hadoop: • Adding files and directories • Retrieving files • Deleting files and directories. 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. **TextBook1: Chapter: sections Ch-2**
2.	Develop a MapReduce program to implement Matrix Multiplication **TextBook1: Chapter: sections Ch-5**
3.	Develop a Map Reduce program that mines weather data and displays appropriate messages indicating the weather conditions of the day **TextBook1: Chapter: sections Ch-5**
4.	Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data. **TextBook1: Chapter: sections Ch-5**
5.	Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB **TextBook2: Chapter: sections Ch-6**
6.	Develop Pig Latin scripts to sort, group, join, project, and filter the data. **TextBook1: Chapter: sections Ch-7**
7.	Use Hive to create, alter, and drop databases, tables, views, functions, and indexes. **TextBook1: Chapter: sections Ch-8**
8.	Implement a word count program in Hadoop and Spark. **TextBook2: Chapter: sections Ch-4**
9.	Use CDH (Cloudera Distribution for Hadoop) and HUE (Hadoop User Interface) to analyze data and generate reports for sample datasets **TextBook2: Chapter: sections Ch-3**

Instructions for conduction of practical part:

• LAB Activities: Conduct laboratory exercises, prepare lab reports, observations and analyze results, perform lab tests, and work on design and implementation tasks.

• Experiential Learning: Students will be evaluated based on their creativity and practical problem-solving skills. This includes program-specific requirements and video-based seminars, presentations, or demonstrations.

<div align="center">

III. COURSE OUTCOMES

</div>

CO1	Implement **Hadoop file management operations** and explore **HDFS storage**.
CO2	Develop **MapReduce programs** to process and analyze structured and unstructured data.
CO3	Use **MongoDB**, **Pig**, and **Hive** for handling and querying large-scale datasets.
CO4	Implement **Hadoop and Spark-based** data processing techniques for real-world applications.
CO5	Apply **big data tools (Cloudera, HUE)** to generate insights and reports from sample datasets.

<div align="center">

IV. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

</div>

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	3	1									2	
CO2	3	3	3	2	1								2	
CO3	3	3	3	2	3	1							2	

CO4	2	2	3	3	2	1	1					2	
CO5	2	3	3	3	2	2	1	1				2	

V.   Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 4

Semester End Examination (SEE): Refer Annexure Section 4

VI.   Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Big data and Analytics	Seema Acharya and Subhashini Chellappan	2nd Edition, 2019	Wiley India Publishers
2	Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning	Rajkamal and Preeti Saxena	2019	McGraw Hill Publication

VII(b): Reference Books:

1	Hadoop: The Definitive Guide	Tom White	4th Edition, 2015	O'reilly Media
2	Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples	John D. Kelleher, Brian Mac Namee, Aoife D'Arcy	2nd Edition, 2020	MIT Press

VII(c): Web links and Video Lectures (e-Resources):

- https://hadoop.apache.org/docs/stable/hadoop-project-dist/hadoop-common/FileSystemShell.html
- https://www.javatpoint.com/matrix-multiplication-mapreduce
- https://hadoop.apache.org/docs/stable/hadoop-mapreduce-client/hadoop-mapreduce-client-core/MapReduceTutorial.html
- https://www.mongodb.com/docs/manual/
- https://www.javatpoint.com/apache-pig
- https://gethue.com

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	PEC		
Course Title: Natural Language Processing					
Course Code:	**23CDP621**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }		3:0:0:0	**Total Hours:**		40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I.   Course Objectives:

This course will enable students to:

• Learn the importance of natural language modeling

● Understand the applications of natural language processing

● Study spelling, error detection and correction methods and parsing techniques in NLP

● Illustrate the information retrieval models in natural language processing

II. Teaching-Learning Process (General Instructions):

These are sample strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.

2. Utilize video/animation films to illustrate the functioning of various concepts.

3. Promote collaborative learning (Group Learning) in the class.

4. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.

5. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.

6. Introduce topics through multiple representations.

7. Demonstrate various ways to solve the same problem and encourage students to devise their own creative solutions.

8. Discuss the real-world applications of every concept to enhance students' comprehension.

9. Use any of these methods: Chalk and board, Active Learning, Case Studies.

III. CO URSE CONTENT

Module-1:	08 Hrs

Introduction: What is Natural Language Processing? Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications. Language Modeling: Statistical Language Model - N-gram model (unigram, bigram), Paninion Framework, Karaka theory.

Textbook1:Chapter:sections Ch:1,2

RBT Levels: L1, L2 & L3

Module-2:	**08 Hrs**

Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-of Speech Tagging. Syntactic Analysis: Context-Free Grammar, Constituency, Top-down and Bottom-up Parsing, CYK Parsing.

Textbook1:Chapter:sections 3,4

RBT Levels: L1, L2 & L3

Module-3:	**08 Hrs**

Information Retrieval: Design Features of Information Retrieval Systems, Information Retrieval Models - Classical, Non-classical, Alternative Models of Information Retrieval - Custer model, Fuzzy model, LSTM model, Major Issues in Information Retrieval. Lexical Resources: WordNet, FrameNet, Stemmers, Parts-of-Speech Tagger, Research Corpora.

Textbook 1:Chapter: sections - Ch: 9, 12

RBT Levels: L1, L2 & L3

Module-4:	**08 Hrs**

Information Retrieval: Design Features of Information Retrieval Systems, Information Retrieval Models - Classical, Non-classical, Alternative Models of Information Retrieval - Custer model, Fuzzy model, LSTM model, Major Issues in Information Retrieval. Lexical Resources: WordNet, FrameNet, Stemmers, Parts-of-Speech Tagger, Research Corpora.

Textbook1:Chapter:sections Ch: 9,12

RBT Levels: L1, L2 & L3

Module-5:	**08 Hrs**

Machine Translation: Language Divergences and Typology, Machine Translation using Encoder-Decoder, Details of the Encoder-Decoder Model, Translating in Low-Resource Situations, MT Evaluation, Bias and Ethical Issues.

Textbook 2:Chapter:sections Ch:13

RBT Levels: L1, L2 & L3

IV. COURSE OUTCOMES

CO1	Apply the fundamental concept of NLP, grammar-based language model and statistical-based language model.
CO2	Explain morphological analysis and different parsing approaches.
CO3	Develop the Naïve Bayes classifier and sentiment analysis for Natural language problems and text classifications.
CO4	Apply the concepts of information retrieval, lexical semantics, lexical dictionaries.
CO5	Apply the concepts of information retrieval, lexical semantics, lexical dictionaries.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	1	1										2	
CO2	1	3	2									1	2	
CO3	1	2	3									1	2	
CO4	2	1	1	2								1	2	
CO5	1	2	2	2								1	2	

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	"Natural Language Processing and Information Retrieval",	Tanveer Siddiqui, U.S. Tiwary,	2012	Oxford University Press.
2	"Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition",	Daniel Jurafsky, James H. Martin,	2023	Pearson Education,

VII(b): Reference Books:(Insert or delete rows as per requirement)

1	"Natural Language Processing Recipes - Unlocking Text Data with Machine Learning	Dan Sullivan,	1st Edition, 2015. (ISBN13: 978-9332557338)	Pearson Education India,

	and Deep Learning using Python",			
2	"Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives",	T V Geetha,	2024.	Pearson,

VII(c): Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=M7SWr5xObkA
2. https://youtu.be/02QWRAhGc7g
3. https://www.youtube.com/watch?v=CMrHM8a3hqw
4. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
5. https://archive.nptel.ac.in/courses/106/106/106106211/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Presentation / Group Discussion/ Assignments.

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science Engineering (Data Science)

Semester:	VI	Course Type:	PEC		
Course Title:	Block chain Technologies				
Course Code:	**23CDP622**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I. Course Objectives:	

- Understand Blockchain terminologies with its applications. design
- Learn working principles of Blockchain and methodologies used in Bitcoin
- Gain knowledge on Ethereum Network, Wallets, Nodes, Smart contract &DApps
- Learn blockchain Based Application Architecture using Hyper-ledger and the Smart Contract Lifecycle.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation/Demonstration to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Use animations/videos to help the students to understand the concepts.

