K.S. Rangasamy College of Technology

(Autonomous)

Curriculum & Syllabi

for

M.Tech. Data Science

(For the batch admitted in 2026 – 2027)

R2025

Accredited by NAAC with 'A++' grade,

Approved by AICTE, Affiliated to Anna University, Chennai.

KSR Kalvi Nagar, Tiruchengode – 637 215.

Namakkal District, Tamil Nadu, India.

M.Tech - DATA SCIENCE

VISION

To emerge as an information technology knowledge hub by imparting quality education, promoting research and innovation.

MISSION

To provide holistic education through curriculum update, inspired and experiential learning

To mold the students as responsible professionals to compete with the emerging global challenges

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: **Core Competence**: Graduates will demonstrate their technical skills and competency in various applications through the use of Data Science

PEO2: **Successful Career:** Graduates will establish their knowledge by adopting Data Science technologies to solve the real-world problems

PEO3: **Ethics and life-long learning:** Graduates will continue to advance in their career through life-long learning with a social and ethical concern

2. PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

PO1: An ability to independently carry out research /investigation and development work to solve practical problems

PO2: An ability to write and present a substantial technical report/document

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO4: Create and develop computer programmes and computer-based systems in the fields of security, web design, and artificial intelligence

PO5: Demonstrate the impact of the professional engineering solutions in societal and environmental contexts for sustainable development.

PO6: Recognize the need of autonomous, lifelong learning in the context of technological change, and possess the necessary skills and readiness.

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The M. Tech (Data Science) Program outcomes leading to the achievement of the objectives are summarized in the following Table.

Program Educational Objectives (PEOs)	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
PEO 1	3	3	2	3	2	3
PEO 2	2	3	2	3	3	2
PEO 3	3	2	3	2	2	3

Contributions: 1- Low, 2- Medium, 3- High

MAPPING – M.Tech (Data Science)

YEAR	SEMESTER	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6
Year I	I	Mathematics for Data Science	2.8	2.4	2.4	2.8	1.2	2
		Research Methodology and IPR	3	3	2	2	2	2
		Data Science and Big Data Technologies	3	3	3	3	3	2.6
		Introduction to Generative AI	3	3	2.67	0	0	0
		Machine Learning Algorithms and Applications	2.2	2	2.2	2.8	3	3
		Artificial Intelligence and Internet of Things	3	2.5	2.5	3	2.67	3
		Soft computing and its applications	2	2	3	2.6	2.8	2.8
		Data Mining and Applications	2.4	2	2.6	2.8	2.8	2.8
		Distributed Systems	2.6	3	2.6	2.6	2.6	2.2
		DevOps for Data Science	3	3	3	2	3	0
		Human-Computer Interaction and AI Design	3	2.5	2.5	3	2.67	3
		English for Research Paper Writing	3	3	2	2.8	2.4	2.6
		Disaster Management	3	3	2	2.8	2.4	2.6
		AI and Machine Learning Laboratory	3	2	2.4	2.5	3	3
	II	Data Analysis and Visualization	3	2	3	2.8	0	0
		Blockchain Applications in Data Science	3	2.4	2.4	2.6	2	0
		Cloud AI and Edge Computing	3	2.2	2.2	2.2	2	
		Data Security and Privacy	2	2	3	2.8	2.8	2.6
		Advanced Algorithms and Optimization	3	2	2.6	2.8	2.8	2.6

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		Intelligent Database Systems	2	2.6	3	2.6	2.6	2
		Advanced Natural Language Processing	2.8	3	2.8	2.8	2.6	3
		R Programming for Data Science	3	1.4	1.6	0	2	0
		Reinforcement Learning	3	2	2.6	2.8	2.8	2.8
		Advanced Recommender Systems	2.8	1.67	2.4	3	2.6	0
		Data Engineering Tools and Techniques	3	3	3	3	3	2.6
		Data Preprocessing and Optimization Techniques	3	2.75	2.5	2	2	0
		Cognitive Science and Analytics	3	3	2	2.8	2.4	2.6
		Constitution of India	3	2.5	2.5	3	2.67	3
		Term Paper and Technical Seminar						
		Data Analysis and Visualization Laboratory	3	2	2.6	0	0	3
Year II	III	Intelligent Systems and Deep Learning	2	2	3	3	2	2
		Cloud Security for Data Science	3	3	2	0	0	0
		IoT Analytics and Smart Infrastructure	3	2.6	2	2	2	0
		Advanced Web Analytics	3	2.6	2	2	2	0
		Business Intelligence and Analytics	2.2	2.5	2.75	2.5	2.75	0
		Social Media and Network Data Analytics	3	2.6	2	2	2	0
		Cybersecurity in AI and ML Systems	2.2	2	2.2	2.8	3	3
		Financial Analytics and Risk Management	2.8	1.67	2.4	3	2.6	0
		Edge Computing for Data Science	2.67	2.5	3	2.5	2.75	2.67
		Next Generation Databases	2	2	3	3	2	2
		GPU Computing	3	3	2.8	3	2	2
		AI for Augmented and Virtual Reality	3	2.6	2.4	1.75	3	0
		Theoretical and Computational Neuroscience	2	2	3	3	2	0
		Fog Computing	2	2	2	3	1	1
		AI in Social Impact and Governance	3	2.67	2.25	2.75	2.75	3
		Quantum Computing for Data Science	3	2.6	2.4	2.6	2.5	0

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Credit Distribution for M.Tech (Data Science) Program: 2026 - 2027 Batch

S.No.	Category	Credits per Semester				Total Credits	%
		I	II	III	IV		
1.	**RM**	03	-	-	-	03	04.17
2.	**PC**	15	14	04	-	33	45.83
3.	**PE**	03	06	09	-	18	25.00
4.	**CG**	-	-	06	12	18	25.00
5.	**AC**	AC I	AC II	-	-		
Total		**21**	**20**	**19**	**12**	**72**	**100**

PC - PROFESSIONAL CORE

PE - PROFESSIONAL ELECTIVE

CG - CAREER GUIDANCE COURSES

AC - AUDIT COURSES

Open Electives are courses offered by different departments that do not have any prerequisites and could be of interest to students of any branch.

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PROFESSIONAL CORE COURSES (PC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-Requisite
1.	70 PDS 101	Mathematics for Data Science	PC	5	3	1	0	4	Basic Knowledge of probability and Statistics, Data Mining
2.	70 PIS 001	Research Methodology and IPR	PC	3	3	0	0	3	Nil
3.	70 PDS 102	Data Science and Big Data Technologies	PC	3	3	0	0	3	Data Mining
4.	70 PDS 103	Introduction to Generative AI	PC	3	3	0	0	3	Machine Learning
5.	70 PDS 104	Machine Learning Algorithms and Applications	PC	3	3	0	0	3	Probability and Statistics, Linear Algebra
6.	70 PDS 1P1	AI and Machine Learning Laboratory	PC	4	0	0	4	2	Basics of Python Programming Fundamentals of Probability and Statistics
7.	70 PDS 201	Data Analysis and Visualization	PC	3	3	0	0	3	Basic knowledge of Data mining and Power BI
8.	70 PDS 202	Blockchain Applications in Data Science	PC	3	3	0	0	3	Computer Networks and Network Security
9.	70 PDS 203	Cloud AI and Edge Computing	PC	3	3	0	0	3	Cloud Computing, Artificial Intelligence
10.	70 PDS 204	Data Security and Privacy	PC	3	3	0	0	3	Basic knowledge of Computer Networks, Cryptography and Network Security
11.	70 PDS 2P2	Data Analysis and Visualization Laboratory	PC	4	0	0	4	2	Basic knowledge of MS Excel and Power BI
12.	70 PDS 301	Intelligent Systems and Deep Learning	PC	5	3	1	0	4	Basic knowledge of Probability & Statistics, Artificial Intelligence and Machine Learning

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SEMESTER I, PROFESSIONAL ELECTIVE I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-Requisite
1.	70 PDS E11	Artificial Intelligence and Internet of Things	PE	3	3	0	0	3	Basic knowledge of Artificial Intelligence, Big Data.
2.	70 PDS E12	Soft computing and its applications	PE	3	3	0	0	3	Basic Knowledge of Neural Network, Deep Learning
3.	70 PDS E13	Data Mining and Applications	PE	3	3	0	0	3	Basic Knowledge of Neural Network, Deep Learning
4.	70 PDS E14	Distributed Systems	PE	3	3	0	0	3	Basic Knowledge of Operating Systems, Computer Networks
5.	70 PDS E15	DevOps for Data Science	PE	3	3	0	0	3	Programming Fundamentals Basic knowledge of Linux commands Understanding of cloud computing concepts
6.	70 PDS E16	Human-Computer Interaction and AI Design	PE	3	3	0	0	3	Basic knowledge of programming, data structures, and artificial intelligence fundamentals.

SEMESTER II, PROFESSIONAL ELECTIVE II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-Requisite
1.	70 PDS E21	Advanced Algorithms and Optimization	PE	3	3	0	0	3	Data Structure, Design and Analysis of Algorithms
2.	70 PDS E22	Intelligent Database Systems	PE	3	3	0	0	3	Database systems, SQL, XML, Data Science
3.	70 PDS E23	Advanced Natural Language Processing	PE	3	3	0	0	3	Theory of Computation, Compiler Design
4.	70 PDS E24	R Programming for Data Science	PE	3	3	0	0	3	Basic Knowledge of Data Science
5.	70 PDS E25	Deep Learning for Recommendation Systems	PE	3	3	0	0	3	Programming & Data Handling

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SEMESTER II, PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-Requisite
1.	70 PDS E31	Reinforcement Learning	PE	3	3	0	0	3	Data Mining, Machine Learning
2.	70 PDS E32	Advanced Recommender Systems	PE	3	3	0	0	3	Data Structures
3.	70 PDS E33	Data Engineering Tools and Techniques	PE	3	3	0	0	3	Big Data Analytics
4.	70 PDS E34	Data Preprocessing and Optimization Techniques	PE	3	3	0	0	3	Mathematics and Statistics and Machine Learning Fundamentals
5.	70 PDS E35	Cognitive Science and Analytics	PE	3	3	0	0	3	Basic knowledge of Artificial Intelligence

SEMESTER III, PROFESSIONAL ELECTIVE IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-Requisite
1.	70 PDS E41	Cloud Security for Data Science	PE	3	3	0	0	3	Data Mining, Machine Learning
2.	70 PDS E42	IoT Analytics and Smart Infrastructure	PE	3	3	0	0	3	Basic knowledge of IoT
3.	70 PDS E43	Advanced Web Analytics	PE	3	3	0	0	3	Basic knowledge of Web Technology, Data Mining, Machine Learning
4.	70 PDS E44	Business Intelligence and Analytics	PE	3	3	0	0	3	Proficiency in Python and SQL
5.	70 PDS E45	Social Media and Network Data Analytics	PE	3	3	0	0	3	Basic knowledge of social media

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SEMESTER III, PROFESSIONAL ELECTIVE V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-Requisite
1.	70 PDS E51	Cybersecurity in AI and ML Systems	PE	3	3	0	0	3	Basic knowledge of AI/ML, Networking, and Cybersecurity
2.	70 PDS E52	Financial Analytics and Risk Management	PE	3	3	0	0	3	Mathematics and Software Engineering
3.	70 PDS E53	Edge Computing for Data Science	PE	3	3	0	0	3	Programming, Mathematics, Machine Learning, Networking
4.	70 PDS E54	Next Generation Databases	PE	3	3	0	0	3	Basic knowledge of Database Technologies and Data Models
5.	70 PDS E55	GPU Computing	PE	3	3	0	0	3	Operating System

SEMESTER III, ELECTIVE VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	70 PDS E61	AI for Augmented and Virtual Reality	PE	3	3	0	0	3	Mathematics & Computer Science Basics Programming & Development Computer Vision & Image Processing
2.	70 PDS E62	Theoretical and Computational Neuroscience	PE	3	3	0	0	3	Basic knowledge of Neural Network and Machine Learning
3.	70 PDS E63	Fog Computing	PE	3	3	0	0	3	Basic knowledge of Data Science, Cloud Computing IoT
4.	70 PDS E64	AI in Social Impact and Governance	PE	3	3	0	0	3	Awareness of Social Science and Public Policy principles
5.	70 PDS E65	Quantum Computing for Data Science	PE	3	3	0	0	3	Algebra, Gates and Circuits, Cryptography

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AUDIT COURSES (AC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-Requisite
1.	70 PAC 001	English for Research Paper Writing	AC	2	2	0	0	0	-
2.	70 PAC 002	Disaster Management	AC	2	2	0	0	0	-
3.	70 PAC 003	Constitution of India	AC	2	2	0	0	0	-

CAREER GUIDANCE COURSES (CG)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Pre-Requisite
1.	70 PDS 2P1	Term Paper and Technical Seminar	CG	2	0	0	2	0	Domain Knowledge in Thrust Areas
2.	70 PDS 3P1	Project Work - Phase I	CG	12	0	0	12	6	Technical Seminar
3.	70 PDS 4P1	Project Work - Phase II	CG	24	0	0	24	12	Technical Seminar

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COURSES OF STUDY
(For the Batch Admitted in 2026 - 2027)

SEMESTER I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	70 PDS 101	Mathematics for Data Science	PC	5	3	1	0	4
2.	70 PIS 001	Research Methodology and IPR	PC	3	3	0	0	3
3.	70 PDS 102	Data Science and Big Data Technologies	PC	3	3	0	0	3
4.	70 PDS 103	Introduction to Generative AI	PC	3	3	0	0	3
5.	70 PDS 104	Machine Learning Algorithms and Applications	PC	3	3	0	0	3
6.	70 PDS E1*	Professional Elective I	PE	3	3	0	0	3
7.	70 PAC 001	English for Research Paper Writing	AC	2	2	0	0	0
PRACTICALS								
8.	70 PDS 1P1	AI and Machine Learning Laboratory	PC	4	0	0	4	2
			Total	26	20	1	4	21

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SEMESTER II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	70 PDS 201	Data Analysis and Visualization	PC	3	3	0	0	3
2.	70 PDS 202	Blockchain Applications in Data Science	PC	3	3	0	0	3
3.	70 PDS 203	Cloud AI and Edge Computing	PC	3	3	0	0	3
4.	70 PDS 204	Data Security and Privacy	PC	3	3	0	0	3
5.	70 PDS E2*	Professional Elective II	PE	3	3	0	0	3
6.	70 PDS E3*	Professional Elective III	PE	3	3	0	0	3
7.	70 PAC 002	Disaster Management	AC	2	2	0	0	0
PRACTICALS								
8.	70 PDS 2P1	Term Paper and Technical Seminar	CG	2	0	0	2	0
9.	70 PDS 2P2	Data Analysis and Visualization Laboratory	PC	4	0	0	4	2
Total				26	20	0	06	20

SEMESTER III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	70 PDS 301	Intelligent Systems and Deep Learning	PC	5	3	1	0	4
2.	70 PDS E4*	Professional Elective IV	PE	3	3	0	0	3
3.	70 PDS E5*	Professional Elective V	PE	3	3	0	0	3
4.	70 PDS E6*	Professional Elective VI	PE	3	3	0	0	3
PRACTICALS								
5.	70 PDS 3P1	Project Work - Phase I	CG	12	0	0	12	6
Total				**26**	**12**	**01**	**12**	**19**

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SEMESTER IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
PRACTICALS								
1.	70 PDS 4P1	Project Work- Phase II	CG	24	0	0	24	12
Total				**24**	**0**	**0**	**24**	**12**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 72

Note:

HS- Humanities and Social Sciences Courses; BS- Basic Science Courses; ES- Engineering Science Courses; PC- Professional Core Courses; PE- Professional Elective Courses; GE- General Elective Courses; OE - Open Elective Courses; CGC-Career Guidance Courses; MC- Mandatory Courses; AC- Audit Courses.

L: Lecture

T: Tutorial

P: Practical

C: Credit

1 Hour Lecture = 1 credit

1 Tutorial = 1 credit

2 Hours Practical = 1 credit

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(An Autonomous Institution affiliated to Anna University)

M. Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2026 - 2027)

FIRST SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1	70 PDS 101	Mathematics for Data Science	2	40	60	100	45	100
2	70 PIS 001	Research Methodology and IPR	2	40	60	100	45	100
3	70 PDS 102	Data Science and Big Data Technologies	2	40	60	100	45	100
4	70 PDS 103	Introduction to Generative AI	2	40	60	100	45	100
5	70 PDS 104	Machine Learning Algorithms and Applications	2	40	60	100	45	100
6.	70 PDS E1*	Professional Elective I	2	40	60	100	45	100
7.	70 PAC 0**	Audit Course – I*	2	100	-	100	-	100
PRACTICAL								
8.	70 PDS 1P1	AI and Machine Learning Laboratory	2	60	40	100	45	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for practical End Semester Examination.

Rev. No.3/w.e.f. 23/11/2024
Approved Passed in BoS Meeting held on 23/11/2024
Academic Council Meeting held on 21/12/2024

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70 PDS 101	Mathematics for Data Science	Category	L	T	P	Credit
		PC	3	1	0	4

Objectives

- To Introduce the basics of data science
- To enrich the skills in linear algebra models
- To understand the concepts of fitting of curves and regression
- To expose the knowledge of optimization Techniques in Advanced Fields.
- To Impart the knowledge in data science methods

Pre-requisites

- Basic Knowledge of Probability and Statistics, Data Mining

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Apply the concepts of linear algebra in data science problems	Apply
CO2	Apply the properties, eigen values and eigen vectors based on linear algebra	Apply
CO3	Solve the real time applications using regression analysis and estimation	Apply
CO4	Compare the optimization techniques to solve the machine Learning	Apply
CO5	Apply the data science concepts as advanced models	Apply

Mapping with Programme Outcomes

COs	Pos					
	1	2	3	4	5	6
CO1	2	2	2	2	2	2
CO2	3	2	3	3	1	2
CO3	3	2	3	3	1	2
CO4	3	3	2	3	1	2
CO5	3	3	2	3	1	2
3 - Strong; 2 - Medium; 1 – Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	10	10	10
Understand (Un)	10	10	20
Apply (Ap)	40	40	70
Analyse (An)	-	-	-
Evaluate (Ev)	-	-	-
Create (Cr)	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
PDS: M. Tech Data Science								
70 PDS 101 - Mathematics for Data Science								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	1	0	60	4	40	60	100

Basics of Data Science Introduction, Typology of Problems, Importance of Linear Algebra, Statistics and Optimization from a Data Science Perspective, Structured Thinking for Solving Data Science Problems	[9]
Linear Algebra Matrix Factorizations (The Cholesky Decomposition, QR Factorization, Singular Value Decomposition), Inner Products, Distance Measures, Projections, Notion of Hyper Planes, Half Planes.	[9]
Regression Analysis and Estimation Curve Fitting by Method of Least Squares - Correlation Properties of Correlation Coefficient - Linear Regression - Least Square Estimation of Regression Coefficients - Regression Lines - Maximum Likelihood Estimation	[9]
Optimization Unconstrained Optimization, Necessary and Sufficiency Conditions for Optima, Gradient Descent Methods, Constrained Optimization, KKT Conditions, Introduction to Non-Gradient Techniques, Introduction to Least Squares Optimization.	[9]
Data Science Methods Linear Regression as an Exemplar Function Approximation Problem, Linear Classification Problems.	[9]
Total Hours:45 +15(Tutorial	60

Text Book(s):	
1.	David C. Lay, 'Linear Algebra and its Applications', 5th Edition, Pearson Education, 2014.
2.	B.S. Grewal, 'Higher Engineering Mathematics', 43rdEdition, Khanna Publishers, Delhi, 2014.
3.	G. Sudha, M. Thangaraj, S. Suguna, "Big Data Analytics: Concepts, Techniques, Tools and Technologies Paperback", PHI Learning, 2022
Reference(s):	
1.	G. Strang 'Introduction to Linear Algebra', 5th Edition, Wellesley-Cambridge Press, 2016.
2.	Anand Rajaraman and Jeffrey David Ullman," Mining of Massive Datasets", Cambridge University Press, 3rd edition 2020.
3.	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4.	Cathy O'Neil and Rachel Schutt, 'Doing Data Science', 4th Edition, O'Reilly Media, Fourth Edition, 2016.

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Approved Passed in BoS Meeting held on 23/11/2024
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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Basics of Data Science**	
1.1	Introduction	1
1.2	Typology of Problems	2
1.3	Importance of Linear Algebra	2
1.4	Statistics and Optimization from a Data Science Perspective	2
1.5	Structured Thinking for Solving Data Science Problems	2
1.6	Tutorial	3
2	**Linear Algebra**	
2.1	Matrix factorizations - The Cholesky Decomposition	1
2.2	QR Factorization	2
2.3	Singular Value Decomposition	2
2.4	Inner Products	1
2.5	Distance Measures, Projections	2
2.6	Notion of Hyper Planes, Half planes	1
2.7	Tutorial	3
3	**Regression Analysis and Estimation**	
3.1	Curve fitting by Method of Least Squares	2
3.2	Correlation, Properties of Correlation Coefficient	2
3.3	Linear Regression	2
3.4	Least Square Estimation of Regression Coefficients - Regression Lines	2
3.5	Maximum Likelihood Estimation	1
3.6	Tutorial	3
4	**Optimization**	
4.1	Unconstrained Optimization	1
4.2	Necessary and Sufficiency Conditions for Optima	1
4.3	Gradient Descent Methods	1
4.4	Constrained Optimization	2
4.5	KKT Conditions	1
4.6	Introduction to Non-Gradient Techniques	2
4.7	Introduction to Least Squares Optimization	1
4.8	Tutorial	3
5	**Data Science Methods**	
5.1	Linear Regression as an Exemplar Function Approximation Problem	5
5.2	Linear Classification Problems	4
5.3	Tutorial	3
	Total 45+15(Tutorial)	60

Course Designer(s)

Ms. S. Annapoorani (annapoorani@ksrct.ac.in)

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Approved Passed in BoS Meeting held on 23/11/2024
Academic Council Meeting held on 21/12/2024

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70 PIS 001	Research Methodology and IPR	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the research process and design.
- To gain the knowledge about sources and collection of research data.
- To understand the procedure of data analysis and preparation of reports.
- To gain the knowledge on intellectual property rights.
- To enlighten the system of patents and benefits

Pre-requisites

- **Nil**

Course Outcomes

On the successful completion of the course, students will be able to

CO1	To understand the research process and design.	Apply
CO2	To gain the knowledge about sources and collection of research data	Apply
CO3	To understand the procedure of data analysis and preparation of reports.	Apply
CO4	To gain the knowledge on intellectual property rights.	Apply
CO5	To enlighten the system of patents and benefits	Analyse

Mapping with Programme Outcomes

COs	Pos					
	1	2	3	4	5	6
CO1	3	3	2	2	2	2
CO2	3	3	2	2	2	2
CO3	3	3	2	2	2	2
CO4	3	3	2	2	2	2
CO5	3	3	2	2	2	2
3 - Strong; 2 - Medium; 1 – Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	10	10	30
Understand (Un)	20	20	30
Apply (Ap)	10	10	30
Analyse (An)	00	00	10
Evaluate (Ev)	00	00	00
Create (Cr)	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
70 PIS 001 - Research Methodology and IPR								
Common to all Branches								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Research Design Overview of research process and design- Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys, Selection of the Right Medium and Journal for publication, Translation of Research	[9]
Data Collection and Sources Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.	[9]
Data Analysis and Reporting Overview of Multivariate Analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation. Checks for Plagiarism, Falsification, Fabrication, and Misrepresentation	[9]
Intellectual Property Rights Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.	[9]
Patents Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.	[9]
Total Hours:	**45**

Text Book(s):	
1.	David I. Bainbridge, “Intellectual Property”, Longman, 9th Edition, 2012.
2.	Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).