III. COURSE CONTENT

Module-1:	**08 Hrs**

Introduction to Block chain and Consensus Mechanisms

Distributed systems, CAP theorem, Byzantine Generals problem, Consensus. The history of blockchain, Introduction to blockchain, Various technical definitions of blockchains, Generic elements of a blockchain, Features of a blockchain, Applications of blockchain technology, Tiers of blockchain technology, Consensus in blockchain, CAP theorem and blockchain, Benefits and

limitations of block chain**.**	
Textbook 1:Chapter: sections Ch-1(1.1-1.10)	
RBT Levels:L1, L2&L3	
Module-2:	**08 Hrs**
Decentralization and Cryptographic Primitives in Blockchain Decentralization using blockchain, Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies Decentralized applications, Platforms for decentralization. Cryptographic primitives: Symmetric cryptography, Asymmetric cryptography, Public and private keys, Hash functions: Compression of arbitrary messages into fixed length digest, Easy to compute, Pre-image resistance, Second pre-image resistance, Collision resistance, Message Digest (MD),Secure Hash Algorithms (SHAs), Merkle trees, Patricia trees, Distributed hash tables (DHTs), Digital signatures, Elliptic Curve Digital signature algorithm (ECDSA).	
Textbook 1:Chapter: sections Ch-2 (2.1-2.14)	
RBT Levels: L1, L2 & L3	
Module-3:	**08 Hrs**
Bitcoin and Smart Contracts Overview Bitcoin, Bitcoin definition, Transactions, The transaction life cycle, The transaction structure, Types of transaction, The structure of a block, The structure of a block header, The genesis block, The bitcoin network, Wallets, Smart Contracts-History, Definition, Ricardian contracts, Smart contract templates, Oracles, Smart Oracles, Deploying smart contracts on a blockchain, The DAO.	
Textbook 1:Chapter: sections Ch-4(4.1-4.13)	
RBT Levels: L1, L2 & L3	
Module-4:	**08 Hrs**
Ethereum Blockchain and Smart Contract Development Ethereum 101, Introduction, Ethereum clients and releases, The Ethereum stack, Ethereum blockchain, Currency (ETH and ETC), Forks, Gas, The consensus mechanism, The world state, Transactions, Contract creation transaction, Message call transaction, Elements of the Ethereum blockchain, Ethereum virtual machine (EVM), Accounts, Block, Ether, Messages, Mining, The Ethereum network. Hands-on: Clients and wallets –Geth.	
Textbook 1:Chapter: sections Ch-7(7.1-7.13)	
RBT Levels: L1, L2 & L3	
Module-5:	**08 Hrs**

Hyperledger and Block chain Frameworks: Hyperledger, Hyperledger as a protocol, Fabric, Hyperledger Fabric, Sawtooth lake, Corda

Textbook1:Chapter: sections Ch-9(9.1-9.4)

RBT Levels: L1, L2 & L3

	IV. COURSE OUTCOMES
CO1	Explain the Blockchain terminologies with its applications. design
CO2	Illustrate the working principles of Blockchain and the Smart Contract Lifecycle
CO3	Demonstrate the principles and methodologies used in Bitcoin
CO4	Develop Ethereum Network, Wallets, Nodes, Smart contract and DApps.
CO5	Make use of Hyper-ledger in Blockchain Based Application Architecture.

V. CO-PO-PSOMAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO!	PSO2
CO1	2	2			2							1	1	
CO2	2	2			2							1	1	
CO3	2	2			2							1	1	
CO4	2	2			2							1	1	
CO5	2	2			2							1	1	

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Mastering Block Chain	Imran Bashir	Third Edition, Packt – 2020	

VII(b): Reference Books

1.	Mastering Bitcoin: Programming the Open Blockchain	Andreas M.	2017	O'rielly

VII(c): Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106104220

- https://www.geeksforgeeks.org/blockchain/

- https://www.tutorialspoint.com/blockchain/ index.htm.

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

 Course Project: Covers the implementation of the major concepts outlined in the syllabus.

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science & Engineering (Data Science)

Semester:	VI	Course Type:	PEC		
Course Title: Distributed File System					
Course Code:		**23CDP623**		**Credits:**	03
Teaching Hours/Week (L: T:P:O) {O – Other pedagogies, mention @ }			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I.   Course Objectives:
• Understand the fundamentals and challenges of distributed file systems.
• Analyse different architectures, data placement, and fault tolerance strategies.
• Study consistency models, replication techniques, and failure recovery.
• Explore real-world DFS implementations and emerging future trends.
II. Teaching-Learning Process (General Instructions):
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
l. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2.Use of Video/Animation to explain functioning of various concepts.
3.Encourage collaborative (Group Learning) Learning in the class.
4.Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5.Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design

III. COURSE CONTENT	
Module-1	**08 Hrs**
Introduction: Definition and characteristics of distributed systems, types of distributed systems (client-server, peer-to-peer, hybrid), key challenges (network latency, fault tolerance, consistency, scalability). **Textbook 1:Chapter: sections Ch-1 (1.1 – 1.3)**	

RBT Levels:L1, L2, L3	

Module-2	08 Hrs

DFS Architecture: Client-server vs. peer-to-peer, data placement, load balancing, fault tolerance, caching, and replication strategies.**File Access Models:** NFS, remote file access, performance optimizations.

Textbook 1 Chapter: sections Ch-2 (2.1, 2.2), Ch-10 (10.1 – 10.3)

RBT Levels: L1, L2, L3	

Module-3:	08 Hrs

Consistency Models: Strong vs. eventual consistency, quorum-based consistency, CAP theorem.
Fault Tolerance & Recovery: Techniques for fault tolerance (RAID, data replication), snapshots, checkpointing, failure recovery.
Textbook 1:Chapter: sections Ch-7 (7.1 – 7.4),
Textbook 2:Chapter: sections Ch-8 (8.1 – 8.3)

RBT Levels: L1, L2, L3	

Module-4:	08 Hrs

Google File System (GFS): Architecture, design principles, data retrieval, fault tolerance.

Hadoop Distributed File System (HDFS): Block storage, data replication, fault tolerance, scalability. **Other DFS Implementations:** Amazon S3 (object storage), Ceph (scalable DFS).

Textbook 2 Chapter: sections Ch-6 (6.1 – 6.3), Ch-7 (7.1 – 7.4)

RBT Levels: L1, L2, L3	

Module-5:	08 Hrs

Future of DFS: Blockchain-based DFS, self-healing storage, quantum computing in DFS.

Textbook 2: **Chapter: sections Ch-11 (11.1 – 11.3)**

RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES	
CO1	Understand the fundamental concepts, characteristics, and challenges of distributed systems.
CO2	Analyze different file system architectures, including client-server and peer-to-peer models, and their performance optimizations.
CO3	Evaluate data consistency models, fault tolerance mechanisms, and recovery techniques in distributed file systems.
CO4	Explore real-world distributed file system implementations such as Google File System (GFS), Hadoop Distributed File System (HDFS), and other scalable storage solutions.
CO5	Investigate advanced topics in distributed file systems, including blockchain-based storage, self-healing systems, and quantum computing applications.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)															
PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2			2							1	1	
CO2	2	2			2							1	1	
CO3	2	2			2							1	1	
CO4	2	2			2							1	1	
CO5	2	2			2							1	1	

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Distributed Systems: Principles and Paradigms	Andrew S Tanenbaum & Maarten Van Steen	Fourth Edition, version 2 2025	Marteen van Steen
2	Designing Data-Intensive Applications	Martin Kleppmann	2017	O'Reillly Media

VII(b): Reference Books:

1	Distributed Systems: An Algorithmic Approach	Sukumar Ghosh	2nd Edition, 2014	CRC Press (Taylor & Francis Group)
2	Distributed Systems: Concepts and Design	George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair	5th Edition, 2011	Pearson

VII(c): Web links and Video Lectures (e-Resources):

- https://www.geeksforgeeks.org/google-file-system-gfs-vs-hadoop-distributed-file-system-hdfs/,
- https://medium.com/@maryamyameen168/google-file-system-apache-hadoop-case-study-d0f0b36682df.