Reference(s):	
1.	Chawla H S., “Introduction to Intellectual Property Rights”, CBS PUB & DIST PVT Limited, INDIA, 2019.
2.	Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007
3.	David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007
4.	Arun K. Narasani, Kankanala K.C., Radhakrishnan V., “Indian Patent Law and Practice”, Oxford University Press, 2010.
5.	Richard Stim, “Patent, Copyright & Trademark - An Intellectual Property Desk Reference”, NOLO Publishers, 2020.
6.	The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Research Design**	
1.1	Overview of research process and design	1
1.2	Use of Secondary and exploratory data to answer the research question	2
1.3	Qualitative research	1
1.4	Observation studies	1
1.5	Experiments and Surveys	1
1.6	Selection of the Right Medium and Journal for publication	2
1.7	Translation of Research	1
2	**Data Collection and Sources**	
2.1	Measurements, Measurement Scales	2
2.2	Questionnaires and Instruments	2
2.3	Sampling and methods	2
2.4	Data - Preparing, Exploring, examining and displaying	3
3	**Data Analysis and Reporting**	
3.1	Overview of Multivariate analysis	1
3.2	Hypotheses testing and Measures of Association	2
3.3	Presenting Insights	1
3.4	Findings using written reports and oral presentation	2
3.5	Checks for Plagiarism	1
3.6	Falsification	1
3.7	Fabrication, and Misrepresentation	1
4	**Intellectual Property Rights**	
4.1	Intellectual Property – The concept of IPR	1
4.2	Evolution and development of concept of IPR, IPR development process	2
4.3	Trade secrets, utility Models, IPR & Bio diversity	2
4.4	Role of WIPO and WTO in IPR establishments	1
4.5	Right of Property, Common rules of IPR practices	1
4.6	Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance	2
5	**Patents**	
5.1	Patents – objectives and benefits of patent, Concept, features of patent	2
5.2	Inventive step, Specification, Types of patent application	2
5.3	Process E-filling, Examination of patent	1
5.4	Grant of patent, Revocation	1
5.5	Equitable Assignments, Licences, Licensing of related patents	2
5.6	Patent agents, Registration of patent agents	1
5.7	**Total Hours**	45

Course Designer(s)

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70 PDS 102	Data Science and Big Data Technologies	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To provide a strong foundation in Data Science concepts and Big Data Technologies.
- To enable students to process and analyse large-scale data using Big Data tools and frameworks.
- To introduce machine learning techniques and statistical models for data-driven decision-making.
- To develop hands-on experience with Hadoop, Spark, NoSQL databases, and data visualization.
- To understand real-world applications of Data Science and Big Data across industries.

Pre-requisites

- Data Mining

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the fundamental concepts of Data Science and Big Data.	Remember
CO2	Apply data preprocessing, cleaning, and transformation techniques.	Understand
CO3	Implement Big Data frameworks like Hadoop and Spark for scalable data processing.	Apply
CO4	Apply machine learning models and Tools for prediction and classification tasks.	Apply
CO5	Develop data visualization and reporting techniques using tools like Tableau, Matplotlib, and Power BI	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	3	3	3	3	2
CO2	3	3	3	3	3	2
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	20	00	20
Understand (Un)	40	20	40
Apply (Ap)	00	40	40
Analyse (An)	00	00	00
Evaluate(Ev)	00	00	00
Create (Cr)	00	00	00
Total	60	100	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS 102 - Data Science and Big Data Technologies								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Introduction to Data Science Overview of Data Science & Big Data, Characteristics of Big data, Data Types and Data Collections, Data Pre-processing, Sources of data: Databases, APIs, Web Scraping Applications of Data Science in different domains	[9]
Statistical & Machine Learning Techniques Descriptive and Inferential Statistics, Linear Regression, Logistic Regression, Classification techniques: Decision Trees, SVM, Naïve Bayes, K-Means Clustering, Hierarchical Clustering, Dimensionality reduction techniques, Principal	[9]
Big Data Technologies Introduction to Hadoop, MapReduce, Hadoop Distributed File System (HDFS) architecture and operations, Basics of MapReduce, Programming. Spark and Data Processing: Introduction to Apache Spark, Spark RDDs, Data Frames and Datasets Spark for Big Data Processing	[9]
Data Warehousing and NoSQL Databases Introduction to Data Warehousing concepts, NoSQL Databases: MongoDB, Cassandra, HBase, Key differences between relational and NoSQL databases	[9]
Data Visualization Importance of Data Visualization, Tools: Matplotlib, Seaborn, Tableau, Power BI, Big Data in Social Media Analysis, Predictive Analytics for Business Intelligence, Applications in Health, Finance, Marketing, and Retail	[9]
Total Hours:	**45**

Text Book(s):	
1.	G. Sudha, M. Thangaraj, S. Suguna, “Big Data Analytics: Concepts, Techniques, Tools and Technologies Paperback”, PHI Learning, 2022
2.	Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015
Reference(s):	
1.	Anand Rajaraman and Jeffrey David Ullman,” Mining of Massive Datasets”, Cambridge University Press, 3rd edition 2020.
2.	Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
3.	Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
4.	Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.

*SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Data Science**	
1.1	Overview of Data Science & Big Data	1
1.2	Characteristics of Big data	1
1.3	Data Types	1
1.4	Data Collections	1
1.5	Data Pre-processing	1
1.6	Sources of data: Databases	1
1.7	APIs	1
1.8	Web Scraping	1
1.9	Applications of Data Science in different domains	1
2.0	Statistical & Machine Learning Techniques	
2.1	Descriptive and Inferential Statistics	1
2.2	Linear Regression	1
2.3	Logistic Regression	1
2.4	Classification techniques: Decision Tree	1
2.5	Support Vector Machine	1
2.6	Naïve Bayes	1
2.7	K-Means Clustering, Hierarchical Clustering	1
2.8	Dimensionality reduction techniques	1
2.9	Principal Component Analysis	1
3.0	**Big Data Technologies**	
3.1	Introduction to Hadoop	1
3.2	MapReduce	1
3.3	HDFS architecture and operations	1
3.4	Basics of MapReduce programming	2
3.5	Spark and Data Processing	1
3.6	Introduction to Apache Spark	1
3.7	Spark RDDs	1
3.8	Data Frames	1
3.9	Datasets Spark for Big Data Processing	
4.0	Data Warehousing and NoSQL Databases	
4.1	Introduction to Data Warehousing concepts	1
4.2	Data Warehousing Architecture	1
4.3	NoSQL Databases	1
4.4	MongoDB	2
4.5	Cassandra	2
4.6	HBase	1
4.7	Key differences between relational and NoSQL databases	1

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5.0	Data Visualization	
5.1	Importance of Data Visualization, Tools: Matplotlib	1
5.2	Seaborn, Tableau	2
5.3	Matplotlib, Power BI	2
5.4	Big Data in Social Media Analysis	1
5.5	Predictive Analytics for Business Intelligence	1
5.6	Applications in Health, Finance	1
5.7	Applications in Marketing, and Retail	1

Course Designer(s)

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70 PDS 103	Introduction to Generative AI	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the fundamentals of Generative AI, including key concepts, types of generative models, and mathematical foundations.
- To study probabilistic models, deep generative models, and their role in generating synthetic data.
- To explore state-of-the-art generative models such as GANs, VAEs, Transformers, and Diffusion Models, along with their architectures and training techniques.
- To analyse real-world applications of generative AI in text, image, video, and multimodal content generation, while addressing ethical and regulatory concerns.
- To examine the future trends in generative AI, including advancements in autonomous AI agents, reinforcement learning, and human-AI collaboration.

Pre-requisites

- Machine Learning

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Recognize the fundamental concepts, mathematical foundations, and types of Generative AI models.	Remember
CO2	Summarize probabilistic generative models, deep learning techniques, and their applications in synthetic data generation.	Understand
CO3	Analyse advanced generative models such as GANs, VAEs, Transformers, and Diffusion Models, along with their real-world applications.	Analyse
CO4	Illustrate the applications of generative AI in text, image, video, and multimodal content generation, while addressing ethical concerns.	Apply
CO5	Discuss the emerging trends, research directions, and future scope of Generative AI in various domains.	Understand

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	3	3	-	-	-
CO2	3	3	3	-	-	-
CO3	3	-	2	-	-	-
CO4	3	-	-	-	-	-
CO5	3	-	-	-	-	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	20	10	34
Understand (Un)	40	10	27
Apply (Ap)	00	20	23
Analyse (An)	00	20	15
Evaluate(Ev)	00	00	00
Create (Cr)	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS 103 - Introduction to Generative AI								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Fundamentals of Generative AI Introduction to Artificial Intelligence and Machine Learning - Overview of Generative AI – Definition, Evolution, and Importance - Differences between Discriminative and Generative Models - Mathematical Foundations – Probability, Statistics, and Linear Algebra for AI - Basics of Neural Networks – Perceptron, MLP, and Backpropagation - Probability Distributions in Generative AI – Gaussian, Bernoulli, and Exponential - Bayesian Networks and Hidden Markov Models (HMM) - Information Theory – Entropy, Cross-Entropy, and KL-Divergence - Introduction to Autoencoders and Representation Learning - Evaluation Metrics for Generative Models – Log-Likelihood, Perplexity, and FID.	[9]
Probabilistic & Deep Generative Models Introduction to Probabilistic Generative Models - Bayesian Learning and Latent Variable Models - Restricted Boltzmann Machines (RBM) – Concepts and Applications - Deep Belief Networks (DBN) – Architecture and Learning - Variational Autoencoders (VAE) – Working Principle and Loss Function - Gaussian Mixture Models (GMM) – Clustering and Applications - Markov Chain Monte Carlo (MCMC) and Gibbs Sampling - Deep Generative Models – An Overview - Reinforcement Learning and Its Role in Generative AI - Regularization and Optimization Techniques in Deep Learning.	[9]
Advanced Generative Models Introduction to Generative Adversarial Networks (GANs) - Architecture of GANs – Generator, Discriminator, and Training Process - Types of GANs – DCGAN, WGAN, StyleGAN, and CycleGAN - Applications of GANs – Image Synthesis, Super-Resolution, and Deepfake Generation - Variational Autoencoders (VAE) vs GANs – Comparison and Use Cases - Transformer-Based Generative Models – BERT, GPT, and T5 - Diffusion Models – Denoising Diffusion Probabilistic Models (DDPM) - Large Language Models (LLMs) and Text Generation – GPT-4, ChatGPT, and Bard - Ethical and Adversarial Concerns in GANs and Deepfake Detection - Performance Evaluation of Advanced Generative Models.	[9]
Applications and Challenges in Generative AI Text Generation and Natural Language Processing (NLP) Applications - Image Synthesis and Enhancement – AI-Generated Art and Style Transfer - Video Generation and Animation using Generative AI - Speech Synthesis and AI-Generated Music (TTS & Voice Cloning) - Multimodal AI – Combining Text, Image, and Video Generation - Generative AI in Healthcare – Drug Discovery, Medical Image Analysis - Generative AI in Gaming and Metaverse – Virtual World and NPCs - Ethical and Legal Concerns – Bias, Fairness, and Copyright Issues - Adversarial Attacks and Defense Mechanisms in Generative AI - Responsible AI Development – Policies, Regulations, and Future Challenges.	[9]
Future Trends and Research Directions in Generative AI Evolution of Generative AI – From Deep Learning to AGI - Self-Supervised and Unsupervised Learning for Generative AI - Autonomous AI Agents and Generative Decision-Making - Neural Architecture Search (NAS) for Improving Generative Models - Generative AI for Scientific Discovery and Creativity - Human-AI Collaboration – Enhancing Productivity with Generative AI - Zero-Shot and Few-Shot Learning in Generative AI Models - AI Alignment and Explainability – Making AI More Transparent - Trends in Computational Power and Quantum Computing for Generative AI - Open Challenges and Research Directions in Generative AI.	[9]
Total Hours:	**45**

Text Book(s):

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press, 2016.

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2.	David Foster, "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play", 2nd Edition, O'Reilly Media, 2022.
Reference(s):	
1.	Sebastian Raschka and Vahid Mirjalili, "Machine Learning with PyTorch and Scikit-Learn", 1st Edition, Packt Publishing, 2022.
2.	Tom Hope, Yehezkel S. Resheff, and Itay Lieder, "Learning TensorFlow: A Guide to Building Deep Learning Systems", O'Reilly Media, 2017.
3.	François Chollet, "Deep Learning with Python", 2nd Edition, Manning Publications, 2021.
4.	Andriy Burkov, "The Hundred-Page Machine Learning Book", 1st Edition, Andriy Burkov, 2019.

*SDG 9 – Industry Innovation and Infrastructure

**SDG 3 – Good Health and Well Being

***SDG 7 – Affordable and Clean Energy

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Fundamentals of Generative AI**	
1.1	Introduction to Artificial Intelligence and Machine Learning	1
1.2	Overview of Generative AI – Evolution and Importance	1
1.3	Discriminative vs. Generative Models	1
1.4	Mathematical Foundations – Probability, Statistics, and Linear Algebra	1
1.5	Basics of Neural Networks – Perceptron, MLP, and Backpropagation	1
1.6	Probability Distributions in Generative AI – Gaussian, Bernoulli, Exponential	1
1.7	Bayesian Networks and Hidden Markov Models (HMM)	1
1.8	Information Theory – Entropy, Cross-Entropy, and KL-Divergence	1
1.9	Evaluation Metrics for Generative Models – Log-Likelihood, FID, Perplexity	1
2.0	**Probabilistic & Deep Generative Models**	
2.1	Introduction to Probabilistic Generative Models	1
2.2	Bayesian Learning and Latent Variable Models	1
2.3	Restricted Boltzmann Machines (RBM) and Applications	1
2.4	Deep Belief Networks (DBN) – Architecture and Training	1
2.5	Variational Autoencoders (VAE) – Concepts and Loss Functions	1
2.6	Gaussian Mixture Models (GMM) – Clustering and Applications	1
2.7	Markov Chain Monte Carlo (MCMC) and Gibbs Sampling	1
2.8	Reinforcement Learning and Its Role in Generative AI	1
2.9	Regularization and Optimization Techniques in Deep Learning	1
3.0	**Advanced Generative Models**	
3.1	Generative Adversarial Networks (GANs) – Concepts and Architectures	1
3.2	Types of GANs – DCGAN, WGAN, StyleGAN, CycleGAN	1
3.3	Applications of GANs – Image Synthesis, Super-Resolution, Deepfakes	1
3.4	Variational Autoencoders (VAE) vs GANs – Use Cases	2
3.5	Transformer-Based Generative Models – BERT, GPT, and T5	1
3.6	Diffusion Models – Denoising Diffusion Probabilistic Models (DDPM)	2

3.7	Large Language Models (LLMs) – GPT-4, ChatGPT, and Bard	1
4.0	**Applications and Challenges in Generative AI**	
4.1	Text Generation – Language Models and NLP Applications	1
4.2	AI-Generated Images – Style Transfer, Image Synthesis	1
4.3	Video Generation and Animation using AI	1
4.4	Speech Synthesis and AI-Generated Music (TTS & Voice Cloning)	1
4.5	Multimodal AI – Combining Text, Image, and Video	1
4.6	Generative AI in Healthcare – Medical Imaging & Drug Discovery	1
4.7	Generative AI in Gaming and Metaverse	1
4.8	Ethical Concerns – Bias, Copyright, and Fairness	1
4.9	Adversarial Attacks and Defense in Generative AI	1
5.0	**Future Trends and Research Directions**	
5.1	Evolution of Generative AI – From Deep Learning to AGI	1
5.2	Self-Supervised and Unsupervised Learning in Generative AI	1
5.3	Autonomous AI Agents and Generative Decision-Making	1
5.4	Neural Architecture Search (NAS) – Automating Model Design	1
5.5	Generative AI for Scientific Discovery and Creativity	1
5.6	Human-AI Collaboration – Enhancing Productivity	1
5.7	Zero-Shot and Few-Shot Learning in Generative AI	1
5.8	AI Explainability and Interpretability	1
5.9	Quantum Computing for Generative AI	1

Course Designer(s)

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70 PDS 104	Machine Learning Algorithms and Applications	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the concepts of machine learning and types of problems tackled by machine learning
- To explore the different supervised learning techniques
- To learn different aspects of unsupervised learning and reinforcement learning
- To learn the role of ensemble and probabilistic methods for machine learning
- To understand the basic concepts of neural networks

Pre-requisites

- Probability and Statistics, Linear Algebra

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand and outline problems for each type of machine learning	Understand
CO2	Apply various supervised learning methods to appropriate problems	Apply
CO3	Design an unsupervised algorithm for an application	Apply
CO4	Create probabilistic learning models for handling unknown pattern	Apply
CO5	Analyse the structure and functionality of Neural Networks	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	-	2	3	3	3
CO2	2	-	2	3	3	3
CO3	2	-	2	2	3	3
CO4	2	-	2	3	3	3
CO5	3	2	3	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	20	10	20
Understand (Un)	20	20	30
Apply (Ap)	20	30	30
Analyse (An)	00	00	20
Evaluate(Ev)	00	00	00
Create (Cr)	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS 104 - Machine Learning Algorithms and Applications								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Introduction to Machine Learning* Introduction - Applications - Types of Machine Learning Problems - Different types of learning - Perspectives and Issues - Version Spaces - Finite and Infinite Hypothesis Spaces - Inductive bias – Evaluation - Training and Test sets - Cross validation - Concept of Over fitting, under fitting - Bias and Variance – Probably Approximately Correct (PAC) Learning – Vapnik Chervonenkis (VC) Dimension	[9]
Supervised Learning* Introduction - Discriminative and Generative Models - Linear Regression – Lasso Regression - Classification - Logistic Regression - Gradient Linear Models -Support Vector Machines – Kernel Methods - Instance based Methods - K-Nearest Neighbours - Tree based Methods - Decision Trees – ID3 – CART - Evaluation of Classification Algorithms	[9]
Unsupervised and Reinforcement Learning* Introduction - Clustering Algorithms - K Means - Hierarchical Clustering - Cluster Validity - Dimensionality Reduction - Principal Component Analysis - Recommendation Systems - EM algorithm - Reinforcement Learning – Elements - Model based Learning - Temporal Difference Learning	[9]
Ensemble and Probabilistic Learning* Model Combination Schemes – Voting – Error Correcting Output Codes - Bagging: Random Forest Trees - Boosting: Adaboost, Stacking. Bayesian Learning - Bayes Optimal Classifier - Naïve Bayes Classifier - Bayesian Belief Networks - Mining Frequent Patterns	[9]
Neural Networks* Neural Networks - Biological Motivation – Perceptron - Multi-layer Perceptron - Feed Forward Network- Back Propagation - Activation and Loss Functions - Limitations of Machine Learning - Use cases	[9]
Total Hours:	**45**

Text Book(s):	
1.	Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, Chapman & Hall/CRC, 2nd Edition, 2014
2.	Kevin Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012
Reference(s):	
1.	Ethem Alpaydin, “Introduction to Machine Learning”, Third Edition, Adaptive Computation and Machine Learning Series, MIT Press, 2014
2.	Tom M Mitchell, “Machine Learning”, McGraw Hill Education, 2013
3.	Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, First Edition, Cambridge University Press, 2012
4.	Shai Shalev-Shwartz and Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, 2015

*SDG 9 – Industry Innovation and Infrastructure
*SDG 3 – Good Health and Well Being

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Machine Learning**	
1.1	Introduction - Applications -	1
1.2	Types of Machine Learning Problems	1
1.3	Different types of learning	1
1.4	Perspectives and Issues - Version Spaces	1
1.5	Finite and Infinite Hypothesis Spaces - Inductive bias – Evaluation	1
1.6	Training and Test sets - Cross validation	1
1.7	Concept of Over fitting, Under fitting - Bias and Variance	1
1.8	Probably Approximately Correct (PAC) Learning – Vapnik Chervonenkis (VC) Dimension	2
2.0	**Supervised Learning**	
2.1	Introduction - Discriminative and Generative Models -	1
2.2	Linear Regression - Lasso Regression - Classification	1
2.3	Logistic Regression - Gradient Linear Models	1
2.4	Support Vector Machines	1
2.5	Kernel Methods - Instance based Methods -	1
2.6	K-Nearest Neighbours - Tree based Methods	1
2.7	Decision Trees – ID3 – CART	2
2.8	Evaluation of Classification Algorithms	1
3.0	**Unsupervised and Reinforcement Learning**	
3.1	Introduction - Clustering Algorithms	1
3.2	K Means - Hierarchical Clustering	1
3.3	Cluster Validity – Dimensionality Reduction	1
3.4	Principal Component Analysis	1
3.5	Recommendation Systems	1
3.6	EM algorithm	1
3.7	Reinforcement Learning	1
3.8	Elements - Model based Learning	1
3.9	Temporal Difference Learning	1
4.0	**Ensemble and Probabilistic Learning**	
4.1	Model Combination Schemes – Voting – Error Correcting Output Codes	1
4.2	Bagging: Random Forest Trees	2
4.3	Boosting: Adaboost, Stacking	2
4.4	Bayesian Learning - Bayes Optimal Classifier	1
4.5	Naïve Bayes Classifier	1
4.6	Bayesian Belief Networks	1
4.7	Mining Frequent Patterns	1
5.0	**Neural Networks**	
5.1	Neural Networks - Biological Motivation	1
5.2	Perceptron	1

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5.3	Multi-layer Perceptron	1
5.4	Feed Forward Network	2
5.5	Back Propagation - Activation and Loss Functions	2
5.6	Limitations of Machine Learning	1
5.7	Use cases	1

Course Designer(s)

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70 PDS 1P1	AI and Machine Learning Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- To implement basic AI and Machine Learning algorithms and models.
- To apply supervised and unsupervised learning techniques for real-world data.
- To perform data preprocessing, feature selection, and model evaluation.
- To explore deep learning frameworks and neural network architectures.
- To analyse AI models for optimization, bias detection, and interpretability.

Pre-requisites

- Basics of Python Programming
- Fundamentals of Probability and Statistics

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Implement fundamental AI and ML algorithms for classification and regression.	Apply
CO2	Develop supervised and unsupervised learning models for pattern recognition.	Apply
CO3	Evaluate and optimize machine learning models using performance metrics.	Analyse
CO4	Implement deep learning techniques using neural networks and frameworks.	Apply
CO5	Analyse AI model behaviour and ethical concerns in real-world applications.	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	2	2	-	3
CO2	3	1	1	3	-	3
CO3	3	3	3	-	3	-
CO4	3	2	3	-	-	3
CO5	3	2	3	-	-	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember (Re)	00	00	20	20
Understand (Un)	00	00	30	30
Apply (Ap)	25	12	50	50
Analyse (An)	25	13	00	00
Evaluate(Ev)	00	00	00	00
Create (Cr)	00	00	00	00
Total	50	25	100	100

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K.S. Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS 1P1– AI and Machine Learning Laboratory								
Semester	**Hours/Week**			**Total Hrs**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	0	0	3	45	1.5	60	40	100

List of Experiments:

1. Data Preprocessing – Handling missing values, normalization, standardization, and feature scaling.
2. Data Visualization – Implementing data visualization using Matplotlib and Seaborn.
3. Supervised Learning – Implementing Linear Regression and Logistic Regression models.
4. Decision Trees and Random Forest – Classification using Decision Trees and ensemble learning with Random Forest.
5. Support Vector Machines (SVM) – Implementing SVM for classification with kernel tricks.
6. Clustering – Implementing K-Means and Hierarchical Clustering for pattern recognition.
7. Dimensionality Reduction – Applying Principal Component Analysis (PCA) for high-dimensional data visualization.
8. Neural Networks – Implementing a basic neural network using TensorFlow/Keras.
9. Convolutional Neural Networks (CNN) – Image classification using CNNs on MNIST/CIFAR-10 datasets.
10. Natural Language Processing (NLP) – Implementing text preprocessing and sentiment analysis using Naïve Bayes or LSTMs.
11. Reinforcement Learning – Implementing Q-learning or an RL environment in OpenAI Gym.
12. AI Model Explainability – Using SHAP/LIME for AI model interpretability and fairness evaluation.

Design Experiments:

1. Building an End-to-End AI Model – Integrating data preprocessing, feature engineering, model training, and evaluation into a complete pipeline.
2. AutoML and Hyperparameter Tuning – Implementing hyperparameter tuning using GridSearchCV or AutoML frameworks.

Lab Manual

1. "AI and Machine Learning Laboratory Lab Manual", Department of Information Technology, KSRCT.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

Course Designer(s)

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K.S. RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE-637215

(An Autonomous Institution affiliated to Anna University)

M. Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2026 - 2027)

SECOND SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	70 PDS 201	Data Analysis and Visualization	2	40	60	100	45	100
2.	70 PDS 202	Blockchain Applications in Data Science	2	40	60	100	45	100
3.	70 PDS 203	Cloud AI and Edge Computing	2	40	60	100	45	100
4.	70 PDS 204	Data Security and Privacy	2	40	60	100	45	100
5.	70 PDS E2*	Professional Elective II	2	40	60	100	45	100
6.	70 PDS E3*	Professional Elective III	2	40	60	100	45	100
7.	70 PAC 002	Disaster Management	2	100	-	100	-	100
PRACTICAL								
8.	70 PDS 2P1	Term Paper and Technical Seminar	2	100	-	100	-	100
9.	70 PDS 2P2	Data Analysis and Visualization Laboratory	2	60	40	100	45	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for practical End Semester Examination.

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Academic Council Meeting held on 21/12/2024

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70 PDS 201	Data Analysis and Visualization	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To introduce big data and its importance towards analytics
- To familiarize the students with fundamentals of data analysis
- To learn about the stream mining concepts
- Understand the concept of Power BI and Develop a Data with Power BI
- Apply Sematic Model in Power BI and some important DAX Formulas

Pre-requisites

- Basic knowledge of Data mining and Power BI

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Identify the differences between reporting and analytics.	Understand
CO2	Demonstrate fundamental mathematics behind analytics	Understand
CO3	Apply mining techniques for stream data	Apply
CO4	Build And Modify Semantic Model in Power BI	Apply
CO5	Understand the DAX Formulas and Power BI Desktop	Understand

Mapping with Programme Outcomes

COs	Pos					
	1	2	3	4	5	6
CO1	3	2	3	3	-	-
CO2	3	2	3	2	-	-
CO3	3	2	3	3	-	-
CO4	3	2	3	3	-	-
CO5	3	2	3	3	-	-
3 - Strong; 2 - Medium; 1 – Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	20	00	00
Understand (Un)	40	40	66
Apply (Ap)	00	20	34
Analyse (An)	00	00	00
Evaluate(Ev)	00	00	00
Create (Cr)	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS 201- Data Analysis and Visualization								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Introduction to data analytics Introduction to Big Data – Need for big data - Web Data – Evolution of Analytic Scalability –Analytic Processes and Tools-Analysis's Reporting–Core Analytics vs Advanced Analytics–Statistical significance–Sampling–inference-Modern Data Analytic Tools	[9]
Data Analysis-Fundamentals Data Analysis Foundations-Univariate, bivariate and multivariate analysis of Numeric and Categorical Attributes– Graph Data - Kernel Methods - Kernel Matrix, Vector Kernels, Basic Kernel Operations in Feature Space and Kernels for Complex Objects - High-dimensional Data -Dimensionality Reduction - Principal Component Analysis, Kernel Principal Component Analysis, Singular Value Decomposition	[9]
Mining Data Streams** Introduction to Streams Concepts–Stream Data Model and Architecture-Stream Computing-Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream –Estimating Moments– Counting One nessina Window–Decaying Window	[9]
Microsoft Data Analytics* Data - Data Analysis - Microsoft Excel - Power BI - Business Intelligence (BI) - Power BI Desktop (Power Query, Power Pivot, Power View) - Power BI Service - Power BI Mobile Flow. Discover Data Analysis - Overview of Data Analysis - Roles in Data - Tasks of a Data Analyst - Building with Power BI - Use Power BI	[9]
Semantic Model and DAX Formulas *** Work with Tables - Create a Date Table - Work with Dimensions - Data Granularity - Work with Relationships and Cardinality - Model Data in Power BI Desktop-DAX Formulas - DAX Data Types - DAX Functions - DAX Operators - DAX Variables.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Bill Franks, 'Taming the Big DataTidalWave:Finding Opportunities in Huge Data Streams with Advanced Analytics',JohnWiley & sons,2012
2.	Mohammedj.Zakiand Wagner Meira, 'Data Mining and Analysis- Fundamental Concepts and Algorithms', Cambridge University Press, 2014.
3.	Alberto Ferrari Marco Russo "The Definitive Guide to DAX: Business intelligence for Microsoft Power BI, SQL Server Analysis Services, and Excel, 2e , 15 September 2020
Reference(s):	
1.	PaulZikopoulos and ChrisEaton, 'Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data', McGraw-Hill Education;1st Edition2011
2.	Philipp K. Janert, 'Data Analysis with Open Source Tools',O'Reilly Media, 201
3.	Errin O'Connor," Microsoft Power Bi Dashboards Step by Step", 6 March 2020
4.	Derek Wilson "Learn Power BI: Step by Step Guide to Building Your Own Reports", Kindle Edition ,7 March 2022

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to data analytics**	
1.1	Introduction to Big Data	1
1.2	Need for big data	1
1.3	Web Data	1
1.4	Evolution of Analytic Scalability	1
1.5	Analytic Processes and Tools-Analysis's Reporting	1
1.6	Core Analytics vs Advanced Analytics, Statistical significance	2
1.7	Sampling, inference	1
1.8	Modern Data Analytic Tools	1
2.0	**Data Analysis-Fundamentals**	
2.1	Data Analysis Foundations	1
2.2	Univariate, bivariate and multivariate analysis of Numeric and Categorical Attributes	2
2.3	Graph Data, Kernel Methods, Kernel Matrix, Vector Kernels	1
2.4	Basic Kernel Operations in Feature Space and Kernels for Complex Objects	1
2.5	High, Dimensional Data, Dimensionality Reduction	1
2.6	Principal Component Analysis	1
2.7	Kernel Principal Component Analysis	1
2.8	Singular Value Decomposition	1
3.0	**Mining Data Streams**	
3.1	Introduction To Streams Concepts	1
3.2	Stream Data Model and Architecture	1
3.3	Stream Computing	1
3.4	Sampling Data in a Stream	2
3.5	Filtering Streams	1
3.6	Counting Distinct Elements in a Stream	1
3.7	Estimating Moments	1
3.8	Counting One nessina Window, Decaying Window	1
4.0	**Microsoft Data Analytics**	
4.1	Data, Data Analysis, Microsoft Excel	1
4.2	Power BI, Business Intelligence (BI)	1
4.3	Power BI Desktop (Power Query, Power Pivot, Power View)	1
4.4	Power BI Service	1
4.5	Power BI Mobile Flow	1
4.6	Discover Data Analysis	1
4.7	Overview of Data Analysis, Roles in Data	1
4.8	Tasks of a Data Analyst	1
4.9	Building with Power BI - Use Power BI	1

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5.0	**Semantic Model and DAX Formulas**	
5.1	Work with Tables	1
5.2	Create a Date Table	1
5.3	Work with Dimensions	1
5.4	Data Granularity, Work with Relationships and Cardinality	2
5.5	Model Data in Power BI Desktop	1
5.6	DAX Formulas, DAX Data Types	2
5.7	DAX Functions, DAX Operators, DAX Variables.	1

Course Designer(s)

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70 PDS 202	Blockchain Applications in Data Science	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To develop a solid foundation in blockchain technology, its components, and its underlying principles.
- To learn about data integrity, security, and decentralized data storage in data science workflows.
- To study the role of smart contracts in automating data transactions and the implications for data-driven decision-making.
- To investigate how blockchains can improve big data processing, sharing, and collaboration in data science environments.
- To understand the ethical challenges and regulatory issues associated with blockchain and its applications in data science.

Pre-requisites

- Computer Networks and Network Security

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explore blockchain technology and its key components such as consensus algorithms, cryptography, and decentralization.	Understand
CO2	Demonstrate practical skills in integrating blockchain with data science projects, ensuring data security and integrity.	Analyse
CO3	Develop smart contracts that automate data management processes, enabling more efficient data workflows.	Apply
CO4	Identify the advantages and limitations of using blockchain in big data environments, with an emphasis on data privacy and scalability.	Understand
CO5	Assess the ethical implications of blockchain applications in data science, including data privacy, security, and regulatory compliance.	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	3	3	3	2	-
CO2	3	2	3	3	2	-
CO3	3	2	2	2	2	-
CO4	3	2	2	3	2	-
CO5	3	3	2	2	2	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	10
Understand	20	20	40
Apply	10	10	20
Analyse	20	20	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PDS 202 – Blockchain Applications in Data Science								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Introduction to Blockchain Technology Blockchain Overview, Evolution of Blockchain, Blockchain Architecture, Distributed ledger, Decentralization, Cryptographic hash functions, Blockchain Types, Consensus Mechanisms, Challenges and Limitations	[9]
Blockchain in Data Science Introduction to data science, Blockchain for data integrity and immutability, Decentralized Data Storage: IPFS, Filecoin, Blockchain's role in securing data pipelines and reducing fraud, Big Data basics, Blockchain and data privacy, Case studies: Blockchain use in healthcare, finance, and supply chain	[9]
Smart Contracts and Data Automation Introduction to Smart Contracts: Definition and Functionality, Blockchain platforms: Ethereum, Hyperledger, and their applications, Writing and deploying smart contracts, Automating Data Transactions with Smart Contracts, Use Cases of Smart Contracts in Data Automation, Security and Limitations	[9]
Big Data and Blockchain Integration Introduction to Big Data, Blockchain Basics for Big Data, Decentralized Data Storage Using Blockchain, Blockchain for Data Integrity and Provenance, Scalability Challenges in Blockchain and Big Data, Privacy and Security in Blockchain and Big Data, Blockchain and Big Data Analytics, Blockchain for Supply Chain and IoT Data	[9]
Ethical and Regulatory Considerations in Blockchain Introduction to Blockchain Ethics, Data Privacy and Blockchain, Blockchain Governance and Accountability, Legal Implications of Blockchain Technology, Regulatory Frameworks for Blockchain, Regulatory Frameworks for Blockchain, Cryptocurrencies and Financial Regulations, Legal and Ethical Considerations	[9]
Total Hours:	**45**

Text Book(s):	
1.	Ahmed Banafa, San Jose State University, "Blockchain Technology and Applications", River Publishers, USA, 2020.
2.	Innar Liiv “Data Science Techniques for Cryptocurrency Blockchains”, 1st Edition, Springer verlag, Singapore,2021.
Reference(s):	
1.	Rekha Kumari,”Emerging Technologies : Learn Data Science and Blockchain Technology” Kindle Edition, 2024
2.	Imran Bashir,“Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts and Decentralized Applications” O’Reilly
3.	Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016
4.	Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018

*SDG 9 – Industry Innovation and Infrastructure
**SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Blockchain Technology**	
1.1	Blockchain Overview	1
1.2	Evolution of Blockchain	1
1.3	Blockchain Architecture	1
1.4	Distributed ledger	1
1.5	Decentralization	1
1.6	Cryptographic hash functions	1
1.7	Blockchain Types	1
1.8	Consensus Mechanisms	1
1.9	Challenges and Limitations	1
2.0	**Blockchain in Data Science**	
2.1	Introduction to data science	2
2.2	Blockchain for data integrity and immutability	2
2.3	Decentralized Data Storage: IPFS, Filecoin	1
2.4	Blockchain's role in securing data pipelines and reducing fraud	1
2.5	Big Data basics	1
2.6	Blockchain and data privacy	2
2.7	Case studies: Blockchain use in healthcare, finance, and supply chain	
3.0	**Smart Contracts and Data Automation**	
3.1	Introduction to Smart Contracts: Definition and Functionality	1
3.2	Blockchain platforms: Ethereum, Hyperledger, and their applications	2
3.3	Writing and deploying smart contracts	1
3.4	Automating Data Transactions with Smart Contracts	2
3.5	Use Cases of Smart Contracts in Data Automation	2
3.6	Security and Limitations	1
4.0	**Big Data and Blockchain Integration**	
4.1	Introduction to Big Data	1
4.2	Blockchain Basics for Big Data	1
4.3	Decentralized Data Storage Using Blockchain	1
4.4	Blockchain for Data Integrity and Provenance	1
4.5	Scalability Challenges in Blockchain and Big Data	1
4.6	Privacy and Security in Blockchain and Big Data	1
4.7	Blockchain and Big Data Analytics	1
4.8	Blockchain for Supply Chain and IoT Data	2
5.0	**Ethical and Regulatory Considerations in Blockchain**	
5.1	Introduction to Blockchain Ethics	1
5.2	Data Privacy and Blockchain	1
5.3	Blockchain Governance and Accountability	1
5.4	Legal Implications of Blockchain Technology	2
5.5	Regulatory Frameworks for Blockchain	1
5.6	Cryptocurrencies and Financial Regulations	2
5.7	Legal and Ethical Considerations	1

Course Designer(s)

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70 PDS 203	Cloud AI and Edge Computing	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To learn how Cloud platforms provide infrastructure
- To understand the workload design and security in Cloud AI
- To know the basic architecture of Edge Computing
- To analyse the Integration of Cloud AI with Edge Computing
- To learn the advanced trends in AI and Edge Computing

Pre-requisites

- Cloud Computing, Artificial Intelligence

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the key concepts of Cloud Computing and AI, and their integration.	Understand
CO2	Design scalable Cloud architectures tailored for AI workloads.	Analyse
CO3	Implement AI models in Edge Computing environments.	Apply
CO4	Integrate Cloud and Edge Computing to optimize AI-driven applications	Analyse
CO5	Explore and apply advanced AI techniques in Cloud and Edge environments.	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	1	1	1	2	-
CO2	3	3	3	3	2	-
CO3	3	2	2	2	2	-
CO4	3	3	3	3	2	-
CO5	3	2	2	2	2	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	10
Understand	20	20	40
Apply	10	10	20
Analyse	20	20	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PDS 203 – Cloud AI and Edge Computing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Introduction to Cloud Computing and AI Overview of Cloud Computing: Service models, Deployment models, Cloud infrastructure and major providers (AWS, Azure, Google Cloud), Cloud management and orchestration tools - Introduction to AI: concepts: Machine Learning (ML), Deep Learning (DL), Neural Networks, AI algorithms and their applications, The role of AI in Cloud environments - Cloud AI Platforms: AI as a service (AIaaS), Major Cloud AI platforms: Google AI, Azure AI, IBM Watson, AWS AI	[9]
Cloud Architecture for AI Workloads AI Workload Design in the Cloud: Key architecture components for AI workloads in the Cloud, Scalability, fault tolerance, and high availability for AI applications, Cloud storage solutions and data management (NoSQL, Big Data storage) - Data Pipelines and AI Workflows: Designing data pipelines for AI applications, Automating AI workflows using Cloud services (e.g., Google Cloud AI, Azure ML), Integrating machine learning models with Cloud storage - Security in Cloud AI: Data privacy, encryption, and security policies, Secure access and user management for AI services	[9]
Edge Computing and its Role in AI Introduction to Edge Computing: concepts of Edge Computing, Edge Computing vs. Cloud Computing, Benefits - Edge AI: AI model deployment on Edge devices (e.g., Raspberry Pi, Nvidia Jetson), Resource constraints and optimizations for Edge AI, Edge AI use cases: smart cities, autonomous vehicles, IoT devices - Edge and Cloud Synergy: Edge Cloud hybrid architecture, Data transfer between Edge and Cloud, Real-time analytics and decision-making.	[9]
Integrating Cloud AI and Edge Computing Cloud-Edge Integration Architecture: Hybrid Cloud-Edge architecture models, Key components for integrating Cloud and Edge AI, Data synchronization and transfer between Cloud and Edge - AI at the Edge with Cloud Offload: Deciding what to compute locally (Edge) and what to offload (Cloud), Optimizing computation and resource management, Handling data privacy and security in hybrid systems – Real time Applications of Cloud-Edge AI Integration: Smart Healthcare, Industrial IoT, Autonomous Vehicles, Use cases that benefit from Cloud-Edge AI integration.	[9]
Advanced Topics and Future Directions in Cloud AI and Edge Computing Advanced AI Techniques for Cloud and Edge: Reinforcement Learning, Federated Learning, Transfer Learning, Edge AI model compression techniques (e.g., quantization, pruning), AutoML for model selection and optimization - AI Security, Privacy, and Ethics: Ethical concerns in AI models and decision-making, Security risks in Cloud and Edge environments, Privacy-preserving techniques for Edge AI (e.g., Federated Learning) - Future Trends and Emerging Technologies: Role of 5G and 6G networks in Cloud-Edge AI, Edge AI and AI-driven hardware (e.g., TPUs, FPGAs), Future challenges in integrating Cloud and Edge Computing.	[9]
Total Hours:	**45**

Text Book(s):

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing: Principles and Paradigms”, Wiley India Pvt. Ltd., 2nd Edition, 2013.
2. Daniel Situnayake, Jenny Plunkett, “AI at the Edge: Solving Real-World Problems with Embedded Machine Learning”, O'Reilly Media, Inc., 1st Edition, 2023.

Reference(s):

1. Aurélien Géron, “Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems”, O'Reilly Media, 2nd Edition, 2019.
2. Online Courses: Google Cloud AI, AWS AI & ML, NVIDIA Deep Learning Institute.
3. Suyel Namasudra, Sheng Wu, “AI and Cloud Computing”, Academic Press, 1st Edition, 2021
4. Danda B. Rawat, Lalit K Awasthi, Valentina Emilia Balas, Mohit Kumar, Jitendra Kumar Samriya , “Convergence of Cloud with AI for Big Data Analytics: Foundations and Innovation”, Scrivener Publishing LLC, 1st Edition, 2023.

*SDG 4 – Quality Education, **SDG 9 – Industry, Innovation and Infra structure

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Academic Council Meeting held on 21/12/2024

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Cloud Computing and AI**	
1.1	Overview of Cloud Computing: Service models	1
1.2	Deployment models	1
1.3	Cloud infrastructure and major providers (AWS, Azure, Google Cloud)	1
1.4	Cloud management and orchestration tools	1
1.5	Introduction to AI: concepts: Machine Learning (ML), Deep Learning (DL)	1
1.6	Neural Networks, AI algorithms and their applications	1
1.7	The role of AI in Cloud environments	1
1.8	Cloud AI Platforms: AI as a service (AIaaS)	1
1.9	Major Cloud AI platforms: Google AI, Azure AI, IBM Watson, AWS AI	1
2.0	**Cloud Architecture for AI Workloads**	
2.1	AI Workload Design in the Cloud: Key architecture components for AI workloads in the Cloud	1
2.2	Scalability, fault tolerance, and high availability for AI applications	1
2.3	Cloud storage solutions and data management (NoSQL, Big Data storage)	1
2.4	Data Pipelines and AI Workflows: Designing data pipelines for AI applications	1
2.5	Automating AI workflows using Cloud services (e.g., Google Cloud AI, Azure ML)	1
2.6	Integrating machine learning models with Cloud storage	1
2.7	Security in Cloud AI: Data privacy	1
2.8	encryption, and security policies	1
2.9	Secure access and user management for AI services	1
3.0	**Edge Computing and its Role in AI**	
3.1	Introduction to Edge Computing: concepts of Edge Computing	1
3.2	Edge Computing vs. Cloud Computing, Benefits	1
3.3	Edge AI: AI model deployment on Edge devices (e.g., Raspberry Pi, Nvidia Jetson)	1
3.4	Resource constraints and optimizations for Edge AI	1
3.5	Edge AI use cases: smart cities, autonomous vehicles	1
3.6	IoT devices	1
3.7	Edge and Cloud Synergy: Edge Cloud hybrid architecture	1
3.8	Data transfer between Edge and Cloud	1
3.9	Real-time analytics and decision-making	1
4.0	**Integrating Cloud AI and Edge Computing**	
4.1	Cloud-Edge Integration Architecture: Hybrid Cloud-Edge architecture models	1
4.2	Key components for integrating Cloud and Edge AI	1
4.3	Data synchronization and transfer between Cloud and Edge	1
4.4	AI at the Edge with Cloud Offload: Deciding what to compute locally (Edge) and what to offload (Cloud)	1
4.5	Optimizing computation and resource management	1
4.6	Handling data privacy and security in hybrid systems	1
4.7	Real time Applications of Cloud-Edge AI Integration: Smart Healthcare	1

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4.8	Industrial IoT, Autonomous Vehicles	1
4.9	Use cases that benefit from Cloud-Edge AI integration.	1
5.0	**Advanced Topics and Future Directions in Cloud AI and Edge Computing**	
5.1	Advanced AI Techniques for Cloud and Edge: Reinforcement Learning, Federated Learning	1
5.2	Transfer Learning, Edge AI model compression techniques (e.g., quantization, pruning)	1
5.3	AutoML for model selection and optimization	1
5.4	AI Security, Privacy, and Ethics: Ethical concerns in AI models and decision-making	1
5.5	Security risks in Cloud and Edge environments	1
5.6	Privacy-preserving techniques for Edge AI (e.g., Federated Learning)	1
5.7	Future Trends and Emerging Technologies: Role of 5G and 6G networks in Cloud-Edge AI	1
5.8	Edge AI and AI-driven hardware (e.g., TPUs, FPGAs)	1
5.9	Future challenges in integrating Cloud and Edge Computing.	1

Course Designer(s)

Mr. R.T. Dinesh Kumar – dineshkumarrt@ksrct.ac.in

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70 PDS 204	Data Security and Privacy	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To study different encryption techniques and attacks
- To learn Model Neuron and Neural Network, and to analyse ANN learning, and its applications
- To develop different single layer/multiple layer Perception learning algorithms
- To design of another class of layered networks using deep learning principles
- To analyse the different privacy preserving technology

Pre-requisites

- Basic knowledge of Computer Networks, Cryptography and Network Security

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Compare different encryption techniques and attacks	Understand
CO2	Model Neuron and Neural Network, and to analyse ANN learning, and its applications	Apply
CO3	Develop different single layer/multiple layer Perception learning algorithms	Analyse
CO4	Design of another class of layered networks using deep learning principles	Apply
CO5	Analyse the different privacy preserving technology	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	2	3	3	3	3
CO2	2	2	3	3	3	2
CO3	2	2	3	3	2	3
CO4	2	2	3	3	3	3
CO5	2	2	3	2	3	2
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	00	00	00
Understand (Un)	30	30	30
Apply (Ap)	30	20	60
Analyse (An)	00	10	30
Evaluate (Ev)	00	00	00
Create (Cr)	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PDS 204 - Data Security and Privacy								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Data Security Fundamentals Computer Security Concepts, Intrusion Detection, Firewalls: Characteristics,Types.Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Polyalphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the Feistel CipherStructure, the Feistel Cipher.	[9]
Public-Key Cryptography Principles of Public-key Cryptosystems, Public-Key Cryptosystems, Applications for Public-Key Cryptosystems, Requirements for Public-Key Cryptosystems. Public-Key Cryptanalysis. The RSA Algorithm, Description of the Algorithm, Computational Aspects, the Security of RSA. Other Public-Key Cryptosystems: Diffe-Hellman Key Exchange, The Algorithm, Key exchange protocols, Man-in-the-Middle Attack, Simple secret key distribution, Secret key distribution with confidentiality and authentication, A hybrid scheme. Public keys certificates, X.509certificates. Public key infrastructure, PKIXManagement Functions, PKIX Management Protocols.	[9]
Authentication and Authorization Authentication Vs Authorization, Authentication Methods –Password authentication, Public Key Cryptography, Biometric authentication, Out of band, Authentication Protocols – SSL, Password Authentication Protocol (PAP), Kerberos, Email authentication, - PGP, Database authentication, Message authentication; secure hash functions and Authorization Approaches to hmac; publickey cryptography principles; public-key cryptography algorithms, digital signatures, key management. Kerberos, x.509 directory authentication service. Authorization Definition, Multilayer authorization,	[9]
Data Privacy and Anonymization **Understanding Privacy:** Social Aspects of Privacy Legal Aspects of Privacy and Privacy Regulations Effect of Database and Data Mining technologies on privacy challenges raised by new emerging technologies such RFID, biometrics, etc., Privacy Models Introduction to Anonymization, Anonymization models:K-anonymity, l-diversity, t-closeness, differentialprivacy Database as aservice	[9]
Data Privacy for Data Science **Using technology for preserving privacy**. Statistical Database security Inference Control Secure Multi-party computation and Cryptography Privacy-preserving Data mining Hippocratic databases. **Emerging Applications:** Social Network Privacy, Location Privacy, Query Log Privacy, Biomedical Privacy	[9]
Total Hours:	**45**

Text Book(s):	
1.	William Stallings, Cryptography and Network Security: Principles and Practice William Stallings, Seventh Edition, Pearson Education, 2017.
2.	Cynthia Dwork and Aaron Roth, The Algorithmic Foundations of Differential Privacy, Vol. 9, Nos. 3 - 4, DOI: 10.1561 / 0400000042, 2014.
Reference(s):	
1.	Claire McKay Bowen, Introduction to Anonymization, https://s3.amazonaws.com/assets.datacamp.com/production/course_6412/slides/chapter1.pdf
2.	Charu C. Aggarwal. and Philip S. Yu, Privacy-Preserving Data Mining: Models and Algorithms, 1st Edition, Springer, 2010.
3.	Michael E. Whitman and Herbert J. Mattord, Principles of Information Security, 6th Edition, Cengage Learning, 2018.
4.	Balaji Raghunathan, The Complete Book of Data Anonymization: From Planning to Implementation, Second Edition, Auerbach Publishers, Incorporated, 2013.