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Mini Project: Build a simple client-server-based DFS where users can upload, retrieve, and delete files from multiple nodes.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	PEC		
Course Title:	Digital Marketing				
Course Code:	**23CDP624**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I.   Course Objectives:

- Understand Digital Marketing Fundamentals
- **Analyze Consumer Behavior Online**
- Develop and Implement Digital Campaigns
- Measure and Interpret Digital Analytics
- Apply Ethical and Legal Considerations

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The teaching and learning process for a Digital Marketing course involves a blend of theoretical concepts, hands-on practice, and real-world case studies to ensure students gain both knowledge and practical skills.

2. The course begins with interactive lectures and discussions on fundamental topics such as SEO, SEM, social media marketing, content marketing, and analytics.

3. To enhance understanding, instructors use live demonstrations, multimedia presentations, and industry-relevant examples.

4. A practical, experiential approach is emphasized through lab sessions, workshops, and project-based learning, where students design and execute their own digital marketing campaigns. They use industry-standard tools like Google Ads, Facebook Business Manager, and Google Analytics to track performance and optimize strategies.

5. Case studies and guest lectures from marketing professionals provide insights into current trends, challenges, and best practices.

6. To reinforce learning, students engage in group discussions, peer reviews, and presentations that encourage critical thinking and collaborative learning. Regular assessments, including quizzes, assignments, live projects, and performance analytics reviews, help track progress and ensure conceptual clarity.

III. COURSE CONTENT	
Module-1	**08 Hrs**

Introduction to the Course and Work plan: Introduction of the digital marketing, Digital vs. Real Marketing, Digital Marketing Channels, Creating initial digital marketing plan, Content management, SWOT analysis, Target group analysis, Web design, Optimization of Web sites, MS Expression Web.

Textbook 1:Chapter: sections Ch-2

RBT Levels: L1, L2 &L3

Module-2	**08 Hrs**

SEO Optimization: Writing the SEO content Google AdWords- creating accounts, Google AdWords- types Introduction to CRM, CRM platform, CRM models**.**

Textbook 2:Chapter: sections Ch-3

RBT Levels: L1, L2& L3

Module-3	**08 Hrs**

Introduction to Web analytics: Web analytics – levels, Introduction of Social Media Marketing Creating a Facebook page, Visual identity of a Facebook page, Types of publications Business opportunities and Instagram options, Optimization of Instagram profiles, Integrating Instagram with a Web Site and other social networks, keeping up with posts**.**

Textbook2 :Chapter:sectionsCh-3, Ch-4

RBT Levels:L1, L2, L3

Module-4	**08 Hrs**

Business tools on LinkedIn: Creating campaigns on LinkedIn, Analyzing visitation on LinkedIn Creating business accounts on YouTube, YouTube Advertising, YouTube Analytics Face book Ads, Creating Face book Ads, Ads Visibility**.**

Textbook 2:Chapter: sections Ch-6

RBT Levels:L1, L2 & L3

Module-5	**08 Hrs**

E-mail marketing: E-mail marketing plan, E-mail marketing campaign analysis, Keeping up with conversions Digital Marketing Budgeting- resource planning, cost estimating, cost budgeting, cost control.

Textbook 2:Chapter: sections Ch-7

RBT Levels:L1, L2& L3

IV. COURSE OUTCOMES	
CO1	Explain Digital Marketing Concepts
CO2	Develop and Manage Digital Campaigns
CO3	Apply Web Analytics for Decision-Making
CO4	Optimize SEO and Content Marketing Strategies
CO5	Demonstrate Ethical and Legal Compliance

V. CO-PO-PSOMAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2										1	2	1
CO2			3		2				1				2	3
CO3				3	2						1		3	2
CO4			3			2	1						2	3
CO5						2		3		1			2	3

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Understanding Digital Marketing	Ryan, D	Third Edition, 2014	Kogan Page
2	Beginners Guide to Digital Marketing	Romuald Andrade	Second Edition, 2017	Createspace Independent Pub

VII(b): Reference Books

1	Epic Content Marketing	Pulizzi, J	Third Edition, 2014	Mc-graw Hill Education.

VII(c): Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=kunkYTKFNtI
2. https://www.youtube.com/watch?v=BZLUEKnMfIY

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, assignments, case studies, group discussions

SJB Institute of Technology

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	OEC		
Course Title: Introduction to Data Structures					
Course Code:	**23CDO611**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I. Course Objectives:

● Introduce primitive and non-primitive data structures

● Understand the various types of data structure along their operations

● Study various searching and sorting algorithms

● Assess appropriate data structures during program development / problem solving

II. Teaching-Learning Process (General Instructions):

These are sample strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.

2. Utilize video/animation films to illustrate the functioning of various concepts.

3. Promote collaborative learning (Group Learning) in the class.

4. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.

5. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.

6. Introduce topics through multiple representations.

7. Demonstrate various ways to solve the same problem and encourage students to devise their own creative solutions.

8. Discuss the real-world applications of every concept to enhance students' comprehension.

9. Use any of these methods: Chalk and board, Active Learning, Case Studies.

III. CO URSE CONTENT		
Module-1:		08 Hrs
Arrays: Introduction, One-Dimensional Arrays, Two-Dimensional Arrays, Initializing Two Dimensional Arrays, Multidimensional arrays. Pointers: Introduction, Pointer Concepts, Accessing Variables through Pointers, Pointer Applications, Dynamic Memory Allocation Functions. Structures and Unions: Introduction, Declaring Structures, Giving Values to Members, Structure Initialization, Comparison of Structure Variables, Arrays of Structures, Arrays within Structures, Nested Structures, Unions, Size of Structures. **Textbook1:Chapter:s ections** . 8.1 to 8.5, Ch. 12.1 to 12.8, 12.10, 12.11 **Textbook 2:Chapter:sections:** Ch. 2.1 to 2.3, 2.5, 2.9		
RBT Levels: L1, L2 & L3		
Module-2:		**08 Hrs**
Stacks: Introduction, Stack Operations, Stack Implementation using Arrays, Applications of Stacks. **Queues:** Introduction, Queue Operations, Queue Implementation using Arrays, Different Types of Queues: Circular Queues, Double-Ended Queues, Priority Queues, Applications of Queues. **Textbook 2:Chapter:sections** : Ch. 6.1 to 6.3, Ch. 8.1 to 8.2.		
RBT Levels: L1, L2 & L3		
Module-3:		**08 Hrs**
Linked Lists: Introduction, Singly Linked List, Self-Referential Structures, Operations on Singly Linked Lists: Insert-Delete-Display, Implementation of Stacks and Queues using Linked List, Concatenate two Lists, Reverse a List without Creating a New Node, Static Allocation Vs Linked Allocation. **Circular Singly Linked List:** Introduction, Operations: Insert-Delete-Display. **Textbook 2: Chapter:sections** Ch. 9.1 to 9.2, 9.3 (Only 9.3.1 to 9.3.5, 9.3.11 to 9.3.12), 9.4 to 9.5.		
RBT Levels: L1, L2 & L3		
Module-4:		**08 Hrs**
Trees: Introduction, Basic Concepts, Representation of Binary Trees, Operations on Binary Trees: Insertion-Traversals-Searching-Copying a Tree, Binary Search Trees, Operations on Binary Search Trees: Insertion-Searching-Find Maximum and Minimum Value-Count Nodes, Expression Trees. **Textbook 2:Chapter:sections** : Ch. 10.1 to 10.4, 10.5 (Only 10.5.1, 10.5.2, 10.5.3.1, 10.5.3.2, 10.5.3.4), 10.6.3		
RBT Levels: L1, L2 & L3		
Module-5:		**08 Hrs**
Sorting: Introduction, Bubble Sort, Selection Sort, Insertion Sort. Searching: Introduction, Linear Search, Binary Search. Textbook 1: **Chapter:sections** Ch. 17.1, 17.2.6, 17.3.2. Textbook 2: **Chapter:sections** Ch. 11.1 to 11.3, 11.10.1.		
RBT Levels: L1, L2 & L3		

IV. COURSE OUTCOMES	
CO1	Develop C programs utilizing fundamental concepts such as arrays, pointers and structures.
CO2	Apply data structures like stacks and queues to solve problems.
CO3	Develop C programs using linked lists and their various types.

CO4	Explain the fundamental concepts of trees and their practical applications.
CO5	Demonstrate different sorting and searching algorithms and determine their algorithmic complexities.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2	1	1	1							1		
CO2	2	2	2	2								1		
CO3	2	2	2	2								1		
CO4	2	2	2	2								1		
CO5	2	2	2	2								1		

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:(Insert or delete rows as per requirement)

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	"C Programming and Data Structures",	"C Programming and Data Structures",	4th Edition, 2007.	McGraw-Hill,
2	A M Padma Reddy,	"Systematic Approach to Data Structures using C"	9th Revised Edition, 2009.	, Sri Nandi Publications,

VII(b): Reference Books:

1	Ellis Horowitz and Sartaj Sahni,	"Fundamentals of Data Structures in C"	2nd Edition, 2014.	Universities Press,
2	"Data Structures Schaum's Outlines",	"Data Structures Schaum's Outlines",	Revised 1st Edition, 2014	McGraw-Hill,

VII(c): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=DFpWCl_49i0
- https://www.youtube.com/watch?v=x7t_-ULoAZM
- https://www.youtube.com/watch?v=I37kGX-nZEI
- https://www.youtube.com/watch?v=XuCbpw6Bj1U
- https://www.youtube.com/watch?v=R9PTBwOzceo @#@10012025 4
- https://www.youtube.com/watch?v=qH6yxkw0u78
- https://archive.nptel.ac.in/courses/106/105/106105085/
- https://onlinecourses.swayam2.ac.in/cec19_cs04/preview

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Presentation / Group Discussion/ Assignments.

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	OEC		
Course Title: Fundamental of Operating System					
Course Code:	**23CDO612**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**CIE Marks:**	50
SEE Type:		Theory		**Exam Hours:**	03

I. Course Objectives:

- To demonstrate the need and different types of OS
- To discuss suitable techniques for management of different resources
- To analyse different memory, storage, and file system management strategies.

II. Teaching-Learning Process (General Instructions):

These are sample strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Utilize video/animation films to illustrate the functioning ofvarious concepts.
3. Promote collaborative learning(Group Learning) in the class.
4. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
5. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
6. Introduce topics through multiple representations.
7. Demonstrate various ways to solve the same problem and encourage students to devise their own creative solutions.
8. Discuss the real-world applications of every concept to enhance students' comprehension.
9. Use any of these methods: Chalk and board, Active Learning, Case Studies.

III. COURSE CONTENT

Theory

Module-1	08hrs

Introduction: What operating systems do; Computer System organization; Computer SystemOrganization,ComputerSystemarchitecture;OperatingSystemoperations;Resource Management

Operating System Structures: Operating System Servies, User and Operating System interface; System calls, Application Program Interface, Types of system calls;	
Textbook1:Chapter1:1.1,1.2,1.3,1.4,1.5Chapter2:2.1,2.2(2.2.1,2.2.2),2.3(2.3.2, 2.3.3)	
RBT Levels: L1, L2, L3	
Module-2	08hrs
ProcessManagement:Processconcept;Processscheduling;Operationsonprocesses; Interprocess Communication **Multi-threaded Programming:** Overview; Multithreading models,Thread Libraries **Textbook1:Chapter3:3.1-3.4,Chapter4:4.1,4.35,4.4**	
RBT Levels: L1, L2, L3	
Module-3	08hrs
CPU Scheduling: Basic Concepts, Scheduling criteria, Scheduling algorithms, Thread Scheduling**, ProcessSynchronization:**Synchronization:Thecriticalsectionproblem;Peterson's solution; Semaphores; Classical problems of synchronization; **Textbook1:Chapter :section: Ch 5:5.1,5.2,5.3.1,5.3.2,5.3.3,5.3.4,5.4 Ch 6:6.1,6.2.,6.3,6.6**	
RBT Levels: L1, L2, L3	
Module-4	08hrs
Deadlocks: Systemmodel;Deadlockcharacterization;Methodsforhandlingdeadlocks; **Deadlock prevention**; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Memory Management:** Background; Contiguous memory allocation; Paging; Structure of page table **Textbook1:Chapter8:8.1-8.8Textbook1:Chapter9:9.1-9.4(9.4.1,9.4.2)**	
RBT Levels: L1, L2, L3	
Module-5	08hrs
Virtual Memory Management: Background;Demandpaging;Copy-on-write;Page replacement; **File System Interface:** File concept; Access methods; Directory Structure, Protection, File System Implementation: File System Structure, File System Operations, **File System Internals**: File Systems, File System Mounting; Partition and Mounting, File sharing; **Textbook1:Chapter10:10.1-10.3,10.4(10.4.1,10.4.2,10.4.4.)** **Chapter13:13.1,13.2, 13.3(13.3.1,13.3.2,13.3.3), 13.4(13.4.1,13.4.2)Chapter15:15.1-15.4**	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES	
CO1	Explain the fundamentals of operating systems.
CO2	Apply appropriate CPU scheduling algorithms for the given problem.
CO3	Analyse the various techniques for process synchronization and deadlock handling.
CO4	Apply the various techniques for memory management
CO5	Analyse the importance of File System Mounting and File Sharing

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)
PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3				2						2	1		
CO2	3	2	2	1	3						2	1		
CO3	3	2	2	1	3						2	1		
CO4	3	2	2		3						2	1		
CO5	3	2	2	1	2						2	1		

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Operating System Principles	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne	10th edition, 2015	Wiley India Publishers

VII(b): Reference Books

1	Understanding Operating System	Ann McHoes Ida M Fylnn	6th Edition,2010	Cengage Learning
2	Operating Systems: A Concept Based Approach	D.M Dhamdher	3rd Edition, 2013	Ed, McGraw- Hill
3	An Introduction to Operating Systems: Concepts and Practice	P.C.P. Bhatt	4thEdition, 2014	PHI(EEE)
4	Operating Systems: Internals and Design Principles	William Stallings	6th Edition, 2008	Pearson

VII(c): Web links and Video Lectures (e-Resources):

https://archive.nptel.ac.in/courses/106/105/106105214/

https://archive.nptel.ac.in/courses/106/102/106102132/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Students are expected to prepare animated PPT to illustrate the different types of Process Scheduling and Paging.

- Students are required to prepare detailed case study report on Deadlocks **OR** Students can illustrate deadlock using any programming language

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	OEC		
Course Title: Introduction to Data Science					
Course Code:	**23CDO613**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}		3:0:0:0		**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**CIE Marks:**	50
SEE Type:		Theory		**Exam Hours:**	03

I. Course Objectives:

- Introduce Mathematical foundations required for Data Science
- Learn data analytics problem solving framework
- Illustrate the use of basic concepts of Data Science in the real-world applications.
- Discuss the functional components of Data Science for real world applications.

II. Teaching-Learning Process (General Instructions):

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

III. COURSE CONTENT

Theory

Module-1	08 Hrs
Introduction: What is Data Science? Applications of Data Science, Data science life cycle, Tools for data science, DS and ML Fundamental Concepts: Classification and function approximations, Model forms, Generality of Data Science, Data Classification, viewing ML Algorithms. **Textbook 1**: Chapter 1 & 2: Section 1.1-1.6, 2.1,2.2,2.4.2, 2.4.3,2.5,2.6	
RBT Levels: L1 - Remembering, L2 - Understanding, L3 - Applying	
Module-2	08 Hrs
Linear Algebra for DS : A framework for solving Data Science Problems, Linear Algebra for DS and ML: Matrix View of Linear Algebra, Fundamental Subspaces, Data Science and Fundamental Subspaces. **Textbook 1: Chapter** 2& 3: Section 2.7, 3.2,3.3, 3.4, 3.5	
RBT Levels: L1 - Remembering, L2 - Understanding, L3 - Applying	
Module-3	08 Hrs

Optimization for DS and ML: Elements of an Optimization Formation, Discussion Objective Functions of Classification, First and Second-order Analytical Conditions for Optimality of Unconstrained NLPs, Numerical Approaches to Solving Optimization Problems.	
Textbook 1: Chapter 4: Section 4.1 - 4.5	
RBT Levels: L1 - Remembering, L2 - Understanding, L3 - Applying	
Module-4	**08 Hrs**
Statistical Foundations for DS and ML : Decomposition of a Data Matrix into Model and Uncertainty Matrcies. Uncertainty Matrcies, Random variables and Probability Mass Functions, Deriving Model Probability Distribution Functions. **Textbook 1:** Chapter 5: Section 5.1, -5.4	
RBT Levels: L1 - Remembering, L2 - Understanding, L3 - Applying	
Module-5	**08 Hrs**
Classification Methods: Types of Classification Problems, Parametric Methods, Non Parametric Methods. Future Directions **Textbook 1**: Chapter 7 & 8: Section 7.1-7.3, 8.1	
RBT Levels: L1 - Remembering, L2 - Understanding, L3 - Applying	

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IV. COURSE OUTCOMES

</div>

CO1	Summarize the fundamental concepts for Data Science.
CO2	Incorporate Mathematical Foundations for Modelling.
CO3	Apply Numerical Approaches to Solving Optimization Problems.
CO4	Interpret the classification methods of Data Science.