*SDG 9 – Industry Innovation and Infrastructure, **SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Data Security Fundamentals**	
1.1	Computer Security Concepts, Intrusion Detection	1
1.2	Firewalls: Characteristics, Types	1
1.3	Classical Encryption Techniques Symmetric Cipher Model, Cryptography	1
1.4	Cryptanalysis and Brute-Force Attack	1
1.5	Substitution Techniques, Caesar Cipher	1
1.6	Monoalphabetic Cipher, Polyalphabetic Cipher, One Time Pad	1
1.7	Block Ciphers and the data encryption standard: Traditional block Cipher structure	1
1.8	Stream Ciphers and Block Ciphers	1
1.9	Motivation for the Feistel Cipher structure, the Feistel Cipher.	1
2.0	**Public-Key Cryptography**	
2.1	Principles of Public-key Cryptosystems, Public-Key Cryptosystems, Applications for Public-Key Cryptosystems.	1
2.2	Requirements for Public-Key Cryptosystems. Public-Key Cryptanalysis.	1
2.3	The RSA Algorithm, Description of the Algorithm.	1
2.4	Computational Aspects, the Security of RSA.	1
2.5	Other Public-Key Cryptosystems: Diffe-Hellman Key Exchange, The Algorithm, Key exchange protocols, Man-in-the-Middle Attack.	1
2.6	Simple secret key distribution, Secret key distribution with confidentiality and authentication, A hybrid scheme.	1
2.7	Public keys certificates.	1
2.8	X.509 certificates.	1
2.9	Public key infrastructure, PKIX Management Functions, PKIX Management Protocols.	1
3.0	**Authentication and Authorization**	
3.1	Authentication Vs Authorization, Authentication Methods –Password authentication, Public Key Cryptography	1
3.2	Biometric authentication, out of band	1
3.3	Authentication Protocols – SSL	1
3.4	Password Authentication Protocol (PAP)	1
3.5	Kerberos, Email authentication	1
3.6	PGP, Database authentication	1
3.7	Message authentication, Secure hash functions and Authorization Approaches to hmac; public key cryptography principles;	1
3.8	Public-key cryptography algorithms, digital signatures, key management.	1
3.9	X.509 directory authentication service. Authorization Definition, Multilayer authorization.	1
4.0	**Data Privacy and Anonymization**	
4.1	Data Privacy and Anonymization Understanding Privacy: Social Aspects of Privacy	1
4.2	Legal Aspects of Privacy and Privacy Regulations	1
4.3	Effect of Database and Data Mining technologies on privacy	1
4.4	Challenges raised by new emerging technologies such RFID, biometrics, etc.,	1
4.5	Privacy Models, Introduction to Anonymization models	1

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4.6	K-anonymity	1
4.7	l-diversity, t-closeness	1
4.8	Differential privacy and Extensions	1
4.9	Database as a service	1
5.0	**Data Privacy for Data Science**	
5.1	Using technology for preserving privacy. Statistical Database security	1
5.2	Inference Control	1
5.3	Secure Multi-party computation and Cryptography	1
5.4	Privacy-preserving Data mining	1
5.5	Hippocratic databases	1
5.6	Emerging Applications: Social Network Privacy	1
5.7	Location Privacy	1
5.8	Query Log Privacy	1
5.9	Biomedical Privacy	1

Course Designer(s)

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K.S.Rangasamy College of Technology – Autonomous R2025								
70 PDS 2P1 – Term Paper and Technical Seminar								
PDS: M.Tech Data Science								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	2	30	0	100	00	100

Objective(s)	• To develop scientific and technical reading and writing skills that they need to Understand and construct research articles. • To obtain information from a variety of sources (i.e Journals, dictionaries, reference books) and then place it in logically developed ideas. • To identify the recent topics in the research area and formulate the problem • To analyse the mathematical model for the identified problem • To design and simulate/ develop prototype model
Course Outcomes	**At the end of the course, the students will be able to** CO1: Survey the relevant bibliography such as national/international referred journals for the preferred areas of research CO2: Develop scientific, technical reading and writing skills for the technical report preparation to apply it in their topics of research CO3: Apply mathematical ideas to any problem in the research field CO4: Implement and analyse the various complex problems in different practical applications CO5: Cultivate presentation skills to deliver their work in front of technically qualified audience

Note: The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic.
2. Stating an objective.
3. Collecting the relevant bibliography (at least 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing each paper.
6. Preparing a working outline.
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Please keep a file where the work carried out by you is maintained.

Activities to be carried out

[9]

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic Stating an Objective	An area of interest, topic has to be selected and objective to be framed	2nd week	3 % Based on clarity of thought, current relevance and clarity in writing
Collecting Information about chosen area & topic	1.List 1 Special Interest Groups or professional society 2.List 2 journals 3.List 3 conferences, symposia or workshops 4. List 1 thesis title	3rd week	3% (the selected information must be area specific

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	5. List 5 web presences (mailing lists, forums, News sites) 6. List 6 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area. 8. Conference/Journal/Symposium in the chosen area.		and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter	• Provide a complete list of references you will be using- Based on the objective -Search various digital libraries and Google Scholar • When picking papers to read – try to: • Pick papers that are related to each other in some ways and/or that are in the same field so that a meaningful survey can be written •Favour papers from well-known journals and conferences, • Favour—first‖ or foundational‖ papers in the field (as indicated in other people's survey paper),Favour more recent papers, • Pick a recent survey of the field so you can quickly gain an overview, • Find relationships with respect to each other and to your topic area (classification scheme/categorization) • Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered	4th week	6% (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process • For each paper form aTable answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • How does the work build on other's work, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research? Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)	5th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Reading and notes for next5 papers	Repeat Reading Paper Process	6th week	8%(the table given should indicate your understanding of the paper and the evaluation isbased on your conclusions about eachpaper)

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Reading and notes for final 5 papers	Repeat Reading Paper Process	7th week	**8%**(the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8th week	**8%**(this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9th week	**6%**(Clarity, purpose and conclusion) **6%** resentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	**5%** (clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11thweek	**10%** (this component will be evaluated based on the linking and classification among the papers)
Conclusions	Write your conclusions and future work	12th week	**5%** (conclusions – clarity and your ideas)
Final Draft	Complete the final draft of your paper	13th week	**10%** (formatting, English, Clarity and linking) **4%** Plagiarism Check Report
Seminar	A brief 15 slides on your paper	14th& 15th week	**10%** (based on presentation and Viva-voce)

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70 PDS 2P2	Data Analysis and Visualization Laboratory	Category	L	T	P	Credit
		PC	0	0	4	2

Objectives

- Understand the concept of Excel
- Be familiar with Microsoft Data Analytics
- Develop a Data with Power BI
- Apply Sematic Model in Power BI
- Learn some important DAX Formulas and Power BI Desktop

Pre-requisites

- Basic knowledge of MS Excel and Power BI

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the basics concepts of excel	Understand
CO2	Understand the Microsoft Data Analytics	Understand
CO3	Apply Model Data with Power BI	Apply
CO4	Build And Modify Semantic Model in Power BI	Apply
CO5	Understand the DAX Formulas and Power BI Desktop	Understand

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	2	-	-	3
CO2	3	2	2	-	-	3
CO3	3	2	3	-	-	-
CO4	3	2	3	-	-	3
CO5	3	2	3	-	-	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Lab Experiments Assessment (Marks)		Model Examination (Marks)	End Sem Examination (Marks)
	Lab	Activity		
Remember	00	00	00	00
Understand	25	13	50	50
Apply	25	12	50	50
Analyse	00	00	00	00
Evaluate	00	00	00	00
Create	00	00	00	00
Total	50	25	100	100

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K.S. Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS 2P2– Data Analysis and Visualization Laboratory								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	3	45	1.5	60	40	100

List of Experiments:

1. Explore the features of Ms-Excel.
2. (i) Get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND).
   ii) Perform data import/export operations for different file formats.
3. Perform statistical operations - Mean, Median, Mode and Standard deviation, Variance, Skewness, Kurtosis.
4. Perform Z-test, T-test & ANOVA.
5. Explore the features of Power BI Desktop.
6. Prepare & Load data.
7. Develop the data model.
8. Perform DAX calculations.
9. Design a report.
10. Create a dashboard and perform data analysis.

Design Experiments:

1. What are the different types of data visualization tools available in Excel (e.g., charts,sparklines)?
2. Use a sample dataset to calculate Mean, Median, Mode, Standard Deviation, Variance, Skewness, and Kurtosis using Excel functions and compare these results with manual calculations or those obtained from statistical software.

Tools used: MATLAB / ALTAIR / Open Source - Scilab

Lab Manual

1.	Rao VSP, “Human Resource Management”, 3rd Edition, Excel Books, 2010.
2	Mahadevan B, “Operations Management -Theory and Practice”,3rd Edition,

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

Course Designer(s)

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K.S. RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE-637215

(An Autonomous Institution affiliated to Anna University)

M. Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2026 - 2027)

THIRD SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1.	70 PDS 301	Intelligent Systems and Deep Learning	2	40	60	100	45	100
2.	70 PDS E4*	Professional Elective IV	2	40	60	100	45	100
3.	70 PDS E5*	Professional Elective V	2	40	60	100	45	100
4.	70 PDS E6*	Professional Elective VI	2	40	60	100	45	100
PRCTICAL								
5.	70 PDS 3P1	Project Work - Phase I	2	100	-	100	-	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination.

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Approved Passed in BoS Meeting held on 23/11/2024
Academic Council Meeting held on 21/12/2024

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70 PDS 301	Intelligent Systems and Deep Learning	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the fundamental concepts of intelligent systems and deep learning.
- To explore different deep learning architectures and their applications.
- To study the impact of deep learning in genomics and biomedicine.
- To apply intelligent systems for real-time decision-making in healthcare, NLP, and computer vision.
- To integrate AI techniques with reinforcement learning and explainable AI for robust models.

Pre-requisites

- Basic knowledge of Probability & Statistics, Artificial Intelligence and Machine Learning

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand intelligent systems and deep learning fundamentals	Understand
CO2	Analyse different deep learning architectures	Analyse
CO3	Apply deep learning techniques in genomics and healthcare	Apply
CO4	Design and implement intelligent systems for biomedical applications	Apply
CO5	Utilize deep learning architectures for real-time NLP and computer vision tasks and explainable AI for decision-making	Apply

Mapping with Programme Outcomes

COs	Pos					
	1	2	3	4	5	6
CO1	2	2	3	3	2	2
CO2	2	2	3	3	2	2
CO3	2	2	3	3	2	2
CO4	2	2	3	3	2	2
CO5	2	2	3	3	2	2
3 - Strong; 2 - Medium; 1 – Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	20	20	30
Apply	00	20	30
Analyse	20	00	20
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS 301 - Intelligent Systems and Deep Learning								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction to Intelligent Systems and Deep Learning Introduction to Intelligent Systems & AI - Evolution of Deep Learning and Neural Networks- Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Regularization – Dropout	[9]
Deep Learning Architectures Convolutional Neural Networks Architectures – Convolution – Pooling Layers – Transfer Learning –Long Short-Term Memory, Gated Recurrent Units, Encoder/Decoder Architectures – Auto encoders – Standard- Sparse – Denoising –Contractive- Variational Auto encoders – Adversarial Generative Networks	[9]
Deep Learning in Genomics and Biomedicine Genomics – Dense Nets and Convolutional Nets for Genomics - Recurrent NN – Autoen coders and representation learning - Generative Models –Drug Discovery and protein structure: - imaging and electronic medical records-Molecule Net – One shot Learning drug discovery - Case Studies	[9]
Deep Learning for Biomedical Data Analysis Understanding and Visualizing Convolutional Neural Networks Lenet, Alexnet, Google net for visual perception tasks- Point of care disease diagnosis using CNN – Capsule Network- Generative Adversarial Networks - Case Studies	[9]
Deep Learning for NLP Words - Regular Expressions - N-grams - Language modelling - Part-of-Speech Tagging - Named Entity Recognition - Topic classification - Syntactic Parsing -Dependency Parsing - Computational Semantics - Lexical Semantics - Vector space models - Bag-of-Words - Term Frequency - Inverse Document Frequency - Attention mechanism - Transformer networks - Convolutional Neural Networks for text classification - Machine Translation **Practice:** 1. Collect data sets from the url : http://deeplearning.net/datasets/ 2. Image processing using CNN 3. Text analysis (Next word prediction, etc) using RNN 4. Text classification using RNN 5. Sentiment Classification using RNN 6. Disease Diagnosis using CNN Deep learning in genomics	[9]
Total Hours:	**45**

Text Book(s):	
1.	Ian Good Fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017.
2	Adam Gibson, Josh Patterson, ’Deep Learning: A Practitioner's Approach’, OReilly, 2016.
Reference(s):	
1.	Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018.
2.	Yoshua Bengio, “Learning Deep Architectures for AI”, Foundations & Trends in Machine Learning, 2009
3.	Nicholas Locascio and Nikhil Buduma "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", OReilly, 2017.
4.	Yoav Goldberg, Neural Network Methods for Natural Language Processing, Synthesis Lectures on Human Language Technologies, Morgan & Claypool Publishers, 2017.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being

Rev. No.3/w.e.f. 23/11/2024
Approved Passed in BoS Meeting held on 23/11/2024
Academic Council Meeting held on 21/12/2024

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***SDG 7 – Affordable and Clean Energy

Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Intelligent Systems and Deep Learning**	
1.1	Introduction to Intelligent Systems & AI, Evolution of Deep Learning and Neural Networks	1
1.2	Feed Forward Neural Networks	1
1.3	Gradient Descent	1
1.4	Back Propagation Algorithm	1
1.5	Vanishing Gradient problem	1
1.6	Heuristics for Avoiding Bad Local Minima	1
1.7	Heuristics for Faster Training	1
1.8	Regularization	1
1.9	Dropout	1
2.0	**Deep Learning Architectures**	
2.1	Convolutional Neural Networks Architectures	1
2.2	Convolution – Pooling Layers	1
2.3	Transfer Learning	1
2.4	Long Short-Term Memory, Gated Recurrent Units	1
2.5	Encoder/Decoder Architectures	1
2.6	Autoencoders	1
2.7	Standard- Sparse – Denoising , Contractive	1
2.8	Variational Autoencoders	1
2.9	Adversarial Generative Networks	1
3.0	**Deep Learning in Genomics and Biomedicine**	
3.1	Genomics	1
3.2	Dense Nets and Convolutional Nets for Genomics	1
3.3	Recurrent NN	1
3.4	Autoencoders and representation learning	1
3.5	Generative Models	1
3.6	Drug Discovery and protein structure: - imaging and electronic medical records	1
3.7	MoleculeNet	1
3.8	One shot Learning drug discovery	1
3.9	Case Studies	1
4.0	**Deep Learning for Biomedical Data Analysis**	
4.1	Understanding and Visualizing Convolutional Neural Networks	1
4.2	Lenet, Alexnet	2
4.3	GoogleNet for Visual perception tasks	2
4.4	Point of care disease diagnosis using CNN	1
4.5	Capsule Network	1
4.6	Generative Adversarial Networks	1

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4.7	Case Studies	1
5.0	**Deep Learning for NLP**	
5.1	Words - Regular Expressions - N-grams	1
5.2	Language modelling - Part-of-Speech Tagging -	1
5.3	Named Entity Recognition	1
5.4	Topic classification - Syntactic Parsing -Dependency Parsing	2
5.5	Computational Semantics - Lexical Semantics - Vector space models - Bag-of-Words	2
5.7	Term Frequency - Inverse Document Frequency - Attention mechanism	1
5.8	Transformer networks - Convolutional Neural Networks for text classification	1
Practice		
P.1	Collect data sets from the url : http://deeplearning.net/datasets/	1
P.2	Image processing using CNN	2
P.3	Text analysis (Next word prediction, etc) using RNN	2
P.4	Text classification using RNN	2
P.5	Sentiment Classification using RNN	2
P.6	Disease Diagnosis using CNN	3
P.7	Deep learning in genomics	3

Course Designer(s)

Dr.J.Nithya - nithyaj@ksrct.ac.in

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K.S.Rangasamy College of Technology – Autonomous R2025								
M.TECH DATA SCIENCE								
70 PDS 3P1 – Project Work - Phase I								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	0	0	12	60	6	100	-	100

Objective(s)	• To import the practical knowledge to the students and also to make them to carry out the technical procedures in their project work. • To provide an exposure to the students to refer, read and review the research articles, journals and conference proceedings relevant to their project work and placing this as their beginning stage for their final presentation.
Course Outcomes	**At the end of the course, the students will be able to** 1. Survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selected topic of research. 2. Use different experimental techniques/different software/computational/analytical tools. 3. Design and develop an experimental set up/ equipment/testing. 4. Conduct tests on existing set ups/equipment and draw logical conclusions from the results after analyzing them. 5. Work in a research environment or in an industrial environment.

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M.E/M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report.
The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

Assessment Pattern

Internal Assessment: 100 Marks

Review I (R1)			**Review II (R2)**		**Review III (R3)**			**Total (R1+R2+R3)**	**Internal**
Literature Survey	Topic Identification & Justification	Work Plan	Approach	Conclusion	Demo-Existing System	Presentation	Report	Total	
10	10	10	20	20	10	10	10	100	100

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE-637215

(An Autonomous Institution affiliated to Anna University)

M. Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted in 2026 - 2027)

FOURTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment	End Semester Exam	Max. Marks	End Semester Exam	Total
PRCTICAL								
1.	70 PDS 4P1	Project Work - Phase II	2	60	40	100	45	100

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K.S. Rangasamy College of Technology – Autonomous R2025								
M.TECH DATA SCIENCE								
70 PDS 4P1 – Project Work - Phase II								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
IV	0	0	24	60	12	60	40	100
Objective(s)	• This enables and strengthens the students to carry out the project on their own and to implement their innovative ideas to forefront the risk issues and to retrieve the hazards by adopting suitable assessment methodologies and staring it to global.							
Course Outcomes	**At the end of the course, the students will be able to** 1. Develop attitude of lifelong learning and will develop interpersonal skills to deal with people working in diversified field will. 2. Write technical reports and research papers to publish at national and international level. 3. Develop strong communication skills to defend their work in front of technically qualified audience.							

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M.E/M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report.

The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

Assessment Pattern

Internal Assessment: 100 Marks

Review I (R1)			**Review II (R2)**		**Review III (R3)**			**Total (R1+R2+R3)**	**Internal**
Literature Survey	Topic Identification & Justification	Work Plan	Approach	Conclusion	Demo-Existing System	Presentation	Report	Total	
10	10	10	20	20	10	10	10	100	100

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70 PAC 001	English for Research Paper Writing	Category	L	T	P	Credit
		AC	2	0	0	0

Objectives

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

Pre-requisites

- **Nil**

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand that how to improve your writing skills and level of readability	Understand
CO2	Learn about what to write in each section	Remember
CO3	Understand the skills needed when writing a Title	Understand
CO4	Understand the skills needed when writing the Conclusion	Understand
CO5	Ensure the good quality of paper at very first-time submission	Apply

Mapping with Programme Outcomes

COs	Pos					
	1	2	3	4	5	6
CO1	3	3	2	3	2	3
CO2	3	3	2	3	3	2
CO3	3	3	2	3	3	3
CO4	3	3	2	3	2	2
CO5	3	3	2	2	2	3
3 - Strong; 2 - Medium; 1 – Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)	
	1	2
Remember(Re)	30	10
Understand (Un)	30	20
Apply (Ap)	00	10
Analyse (An)	00	20
Evaluate(Ev)	00	00
Create (Cr)	00	00
Total	60	60

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
70 PAC 001 - English for Research Paper Writing								
Common to all Branches								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I/II	2	0	0	30	0	100	-	100

Introduction to Research Paper Writing: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	[6]
Presentation Skills Clarifying: Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	[6]
Title Writing Skills: Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	[6]
Result Writing Skills Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	[6]
Verification Skills Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first time submission	[6]
Total Hours:	**30**

Text Book(s):	
1.	Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2.	Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
Reference(s):	
1.	Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
2.	Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.
3.	Phill Williams, Advanced Writing skills for students of English, Rumian Publishers, 2018
4.	Sudhir S. Pandhye, English Grammar and Writing Skills, Notion Press, 2017.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1	**Introduction to Research Paper Writing**	
1.1	Planning and Preparation	1
1.2	Word Order, Breaking up long sentences	2
1.3	Structuring Paragraphs and Sentences	1
1.4	Being Concise and Removing Redundancy	1
1.5	Avoiding Ambiguity and Vagueness	1
2	**Presentation Skills**	
2.1	Clarifying Who Did What	1
2.2	Highlighting Your Findings	1
2.3	Hedging and criticizing,	1
2.4	Paraphrasing and Plagiarism,	1
2.5	Sections of a Paper	1
2.6	Abstracts, Introduction	1
3	**Title Writing Skills**	
3.1	Key skills are needed when writing a Title	1
3.2	key skills are needed when writing an Abstract, key skills are needed when writing an Introduction	1
3.3	skills needed when writing a Review of the Literature	1
3.4	Methods, Results	1
3.5	Discussion	1
3.6	Conclusions, The Final Check	1
4	**Result Writing Skills**	
4.1	Skills are needed when writing the Methods	1
4.2	skills needed when writing the Results	2
4.3	skills are needed when writing the Discussion	2
4.4	skills are needed when writing the Conclusions	1
5	**Verification Skills**	
5.1	Useful phrases, checking Plagiarism	3
5.2	how to ensure paper is as good as it could possibly be the first time submission	3
	Total Hours	30

Course Designer(s)

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70 PAC 002	Disaster Management	Category	L	T	P	Credit
		AC	2	0	0	0

Objectives

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches Teach how to improve writing skills and level of readability

Pre-requisites

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand that how to improve your writing skills and level of readability	Understand
CO2	Learn about what to write in each section	Remember
CO3	Understand the skills needed when writing a Title	Understand
CO4	Understand the skills needed when writing the Conclusion	Understand
CO5	Ensure the good quality of paper at very first-time submission	Apply

Mapping with Programme Outcomes

COs	Pos					
	1	2	3	4	5	6
CO1	3	3	2	3	2	3
CO2	3	3	2	3	3	2
CO3	3	3	2	3	3	3
CO4	3	3	2	3	2	2
CO5	3	3	2	2	2	3
3 - Strong; 2 - Medium; 1 – Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)	
	1	2
Remember(Re)	30	30
Understand (Un)	30	30
Apply (Ap)	00	00
Analyse (An)	00	00
Evaluate(Ev)	00	00
Create (Cr)	00	00
Total	60	60

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PAC 002 – Disaster Management								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	2	0	0	30	0	100	-	100

Introduction Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.	[6]
Repercussions of Disasters and Hazards : Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.	[6]
Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics	[6]
Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness.	[6]
Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.	[6]
Total Hours:	**30**

Text Book(s):	
1.	Goel S. L., Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2.	Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company,2007.
Reference(s):	
1.	Sahni, Pardeep et.al.," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, 2001.
2.	Subramanian R,"Disaster Management", Vikas publishing Housing Pvt. Ltd., 2018.
3.	Chu-hua Kuei, Christian N Madu, Handbook of Disaster Management Risk Reduction & Management: Climate change and Natural Disaster, world scientific, 2017.
4.	Janki Andharia, Disaster studies: Exploring Intersectional ties in Disaster Discourse, Springer, 2020.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Disaster: Definition, Factors and Significance	2
1.2	Difference between Hazard and Disaster	1
1.3	Natural and Manmade Disasters: Difference,	1
1.4	Nature, Types and Magnitude.	2
2.0	**Repercussions of Disasters and Hazards**	
2.1	Economic Damage, Loss of Human and Animal Life	1
2.2	Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis	1
2.3	Floods, Droughts and Famines, Landslides and Avalanches	1
2.4	Man-made disaster: Nuclear Reactor Meltdown	1
2.5	Industrial Accidents, Oil Slicks and Spills	1
2.6	Outbreaks Of Disease and Epidemics, War and Conflicts.	1
3.0	**Disaster Prone Areas in India**	
3.1	Study of Seismic Zones	1
3.2	Areas Prone to Floods and Droughts	1
3.3	Landslides and Avalanches	1
3.4	Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami	2
3.5	Post-Disaster Diseases and Epidemics	1
4.0	**Disaster Preparedness and Management Preparedness:**	
4.1	Monitoring of Phenomena Triggering a Disaster or Hazard	2
4.2	Evaluation of Risk: Application of Remote Sensing	1
4.3	Data from Meteorological and other Agencies	1
4.4	Media Reports: Governmental and Community Preparedness.	2
5.0	**Risk Assessment**	
5.1	Disaster Risk : Concept and Elements	1
5.2	Disaster Risk Reduction, Global and National Disaster Risk Situation.	2
5.3	Techniques of Risk Assessment	1
5.4	Global Co-Operation in Risk Assessment and Warning	1
5.5	People's Participation in Risk Assessment. Strategies for Survival	1

Course Designer(s)

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70 PAC 003	Constitution of India	Category	L	T	P	Credit
		AC	2	0	0	0

Objectives

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional.
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in1917 and its impact on the initial drafting of the Indian Constitution.