<div align="center">

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

</div>

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	1		2							1		
CO2	3	3	2		1							1		
CO3	3	2	2		1							1		
CO4	3	3	2		2							1		

<div align="center">

VI. Assessment Details (CIE & SEE)

</div>

General Rules: Refer CIE and SEE Guidelines.
Continuous Internal Evaluation (CIE): Refer Annexure Section 1
Semester End Examination (SEE): Refer Annexure Section 1

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VII.   Learning Resources

</div>

VII(a): Textbooks

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Data Science for Engineers	Ragunathan, Rengaswamy Reshmi Suresh	CRC Press 2023	CRC Press 2023

VII(c): Web links and Video Lectures (e-Resources):

- Introduction to Data Science | PPT (slideshare.net)
- https://www.slideserve.com/Priya72/introduction-to-data-science.

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Assignments, Quiz, Presentation.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	OEC		
Course Title:		**OOPs with Java**			
Course Code:		**23CDO614**		**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I. Course Objectives:

This course will enable students to:

• To acquire proficiency in fundamental constructs of the Java programming language.

• To Comprehend and apply the principles of Object-Oriented Programming (OOP) in Java.

• To acquire expertise in advanced Java concepts including packages, multithreaded programming, and exception handling.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Diverse Teaching Methods: Instead of relying solely on traditional lecture methods, can explore alternative and effective teaching approaches. These might include interactive discussions, hands-on activities, or multimedia presentations.

2. Visual Aids: Utilize videos and animations to elucidate complex concepts. Visual representations enhance understanding and engagement among students.

3. Collaborative Learning: Encourage group learning within the classroom. Collaborative activities foster teamwork, communication, and a deeper grasp of subject matter.

4. Higher Order Thinking (HOT) Questions: Pose at least three thought-provoking questions during class. These questions stimulate critical thinking and encourage students to analyze and evaluate information.

5. Problem-Based Learning (PBL): Implement PBL, which nurtures analytical skills. PBL goes beyond rote memorization by challenging students to design solutions, evaluate evidence, and think critically.

6. Multiple Representations: Introduce topics using various representations. Visuals, diagrams, and real-world examples cater to diverse learning styles.

7. Creative Problem Solving: Present different approaches to solving the same problem. Encourage students to think outside the box and devise their own innovative solutions.

8. Real-World Application: Discuss how each concept relates to practical scenarios. Connecting theoretical knowledge to real-world contexts enhances students' comprehension and retention. Chalk & Talk Stud. Assignment Web Resources LCD/Smart Boards Stud. Seminars

III. COURSE CONTENT	
Module-1:	**08 Hrs**
Overview of Java: Object-Oriented Programming (Paradigms, Abstraction, Three OOP Principles), Code Blocks, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, Java Keywords). Data Types, Variables, Arrays: Primitive Types, Type Conversion and Casting, Automatic Type Promotion, Arrays, Type Inference with Local Variables. Operators: Arithmetic, Relational, Boolean Logical, Assignment, Operator Precedence, Parentheses Usage. Control Statements: Selection (if, switch), Iteration (while, do-while, for, For-Each Loop, Nested Loops), Jump Statements (break, continue, return). **Textbook: 1 Chapter: sectionsCh-2, Ch-3, Ch-4, Ch-5**	
RBT Levels: L1&L2	
Module-2:	**08 Hrs**
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, This Keyword, Garbage Collection. Methods and Classes: Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, understanding static, introducing final, Introducing Nested and Inner Classes. **Textbook: 1 Chapter: sectionsCh-6,Ch-7**	
RBT Levels: L1& L2	
Module-3:	**08 Hrs**
Inheritance: Inheritance Basics, using super, creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class. Interfaces: Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods. **Textbook: 1 Chapter: sectionsCh-8, Ch-9**	
RBT Levels: L1, L2 & L3	
Module-4:	**08 Hrs**
Packages: Packages, Packages and Member Access, Importing Packages. Exceptions: ExceptionHandling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions. **Textbook: 1 Chapter: sections Ch-9, Ch-10**	
RBT Levels: L1, L2 & L3	
Module-5:	**08 Hrs**

Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's 23 State. Enumerations, Type Wrappers and Autoboxing: Enumerations (Enumeration Fundamentals, The values () and valueOf() Methods), Type Wrappers (Character, Boolean, The Numeric Type Wrappers), Autoboxing (Autoboxing and Methods, Autoboxing/Unboxing Occurs in Expressions, Autoboxing / Unboxing Boolean and Character Values).

Textbook: 1 Chapter: sections Ch-11, Ch-12

RBT Levels: L1, L2 & L3

IV. COURSE OUTCOMES

CO1	Demonstrate proficiency in writing simple programs involving branching and looping structures.
CO2	Design a class involving data members and methods for the given scenario.
CO3	Exert the concepts of inheritance and interfaces in solving real world problems.
CO4	Apply the concept of packages and exception handling in solving complex problem
CO5	Employ the concepts of multithreading, auto boxing and enumerations in program development

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	1	3		2						2	2		
CO2	1	3									1	1		
CO3	2	1	2		1						1	1		
CO4	2	3	2	2	2						1	1		
CO5	1	2	3		2						2	1		

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Java: The Complete Reference	Herbert Schildt	12th Edition, November 2021	McGraw-Hill, ISBN: 9781260463422

VII(b): Reference Books

1	Programming with Java E	Balagurusamy	6th Edition Mar-2019	McGraw Hill Education, ISBN: 9789353162337.
2	Thinking in Java	Bruce Eckel	Fourth Edition, 2006	Prentice Hall

VII(c): Web links and Video Lectures (e-Resources):

1. Java Tutorial: https://www.geeksforgeeks.org/java/

2. Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu):

https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/

3. Java Tutorial: https://www.w3schools.com/java/ 24 4. Java Tutorial:

https://www.javatpoint.com/java-tutorial

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Assignments, Quizzes, and Seminar.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	ETC		
Course Title:		**UI/UX with Flutter**			
Course Code:	**23CDE641**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}		3:0:0:@	**Total Hours:**	40	
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	3

I.   Course Objectives:

This course will enable students to:

- Explain the installation process of Flutter SDK, Xcode, and Android Emulator.

- Describe Stateless and Stateful Widgets and illustrate the Widget Tree structure.

- Apply fundamental Dart programming concepts in Flutter development.

- Discuss the application of animations in a Flutter app.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

III. COURSE CONTENT	
Module-1:	**8 Hrs**

Introducing Flutter and Getting Started : Introducing Flutter, Defining Widgets and Elements, Understanding Widget Lifecycle Events, The Stateless Widget Lifecycle, The Stateful Widget Lifecycle,Understanding the Widget Tree and the Element Tree, Stateless Widget andElement Trees, Stateful Widget and Element Trees, Installing the Flutter SDK,Installing on mac OS, System Requirements, Get the Flutter SDK, Check for Dependencies, iOS Setup: Install Xcode, Android Setup: Install Android Studio, Set Up the Android Emulator, Installing on Windows, System Requirements, Get the Flutter SDK, Check for Dependencies, Install Android Studio, Set Up theAndroid Emulator, Installing on Linux, System Requirements, Get the Flutter SDK,Check for Dependencies, Install Android Studio, Set Up the Android Emulator,Configuring the Android Studio Editor.

Textbook 1:Chapter:sections: Ch:1

RBT Levels:L1,L2

Module-2:	**8 Hrs**

Creating a Hello World App: Setting Up the Project, Using Hot Reload, Using Themes to Style Your App, Usinga Global App Theme, Using a Theme for Part of an App, Understanding StatelessandStateful Widgets, Using External Packages.

Textbook 1:Chapter:sections: Ch:2

RBT Levels:L1,L2,L3

Module-3:	**8 Hrs**

Learning Dart Basics : Use of Dart, Commenting Code, Running the main() Entry Point, Referencing, Variables, Declaring Variables, Numbers, Strings, Booleans, Lists, Maps, Runes, Using Operators, Using Flow Statements, if and else, ternary operator, for Loops, while and do-while, while and break, continue, switch and case, Using Functions, Import Packages, Using Classes, Class Inheritance, Class Mixins, Implementing Asynchronous Programming.

Textbook 1:Chapter:sections: Ch:3

RBT Levels:L1,L2, L3

Module-4:	**8 Hrs**

Creating a Starter Project Template: Creating and Organizing Folders and Files, Structuring Widgets. Understanding the Widget Tree: Introduction to Widgets, Building the Full Widget Tree, Building a Shallow WidgetTree.

Textbook 1:Chapter:sections: Ch:4,5

RBT Levels:L1,L2, L3

Module-5:	**8 Hrs**

Using Common Widgets : Using Basic Widgets, Safe Area, Container, Text, Rich Text, Column, Row,Column and Row Nesting, Buttons, Floating Action Button, Flat Button, RaisedButton, Icon Button, Popup Menu Button, Button Bar, Using Images and Icons,Asset Bundle, Image, Icon, Using Decorators, Using the Form Widget to ValidateText Fields, Checking Orientation.

Textbook 1:Chapter:sections:Ch:6

RBT Levels:L1,L2, L3

	IV. COURSE OUTCOMES
CO1	Understand the basics of Flutter, widgets, and their lifecycle.
CO2	Configure Flutter SDK and development environment on different operating systems.
CO3	Create a simple Flutter application using widgets and themes.
CO4	Explore Dart programming concepts like variables, functions, and object-oriented principles.
CO5	Use common Flutter widgets to design user interfaces effectively.

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	1	1	2							1	2	
CO2	3	2	2	2	3							1	2	1
CO3	2	2	2	2	3							1	2	1
CO4	2	2	2	2	3							1	2	1
CO5	2	3	3	3	3							1	2	1

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Beginning Flutter: A Hands-on Guide to App Development	Marco L. Napoli,	1st Edition,	Wrox publisher

VII(b): Reference Books:

1	Beginning App Development with Flutter: Create Cross-Platform Mobile Apps	Rap Payne	1st edition	Apress.
2	Practical Flutter: Improve your Mobile Development withGoogle's Latest Open-Source SDK	Frank Zammetti,	1st edition	Apress

VII(c): Web links and Video Lectures (e-Resources):

1. https://codewithandrea.com/?utm_source=chatgpt.com
2. https://www.geeksforgeeks.org/flutter-tutorial/?utm_source=chatgpt.com

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Presentation / Group Discussion/ Assignments.

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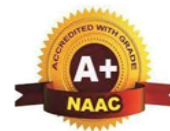
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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	V	Course Type:	ETC			
Course Title:	**Parallel Programming**					
Course Code:	**23CDE642**			**Credits:**		3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**		40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**		100
SEE Type:		THEORY		**Exam Hours:**		3

I.   Course Objectives:

This course will enable students to:

- Explore the need for parallel programming

- Explain how to parallelize on MIMD systems

- To demonstrate how to apply MPI library and parallelize the suitable programs

- To demonstrate how to apply OpenMP pragma and directives to parallelize the suitable

- Programs to demonstrate how to design CUDA program

II. Teaching-Learning Process (General Instructions):

These are sample Strategies which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.

6. Introduce Topics in manifold representations.

7. Show the different ways to solve the same problem with different approaches and encourage the students to come up with their own creative ways to solve them.

8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding

III. COURSE CONTENT	
Module-1:	**08 Hrs**
Introduction to parallel programming, Parallel hardware and parallel software – Classifications of parallel computers, SIMD systems, MIMD systems, Interconnection networks, Cache coherence, Shared-memory vs. distributed-memory, Coordinating the processes/threads, Shared-memory, Distributed-memory.	
Text Book1:Chapter:Section Ch: 2-2.3, 2.4	
RBT Levels:L1,L2	
Module-2:	**08 Hrs**
GPU programming, Programming hybrid systems, MIMD systems, GPUs, Performance – Speedup and efficiency in MIMD systems, Amdahl's law, Scalability in MIMD systems, Taking timings of MIMD programs, GPU performance.	
Text Book1:Chapter:Section Ch :2-2.5, 2.6, 2.7, 2.8	
RBT Levels:L1,L2	
Module-3:	**08 Hrs**
Distributed memory programming with MPI – MPI functions, The trapezoidal rule in MPI, Dealing with I/O, Collective communication, MPI-derived datatypes, Performance evaluation of MPI programs, A parallel sorting algorithm.	
Text Book1:Chapter:Section Ch: 3.	
RBT Levels:L1,L2, L3	
Module-4:	**08 Hrs**
Shared-memory programming with OpenMP – openmp pragmas and directives, The trapezoidal rule, Scope of variables, The reduction clause, loop carried dependency, scheduling, producers and consumers, Caches, cache coherence and false sharing in openmp, tasking, tasking, thread safety. **Text Book1:Chapter:Section Ch: 5-5.1, 5.2, 5.3, 5.4, 5.8, 5.9, 5.10**	
RBT Levels:L1,L2,L3	
Module-5:	**08 Hrs**
Parallel Program Development - Two n-Body Solvers, Tree Search - Recursive depth-first search, Non recursive depth-first search, Data structures for the serial implementations, Performance of the serial implementations, Parallelizing tree search **Text Book1:Chapter:Section Ch: 6-6.1, 6.2 (6.2.1 to 6.2.5)**	
RBT Levels:L1,L2,L3	

IV. COURSE OUTCOMES	
After going through this course, the student will be able to	
CO1	Explain the need for parallel programming
CO2	Demonstrate parallelism in MIMD system.
CO3	Apply MPI library to parallelize the code to solve the given problem.
CO4	Apply OpenMP pragma and directives to parallelize the code to solve the given problem
CO5	Design a CUDA program for the given problem.

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	2	3		3								2	1
CO2	2	3	2		2								2	1
CO3	3	2	3		2								2	1
CO4	3	3	2		2								2	1
CO5	3	2	3		2								2	1

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Publication	Edition
1	An Introduction to Parallel Programming	Peter S Pacheco, Matthew Malensek	Morgan Kauffman	2nd Edition
2	Parallel Programming in C with MPI and OpenMp,	Michael J Quinn –	McGrawHill.	1st Edition

VII(b): Reference Books:

2	Principles of Parallel Programming,	Calvin Lin, Lawrence Snyder	Pearson	1st Edition,
3	Using OpenMP: Portable Shared Memory Parallel Programming, Scientific and Engineering Computation	Barbara Chapman	The MIT Press	2nd Edition
4	Ewing Lusk – Using MPI:Portable Parallel Programing	William Gropp	Scientific and Engineering Computation.	3rd Edition

VII(c): Web links and Video Lectures (e-Resources):

WebLinks:
Introduction to parallel programming: https://nptel.ac.in/courses/106102163

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	ETC		
Course Title:		**Prompt Engineering**			
Course Code:	**23CDE643**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @ }		3:0:0:@		**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	03

I. Course Objectives:	

This course will enable students to:

- Learn the fundamentals of prompt engineering and effective prompt design.

- Understand how large language models generate text and images.

- Explore AI tools for content creation and automation.

- Develop hands-on skills in crafting prompts for AI-generated outputs.