Pre-requisites

- NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand that how to improve your writing skills and level of readability	Understand
CO2	Learn about what to write in each section	Remember
CO3	Understand the skills needed when writing a Title	Understand
CO4	Understand the skills needed when writing the Conclusion	Understand
CO5	Ensure the good quality of paper at very first-time submission	Apply

Mapping with Programme Outcomes

COs	Pos					
	1	2	3	4	5	6
CO1	3	2	-	-	3	-
CO2	-	3	2	-	-	3
CO3	-	-	3	-	2	-
CO4	-	-	-	3	3	-
CO5	-	-	-	-	-	3
3 - Strong; 2 - Medium; 1 – Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)	
	1	2
Remember(Re)	30	30
Understand (Un)	30	30
Apply (Ap)	00	00
Analyse(An)	00	00
Evaluate (Ev)	00	00
Create (Cr)	00	00
Total	60	60

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K.S. Rangasamy College of Technology – Autonomous R2025								
60 PAC 003 – Constitution of India								
Common to all Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	2	0	0	30	0	100	-	100

History of Making of The Indian Constitution History, Drafting Committee, (Composition & Working)	[3]
Philosophy of The Indian Constitution Preamble, Salient Features	[3]
Contours of Constitutional Rights and Duties Fundamental Rights, Right to Equality, Right to Freedom, right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.	[6]
Organs of Governance Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.	[6]
Local Administration District's Administration head: Role and Importance Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	[6]
Election Commission Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.	[6]
Total Hours	**30**

Text Book(s):	
1.	The Constitution of India,1950 (Bare Act), Government Publication.
2	Busi S N, Ambedkar B R, "Framing of Indian Constitution",1st Edition, 2015.
Reference(s):	
1.	Jain, M P, "Indian Constitution Law", 7th Edition, Lexis Nexis,2014
2.	Basu, D D, "Introduction to the Constitution of India", Lexis Nexis, 2015.
3.	Bhansali S R., "Textbook on The Constitution of India", Universal Publishers, 2015
4.	Jain, M P.," Outlines of Indian Legal and Constitutional History", Lexis Nexis, 2014

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**History of Making of The Indian Constitution**	
1.1	History	1
1.2	Drafting Committee	1
1.3	(Composition & Working)	1
1.4	Preamble, Salient Features	3
2.0	**Contours of Constitutional Rights and Duties**	
2.1	Fundamental Rights, Right to Equality	1
2.2	Right to Freedom, right against Exploitation	1
2.3	Right to Freedom of Religion, Cultural and Educational Rights	1
2.4	Right to Constitutional Remedies	1
2.5	Directive Principles of State Policy, Fundamental Duties.	2
3.0	**Organs of Governance**	
3.1	Parliament, Composition, Qualifications and Disqualifications	1
3.2	Powers and Functions, Executives	1
3.3	President, Governor, Council of Ministers,	1
3.4	Judiciary, Appointment and Transfer of Judges,	1
3.5	Qualifications	1
3.6	Powers and Functions.	1
4.0	**Local Administration**	
4.1	District's Administration head: Role and Importance Municipalities	1
4.2	Introduction, Mayor and role of Elected Representative	1
4.3	CEO, Municipal Corporation. Panchayat raj: Introduction, PRI:	1
4.4	Organizational Hierarchy (Different departments)	1
4.5	Village level: Role of Elected and Appointed officials	1
4.6	Importance of grass root democracy.	1
5.0	**Election Commission**	
5.1	Election Commission: Role and Functioning.	2
5.2	Chief Election Commissioner and Election Commissioners	2
5.3	Institute and Bodies for the welfare of SC/ST/OBC and women.	2

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70 PDS E11	Artificial Intelligence and Internet of Things	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To present an overview of artificial intelligence (AI) principles and approaches
- To develop a basic understanding of the building blocks of AI
- To implement a small AI system in a team environment.
- To provide the students with understanding of Internet of Things (IoT).
- To learn about various IOT-related protocols

Pre-requisites

- Basic knowledge of Artificial Intelligence, Big Data.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the various characteristics of Intelligent agents.	Understand
CO2	Learn the different search strategies in AI.	Analyse
CO3	Learn to represent knowledge in solving AI problems.	Apply
CO4	Explain the concept of IoT	Understand
CO5	Analyse various protocols for IoT	Analyse

Mapping with Programme Outcomes

COs	Pos					
	1	2	3	4	5	6
CO1	3	2	-	-	3	-
CO2	-	3	2	-	-	3
CO3	-	-	3	-	2	-
CO4	-	-	-	3	3	-
CO5	-	-	-	-	-	3
3 - Strong; 2 - Medium; 1 – Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember(Re)	10	10	00
Understand (Un)	20	20	20
Apply (Ap)	20	30	40
Analyse(An)	10	00	40
Evaluate(Ev)	00	00	00
Create (Cr)	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2026								
M.Tech – Data Science								
70 PDS E11 - Artificial Intelligence and Internet of Things								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Introduction Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.	[9]
Problem Solving Methods Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games	[9]
Knowledge Representation First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories –Reasoning with Default Information.	[9]
Fundamentals of IoT Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects	[9]
IoT Protocols IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.	[9]
Total Hours:	**45**

Text Book(s):

1.	S. Russell and P. Norvig, 'Artificial Intelligence: A Modern Approachll, Prentice Hall', 3rd Edition, 2009.
2.	David Hanes, 'Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry', —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.

Reference(s):

1.	M. Tim Jones, — 'Artificial Intelligence: A Systems Approach(Computer Science)', Jones and Bartlett Publishers, Inc.; 1st Edition, 2008
2.	Nils J. Nilsson, —'The Quest for Artificial Intelligencell', Cambridge University Press, 2009.
3.	ArshdeepBahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015.
4.	Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).

*SDG 4 – Quality Education

**SDG 9 – Industry, Innovation, and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Introduction	1
1.2	Definition	1
1.3	Future of Artificial Intelligence	2
1.4	Characteristics of Intelligent Agents	2
1.5	Typical Intelligent Agents	2
1.6	Problem Solving Approach to Typical AI problems	1
2.0	**Problem Solving Methods**	
2.1	Problem solving Methods	1
2.2	Search Strategies- Uninformed – Informed	1
2.3	Heuristics – Local Search Algorithms and Optimization Problems	1
2.4	Searching with Partial Observations	1
2.5	Constraint Satisfaction Problems	1
2.6	Constraint Propagation – Backtracking Search	1
2.7	Game Playing – Optimal Decisions in Games	1
2.8	Alpha – Beta Pruning	1
2.9	Stochastic Games	1
3.0	**Knowledge Representation**	
3.1	First Order Predicate Logic	1
3.2	Prolog Programming – Unification	1
3.3	Forward Chaining-Backward Chaining	1
3.4	Resolution – Knowledge Representation	1
3.5	Ontological Engineering	1
3.6	Categories and Objects	1
3.7	Events – Mental Events and Mental Objects	1
3.8	Reasoning Systems for Categories	1
3.9	Reasoning with Default Information	1
4.0	**Fundamentals of IoT**	
4.1	Evolution of Internet of Things	1
4.2	Enabling Technologies	1
4.3	IoT Architectures: oneM2M	1
4.4	IoT World Forum (IoTWF) and Alternative IoT models	1
4.5	Simplified IoT Architecture and Core IoT Functional Stack	1
4.6	Fog, Edge and Cloud in IoT	1
4.7	Functional blocks of an IoT ecosystem	1
4.8	Sensors, Actuators, Smart Objects	1
4.9	Connecting Smart Objects	1

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5.0	**IoT Protocols**	
5.1	IoT Access Technologies: Physical and MAC layers	1
5.2	Topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN	1
5.3	Network Layer: IP versions	1
5.4	Constrained Nodes and Constrained Networks	1
5.5	Optimizing IP for IoT: From 6LoWPAN to 6Lo	1
5.6	Routing over Low Power and Lossy Networks	1
5.7	Application Transport Methods: Supervisory Control and Data Acquisition	1
5.8	Application Layer Protocols: CoAP and MQTT	2

Course Designer(s)

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70 PDS E12	Soft Computing and its Applications	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand Soft Computing concepts, technologies, and applications
- To know the underlying principle of soft computing with its usage in various application.
- To compare different genetic algorithms
- To analyse supervised and unsupervised learning algorithms
- To understand different soft computing tools for solving real life problems.

Pre-requisites

- Basic knowledge of Neural Network, and Deep Learning

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Know soft computing basics	Analyse
CO2	Develop application on different soft computing techniques like Fuzzy logic and its applications.	Apply
CO3	Solve single-objective optimization problems using Gas	Apply
CO4	Compare artificial neural networks and its applications	Apply
CO5	Apply Soft computing to solve problems in various application domains.	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	2	3	2	3	3
CO2	2	2	3	3	3	3
CO3	2	2	3	2	2	2
CO4	2	2	3	3	3	3
CO5	2	2	3	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember(Re)	10	10	00
Understand (Un)	20	20	20
Apply (Ap)	20	30	40
Analyse (An)	10	00	40
Evaluate (Ev)	00	00	00
Create (Cr)	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2026								
M.Tech – Data Science								
70 PDS E12 - Soft Computing and its Applications								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Introduction to Soft Computing Concept of computing systems - "Soft" computing versus "Hard" computing - Characteristics of Soft computing - Some applications of soft computing techniques	[9]
Fuzzy logic Introduction to Fuzzy logic - Fuzzy sets and membership functions - Operations on Fuzzy sets - Fuzzy relations, rules, propositions, implications and inferences - Defuzzification techniques - Fuzzy logic controller design - Some applications of Fuzzy logic	[9]
Genetic Algorithms Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques - Basic GA framework and different GA architectures - GA operators: Encoding, Crossover, Selection, Mutation - Solving single - objective optimization problems using Gas	[9]
Artificial Neural Networks Supervised Learning: Introduction and how brain works, Neuron as a simple computing element, The perceptron, Back propagation networks: architecture, multilayer perceptron, backpropagation learning-input layer, accelerated learning in multilayer perceptron - Unsupervised Learning: Hebbian Learning, Generalized Hebbian learning algorithm, Competitive learning, Self- Organizing Computational Maps: Kohonen Network.	[9]
Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems - Embedded Hybrid Systems - Neuro-Fuzzy Hybrid Systems, Neuro - Genetic Hybrid Systems - Fuzzy - Genetic Hybrid Systems	[9]
Total Hours:	**45**

Text Book(s):	
1.	Randy L. Haupt and sue Ellen Haupt,' Practical Genetic Algorithms' John Willey & Sons, 2002.
2.	Neural Networks and Learning Machines, 3rd Edition, Simon Haykin, PHI Learning, 2011.
Reference(s):	
1.	Fuzzy Logic with Engineering Applications 3rd Edition, Timothy J. Ross, Willey, 2010.
2.	An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
3.	Genetic Algorithms in Search, Optimization and Machine Learning, David E. Goldberg, Pearson Education, 2002.
4.	https://archive.nptel.ac.in/courses/106/105/106105173/

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Soft Computing**	
1.1	Introduction	1
1.2	Concept of computing	1
1.3	systems	1
1.4	"Soft" computing versus "Hard" computing	1
1.5	Characteristics of Soft	1
1.6	computing	1
1.7	Some applications of soft computing techniques	1
1.8	Soft computing	1
1.9	Hard computing	1
2.0	**Fuzzy logic**	
2.1	Introduction to Fuzzy logic	1
2.2	Fuzzy sets and membership functions	1
2.3	Operations on Fuzzy sets	1
2.4	Fuzzy relations, rules,	1
2.5	propositions, implications and inferences	1
2.6	Defuzzification techniques	1
2.7	Fuzzy logic controller design	1
2.8	Some applications of Fuzzy logic	1
2.9	Some applications of Fuzzy logic	1
3.0	**Genetic Algorithms**	
3.1	Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques	1
3.2	Basic GA framework and different GA architectures	1
3.3	GA operators:	1
3.4	Encoding	1
3.5	Crossover	1
3.6	Selection	1
3.7	Mutation	1
3.8	Solving single	1
3.9	objective optimization problems using Gas	1
4.0	**Artificial Neural Networks**	
4.1	Supervised Learning	1
4.2	Introduction and how brain works	1
4.3	Neuron as a simple computing element	1
4.4	The perceptron, Back propagation networks	1
4.5	architecture, multilayer perceptron, backpropagation learning	1
4.6	Input layer, accelerated learning in multilayer perceptron	1
4.7	Unsupervised Learning: Hebbian Learning,	1
4.8	Generalized Hebbian learning algorithm, Competitive learning,	1
4.9	Self- Organizing Computational Maps: Kohonen Network.	1

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5.0	**Hybrid Systems**	
5.1	Sequential Hybrid Systems	1
5.2	Auxiliary Hybrid Systems	1
5.3	Embedded Hybrid Systems	1
5.4	Neuro-Fuzzy Hybrid Systems	1
5.5	Neuro - Genetic Hybrid Systems	1
5.6	Neuro - Genetic Hybrid Systems	1
5.7	Fuzzy - Genetic Hybrid Systems	1
5.8	Embedded Hybrid Systems	1
5.9	Fuzzy - Genetic Hybrid Systems	1

Course Designer(s)

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70 PDS E13	Data Mining and Applications	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To identify the scope and necessity of Data Mining algorithms.
- To understand the fundamentals of data mining and its functionalities.
- To realize the issues regarding classification and prediction.
- To understand various tools of Data Mining and their techniques to solve the real time problems.
- To acquire skills to understanding the concepts of Spatial Mining

Pre-requisites

- Basic knowledge of Neural Network, and Deep Learning

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Classify the diverse attributes in data mining	Analyse
CO2	Analyse decision tree algorithm for classification	Apply
CO3	Apply various clustering algorithms for different datasets	Apply
CO4	Analyse the concepts of rule mining and visualization	Apply
CO5	Apply the concepts of Web, Temporal and spatial data mining	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	2	3	3	3
CO2	2	2	3	3	3	3
CO3	2	2	3	2	2	2
CO4	2	2	3	3	3	3
CO5	3	2	2	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember(Re)	10	10	00
Understand (Un)	20	20	20
Apply (Ap)	20	30	40
Analyse(An)	10	00	40
Evaluate (Ev)	00	00	00
Create (Cr)	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2026								
M.Tech – Data Science								
70 PDS E13 - Data Mining and Applications								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Introduction to Data Mining Definition of Data Mining-Kind of Data-Data Mining Functionalities-Kinds of Patterns-Classification of Data Mining Systems-Data Mining Task Primitives-Integration of A Data Mining System with A Database- Major Issues In Data Mining-Types of Data Sets and Attribute Values-Basic Statistical Descriptions of Data- Data Visualization- Measuring Data Similarity. PREPROCESSING: Data Quality- Major Tasks in Data Preprocessing- Data Reduction-Data Transformation and Data Discretization- Data Cleaning and Data Integration.	[9]
Classification Classification -Classification by Decision Tree Introduction- Bayesian Classification-Rule Based Classification -Classification by Back propagation-Support Vector Machines -Associative Classification, Classification Using Frequent Patterns - k-Nearest-Neighbor Classifiers - Case-Based Reasoning- Multiclass Classification - Semi-Supervised Classification- Mining Time series Data-Periodicity Analysis for time related sequence data	[9]
Clustering Analysis Cluster Analysis: Types of Data in Cluster Analysis-A Categorization of Major Clustering Methods-Partitioning Methods-Hierarchical methods-Density Based Methods-Grid Based Methods-Model Based Clustering Methods-Clustering HighDimensional Data-ConstraintBased Cluster Analysis, Outlier Analysis- Distribution Based Outlier Detection - A Statistics Based Approach-Classification Based Outlier Detection-Clustering Based Outlier Detection-Deviation Based Outlier Detection.	[9]
Association Rule Mining and Visualization Association Rule Mining – Introduction – Large Item sets – Basic Algorithms – Parallel and Distributed Algorithms – Comparing Approaches – Incremental Rules – Advanced Association Rule Techniques – Measuring the Quality of Rules – Visualization of Multidimensional Data – Diagrams for Multidimensional visualization – Visual Data Mining – Data Mining Applications	[9]
Web, Text, Temporal and Spatial Data Mining Multidimensional Analysis and Descriptive Mining of Complex Data Objects-Introduction, webmining, webcontent mining, web structure mining, we usage mining, Text mining, unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering. Introduction; Temporal Data Mining , Temporal Association Rules, Sequence Mining, GSP algorithm,SPADE,SPIRIT Episode Discovery, Time Series Analysis, Spatial Mining, Spatial Mining Tasks,Spatial Clustering.Data Mining Applications.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Jiawei Han and MichelineKamber 'Data Mining Concepts and Techniques'2nd Edition, Elsevier, Reprinted 2008.
2.	Pang-Ning Tan, 'Michael Steinbach and Vipin Kumar "Introduction to Data Mining', Pearson Education, 2007.
Reference(s):	
1.	Ian H. 'Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques' 4th Edition, Morgan Kaufmann, 2016
2.	Jiawei Han, MichelineKamber, Jian Pei, 'Data Mining Concepts and Techniques', Morgan Kaufman Publications, 3rd Edition, 2011
3.	Nathan Marz, Samuel E. Ritchie 'Big Data Principles and best practices of scalable real time data systems' ", Manning Publications Company, 2013
4.	Alex Berson and Stephen J. Smith 'Data Warehousing, Data Mining & OLAP', Tata McGraw Hill Edition, Tenth Reprint 2007.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Data Mining**	
1.1	Definition of Data Mining-Kind of Data-Data Mining Functionalities-Kinds of Patterns	1
1.2	Classification of Data Mining Systems-Data Mining Task Primitives	1
1.3	Integration of A Data Mining System with A Database	1
1.4	Major Issues in Data Mining-Types of Data Sets and Attribute Values	1
1.5	Basic Statistical Descriptions of Data- Data Visualization- Measuring Data Similarity	1
1.6	PREPROCESSING: Data Quality- Major Tasks in Data Preprocessing	1
1.7	Data Reduction	1
1.8	Data Transformation and Data Discretization	1
1.9	Data Cleaning and Data Integration	1
2.0	**Classification**	
2.1	Classification -Classification by Decision Tree Introduction	1
2.2	Bayesian Classification-Rule Based Classification -Classification by Back propagation	1
2.3	Support Vector Machines -Associative Classification	1
2.4	Classification Using Frequent Patterns - k-Nearest-Neighbor Classifiers	1
2.5	Case-Based Reasoning- Multiclass Classification	1
2.6	Semi-Supervised Classification	1
2.7	Mining Time series Data	1
2.8	Periodicity Analysis for time related sequence data	1
3.0	**Clustering Analysis**	
3.1	Cluster Analysis: Types of Data in Cluster Analysis-A Categorization of Major Clustering Methods	1
3.2	Partitioning Methods-Hierarchical Methods-Density Based Methods	1
3.3	Grid Based Methods-Model Based Clustering Methods	1
3.4	Clustering High Dimensional Data-Constraint Based Cluster Analysis	1
3.5	Outlier Analysis- Distribution Based Outlier Detection	1
3.6	A Statistics Based Approach	1
3.7	Classification Based Outlier Detection	1
3.8	Clustering Based Outlier Detection	1
3.9	Deviation Based Outlier Detection	1
4.0	**Association Rule Mining and Visualization**	
4.1	Association Rule Mining – Introduction – Large Item sets	1
4.2	Basic Algorithms – Parallel and Distributed Algorithms	1
4.3	Comparing Approaches- Incremental Rules	1
4.4	Advanced Association Rule Techniques	1
4.5	Measuring the Quality of Rules	1
4.6	Visualization of Multidimensional Data	1
4.7	Diagrams for Multidimensional visualization	1
4.8	Visual Data Mining	1
4.9	Data Mining Applications	1

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5.0	**Web, Text, Temporal and Spatial Data Mining**	
5.1	Multidimensional Analysis and Descriptive Mining of Complex Data Objects	1
5.2	Introduction, web mining, web content mining, web structure mining,	1
5.3	we usage mining, Text mining, unstructured text,	1
5.4	Episode rule discovery for texts, hierarchy of categories, text clustering	1
5.5	Introduction; Temporal Data Mining, Temporal Association Rules	1
5.6	Sequence Mining, GSP algorithm, SPADE	1
5.7	SPIRIT Episode Discovery, Time Series Analysis	1
5.8	Spatial Mining, Spatial Mining Tasks	1
5.9	Spatial Clustering. Data Mining Applications	1

Course Designer(s)

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70 PDS E14	Distributed Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learn the principles, architectures, algorithms and programming models used in distributed systems.
- To examine the message ordering and group communication of distributed systems
- To gain knowledge of distributed mutual exclusion and deadlock detection algorithms
- To understand the significance of agreement, fault tolerance and recovery protocols in distributed systems
- To learn the characteristics of peer-to-peer and distributed shared memory systems

Pre-requisites

- Basic knowledge of Operating System, Computer Networks

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the principles, architectures, algorithms and programming models used in distributed systems.	Remember
CO2	Learn issues related to clock Synchronization and the need for global state in distributed systems	Analyse
CO3	Design and implement distributed mutex and deadlock detection algorithms	Apply
CO4	Design and implement the significance of agreement, fault tolerance and recovery protocols in distributed Systems	Apply
CO5	Learn the characteristics of peer-to-peer and distributed shared memory systems	Understand

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	3	2	2	2	2
CO2	3	3	3	3	3	2
CO3	2	3	2	2	2	2
CO4	3	3	3	3	3	2
CO5	3	3	3	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember(Re)	10	10	00
Understand (Un)	20	20	20
Apply (Ap)	20	30	40
Analyse(An)	10	00	40
Evaluate(Ev)	00	00	00
Create (Cr)	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2026								
Common to all Branches								
70 PDS E14 - Distributed Systems								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Introduction Introduction: Definition –Relation to computer system components –Motivation –Relation to parallel systems – Message-passing systems versus shared memory systems –Primitives for distributed communication –Synchronous versus asynchronous executions –Design issues and challenges. A model of distributed computations: A distributed program –A model of distributed executions –Models of communication networks –Global state – Cuts –Past and future cones of an event –Models of process communications	[9]
Message ordering &Snapshots Message ordering and group communication: Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) – Total order. Global state and snapshot recording algorithms: Introduction –System model and definitions –Snapshot algorithms for FIFO channels	[9]
Distributed mutex & Deadlock Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport‘s algorithm –Ricart-Agrawala algorithm – Maekawa‘s algorithm – Suzuki–Kasami‘s broadcast algorithm. Deadlock detection in distributed systems: Introduction – System model – Preliminaries –Models of deadlocks – Knapp‘s classification –Algorithms for the single resource model, the AND model and the OR model.	[9]
Recovery Checkpointing and rollback recovery: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery	[9]
P2P& Distributed Shared Memory Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. Distributed shared memory: Abstraction and advantages – Memory consistency models –Shared memory Mutual Exclusion.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2.	George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education, 2012.
Reference(s):	
1.	Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.
2.	Mukesh Singhal and Niranjan G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
3.	Tanenbaum A.S., Van Steen M., Distributed Systems: Principles and Paradigms, Pearson Education, 2007.
4.	Liu M.L., Distributed Computing, Principles and Applications, Pearson Education, 2004.
5.	Nancy A Lynch, Distributed Algorithms, Morgan Kaufman Publishers, USA, 2003.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Definition – Relation to computer system components	1
1.2	Motivation – Relation to parallel systems	1
1.3	Message-passing systems versus shared memory systems	1
1.4	Primitives for distributed communication	1
1.5	Synchronous versus asynchronous execution - Design issues and challenges	1
1.6	A model of distributed computations: A distributed program	1
1.7	A model of distributed executions -Models of communication networks	1
1.8	Global state – Cuts –Past and future cones of an event	1
1.9	Models of process communications	1
2.0	**Message ordering & Snapshots**	
2.1	Message ordering and group communication	1
2.2	Message ordering paradigms	1
2.3	Asynchronous execution with synchronous communication	1
2.4	Synchronous program order on an asynchronous system	1
2.5	Group communication	1
2.6	Causal order (CO) - Total order	1
2.7	Global state and snapshot recording algorithms	1
2.8	Introduction –System model and definitions	1
	Snapshot algorithms for FIFO channels	
3.0	**Distributed mutex & Deadlock**	
3.1	Distributed mutual exclusion algorithms: Introduction	1
3.2	Preliminaries – Lamport‘s algorithm	1
3.3	Ricart-Agrawala algorithm	1
3.4	Maekawa‘s algorithm	1
3.5	Deadlock detection in distributed systems: Introduction	1
3.6	System model – Preliminaries	1
3.7	Models of deadlocks – Knapp‘s classification	1
3.8	Algorithms for the single resource model the AND model and the OR model	1
3.9	**Distributed mutex & Deadlock**	1
4.0	**Deep Learning for Biomedical Data Analysis**	
4.1	Check pointing and rollback recovery: Introduction	1
4.2	Background and definitions	1
4.3	Issues in failure recovery	1
4.4	Check point based recovery	1
4.5	Log based rollback recovery	1
4.6	Coordinated check pointing algorithm	1
4.7	Algorithm for asynchronous check pointing and recovery	1

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5.0	**P2P& Distributed shared memory**	
5.1	Peer-to-peer computing and overlay graphs: Introduction	1
5.2	Data indexing and overlays- Chord	1
5.3	Content addressable networks	1
5.4	Tapestry	1
5.5	Distributed shared memory	2
5.6	Abstraction and advantages	1
5.7	Memory consistency models	1
5.8	Shared memory Mutual Exclusion.	1
	Total	45

Course Designer(s)

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70 PDS E15	DevOps for Data Science	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

1. To understand DevOps & MLOps principles and implement version control for data science workflows
2. To automate infrastructure provisioning and deployment using Infrastructure as Code (IAC) and containerization
3. To build, test, and automate machine learning pipelines with CI/CD workflows
4. To monitor, log, and secure machine learning models and pipelines
5. Develop scalable and serverless ML architectures for real-world applications

Pre-requisites

- Programming Fundamentals
- Basic knowledge of Linux commands
- Understanding of cloud computing concepts

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Apply DevOps and MLOps practices in data science workflows	Apply
CO2	Automate infrastructure provisioning and deployment using containerization and orchestration	Apply
CO3	Develop and implement CI/CD pipelines for machine learning models	Analyse
CO4	Monitor, log, and secure machine learning pipelines effectively	Apply
CO5	Design scalable and serverless ML architectures for production environments	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	3	3	2	3	-
CO2	3	3	3	2	3	-
CO3	3	3	3	2	3	-
CO4	3	3	3	2	3	-
CO5	3	3	3	2	3	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	34
Understand	40	40	66
Apply	00	00	00
Analyse	00	00	00
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS E61- DevOps for Data Science								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Introduction to Devops for Data Science **DevOps & MLOps** - Differences between DevOps and MLOps, Importance in data science workflows. **Version Control Systems (VCS) -:** Git, GitHub, GitLab, Bitbucket-Branching strategies, pull requests, and code collaboration. **Code and Data Management:** Data Version Control (DVC) -Managing datasets, notebooks, and models	[9]
Infrastructure ss Code (IAC) And Automation **Infrastructure as Code (IAC)** : Terraform, AWS CloudFormation, Ansible - Deploying cloud resources for data science .**Containerization & Virtualization**: Introduction to Docker & Kubernetes - Dockerizing a Jupyter Notebook or ML model. **Automated Workflows**: Creating automated scripts with Bash/Python - Scheduling jobs with Apache Airflow & Cron	[9]
Continuous Integration & Continuous Deployment (Ci/Cd) For Ml **CI/CD Pipelines for Data Science**: Automating ML pipelines with Jenkins, GitHub Actions, GitLab CI/CD - Testing and validation in data science projects. **Model Versioning and Deployment** -: Model registry with MLflow - Deploying ML models with Flask/FastAPI. **Automating ML Model Retraining** - Triggering model updates based on new data - Workflow orchestration with Kubeflow	[9]
Monitoring, Logging, And Security **Logging & Monitoring for ML Systems:** ELK Stack (Elasticsearch, Logstash, and Kibana), Prometheus & Grafana - Model performance monitoring, drift detection**. Security in DevOps for Data Science-** Securing ML pipelines (IAM, role-based access) **-** Compliance & best practices for handling sensitive data**. Debugging and Incident Management :** Root cause analysis for failed ML deployments	[9]
Scalable & Serverless Ml Architectures **Serverless Computing for ML** : AWS Lambda, Google Cloud Functions, Azure Functions - Deploying lightweight ML inference models .**Big Data Processing in DevOps** - Apache Spark, Databricks, Hadoop for large-scale ML - Streaming ML with Kafka .**Auto-scaling and Load Balancing** : Scaling ML workloads in Kubernetes - Load balancing strategies for inference services	[9]
Total Hours:	**45**

Text Book(s):	
1.	Alex K. Gold, **DevOps for Data Science** , 1st Edition, Chapman & Hall Publisher,19 June 2024
Reference(s):	
1.	Nicole Forsgren Phd (Author), Jez Humble (Author), Gene Kim (Author), **"Accelerate: The Science of Lean Software and DevOps - Building and Scaling High Performing Technology Organizations (Grayscale Indian Edition)",** First Edition, Shroff/IT Revolution Publisher, New Delhi 22 May 2024.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Unit I - Introduction to Devops for Data Science**	
1.1	DevOps & MLOps - Differences between DevOps and MLOps	1
1.2	Importance in data science workflows	1
1.3	Version Control Systems (VCS) : Git, GitHub, GitLab	1
1.4	Bitbucket - Branching strategies, pull requests, and code collaboration	1
1.5	Code and Data Management: Data Version Control (DVC)	1
1.6	Managing datasets, notebooks, and models	1
2.0	**Unit II - Infrastructure as Code (IAC) and Automation**	
2.1	**Infrastructure as Code (IAC)** : Terraform	1
2.2	AWS CloudFormation, Ansible	1
2.3	Deploying cloud resources for data science	1
2.4	Introduction to Docker & Kubernetes	1
2.5	Dockerizing a Jupyter Notebook or ML model.	1
2.6	Creating automated scripts with Bash/Python , Scheduling jobs with Apache Airflow & Cron	1
3.0	Unit III - **Continuous Integration & Continuous Deployment (CI/CD) for Ml**	
3.1	**CI/CD Pipelines for Data Science**: Automating ML pipelines with Jenkins,	1
3.2	GitHub Actions, GitLab CI/CD	1
3.3	Testing and validation in data science projects.	1
3.4	Model registry with MLflow , Deploying ML models with Flask/FastAPI	1
3.5	**Automating ML Model Retraining** - Triggering model updates based on new data	1
3.6	Workflow orchestration with Kubeflow	1
4.0	UNIT IV - **Monitoring, Logging, and Security**	
4.1	**Logging & Monitoring for ML Systems:** ELK Stack (Elasticsearch, Logstash, and Kibana)	1
4.2	Prometheus & Grafana - Model performance monitoring, drift detection**.**	1
4.3	**Security in DevOps for Data Science-** Securing ML pipelines (IAM, role-based access)	2
4.4	Compliance & best practices for handling sensitive data**.**	1
4.5	**Debugging and Incident Management :** Root cause analysis for failed ML deployments	1
5.0	**UNIT V: AI-Driven Rendering, Simulation & Personalization In AR/VR**	
5.1	AI for real-time rendering and graphics enhancement	
5.2	Neural networks for realistic textures and environments	1
5.3	AI-driven content personalization in AR/VR experiences	1
5.4	Generative AI for world-building (GANs, Stable Diffusion)	2
5.5	Ethical considerations and future trends in AI-powered AR/VR	2
	Total	**45**

Course Designer(s)

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Rev. No.3/w.e.f. 23/11/2024
Approved Passed in BoS Meeting held on 23/11/2024
Academic Council Meeting held on 21/12/2024

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70 PDS E16	Human-Computer Interaction and AI Design	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- Understand the principles and methodologies of Human-Computer Interaction (HCI) and AI-driven interface design.
- Apply design thinking and user experience (UX) principles to create AI-driven interactive systems.
- Develop and evaluate AI-powered user interfaces considering usability, accessibility, and ethics.
- Analyse cognitive psychology and behavioural models in AI-HCI integration.
- Implement real-world AI-based HCI applications using machine learning and natural language processing.

Pre-requisites

- Basic knowledge of programming, data structures, and artificial intelligence fundamentals.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explain the fundamental concepts of HCI, usability, and design principles.	Understand
CO2	Recall the fundamental AI technologies used in HCI systems and identify their key challenges	Remember
CO3	Apply AI-based techniques to design intelligent and adaptive user interfaces.	Apply
CO4	Implement and test AI-driven HCI systems to enhance usability and user experience.	Apply
CO5	Analyse the AI-HCI solutions for real-world applications to identify strengths and limitations.	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	-	-	3	-
CO2	-	3	2	-	-	3
CO3	-	-	3	-	2	-
CO4	-	-	-	3	3	-
CO5	-	-	-	-	-	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	00	10
Understand	40	40	20
Apply	00	20	30
Analyse	00	00	40
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2026								
M.Tech – Data Science								
70 PDS E16 - Human-Computer Interaction and AI Design								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

Fundamentals of Human-Computer Interaction* Introduction to HCI: Evolution and Importance - Cognitive Psychology and User Behavior - Usability Engineering and UX Principles - Interaction Design and Prototyping - User-Centered Design (UCD) Process - HCI Design Patterns and Frameworks - Heuristic Evaluation and Usability Testing - HCI and AI Synergy: Enhancing User Experience - Ethical Considerations in AI-HCI	[9]
AI in HCI - Foundations and Applications AI-Driven User Interfaces - Machine Learning for Personalized User Experiences - Natural Language Processing in Interaction Design - Speech and Gesture Recognition Systems - AI and Adaptive User Interfaces - Conversational Agents and Chatbots - Emotion AI and Sentiment Analysis - AI in Accessibility and Assistive Technologies - Bias and Fairness in AI-HCI Systems	[9]
Designing Intelligent User Interfaces** Principles of Intelligent Interface Design - AI in Web and Mobile UI/UX - Adaptive and Context-Aware Systems - Augmented Reality (AR) and Virtual Reality (VR) Interfaces - Multi-Modal Interaction (Speech, Gesture, Touch) - Human-Centered AI: Design and Implementation - Personalization and Recommender Systems - Cognitive Load and User Experience - Designing for Explainability in AI Systems	[9]
Evaluation and Optimization of AI-HCI Systems Methods for Evaluating AI-HCI Systems - Usability Metrics and Performance Evaluation - A/B Testing and Data-Driven UI Improvements - AI in Decision-Support Systems - Explainable AI (XAI) and User Trust - Human Factors in AI Interaction - Ethics, Privacy, and Security in AI-Driven HCI - AI and Automation in UX Research - Future Trends in AI-HCI	[9]
Real-World Applications and Case Studies AI in Smart Homes and IoT Devices - AI for Healthcare and Assistive Technologies - AI in Education and E-Learning - HCI in Autonomous Systems and Robotics - AI in Gaming and Virtual Assistants - AI-Powered Digital Marketing and E-Commerce - HCI in Cybersecurity and Biometric Authentication - Case Studies of AI-Enhanced HCI Innovations - Future Directions: AI-HCI Convergence	[9]
Total Hours:	**45**

Text Book(s):	
1.	Yvonne Rogers, Helen Sharp, and Jenny Preece, “Interaction Design: Beyond Human-Computer Interaction” (6th Edition), Wiley, 2023.
2.	Ben Shneiderman, “Human-Centered AI”, Oxford University Press, 2022.
Reference(s):	
1.	Muhammad Raees et al., "From Explainable to Interactive AI: A Literature Review on Current Trends in Human-AI Interaction", arXiv, 2024.
2.	Lujain Ibrahim et al., "Characterizing and Modeling Harms from Interactions with Design Patterns in AI Interfaces", arXiv, 2024.
3.	Shristi Sharma and Sushil Shrestha, "Integrating HCI Principles in AI: A Review of Human-Centered Approaches in AI System Design", FAITH Journal, 2024.
4.	Lancelot Blanchard et al., "Designing Intelligent User Interfaces Using AI and Computer Vision", Preprints, 2024.

*SDG 4 – Quality Education
**SDG 9 – Industry, Innovation, and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Fundamentals of Human-Computer Interaction**	
1.1	Introduction to HCI: Evolution and Importance	1
1.2	Cognitive Psychology and User Behavior	1
1.3	Usability Engineering and UX Principles	1
1.4	Interaction Design and Prototyping	1
1.5	User-Centered Design (UCD) Process	1
1.6	HCI Design Patterns and Frameworks	1
1.7	Heuristic Evaluation and Usability Testing	1
1.8	HCI and AI Synergy: Enhancing User Experience	1
1.9	Ethical Considerations in AI-HCI.	1
2.0	**AI in HCI - Foundations and Applications**	
2.1	AI-Driven User Interfaces	1
2.2	Machine Learning for Personalized User Experiences	1
2.3	Natural Language Processing in Interaction Design	1
2.4	Speech and Gesture Recognition Systems	1
2.5	AI and Adaptive User Interfaces	1
2.6	Conversational Agents and Chatbots	1
2.7	Emotion AI and Sentiment Analysis	1
2.8	AI in Accessibility and Assistive Technologies	1
2.9	Bias and Fairness in AI-HCI Systems	1
3.0	**Designing Intelligent User Interfaces**	
3.1	Principles of Intelligent Interface Design	1
3.2	AI in Web and Mobile UI/UX	1
3.3	Adaptive and Context-Aware Systems	1
3.4	Augmented Reality (AR) and Virtual Reality (VR) Interfaces	1
3.5	Multi-Modal Interaction (Speech, Gesture, Touch)	1
3.6	Human-Centered AI: Design and Implementation	1
3.7	Personalization and Recommender Systems	1
3.8	Cognitive Load and User Experience	1
3.9	Designing for Explainability in AI Systems	1
4.0	**Evaluation and Optimization of AI-HCI Systems**	
4.1	Methods for Evaluating AI-HCI Systems	1
4.2	Usability Metrics and Performance Evaluation	1
4.3	A/B Testing and Data-Driven UI Improvements	1
4.4	AI in Decision-Support Systems	1
4.5	Explainable AI (XAI) and User Trust	1
4.6	Human Factors in AI Interaction	1
4.7	Ethics, Privacy, and Security in AI-Driven HCI	1
4.8	AI and Automation in UX Research	1

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4.9	Future Trends in AI-HCI	1
5.0	**Real-World Applications and Case Studies**	
5.1	AI in Smart Homes and IoT Devices	1
5.2	AI for Healthcare and Assistive Technologies	1
5.3	AI in Education and E-Learning	1
5.4	HCI in Autonomous Systems and Robotics	1
5.5	AI in Gaming and Virtual Assistants	1
5.6	AI-Powered Digital Marketing and E-Commerce	1
5.7	HCI in Cybersecurity and Biometric Authentication	1
5.8	Case Studies of AI-Enhanced HCI Innovations	1
5.9	Future Directions: AI-HCI Convergence	1

Course Designer(s)

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70 PDS E21	Advanced Algorithms and Optimization	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To analyse the asymptotic performance of algorithms.
- To study the concepts of graph and greedy algorithm
- To synthesize efficient algorithms in common engineering design situations.
- To apply important algorithmic design paradigms
- To study methods of analysis

Pre-requisites

- Data Structure, Design and Analysis of Algorithms

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Analyse algorithms to determine algorithm correctness and time efficiency	Analyse
CO2	Compare a variety of advanced data structures and their implementations	Understand
CO3	Apply a variety of different algorithm design techniques	Apply
CO4	Apply and implement the learnt algorithm design techniques to solve problems	Apply
CO5	Discuss the NP completeness problems	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	2	3	3	2
CO2	3	2	3	3	3	3
CO3	3	2	3	2	2	2
CO4	3	2	3	3	3	3
CO5	3	2	2	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	00
Understand	20	20	20
Apply	20	30	40
Analyse	10	00	40
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech-Data Science								
70 PDS E21 – Advanced Algorithms and Optimization								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Basics of Algorithm Analysis Computational Tractability – Asymptotic Order of Growth – Implementing the Stable Matching Algorithm Using Lists and Arrays – A survey of common running times – A more Complex Data Structure: Priority Queues.	[9]
Graphs and Greedy Algorithms Graphs: Basic Definitions and Applications – Graph connectivity and Graph traversal – Implementing Graph Traversal using Queues and Stacks – Testing Bipartiteness: An application of Breadth First search Greedy Algorithms: Interval Scheduling: The Greedy Algorithm Stays Ahead – Optimal Caching: A More Complex Exchange Argument – The Minimum Spanning Tree Problem – Implementing Kruskal's Algorithm: The Union-Find Data Structure – Clustering – Huffman Codes and Data Compression.	[9]
Divide and Conquer The Mergesort Algorithm – Further Recurrence Relations – Counting Inversions – Finding the Closest Pair of Points – Integer Multiplication Dynamic Programming: Weighted Interval Scheduling: A Recursive Procedure – Principles of Dynamic Programming: Memoization or Iteration over Subproblems – Segmented Least Squares: Multi-way Choices – Subset Sums and Knapsacks: Adding a variable – Shortest Paths in a Graph – Shortest Paths and Distance Vector Protocols – Negative Cycles in a Graph.	[9]
Network Flow The Maximum-Flow Problem and the Ford-Fulkerson Algorithm – Maximum Flows and Minimum Cuts in a Network – Choosing Good Augmenting Paths – A First Application: The Bipartite Matching Problem – Disjoint Paths in Directed and Undirected Graphs.	[9]
NP and Computational Intractability Polynomial-Time Reductions – Efficient Certification and the Definition of NP – NP-Complete Problems – Sequencing Problems – Partitioning Problems – Graph Coloring – Co-NP and the Asymmetry of NP.	[9]
Total Hours:	**45**

Text Book(s):

1. Jon Kleinberg, ÉvaTardos, 'Algorithm Design', Pearson Education Limited 2014
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 'Introduction to Algorithms', MIT Press, 2009

Reference(s):

1. Ellis Horowitz, SartajSahni and Sanguthevar Rajasekaran, 'Fundamentals of Computer Algorithms', Second Edition, Universities Press, Hyderabad, 2008
2. AnanyLevitin, 'Introduction to the Design and Analysis of Algorithms', Third Edition, Pearson Education Asia, 2008.
3. Marcello La Rocca, , 'Advanced Algorithms and Data Structures', May 2021,ISBN 9781617295485
4. Timo Masters, 'Advanced algorithms for neural networks: a C++ sourcebook', April 1995, ISBN 0471105880

*SDG 4 – Quality in Education

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Basics of Algorithm Analysis**	
1.1	Computational Tractability	1
1.2	Asymptotic Order of Growth	1
1.3	Implementing the Stable Matching Algorithm	1
1.4	Implementing the Stable Matching Algorithm Using Lists	1
1.5	Implementing the Stable Matching Algorithm Using Arrays	1
1.6	A survey of common running times	1
1.7	A more Complex Data Structure	1
1.8	Priority Queues	1
1.9	Priority Queues Types	1
2.0	**Graphs and Greedy Algorithms**	
2.1	Basic Definitions and Applications	1
2.2	Graph connectivity and Graph traversal	1
2.3	Implementing Graph Traversal using Queues and Stacks	1
2.4	Testing Bipartitions: An application of Breadth First search	1
2.5	Interval Scheduling - The Greedy Algorithm Stays Ahead	1
2.6	Optimal Caching: A More Complex Exchange Argument	1
2.7	The Minimum Spanning Tree Problem	1
2.8	Implementing Kruskal's Algorithm: The Union-Find Data Structure	1
2.9	Clustering – Huffman Codes and Data Compression	1
3.0	**Divide and Conquer**	
3.1	The Merge sort Algorithm	1
3.2	Further Recurrence Relations – Counting Inversions	1
3.3	Finding the Closest Pair of Points	1
3.4	Integer Multiplication Dynamic Programming: Weig+hted Interval Scheduling: A Recursive Procedure	1
3.5	Principles of Dynamic Programming: Memorization or Iteration over Sub problems	1
3.6	Segmented Least Squares: Multi-way Choices	1
3.7	Subset Sums and Knapsacks: Adding a variable	1
3.8	Shortest Paths in a Graph – Shortest Paths and Distance Vector Protocols	1
3.9	Negative Cycles in a Graph	1
4.0	**Network Flow**	
4.1	The Maximum Flow Problem	1
4.2	Fulkerson Algorithm	1
4.3	Maximum Flows in a Network	1
4.4	Minimum Cuts in a Network	1
4.5	Choosing Good Augmenting Paths	1
4.6	A First Application	1
4.7	The Bipartite Matching Problem	1
4.8	Disjoint Paths in Directed Graphs	1

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4.9	Disjoint Paths in Undirected Graphs	1
5.0	**NP and Computational Intractability**	
5.1	Polynomial	1
5.2	Time Reductions	1
5.3	Efficient Certification	1
5.4	Definition of NP	1
5.5	NP-Complete Problems	1
5.6	Sequencing Problems	1
5.7	Partitioning Problems	1
5.8	Graph Colouring	1
5.9	Co-NP and the Asymmetry of NP.	1

Course Designer(s)

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70 PDS E22	Intelligent Database Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learn NoSQL databases into web applications.
- To deploy analytical databases for OLAP and OLTP.
- To understand semi- structured data and to process XML data.
- To learn data warehouse.
- To understand some key concepts of data science.

Pre-requisites

- Database systems, SQL, XML, Data Science

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand basic concept of database systems	Remember
CO2	Apprehend the basics of MySQL.	Understand
CO3	Apply dimensional Modeling, star schemas, and ETL (extract-transform-load) for a data warehouse.	Apply
CO4	Ability of XML file format for storing, transmitting, and reconstructing arbitrary data.	Apply
CO5	Understand some key concepts of data virtualization	Understand

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	2	3	3	2	2
CO2	2	3	3	3	3	2
CO3	2	2	3	2	2	2
CO4	2	3	3	3	3	2
CO5	2	3	3	2	3	2
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	30	20	20
Understand	30	20	40
Apply	00	20	40
Analyse	00	00	00
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech-Data Science								
70 PDS E22 – Intelligent Database Systems								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Overview of Intelligent Database Systems Data modeling– Conceptual models and entity-relationship diagrams– Logical models and relational schemas – Mapping ER diagrams to relational schemas – Physical data models – phpMyAdmin	[9]
MySQL MySQL Workbench - Update anomalies - Functional dependencies and normalization - Entity and referential integrity constraints - Relational databases and web applications - Basic HTML and PHP - SQL injection attacks - PHP prepared statements - Object-relational mapping (ORM) - PHP Data Objects (PDO)	[9]
Data warehousing Dimensional modeling and star schemas - Dimension tables and fact tables- Operational databases and online transaction processing (OLTP) - Analytical databases and online analytical processing (OLAP) - Extract-transform-load (ETL) - Content management and WordPress	[9]
XML Semi-structured data and XML - Oxygen XML Editor - XPath and XQuery - FLWOR expressions - NoSQL databases and web applications – MongoDB - Documents and collections - CAP theorem vs. ACID - The Express server-side framework - Database CRUD actions and HTTP verbs - The REST API and RESTful web services	[9]
Data virtualization Data virtualization - The Cisco Information Server - Query optimization - Database failure and recovery – RAID - Distributed databases - Object databases - Cloud computing - Data science - Data mining- Big Data, Hadoop, and MapReduce	[9]
Total Hours:	**45**

Text Book(s):	
1.	NenadJukic, Susan Vrbsky, and SvetlozarNestorov, 'Database Systems: Introduction to Databases and Data Warehouses', Prospect Press, 2017
2.	Ralph Kimball and Margy Ross, 'The Kimball Group Reader: Relentlessly Practical Tools for Data Warehousing and Business Intelligence', Wiley, 2015
Reference(s):	
1.	Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Windom, 'Database Systems: The Complete Book, Second edition', Pearson Prentice Hall, 2009.
2.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", SixthEdition, McGraw-Hill, 2017.
3.	RamezElmasri and Shamkant B. Navathe, "Fundamental Database Systems", Sixth Edition, Pearson Education, 2010.
4.	Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing, Third Edition, 2014.

*SDG 4 – Quality in Education

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Overview of Intelligent Database Systems**	
1.1	Data Modelling	1
1.2	Conceptual models	1
1.3	Entity-relationship diagrams	1
1.4	Logical models	1
1.5	Relational schemas	1
1.6	Mapping ER diagrams to relational schemas	1
1.7	Physical data models	1
1.8	PhpMyAdmin	1
2.0	**MySQL**	
2.1	MySQL Workbench	1
2.2	Update anomalies	1
2.3	Functional dependencies and normalization	1
2.4	Entity and referential integrity constraints	1
2.5	Relational databases and web applications	1
2.6	Basic HTML and PHP	1
2.7	SQL injection attacks	1
2.8	PHP prepared statements	1
2.9	Object-relational mapping (ORM)	1
2.10	PHP Data Objects (PDO)	1
3.0	**Data Warehousing**	
3.1	Dimensional modeling and star schemas	1
3.2	Dimension tables and fact tables	1
3.3	Operational databases and online transaction processing (OLTP)	1
3.4	Analytical databases and online analytical processing (OLAP)	1
3.5	Extract-transform-load (ETL)	1
3.6	Content management and WordPress	1
4.0	**XML**	
4.1	Semi-structured data and XML	1
4.2	Oxygen XML Editor	1
4.3	XPath and XQuery	1
4.4	FLWOR expressions	1
4.5	NoSQL databases and web applications	1
4.6	MongoDB - Documents and collections	1
4.7	CAP theorem vs. ACID	1
4.8	The Express server-side framework	1
4.9	Database CRUD actions and HTTP verbs	1
4.10	The REST API and RESTful web services	1

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5.0	**Data Virtualization**	
5.1	Data virtualization - The Cisco Information Server	1
5.2	Query optimization	1
5.3	Database failure and recovery	1
5.4	RAID	1
5.5	Distributed databases and Object databases	1
5.6	Cloud computing	1
5.7	Data science	1
5.8	Data mining- Big Data, Hadoop, and MapReduce	1

Course Designer(s)

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70 PDS E23	Advanced Natural Language Processing	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To teach the fundamentals of NLP, and also to make them for understanding CFG, PCFG in NLP
- To understand the basic concepts of n-grams, smoothing, interpolation and part-of-speech tagging.
- To build the syntactic analysis of parsing and ambiguity
- To know the role of semantics of sentences and pragmatic.
- To understand the basic concepts of speech processing along with Analysis and Modeling.