- Analyze the capabilities, limitations, and ethical aspects of generative AI.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

III. COURSE CONTENT	
Module-1:	**8 Hrs**

Introduction to LLM and Prompting : Introduction to Large Language Models What are Text Generation Models, Large Language Models are Magic, A Brief History of Language Models, LLMs in the Market Understanding Prompting and Prompt Techniques Five Principles of Prompting, Introducing LLM Prompts, How LLM Prompts Work, Types of Prompts, Components of an Prompt, Defining Personality in Prompts, Mix and Match Strategic Combination for Enhanced Prompts, Challenges and Limitations of Using Prompts.
Textbook1:Chapter:sections: Ch:1,2

RBT Levels:L1,L2	
Module-2:	**8 Hrs**

Standard Practices for Text Generation: Generating Lists, Explain It Like I'm Five, Universal Translation Through LLMs, Ask For Context, Text Style Unbundling, Identifying the Desired Textual Features, Generating New Content with the Extracted Features, Role Prompting, Analyzing Existing Prompts for Strengths and Weaknesses
Textbook1:Chapter:sections: Ch:3

RBT Levels:L1,L2,L3	
Module-3:	**8 Hrs**

Generating Text with AI for Content Creation: Using AI for Copywriting, Creating Social Media Posts. Writing Video Scripts, Using AI for Personalized Messaging, Creating Engaging and Tailored Content with AI, Techniques for Crafting Effective Prompts for Surveys, Assessments, and Data Collection, Using Prompts in Research Methodology.
Textbook1:Chapter:sectionsCh:4,5

RBT Levels:L1,L2, L3	
Module-4:	**8 Hrs**

Introduction to Diffusion Models for Image Generation: Introduction to Image Generation with AI, Principles of Designing Prompts for Image Generation, Available Models - OpenAI DALL-E, Midjourney, Stable Diffusion, Google Gemini, Text to Video, Model Comparison, Reverse Engineering Prompts, Negative Prompts, Prompt Re-Writing, Prompt Analysis.
Textbook1:Chapter:sections: Ch:7

RBT Levels:L1,L2, L3	
Module-5:	**8 Hrs**

Building AI Powered Applications: AI Blog Writing, Topic Research, Expert Interview, Generate Outline, Text Generation, Writing Style, Title Optimization, AI Blog Images, User Interface, Ethical Considerations of Using AI for Text and Image Generation.
Textbook1:Chapter:sections: Ch:8

RBT Levels:L1,L2, L3	

IV. COURSE OUTCOMES	
CO1	Design clear, concise, and effective prompts using standard prompt engineering principles.
CO2	Utilize LLMs to generate high-quality text and images for content creation
CO3	Analyze and refine existing prompts to enhance AI-generated outputs.
CO4	Apply prompt engineering techniques across various AI applications
CO5	Evaluate the ethical considerations and limitations of AI-generated content.

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	1							1	2	1
CO2	3	2	2	2	1							1	2	1
CO3	3	2	2	2	1							1	2	1
CO4	2	2	2	2	1							1	2	1
CO5	2	3	3	3	1							1	2	1

<div align="center">

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

VI. Assessment Details (CIE & SEE)

</div>

General Rules: Refer Academic Regulations

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

<div align="center">

VII. Learning Resources

</div>

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Prompt Engineering for Generative AI: Future-Proof Inputs for Large Language Models	James Phoenix and Mike Taylor	First Edition,2024	O'Reilly Media

VII(b): Reference Books:

1	Prompt Engineering in Practice	Richard Davies	May 2024	Manning Publications
2	Prompt Engineering for LLMs: The Art and Science of Building Large Language Model-Based Applications	SinanOzdemir and Eric Nichols	First Edition,2024	O'Reilly Media
3.	The Art of Prompt Engineering with Chatgpt: A Hands-On Guide	Nathan Hunter	2023	

VII(c): Web links and Video Lectures (e-Resources):

- https://www.tutorialspoint.com/prompt_engineering/index.html
- https://www.promptingguide.ai/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Presentation / Group Discussion/ Assignments.

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SJB Institute of Technology

BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Computer Science and Engineering (Data Science)

Semester:	VI	Course Type:	ETC		
Course Title:	**Data Security And Privacy**				
Course Code:	**23CDE644**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}		3:0:0:@		**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:		Theory		**Exam Hours:**	3

I.	Course Objectives:

This course will enable students to:

- Explain standard algorithms used to provide confidentiality, integrity and authenticity fordata.
- Distinguish key distribution and management schemes.
- Deploy encryption techniques to secure data in transit across data networks.
- Implement security applications in the field of Information technology.
- Illustrate data privacy.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

2. Use of Video/Animation to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

III. COURSE CONTENT	
Module-1:Classical Encryption Techniques	**8 Hrs**

Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. **Block Ciphers and thedata 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.

Text Book1:Chapter:sections:Ch: 3,4

RBT Levels:L1,L2

Module-2:Public-Key Cryptography and RSA:	**8 Hrs**

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public- key cryptosystems. Applications for public-key cryptosystems, requirements for publickey cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:**Diffiehellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on a asymmetric cipher

Text book 1:Chapter:sections: Ch: 9,10

RBT Levels:L1,L2,L3

Module-3:Key Management and Distribution:	**8 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.

Text Book 1: Chapter: sections: Ch:14

RBT Levels:L1,L2, L3

Module-4:An Introduction to privacy preserving data mining:	**8 Hrs**

An Introduction to privacy preserving data mining: Privacy-Preserving Data Mining Algorithms, The Randomization Method, Group Based Anonymization.
Text Book 2:Chapter:sections: Ch:1 -1.1, 1.2 ,2 - 2.2, 2.3.

RBT Levels: L1,L2, L3

Module-5:Distributed Privacy	**8 Hrs**

Distributed Privacy-Preserving Data Mining, Privacy-Preservation of Application Results, Limitations of Privacy: The Curse of Dimensionality, Applications of Privacy Preserving Data Mining
Text Book 2: Chapter: sections: Ch: 2 - 2.4, 2.5,2.6,2.7

RBT Levels:L1,L2, L3

	IV. COURSE OUTCOMES
CO1	Analyze 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	Evaluate security mechanisms using rigorous approaches, including theoretical.
CO4	Describe importance of data privacy, limitations and applications

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	1	1								1	2	1
CO2	3	3	2	2								1	1	1
CO3	2	2	2	1								1	1	1
CO4	2	2	1	1								1	1	1

VI. Assessment Details (CIE & SEE)

General Rules: Refer Academic Regulations.

Continuous Internal Evaluation (CIE): Refer Annexure Section 1

Semester End Examination (SEE): Refer Annexure Section 1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Cryptography and Network Security,	William Stallings.,	7th edition.	Pearson
2	Privacy Preserving Data Mining: Models and Algorithms,	Charu C. Aggarwal, Philip S Yu, Kluwer	2008, ISBN 978-0-387-70991-8, DOI 10.1007/978- 0-387-70992-5	Academic Publishers

VII(b): Reference Books:

1	Cryptography and Network Security	AtulKahate	4th Edition	McGraw Hill Education
2	Cryptography and Information Security	V K Pachghare	2nd edition	PHI

VII(c): Web links and Video Lectures (e-Resources):

3. https://www.coursera.org/courses?query=data%20security%20and%20privacy
4. https://www.youtube.com/watch?v=wjW72QO8pYc

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Presentation / Group Discussion/ Assignments.

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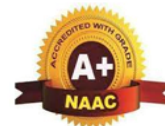
SJB Institute of Technology

BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 – 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Semester:	VI	Course Type:		AEC		
Course Title: Research Methodology & IPR						
Course Code:		**23RMAE61**		**Credits:**		03
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**		40
CIE Marks:	50	**SEE Marks:**		50	**Total Marks:**	100
SEE Type:		Theory			**Exam Hours:**	03

I.   Course Objectives:

- To Understand the knowledge on basics of research and its types.
- To Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
- To learn Ethics in Engineering Research.
- To Discuss the concepts of Intellectual Property Rights in engineering.

II. Teaching-Learning Process:

- Chalk and talk method
- Power point presentation/keynotes
- Videos

III. COURSE CONTENT

III(a). Theory PART

Module-1:Introduction	08Hrs

Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem.

Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

Textbook 1 : Chapter1 : sections: 1.1,1.2,1.3,1.4
Textbook 1 : Chapter5 : sections: 5.1,5.2,5.3

Self Learning: Case Studies

RBT Levels: L2

Module-2:Literature Review and Technical Reading	08Hrs

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet.

Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.   **Textbook1: Chapter2: sections: 2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10**   **Textbook1: Chapter3: sections: 3.1,3.2,3.3,3.4**

Self Learning: Case Studies

RBT Levels: L2

Module-3: Introduction To Intellectual Property	08Hrs

Introduction To Intellectual Property: Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India.   **Patents:** Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting.   **Process of Patenting.** Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition.   **Textbook2:Chapter1: sections:1.1,1.2,1.3,1.4,1.6**   **Textbook2: Chapter2: sections:2.1 (2.1.1 to 2.1.9)**

Self Learning: Case Studies
RBT Levels: L2

Module-4: Copyrights and Related Rights	08 Hrs

Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases.   **Trademarks**: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

Textbook2:Chapter2: sections: 2.2 (except 2.2.6)
Textbook2: Chapter2: sections:2.3 (2.3.1 to 2.3.10, 2.3.14)

Learning: Case Studies

RBT Levels: L2

Module-5: Industrial Designs	08Hrs

Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Geographical Indications: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India.

Textbook2: Chapter2: Sections : 2.4, 2.5 (2.5.1 – 2.5.13)

Self Learning: Case Studies

RBT Levels:L2

IV. COURSE OUTCOMES

CO1	Understand the importance of engineering research and its ethics.
CO2	Interpret the fundaments of Literature Review and Technical Reading.
CO3	Outline the fundamentals of patens laws and drafting procedure.
CO4	Illustrate the copyright laws and basic principles of design rights.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2							2		1		2				
CO2	2							3		3		2				
CO3				2				3	2	2		3				
CO4								3	2	2		3				

VI. Assessment Details (CIE & SEE)

General Rules: Refer to – Academic regulations

Continuous Internal Evaluation (CIE):
Refer to Annexure, SL #5
Rubrics: Refer to Annexure, SL #5

Semester End Examination (SEE):
Refer to - Annexure, SL #5
Rubrics: Refer to - Annexure, SL #5

VII. Learning Resources				
VII(a): Textbooks:				
Sl. No.	**Title of the Book**	**Name of the author**	**Edition and Year**	**Name of the publisher**
1	Engineering Research Methodology	DipankarDeb, RajeebDey, ValentinaE.Balas	ISSN1868- 4394 ISSN 1868-4408 (electronic)	Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook),
2	Intellectual Property A Primer for Academia	Prof. Rupinder Tewari Ms. Mamta Bhardwaj	2021	Publication Bureau, Panjab University Chandigarh-160014, India
VII(b): Reference Books:				
1	Research Methods for Engineers	David V. Thiel	978-1-107-03488-4	Cambridge University Press
2	Intellectual Property Rights	N.K.Acharya	ISBN: 978-93-81849-30-9	Asia Law House 6th Edition
VII(c): Web links and Video Lectures (e-Resources):				
https://www.youtube.com/watch?v=5fvpsqPWZac http://kcl.digimat.in/nptel/courses/video/109106137/L68.html http://kcl.digimat.in/nptel/courses/video/109106137/L72.html http://acl.digimat.in/nptel/courses/video/109106137/L04.html				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Quizzes, Assignments, Seminars				

Semester:	VI	Course Type:	HSMC		
Course Title: Social Connect Responsibility					
Course Code:	23SCRH08	Credits:			01
Teaching Hours/Week (L: T: P: O)		1:0:0:0	Total Hours:		15
CIE Marks:	50		Total Marks:		50

I. Course Objectives:

- This course aims to familiarize students with the dynamics of society and importance of conscious participation in the formation of an ideal society

- The course enables students to critically analyze the social processes of globalization, modernization and social change, and its impact on the socio-cultural system.

- The course aims to develop socially responsible engineers by engaging them in real-world social issues, analyzing their impact, proposing innovative solutions, and effectively documenting their findings.

- The course enables students to create a responsible connection with the society.

II. Teaching-Learning Process (General Instructions):

This course is designed to provide students with hands-on learning experiences that foster social awareness, critical thinking, and problem-solving skills. Teachers play a crucial role in guiding students through real-world issues and encouraging innovative, ethical solutions.

1. Foster an Experiential Learning Approach

- Encourage field visits, case studies, and real-world problem analysis rather than relying solely on theoretical lectures.

- Use problem-based learning (PBL) where students actively engage with a community issue and work towards solving it.

2. Facilitate Active Student Engagement

- Conduct brainstorming sessions to help students identify and understand societal problems.

- Promote group discussions and debates on contemporary social issues.

3. Encourage Innovative & Feasible Solutions

- Help students explore technology-driven solutions using engineering principles.

- Promote a multi-disciplinary approach, integrating environmental, social, and economic aspects.

4. Promote Community Interaction & Implementation

- Guide students to collaborate with NGOs, local communities, or government agencies.

- Ensure that students test their solutions in real-world settings and collect feedback.

- Emphasize the importance of ethical considerations in community engagement.

5. Train Students in Documentation & Reporting

- Teach students how to prepare structured reports on their findings, solutions, and implementation outcomes.

  - Encourage presentations, digital storytelling, and video documentation for effective communication.

  - Provide constructive feedback on student projects and ensure continuous improvement.

III. COURSE CONTENT	
Module-1:Introduction to Social Connect Responsibility	03Hrs

1. Identify the factors comprising the socio-cultural system and its impact on society

2. The concept of inter-relatedness of society and culture, socio-cultural dimensions, factors contributing to socio-cultural revolution.

3. Identifying problems in areas such as education, healthcare, environment, and infrastructure.

Module-2: Understanding Social Issues	03 Hrs

1. Understanding societal challenges in local and global contexts.

2. Role of engineers in addressing these issues.

3. Conducting preliminary field surveys and interviews

Module-3: Analyzing the Social Problem	03 Hrs

1. Understanding the economic, environmental, and societal impact of the problem

2. Ethical and moral considerations in problem-solving by Interaction with stakeholders (community members, NGOs, government bodies)

3. Root cause analysis using tools like SWOT, Fishbone Diagram, and Case Studies.

Module-4: Proposing Engineering Solutions	03 Hrs

1. Application of engineering knowledge to develop feasible solutions.

2. Use of technology for social good (IoT, AI, Renewable Energy, Smart Systems, etc.).

3. Sustainable and cost-effective approaches.

4. Feasibility analysis and implementation strategies.

Module-5: Documentation & Reporting	03 Hrs

1. Preparing a structured report with problem identification, analysis, proposed solutions, and implementation insights.

2. Creating presentations, videos, and other forms of project documentation.

3. Reflecting on personal learning and the social impact of the project.

	4. Submission of a final report and group presentation.

	IV.COURSE OUTCOMES
CO1	Students will be able to recognize and define real-world social issues, assessing their relevance and impact on communities.
CO2	Students will develop analytical skills to investigate the root causes of social problems and evaluate their economic, environmental, and ethical implications.
CO3	Students will apply engineering principles and innovative thinking to propose feasible, sustainable, and technology-driven solutions for identified social issues.
CO4	Students gain from stakeholder's interaction and develop presentation skills.

V.CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12
CO1			1			2	1	1	1			1
CO2			1			1	2	1	1			1
CO3			1			2	2	1	1			1
CO4			1			2	1	1	1			1

VI. Formative Assessment Details (CIE)
Continuous Internal Evaluation (CIE)& Rubrics: *Refer to Annexure section -8*

VII. Learning Resources

VII (a). Reference Books :

1. C. N. Shankar Rao (2006) Sociology of Indian Society, 2nd, S. Chand publication

2. Nandan Nilekani, Imagining India: The Idea of a Renewed Nation, Penguin Books, 2009.

3. Gurcharan Das, India Unbound: From Independence to the Global Information Age, Anchor Books, 2002.

4. Raghuram G. Rajan, I Do What I Do, Harper Business, 2017.

VIII. Activity Based Learning

1. **Community Survey:** Students visit local communities (rural/urban) to identify real social issues (sanitation, education, healthcare, infrastructure)
2. **Collaboration with NGOs & CSR Units:** Partner with organizations working on social impact projects.
3. **Sustainability Planning:** Students draft plans for scaling up their solutions in a sustainable manner.
4. **Video Documentation:** Create short films showcasing their social project progress and community feedback.