Pre-requisites

- Theory of Computation, Compiler Design

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the fundamentals of natural language processing	Remember
CO2	Apply the use of CFG and PCFG in NLP	Apply
CO3	Understand the role of semantics sentences and pragmatic	Understand
CO4	Apply the speech production and related parameters of speech	Apply
CO5	Analyse the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	3	3	2	2	3
CO2	3	3	3	3	3	3
CO3	2	3	2	3	3	3
CO4	3	3	3	3	2	3
CO5	3	3	3	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	20	20
Understand	30	20	30
Apply	20	20	40
Analyse	00	00	10
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PDS E23 – Advanced Natural Language Processing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Introduction* Origins and challenges of NLP – language Modeling: grammar-based LM, statistical LM – regular expressions, finite-state automata – English morphology, transducers for lexicon and rules, tokenization, detecting and correcting spelling errors, minimum edit distance	[9]
Word Level Analysis Unsmoothed n-grams, evaluating n-grams, smoothing, interpolation and backoff – word classes, part-of-speech tagging, rule-based, stochastic and transformation-based tagging, issues in Pos tagging – Hidden Markov and maximum entropy models.	[9]
Syntactic Analysis Context free grammars, grammar rules for English, treebanks, normal forms for grammar – dependency grammar – syntactic parsing, ambiguity, dynamic programming parsing – shallow parsing – probabilistic CFG, probabilistic CYK, probabilistic lexicalized CFGS – feature structures, unification of feature structures.	[9]
Semantics And Pragmatics Requirements for representation, first-order logic, description logics – syntax-driven semantic analysis, semantic attachments – word senses, relations between senses, thematic roles, selectional restrictions – word sense disambiguation, WSD using supervised, dictionary & thesaurus, bootstrapping methods – word similarity using thesaurus and distributional methods.	[9]
Basic Concepts of Speech Processing** Speech fundamentals: articulatory phonetics – production and classification of speech sounds; acoustic phonetics – acoustics of speech production; review of digital signal processing concepts; short-time Fourier transform, filter- bank and IPC methods.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2.	Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3.	Lawrence Rabiner and Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.
4.	Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction To Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education, 2002.
Reference(s):	
1.	Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press, 1997.
2.	Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015
3.	Richard M Reese, —Natural Language Processing with Java, OReilly Media, 2015.
4.	Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
5.	Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Origins and challenges of NLP	1
1.2	Language Modeling: Grammar-based LM, statistical LM	1
1.3	Regular Expressions	1
1.4	Finite-State Automata	1
1.5	English Morphology,	1
1.6	Transducers for lexicon and rules,	1
1.7	Tokenization	1
1.8	Detecting and correcting spelling errors	1
1.9	Minimum edit distance	1
2.0	**Word Level Analysis**	
2.1	Unsmoothed n-grams	1
2.2	Evaluating n-grams	1
2.3	Smoothing, Interpolation and backoff	1
2.4	Word classes	1
2.5	Part-of-speech tagging	1
2.6	Rule-based, Stochastic and transformation	2
2.7	Based tagging, Issues in Pos tagging	1
2.8	Hidden Markov and maximum entropy models.	1
3.0	**Syntactic Analysis**	
3.1	Context free grammars, Grammar rules for English	1
3.2	Treebanks, normal forms for grammar	1
3.3	Dependency grammar	1
3.4	Syntactic parsing, ambiguity	1
3.5	Dynamic programming parsing	1
3.6	Shallow parsing – probabilistic CFG	1
3.7	Probabilistic CYK	1
3.8	Probabilistic lexicalized CFGS	1
3.9	Feature structures, unification of feature structures	1
4.0	**Semantics And Pragmatics**	
4.1	Requirements for representation, first-order logic, description logics	1
4.2	Syntax-driven semantic analysis	1
4.3	Semantic attachments	1
4.4	Word senses, relations between senses	1
4.5	Thematic roles, Selectional restrictions	1
4.6	Word sense disambiguation, WSD using supervised	1
4.7	Dictionary & thesaurus	1
4.8	Bootstrapping methods	2
4.9	Word similarity using thesaurus and distributional methods.	1

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5.0	**Basic Concepts of Speech Processing**	
5.1	Speech fundamentals: articulatory phonetics	1
5.2	Production and classification of speech sounds	1
5.3	Acoustic phonetics	1
5.4	Acoustics of speech production	2
5.5	Review of digital signal processing concepts	1
5.6	Short-time Fourier transform	2
5.7	Filter- bank and IPC methods.	1
	Total	45

Course Designer(s)

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70 PDS E24	R Programming for Data Science	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To apply fundamental tidy data concepts
- To data wrangle R techniques
- To pull data from CSV or web (using API)
- To perform operations in R including sorting, data wrangling, and making plots
- To develop R notebook (reproducible report).

Pre-requisites

- Basic Knowledge of Data Science

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Develop relevant programming abilities.	Understand
CO2	Demonstrate proficiency with statistical analysis of data	Understand
CO3	Develop the ability to build and assess data-based models	Understand
CO4	Analysis and execute statistical analyses with professional statistical software	Analyse
CO5	Demonstrate skill in data management	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	1	-	-	-
CO2	3	1	2	-	2	-
CO3	3	1	2	-	-	-
CO4	3	2	2	-	2	-
CO5	3	1	1	-	2	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	10
Understand	40	20	40
Apply	00	10	20
Analyse	00	20	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS E24 – R Programming for Data Science								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Introduction Introduction to R: R software, R packages, Data Types in R: Scalars, Vectors, Matrices, Data frames, Lists, Variables and Logical Operations. R Matrix Create, Print, Column, Slice, Factors in R, Categorical and continuous Variables	[9]
R Data Structures Scalars -Vectors Matrices - List - Data Frames-Factors -Packages - Data Reshaping – Data management with repeats, sorting, ordering and lists - Vector indexing, factors, Data management with strings, display and formatting.	[9]
Data Preparations R Data Frame: Create, Append, Select, Subset. R sort a data Frame using Order (), R Dplyr: Data manipulation and Cleaning, Merge Data Frames in R: Full and Partial Match, Functions in R programming.	[9]
Data Frames Data frames, Import of external data in various le formats, Statistical functions, Compilation of data - Graphics and plots, Statistical functions for central tendency, Variation, Skewness and kurtosis, Handling of bivariate data through graphics, Correlations, Programming and illustration with examples.	[9]
Interfacing R - CSV Files - Excel File - Binary Files - XML files - Web Data - Database - Regression - Decision Tree - Random Forest, R Random Forest, Generalized Linear Model in R with example, K-means Clustering in R with example	[9]
Total Hours:	**45**

Text Book(s):	
1.	Roger D. Peng, “R programming for Data Science “, Lulu.com, Version 2020.
2.	Han, J., Kamber, M., Pei, J. “Data mining concepts and techniques”, Morgan Kaufmann, 2011
Reference(s):	
1.	Hastie, T., Tibshirani, R., Friedman, J. “The Elements of Statistical Learning”, 2nd edition. Springer, 2009
2.	Nina Zumel, John Mount. Manning, “Practical Data Science with R”, 2014
3.	F. Provost, T Fawcett, “Data Science for business”, O'Reilly Media, 2013
4.	Murphy, K., “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012

*****SDG 4 – Quality Education

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Academic Council Meeting held on 21/12/2024

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Introduction to R	1
1.2	R software, R packages	1
1.3	Data Types in R: Scalars	1
1.4	Vectors, Matrices	1
1.5	Data frames	1
1.6	Lists, Variables	1
1.7	Logical Operations	1
1.8	Factors in R	1
1.9	Categorical and continuous Variables	1
2.0	**R Data Structures**	
2.1	Scalars	1
2.2	Vectors Matrices	1
2.3	List - Data Frames	1
2.4	Factors -Packages	1
2.5	Data Reshaping	1
2.6	Data management with repeats	1
2.7	Sorting, ordering and lists	1
2.8	Vector indexing, factors	1
2.9	Data management with strings, display and formatting.	1
3.0	**Data Preparations**	
3.1	R Data Frame	1
3.2	Create, Append	1
3.3	Select, Subset	1
3.4	R sort a data Frame using Order	1
3.5	R Dplyr: Data manipulation and Cleaning	2
3.6	Merge Data Frames in R	1
3.7	Full and Partial Match	1
3.8	Functions in R programming	1
4.0	**Data Frames**	
4.1	Data frames	1
4.2	Import of external data in various le formats	1
4.3	Statistical function	1
4.4	Compilation of data - Graphics and plots	1
4.5	Statistical functions for central tendency	1
4.6	Variation, skewness and kurtosis	1
4.7	Handling of bivariate data through graphics	1
4.8	Correlations	1
4.9	Programming and illustration with examples	1

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5.0	**Interfacing**	
5.1	R - CSV Files	1
5.2	Excel File - Binary Files	1
5.3	XML files	1
5.4	Web Data	1
5.5	Database - Regression	1
5.6	Decision Tree - Random Forest	1
5.7	R Random Forest	1
5.8	Generalized Linear Model in R with example	1
5.9	K- means Clustering in R with example	1

Course Designer(s)

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70 PDS E25	Deep Learning for Recommendation Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Understand the Fundamentals of Recommendation Systems.
- Explore Deep Learning Architectures for Recommendations.
- Implement Neural Network-based Recommendation Models.
- Understand Sequence-based Recommendation Models.
- Explore Emerging Trends in AI-powered Recommendations.

Pre-requisites

- Programming & Data Handling

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the fundamentals of deep learning and its applications in recommendation systems	Understand
CO2	Analyse different types of recommendation systems, including collaborative filtering, content-based filtering, and hybrid approaches.	Analyse
CO3	Implement deep learning models such as neural collaborative filtering, autoencoders, and recurrent neural networks (RNNs) for personalized recommendations.	Apply
CO4	Apply deep learning frameworks (e.g., TensorFlow, PyTorch) to build and optimize recommendation models.	Apply
CO5	Explore emerging trends in deep learning for recommendations, including reinforcement learning and self-supervised learning	Understand

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	2	3	3	2	2
CO2	2	2	3	3	2	2
CO3	2	2	3	3	2	2
CO4	2	2	3	3	2	2
CO5	2	2	3	3	2	2
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	30
Understand	20	40	30
Apply	10	10	20
Analyse	10	00	20
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PDS E25 - Deep Learning for Recommendation Systems								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Introduction to Recommendation Systems Fundamentals of Recommendation Systems - Types of Recommendation Systems – Content based Approach - Collaborative Filtering - Hybrid Approaches- Traditional Machine Learning-based Approaches - Challenges in Recommendation Systems - Overview of Deep Learning in Recommendation Systems.	[9]
Deep Learning Foundations for Recommendations Deep Learning Architectures for Recommendations - Embeddings and Representation Learning - Neural Collaborative Filtering (NCF) - Autoencoders for Collaborative Filtering - Sequence-based Models (RNNs, LSTMs) for Sequential Recommendations.	[9]
Advanced Deep Learning Models for Recommendation Systems Advanced Deep Learning Models - Attention Mechanisms in Recommendation - Transformer-based Models (BERT4Rec, SASRec) - Graph Neural Networks (GNNs) for Recommendations - Reinforcement Learning for Personalized Recommendations - Multi-task Learning and Self-Supervised Learning in Recommendations.	[9]
Practical Implementation and Optimization Large-scale Recommendation Systems: Scalable Architectures - Model Training, Hyperparameter Tuning, and Evaluation Metrics - Bias, Fairness, and Explainability in Recommendation Systems - Deploying Recommendation Models in Production (TensorFlow, PyTorch, NVIDIA Merlin) - Case Studies: Netflix, Spotify, Amazon, YouTube.	[9]
Real-world Applications and Research Trends Cross-domain and Multi-modal Recommendation Systems - Federated Learning and Privacy-preserving Recommendation Systems - Real-time and Dynamic Recommendations - Industry Applications and Business Impact - Emerging Trends and Future Direction.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Ian Good Fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017
2.	Adam Gibson, Josh Patterson, ’Deep Learning: A Practitioner's Approach’, OReilly, 2016.
Reference(s):	
1.	Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018.
2.	Yoshua Bengio, “Learning Deep Architectures for AI”, Foundations & Trends in Machine Learning, 2009
3.	Nicholas Locascio and Nikhil Buduma "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", OReilly, 2017.
4.	Yoav Goldberg, Neural Network Methods for Natural Language Processing, Synthesis Lectures on Human Language Technologies, Morgan & Claypool Publishers, 2017.

*SDG 4: Quality Education

**SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Recommendation Systems**	
1.1	Fundamentals of Recommendation Systems	1
1.2	Types of Recommendation Systems	1
1.3	Content-based Approach	1
1.4	Collaborative Filtering	1
1.5	Hybrid Approaches	1
1.6	Traditional Machine Learning-based Approach	2
1.7	Challenges in Recommendation Systems	1
1.8	Overview of Deep Learning in Recommendation Systems.	1
2.0	**Deep Learning Foundations for Recommendations**	
2.1	Deep Learning Architectures for Recommendations	2
2.2	Embeddings and Representation Learning	2
2.3	Neural Collaborative Filtering (NCF)	2
2.4	Sequence-based Models	1
2.5	(RNNs, LSTMs) for Sequential Recommendations	2
3.0	**Advanced Deep Learning Models for Recommendation Systems**	
3.1	Advanced Deep Learning Models.	1
3.2	Attention Mechanisms in Recommendation	1
3.3	Transformer-based Models	1
3.4	BERT4Rec, SASRec	2
3.5	Graph Neural Networks (GNNs) for Recommendations	1
3.6	Reinforcement Learning for Personalized Recommendations	1
3.7	Multi-task Learning	1
3.8	Self-Supervised Learning in Recommendations.	1
4.0	**Practical Implementation and Optimization**	
4.1	Large-scale Recommendation Systems	1
4.2	Scalable Architectures	1
4.3	Model Training	1
4.4	Hyperparameter Tuning, Evaluation Metrics	2
4.5	Bias, Fairness, and Explainability in Recommendation Systems	1
4.6	Deploying Recommendation Models in Production	1
4.7	TensorFlow, PyTorch, NVIDIA Merlin	1
4.8	Case Studies: Netflix, Spotify, Amazon, YouTube.	1
5.0	**Real-world Applications and Research Trends**	
5.1	Cross-domain Recommendation Systems	1
5.2	Multi-modal Recommendation Systems	1
5.3	Federated Learning and Privacy	1
5.4	Preserving Recommendation Systems	2
5.5	Real-time Recommendation Systems	1
5.6	Dynamic Recommendations	1
5.7	Industry Applications and Business Impact	1
5.8	Emerging Trends and Future Direction.	1

Course Designer(s)

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70 PDS E31	Reinforcement Learning	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the basic mathematical foundations of reinforcement learning
- To impart knowledge on the temporal difference and eligibility traces
- To explore a dynamic programming and Monte-Carlo methods
- To analyse the policy gradient methods
- To develop hierarchical RL frameworks

Pre-requisites

- Data Mining, Machine Learning

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Identify the reward function and Markov Decision Process	Understand
CO2	Apply temporal difference (TD) learning method for reinforcement learning problem	Apply
CO3	Analyse to Solve problems using Dynamic Programming	Analyse
CO4	Recognize to Gradient methods for Reinforcement Learning	Understand
CO5	Apply Hierarchical Reinforcement Learning Algorithms	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	2	3	3	3
CO2	3	2	3	3	3	3
CO3	3	2	3	2	2	2
CO4	3	2	3	3	3	3
CO5	3	2	2	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	10
Understand	20	20	30
Apply	20	20	30
Analyse	00	10	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PDS E31 - Reinforcement Learning								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Reinforcement Learning Problem Evaluative feedback-non associative learning-Rewards and returns-Markov Decision Processes-Value functions-optimality and approximation. Bandit Problems: Explore-exploit dilemma- Binary Bandits-Learning automata-exploration schemes **Case study**: Elevator dispatching	[9]
Temporal Difference Learning TD prediction, -Optimality of TD(0)- SARSA- Q-learning-R-learning-Games and after states. Eligibility Traces: n-step TD prediction-TD(lambda)-forward and backward views-Q(lambda)-SARSA (lambda)-replacing traces and accumulating traces. **Case study: T** Dgammon	[9]
Dynamic Programming Value iteration, -policy iteration- asynchronous DP-generalized policy iteration. Monte-Carlomethods: Policy evaluation-roll outs -on policy and off policy learning-importance sampling – **Case study**: Helicopter piloting	[9]
Function Approximation Value prediction-gradient descent methods- linear function approximation- Control algorithms- Fitted Iterative Methods. Policy Gradient Methods: non-associative learning - REINFORCE algorithm-exact gradient methods-estimating gradients-approximate policy gradient algorithms-actor critic methods **Case study:** Computational Neuroscience	[9]
Hierarchical Rl Anddeep Reinforcement Learning MAXQ framework-Options framework-HAM framework-Option discovery algorithms. Deep Q-Networks- Double Deep-Q Networks(DQN, DDQN, Dueling DQN, Prioritized Experience Replay).- **Case study**: on real world problems in Deep Reinforcement learning	[9]
Total Hours:	**45**

Text Book(s):	
1.	Richard S. Sutton and Andrew G. Barto, 'Reinforcement learning: An Introduction', 2nd Edition, MIT Press, 2019.
2.	Russell, Stuart J., and Peter Norvig. 'Artificial intelligence: a modern approach', Pearson Education Limited, 2016.
Reference(s):	
1.	Ian Goodfellow, YoshuaBengio, and Aaron Courville. 'Deep learning'. MIT press, 2017.
2.	Keng, Wah Loon, Graesser, Laura, 'Foundations of Deep Reinforcement Learning: Theory and Practice in Python', Addison Wesley Data & Analytics Series, 2020.
3.	Francois Chollet, 'Deep Learning with Python', Manning Publications, 2018.
4.	Michael Wooldridge, 'An Introduction to Multi Agent Systems', John Wiley, 2002.

*SDG 4: Quality Education

**SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Reinforcement Learning Problem**	
1.1	Evaluative Feedback, Non-Associative Learning	1
1.2	Rewards and Returns	1
1.3	Markov Decision Processes	1
1.4	Value Functions	1
1.5	Optimality and Approximation	1
1.6	Bandit Problems: Explore- Exploit Dilemma	1
1.7	Binary Bandits	1
1.8	Learning Automata	1
1.9	Exploration Schemes	
2.0	**Temporal Difference Learning**	
2.1	TD Prediction	1
2.2	Optimality Of TD (0)- SARSA	1
2.3	Q-Learning,R-Learning	1
2.4	Games and After States	1
2.5	Eligibility Traces: N-Step TD Prediction	1
2.6	TD (Lambda)	1
2.7	Forward And Backward Views	1
2.8	Q(Lambda),SARSA (Lambda)	1
2.9	Replacing Traces And Accumulating Traces.	1
3.0	**Function Approximation**	
3.1	Value Prediction	1
3.2	Gradient Descent Methods	1
3.3	Linear Function Approximation	1
3.4	Control Algorithms	1
3.5	Fitted Iterative Methods	1
3.6	Policy Gradient Methods: Non-Associative Learning	1
3.7	REINFORCE Algorithm	1
3.8	Exact Gradient Methods, Estimating Gradients	1
3.9	Approximate Policy Gradient Algorithms-Actor Critic Methods	1
4.0	**Practical Implementation and Optimization**	
4.1	Large-scale Recommendation Systems	1
4.2	Scalable Architectures	1
4.3	Model Training	1
4.4	Hyperparameter Tuning	1
4.5	Evaluation Metrics	1
4.6	Bias, Fairness, and Explainability in Recommendation Systems	1
4.7	Deploying Recommendation Models in Production	1
4.8	TensorFlow, PyTorch, NVIDIA Merlin	1

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4.9	Case Studies: Netflix, Spotify, Amazon, YouTube.	1
5.0	**Hierarchical Rl and Deep Reinforcement Learning**	
5.1	MAXQ framework	1
5.2	Options framework	1
5.3	HAM framework	1
5.4	Option discovery algorithms	1
5.5	Deep Q-Networks	1
5.6	Double Deep	1
5.7	Q Networks (DQN, DDQN, Dueling DQN, Prioritized Experience Replay)	1

Course Designer(s)

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70 PDS E32	Advanced Recommender Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To Ensure recommendations are relevant and match user preferences.
- To Provide varied recommendations to redundancy and expand user exploration.
- To explain the Handle large datasets efficiently while maintaining performance
- To explain the Ensure users understand why recommendations are made and trust the system
- To protect user data while maintaining recommendation quality.

Pre-requisites

- Data Structures

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Develop an understanding of recommender systems and data mining techniques used.	Understand
CO2	Apply collaborative filtering techniques and addressing attacks on collaborative recommender systems.	Apply
CO3	Design content-based recommender systems using similarity retrieval or classification algorithms.	Apply
CO4	Employ knowledge representation and reasoning in recommender systems and opportunities for hybridization	Understand
CO5	Evaluate and improve recommender systems for real-time application	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	-	2	3	3	-
CO2	2	-	3	3	3	-
CO3	3	2	2	3	1	-
CO4	3	2	3	3	3	-
CO5	3	1	2	3	3	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	30
Understand	10	20	20
Apply	30	30	50
Analyse	00	00	00
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.Tech-Data Science								
70 PDS E32 – Advanced Recommender Systems								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Introduction Basic taxonomy of recommender systems - Data mining methods for recommender systems - Recommender system functions - Understanding ratings - Applications of recommendation systems - Issues with recommender system.	[9]
Collaborative Filtering Nearest-neighbor collaborative filtering (CF). User-based and item-based CF, comparison, Components of neighborhood methods Hybrid recommender systems. Attacks on collaborative recommender systems.	[9]
Content-based recommendation High-level architecture of content-based systems - Advantages and drawbacks of content- based filtering, Item profiles - Discovering features of documents - Obtaining item features from tags - Representing item profiles - Methods for learning user profiles - Similarity based retrieval - Classification algorithms..	[9]
Knowledge- Based Recommendation * Knowledge representation and reasoning – Constraint-based recommenders – Case-based recommenders - Hybrid approaches: Opportunities for hybridization - Monolithic hybridization design - Parallelized hybridization design - Pipelined hybridization design.	[9]
Evaluating Recommender System* Introduction - Evaluation designs - Evaluation on historical datasets - Community-Based Web Search -Social Tagging Recommenders Systems - Trust and Recommendations	[9]
Total Hours:	**45**

Text Book(s):	
1.	T.V.Geetha and S.Sendhilkumar, Machine Learning: Concepts,Techniques and Applications, First Edition, CRC Press, Taylor and Franics, 2023
2.	Leskovec, Jure, Anand Rajaraman, and Jeffrey David Ullman. Mining of massive data sets. Second Edition, Dreamtech Press, 2016.
Reference(s):	
1.	Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st edition
2.	F. Ricci, L Rokach, B. Shapira and P.B. Kantor, Recommender systems handbook, Springer 2010.
3.	Schutze, Hinrich, Christopher D. Manning, and Prabhakar Raghavan. Introduction to information retrieval. Cambridge University Press, 2008.
4.	C.C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.

*SDG 4 – Quality in Education

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Basic taxonomy of recommender systems	1
1.2	Data mining methods for recommender systems	1
1.3	Recommender system functions	1
1.4	Understanding ratings	2
1.5	Applications of recommendation systems	2
1.6	Issues with recommender system	2
2.0	**Collaborative Filtering**	
2.1	Nearest-neighbor collaborative filtering (CF)	2
2.2	User-based and item-based CF	1
2.3	Comparison	2
2.4	Components of neighborhood methods Hybrid recommender systems	2
2.5	Attacks on collaborative recommender systems	2
3.0	**Content-based recommendation**	
3.1	High-level architecture of content-based systems	
3.2	Advantages and drawbacks of content- based filtering	1
3.3	Item profiles	1
3.4	Discovering features of documents	1
3.5	Obtaining item features from tags	1
3.6	Representing item profiles	1
3.7	Methods for learning user profiles	1
3.8	Similarity based retrieval	2
3.9	Classification algorithms	1
4.0	**Knowledge- Based Recommendation**	
4.1	Knowledge representation and reasoning	1
4.2	Constraint-based recommenders	1
4.3	Case-based recommenders	1
4.4	Hybrid approaches: Opportunities for hybridization	2
4.5	Monolithic hybridization design	2
4.6	Pipelined hybridization design	2
5.0	**Evaluating Recommender System**	
5.1	Introduction - Evaluation designs	1
5.2	Evaluation designs	1
5.3	Evaluation on historical datasets	1
5.4	Community-Based Web Search	2
5.5	Social Tagging Recommenders Systems	1
5.6	Trust	2
5.7	Recommendations	1

Course Designer(s)

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70 PDS E33	Data Engineering Tools and Techniques	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Understand the core principles of data engineering, including data ingestion, transformation, and storage.
- Learn to use essential data engineering tools such as Apache Spark, Hadoop, Kafka, and Airflow for building scalable data pipelines.
- Develop efficient ETL workflows for structured and unstructured data.
- Explore real-time and batch data processing techniques to handle large-scale datasets.
- Apply best practices in data governance, security, and performance optimization in data engineering workflows.

Pre-requisites

- Big Data Analytics

Course Outcomes

On the successful completion of the course, students will be able to

CO1	**Explain** the role of data engineering in big data ecosystems and analytics.	Remember
CO2	**Design and implement** data pipelines using ETL techniques and modern data engineering tools.	Apply
CO3	**Work with** distributed data processing frameworks like Apache Spark and Hadoop.	Apply
CO4	**Integrate and manage** real-time data streaming using Apache Kafka and related technologies.	Apply
CO5	**Ensure** data quality, security, and scalability in data processing and storage solutions.	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	3	3	3	3	2
CO2	3	3	3	3	3	2
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	10
Understand	40	40	30
Apply	10	10	40
Analyse	00	00	20
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS E33- Data Engineering Tools and Techniques								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Introduction to Data Engineering Overview of Data Engineering: Role, importance, and challenges, Data Engineering vs. Data Science, Data Lifecycle: Ingestion, storage, processing, analysis, and visualization.	[9]
Data Storage Technologies Relational Databases: SQL databases, schema design, normalization and indexing. NoSQL Databases: Document, key-value, column-family, and graph databases. Data Warehouses: Concepts, star and snowflake schemas, OLAP and data marts. Distributed File Systems: Hadoop, HDFS, Google Cloud Storage, Amazon S3.	[9]
Data Processing Technologies Batch Processing: MapReduce, Apache Spark, data parallelism. Stream Processing: Apache Kafka, Apache Flink, event-driven architectures. In-Memory Computing: Redis, Apache Ignite, Memcached.	[9]
Data Integration and ETL Data Integration Tools: Apache NIFI, Talend, Informatica. Data Transformation: Data cleaning, Enrichment, Aggregation, and Denormalization.	[9]
Emerging Trends in Data Engineering Integration of Big data and Machine learning-Machine Learning and AI in Data Engineering-Edge Computing and Data Engineering-Future Directions in Data Engineering	[9]
Total Hours:	**45**

Text Book(s):	
1.	G. Sudha, M. Thangaraj, S. Suguna, “Big Data Analytics: Concepts, Techniques, Tools and Technologies Paperback”, PHI Learning, 2022
2.	Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015
Reference(s):	
1.	Anand Rajaraman and Jeffrey David Ullman,” Mining of Massive Datasets”, Cambridge University Press, 3rd edition 2020.
2.	Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
3.	Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
4.	Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.

*SDG 9 – Industry Innovation and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Data Engineering**	
1.1	Overview of Data Engineering	1
1.2	Role and Importance of Data Engineering	1
1.3	Challenges of Data Engineering	1
1.4	Data Engineering Vs Data Science	1
1.5	Data Lifecycle: Ingestion	2
1.6	Sources of data: Databases	1
1.7	Storage, Processing	1
1.8	Visualization.	1
2.0	**Data Storage Technologies**	
2.1	Relational Databases: SQL databases	1
2.2	Schema design	1
2.3	Normalization and indexing	1
2.4	NoSQL Databases: Document, key-value	1
2.5	Column-family and Graph databases	1
2.6	Data Warehouses: Concepts, star and snowflake schemas	1
2.7	OLAP and data marts	1
2.8	Distributed File Systems: Hadoop, HDFS	1
2.9	Google Cloud Storage and Amazon S3	1
3.0	**Data Processing Technologies**	
3.1	Batch Processing: MapReduce	1
3.2	Apache Spark	1
3.3	Data parallelism	1
3.4	Stream Processing: Apache Kafka	1
3.5	Apache Flink	1
3.6	Event-driven architectures	1
3.7	In-Memory Computing: Redis	1
3.8	Apache Ignite	1
3.9	Memcached	1
4.0	**Data Integration and ETL**	
4.1	Data Integration Tools	1
4.2	Apache Nifi,	2
4.3	Talend, Informatica	2
4.4	Data Transformation: Data cleaning	1
4.5	Enrichment	1
4.6	Aggregation	1
4.7	Denormalization	1
5.0	**Emerging Trends in Data Engineering**	
5.1	Integration of Big data and Machine learning	
5.2	Machine Learning and AI in Data Engineering	2
5.3	Edge Computing and Data Engineering	2
5.4	Future Directions in Data Engineering	2

Course Designer(s)

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70 PDS E34	Data Preprocessing and Optimization Techniques	Category	L	T	P	Credit
		PC	3	0	0	3

Objectives

- To understand the concept of data pre-processing
- To analyse the concept of data transformation
- To explore the data deduction and feature selection.
- To learn the concept of optimization techniques.
- To demonstrate the constrained and unconstrained optimization.

Pre-requisites

- Mathematics and Statistics and Machine Learning Fundamentals

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Analyse the concept of data pre-processing	Analyse
CO2	Understand and analyses the concept of data transformation	Understand
CO3	Explore the data deduction and feature selection.	Understand
CO4	Apply the concept of unconstrained optimization techniques.	Apply
CO5	Demonstrate the constrained in data analytics.	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	-	-	-	-	-
CO2	3	3	3	2	-	-
CO3	3	3	3	2	2	-
CO4	3	3	2	2	-	-
CO5	3	2	2	2	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	20	10
Understand	20	20	40
Apply	10	20	20
Analyse	20	00	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PDS E34 – Data Preprocessing and Optimization Techniques								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Introduction To Data Preparation Data Sets and Proper Statistical Analysis of Data Mining Techniques, Data Preparation Basic Models, Data Integration, Data Cleaning, Data Normalization	[9]
Data Pre-Processing & Transformation Dealing with Missing Values, Dealing with Noisy Data, Linear Transformations, Quadratic Transformations, Non-polynomial Approximations of Transformations, Polynomial Approximations of Transformations, Nominal to Binary Transformation	[9]
Data Reduction &Feature Selection Principal Components Analysis, Data Sampling, Data condensation, Data squashing, Data clustering, Feature Selection, Exhaustive Methods, Heuristic Methods, Nondeterministic Methods, Instance Selection: Prototype Selection Taxonomy, Edition Algorithms, Hybrid Algorithms	[9]
Unconstrained Optimization Introduction, Conditions for Local Minimizes, Golden Section Search, Newton's Method, SecantMethod, Gradient Methods, Steepest Descent, Conjugate Direction Methods, Unconstrained Optimization and Neural Networks.	[9]
Constrained Optimization Simplex Method, Nonsimplex Methods, Problems with Equality Constraints: Tangent and Normal Spaces, Lagrange Condition, Convex Optimization Problems, Projections, Projected Gradient Methods with Linear Constraints.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Luengo, Julián, García, Salvador "Data Pre-processing in Data Mining", (Intelligent Systems Reference Library Book 72) — Springer.
2.	E. K. P. Chong and S. H. Zak, ‖ An Introduction to Optimization‖, 2nd Ed., Wiley India Pvt. Ltd., 2020
Reference(s):	
1.	"Python for Data Preprocessing for Beginners", Ai Sciences LLC, Amazon, Kobo and B&N - 2019
2.	Mohan, Chander, "Optimization Techniques", New Age International (P) Ltd, 1st Edition 2019
3.	Robert M. Gower & Alexandre Gramfort "Optimization for Data Science" Master 2 Data Science, Univ. Paris Saclay
4.	Stephen J. Wright "Optimization Algorithms for Data Analysis" IAS/Park City Mathematics Series.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction To Data Preparation**	
1.1	Data Sets	1
1.2	Proper Statistical Analysis of Data Mining Techniques	1
1.3	Data Preparation	1
1.4	Basic Models	1
1.5	Data Integration	1
1.6	Data Cleaning	2
1.7	Data Normalization	2
2.0	**Data Pre-Processing & Transformation**	
2.1	Dealing with Missing Values	2
2.2	Dealing with Noisy Data	2
2.3	Linear Transformations	1
2.4	Quadratic Transformations	1
2.5	Non-polynomial Approximations of Transformations	1
2.6	Polynomial Approximations of Transformations	2
2.7	Nominal to Binary Transformation	
3.0	**Data Reduction &Feature Selection**	
3.1	Principal Components Analysis	1
3.2	Data Sampling, Data condensation	1
3.3	Data squashing, Data clustering	1
3.4	Feature Selection, Exhaustive Methods	1
3.5	Heuristic Methods, Nondeterministic Methods	2
3.6	Instance Selection: Prototype Selection Taxonomy	1
3.7	Edition Algorithms, Hybrid Algorithms	2
4.0	**Unconstrained Optimization**	
4.1	Introduction, Conditions for Local Minimizes	2
4.2	Golden Section Search	1
4.3	Newton's Method	1
4.4	SecantMethod	1
4.5	Gradient Methods, Steepest Descent	2
4.6	Conjugate Direction Methods	1
4.7	Unconstrained Optimization and Neural Networks	1
5.0	**Constrained Optimization**	
5.1	Simplex Method, Nonsimplex Methods	1
5.2	Problems with Equality Constraints	1
5.3	Tangent and Normal Spaces	1
5.4	Lagrange Condition	2
5.5	Convex Optimization Problems	1
5.6	Projections	2
5.7	Projected Gradient Methods with Linear Constraints	1

Course Designer(s)

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70 PDS E35	Cognitive Science and Analytics	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To study the basic concepts and approaches in the field of cognitive science
- To apply the concepts of planning, reasoning and learning models in cognitive applications
- To analyse language and semantic models of cognitive process
- To Understand the concepts of cognitive development
- To acquire knowledge in language processing & semantics

Pre-requisites

- Basic knowledge of Artificial Intelligence

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Apply the basic concept of cognitive science	Apply
CO2	Analyse the learning model and apply the same to appropriate real-world applications	Analyse
CO3	Apply reasoning methodology to real world applications	Apply
CO4	Create the new concepts of cognitive development & learning	Create
CO5	Analyse the knowledge in language processing and understanding	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	3	2	3	2	3
CO2	3	3	2	3	3	2
CO3	3	3	2	3	3	3
CO4	3	3	2	3	2	2
CO5	3	3	2	2	2	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember(Re)	00	00	00
Understand (Un)	40	00	20
Apply (Ap)	10	30	30
Analyse(An)	10	20	30
Evaluate(Ev)	00	00	00
Create (Cr)	00	10	20
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2026								
M.Tech – Data Science								
70 PDS E35 - Cognitive Science and Analytics								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Introduction to Cognitive Science Fundamental Concepts of cognitive science – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science – Artificial Intelligence: Knowledge representation, semantic networks, frames, conceptual dependency, scripts, Ontology Understanding, Common Sense Reasoning.	[9]
Planning and Learning Methods Planning – Situation Logic- Learning in Cognitive Systems- Rote Learning – Learning by Examples - Incremental Concept Learning – Inductive Learning - Classification Techniques – Statistical Reasoning- Bayesian Classification- Bayesian Networks- Concept Learning- Version Spaces - Discrimination Trees.	[9]
Reasoning methods & Cognitive Modeling Reasoning by analogy – Explanation based reasoning – Case based reasoning- Constraint Satisfaction- Constraint Propagation- Temporal reasoning – Temporal Constraint Networks Spatial reasoning- Visual Spatial reasoning- Meta reasoning – Learning by correcting mistakes AI ethics, Declarative/ logic-based computational cognitive modelling - connectionist models of cognition - Bayesian models of cognition - Cognitive Models of Memory and Language - Computational models of episodic and semantic memory - modelling psycholinguistics (with emphasis on lexical semantics) - towards deep understanding - modelling the interaction of language, memory and learning.	[9]
Cognitive Development Child concept acquisition - Child language learning - Acquisition of arithmetic skills – Distributed Cognition and Learning- Simple and Complex Decision Making – Reasoning Under Uncertainty – Natural Language Understanding – Natural Language Processing – Automated Natural Language Generation.	[9]
Language and Semantic Processing Knowledge Acquisition – Semantics in Cognitive Science – Meaning and Entailment – Cognitive and Computational Models of Semantic Processing – Information Processing Models of the Mind Physical symbol systems and language of thought- Applying the Symbolic Paradigm- Neural networks and distributed information processing- Neural network models of Cognitive Processes Dynamical systems and situated cognition.	[9]
Total Hours:	**45**

Text Book(s):

1. Jose Luis Bermudez, “Cognitive Science: An Introduction to the Science of the Mind”, Cambridge University Press, New York, 2014.
2. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing”, IGI Global Publishers, 2019.

Reference(s):

1. Stuart J. Russell, Peter Norvig, “Artificial Intelligence - A Modern Approach”, Third Edition, Pearson Publishers, 2015.
2. Paul Miller, “An Introductory Course in Computational Neuroscience”, MIT Press, 2018.
3. Jerome R. Busemeyer, Zheng Wang, James T. Townsend, Ami Eidels(Ed), “The Oxford Handbook of Computational and Mathematical Psychology”,Oxford University Press (2015).
4. Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, “Cognitive Science: An Introduction”, Second Edition, MIT press ,1995.

*SDG 4 – Quality Education
**SDG 9 – Industry, Innovation, and Infrastructure

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Cognitive Science**	
1.1	Fundamental Concepts of cognitive science	1
1.2	Computers in Cognitive Science	1
1.3	Applied Cognitive Science	1
1.4	The Interdisciplinary Nature of Cognitive Science	1
1.5	Artificial Intelligence: Knowledge representation	1
1.6	semantic networks, frames	1
1.7	conceptual dependency, scripts	1
1.8	Ontology Understanding	1
1.9	Common Sense Reasoning.	1
2.0	**Planning and Learning Methods**	
2.1	Planning – Situation Logic	1
2.2	Learning in Cognitive Systems	1
2.3	Rote Learning – Learning by Examples	1
2.4	Incremental Concept Learning – Inductive Learning	1
2.5	Classification Techniques – Statistical Reasoning	1
2.6	Bayesian Classification	1
2.7	Bayesian Networks	1
2.8	Concept Learning- Version Spaces	1
2.9	Discrimination Trees.	1
3.0	**Reasoning methods & Cognitive Modeling**	
3.1	Reasoning by analogy – Explanation based reasoning – Case based reasoning	1
3.2	Constraint Satisfaction- Constraint Propagation- Temporal reasoning	1
3.3	Temporal Constraint Networks Spatial reasoning- Visual Spatial reasoning- Meta reasoning	1
3.4	Learning by correcting mistakes AI ethics, Declarative/ logic-based computational cognitive modelling	1
3.5	Connectionist models of cognition - Bayesian models of cognition	1
3.6	Cognitive Models of Memory and Language	1
3.7	Computational models of episodic and semantic memory	1
3.8	Modelling psycholinguistics (with emphasis on lexical semantics) - towards deep understanding	1
3.9	Modelling the interaction of language, memory and learning.	1
4.0	**Cognitive Development**	
4.1	Child concept acquisition	1
4.2	Child language learning	1
4.3	Acquisition of arithmetic skills	1
4.4	Distributed Cognition and Learning	1
4.5	Simple and Complex Decision Making	1
4.6	Reasoning Under Uncertainty	1
4.7	Natural Language Understanding	1

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4.8	Natural Language Processing	1
4.9	Automated Natural Language Generation.	1
5.0	**Language and Semantic Processing**	
5.1	Knowledge Acquisition	1
5.2	Semantics in Cognitive Science	1
5.3	Meaning and Entailment	1
5.4	Cognitive and Computational Models of Semantic Processing	1
5.5	Information Processing Models of the Mind Physical symbol systems and language of thought	1
5.6	Applying the Symbolic Paradigm	1
5.7	Neural networks and distributed information processing	1
5.8	Neural network models of Cognitive Processes Dynamical systems and situated cognition.	1
5.9	**Language and Semantic Processing**	1

Course Designer(s)

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70 PDS E41	Cloud Security for Data Science	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Understand the fundamental concepts of cloud computing and security principles.
- Explore various cloud service models (IaaS, PaaS, SaaS) and their security implications.
- Learn about security threats, vulnerabilities, and risk mitigation strategies in cloud environments.
- Study data security techniques, including encryption, access control, and secure storage.
- Gain hands-on experience with security tools and frameworks for cloud-based data science.

Pre-requisites

- Data Science & Machine Learning

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Identify key security challenges in cloud computing and data science applications.	Understand
CO2	Analyse security risks and apply appropriate mitigation strategies in cloud-based systems.	Analyse
CO3	Implement identity and access management (IAM) for securing cloud environments.	Analyse
CO4	Apply encryption and data protection techniques in cloud-based data science workflows.	Apply
CO5	Evaluate and deploy security tools for threat detection, monitoring, and incident response.	Evaluate

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	3	2	-	-	-
CO2	3	3	2	-	-	-
CO3	3	3	2	-	-	-
CO4	3	3	2	-	-	-
CO5	3	3	2	-	-	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	10
Understand	20	20	30
Apply	00	00	20
Analyse	20	20	20
Evaluate	00	00	20
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PDS E41 - Cloud Security for Data Science								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction to Cloud Security for Data Science Overview of Cloud Computing & Security Fundamentals - Cloud Deployment Models (Public, Private, Hybrid, Multi-cloud) - Cloud Service Models (IaaS, PaaS, SaaS) - Shared Responsibility Model in Cloud Security - Security Challenges in Cloud-based Data Science - Fundamentals of Data Privacy and Protection in Cloud Environments - Introduction to Cloud Security Compliance and Legal Aspects.	[9]
Cloud Security Threats & Risk Management Common Cloud Security Threats (Data Breaches, Misconfigurations, Insider Threats) - Threat Models for Cloud-based Machine Learning & AI - Risk Assessment and Management in Cloud Environments - Compliance and Regulatory Considerations (GDPR, HIPAA, SOC 2) - Security Policies & Governance in Cloud Computing - Identity Theft, Data Manipulation, and AI Model Poisoning Risks.	[9]
Identity Management, Access Control, and Data Protection Identity and Access Management (IAM) in Cloud Platforms - Authentication and Authorization Mechanisms (OAuth, SAML, Zero Trust) - Data Encryption Techniques (AES, RSA, Homomorphic Encryption) - Secure Data Storage and Secure Data Sharing Strategies - Privacy-Preserving Machine Learning in Cloud Environments - Key Management and Cloud-Based Encryption Solutions (KMS, HSM).	[9]
Security Best Practices for Cloud-based Data Science Secure Data Ingestion and Processing in Cloud Pipelines - Container Security (Docker, Kubernetes) and Secure Model Deployment - Serverless Computing Security and Microservices Security - Secure API Design for Cloud-based ML Services - Logging, Monitoring, and Incident Response in Cloud Security - Secure Software Development Lifecycle (SDLC) for Cloud-Based AI - Role of DevSecOps in Cloud Security for Data Science.	[9]
Security Tools, Frameworks, and Case Studies Cloud Security Tools (AWS Security Hub, Azure Security Centre, Google Cloud Security Command Center) - Intrusion Detection Systems (IDS) - Security Information and Event Management (SIEM) - Case Studies on Security Breaches in Cloud-based AI Systems - Hands-on Lab: Implementing Security in a Cloud.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Practical Cloud Security: A Guide for Secure Design and Deployment ," Chris Dotson" 2019.
2.	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, "Tim Mather, Subra Kumaraswamy, and Shahed Latif" 2020.
Reference(s):	
1.	Machine Learning and Security: Protecting Systems with Data and Algorithms "Clarence Chio and David Freeman" 2018.
2.	Cloud Security: Concepts, Applications and Practices "Jamuna S. Murthy, Siddesh G. M., Srinivasa K. G." Chapman & Hall 2025.
3.	"Cloud Security: Attacks, Techniques, Tools, and Challenges" Preeti Mishra, Emmanuel S. Pilli, R. C. Joshi , Chapman & Hall , 2022.
4.	Data Science and Machine Learning Security" Richard Hurley, Independently Published, 2020.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Cloud Security for Data Science**	
1.1	Overview of Cloud Computing & Security Fundamentals	1
1.2	Cloud Deployment Models (Public, Private, Hybrid, Multi-cloud)	1
1.3	Cloud Service Models (IaaS, PaaS, SaaS)	1
1.4	Shared Responsibility Model in Cloud Security	1
1.5	Security Challenges in Cloud-based Data Science	1
1.6	Fundamentals of Data Privacy and Protection in Cloud Environments	2
1.7	Cloud Security Compliance	1
1.8	Legal Aspects of cloud	1
2.0	**Cloud Security Threats & Risk Management**	
2.1	Common Cloud Security Threats ,Data Breaches	1
2.2	Misconfigurations, Insider Threats)	1
2.3	Threat Models for Cloud based Machine Learning & AI	1
2.4	Risk Assessment and Management in Cloud Environments	1
2.5	Compliance and Regulatory Considerations (GDPR, HIPAA, SOC 2)	1
2.6	Security Policies & Governance in Cloud Computing	2
2.7	Identity Theft, Data Manipulation, and AI Model Poisoning Risks	2
3.0	**Identity Management, Access Control, and Data Protection**	
3.1	Identity and Access Management (IAM) in Cloud Platforms	1
3.2	Authentication and Authorization Mechanisms	1
3.3	Data Encryption Techniques	1
3.4	Secure Data Storage	2
3.5	Secure Data Sharing Strategies	1
3.6	Privacy-Preserving Machine Learning in Cloud Environments	1
3.7	Key Management and Cloud	1
3.8	Based Encryption Solutions	1
4.0	**Security Best Practices for Cloud-based Data Science**	
4.1	Secure Data Ingestion and Processing in Cloud Pipelines	2
4.2	Container Security (Docker, Kubernetes) and Secure Model Deployment	2
4.3	Serverless Computing Security and Micro services Security	1
4.4	Secure API Design for Cloud-based ML Services	1
4.5	Logging, Monitoring, and Incident Response in Cloud Security	2
4.6	Secure Software Development Lifecycle (SDLC	1
5.0	**Security Tools, Frameworks, and Case Studies**	
5.1	Cloud Security Tools	1
5.2	AWS Security Hub, Azure Security Centre	1
5.3	Google Cloud Security Command Center	1
5.4	Intrusion Detection Systems (IDS)	2
5.5	Security Information and Event Management (SIEM)	2
5.6	Case Studies on Security Breaches in Cloud	1
5.7	Implementing Security in a Cloud	1

Course Designer(s)

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Approved Passed in BoS Meeting held on 23/11/2024
Academic Council Meeting held on 21/12/2024

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70 PDS E42	IoT Analytics and Smart Infrastructure	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- Understand IoT Analytics and Challenges
- Examine the role of cloud-based IoT platforms in data analytics
- Understand the architecture for searching social and physical sensors
- Outline the concepts of machine and deep learning with IoT
- Analyse IoT analytics applications in smart infrastructure

Pre-requisites

- Basic knowledge of IoT

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand IoT Analytics Lifecycle and Techniques	Understand
CO2	Examine the characteristics of IoT Generated Data	Analyse
CO3	Use development tools for IoT Analytics Applications	Understand
CO4	Learn Machine Learning for IoT data	Understand
CO5	Analyse IoT Data Analytics applications	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	2	2	2	-
CO2	3	3	2	2	2	-
CO3	3	3	2	2	2	-
CO4	3	3	2	2	2	-
CO5	3	2	2	2	2	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	10
Understand	30	40	60
Apply	00	00	00
Analyse	10	00	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

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M.Tech – Data Science								
70 PDS E42– IoT Analytics and Smart Infrastructure								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introducing IoT Analytics Types of Data Sources, Understanding Big Data, Applications of Big Data Analytics, IoT Data and Big Data, Defining IoT Analytics, Challenges of IoT Analytics, IoT Analytics Lifecycle and Techniques.	[9]
IoT, Cloud and Big Data Integration for IoT Analytics * Cloud-based IoT Platform, Requirements of IoT Big Data Analytics Platform, Functional Architecture, Data Analytics for the IoT, Characteristics of IoT Generated Data, Data Analytic Techniques and Technologies, Data Collection Using Low-power, Long-range Radios, IoT Analytics for the cloud.	[9]
Searching the Internet of Things A Search Architecture for Social and Physical Sensors, Local Event Retrieval, Using Sensor Metadata Streams to Identify Topics of Local Events in the City, Venue Recommendation, Development Tools for IoT Analytics Applications.	[9]
Data Science for IoT Analytics Machine Learning, Feature Engineering with IoT Data, Validation Methods, Bias, Variance, comparing different Models to find the Best fit, Anomaly Detection, Forecasting, Deep Learning with IoT data; Strategies to organize data for Analytics; The Economics of IoT Analytics: Cost Considerations for IoT Analytics.	[9]
IoT Analytics Applications and Case Studies Data Analytics in Smart Buildings, Internet-of Things Analytics for Smart Cities, Ethical IoT.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Minteer, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd. July 2024
2.	Kai Hwang, Min Chen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley.
Reference(s):	
1.	John Soldatos, “Building Blocks for IoT Analytics”, River Publishers, 2024
2.	Hwaiyu Geng, Internet of Things and Data Analytics Handbook, Wiley.

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Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1.0	**Introducing IoT Analytics**	
1.1	Types of Data Sources	1
1.2	Understanding Big Data	1
1.3	Applications of Big Data Analytics	1
1.4	IoT Data and Big Data	1
1.5	Defining IoT Analytics	1
1.6	Challenges of IoT Analytics	1
1.7	IoT Analytics Lifecycle	1
1.8	IoT Analytics Lifecycle	1
1.9	IoT Analytics Techniques	1
2.0	**IoT, Cloud and Big Data Integration for IoT Analytics**	
2.1	Cloud-based IoT Platform	1
2.2	Requirements of IoT Big Data Analytics Platform	1
2.3	Functional Architecture	1
2.4	Data Analytics for the IoT	1
2.5	Characteristics of IoT Generated Data	1
2.6	Data Analytic Techniques and Technologies	1
2.7	Data Collection Using Low-power	1
2.8	Long-range Radios	1
2.9	IoT Analytics for the cloud	1
3.0	**Searching the Internet of Things**	
3.1	A Search Architecture for Social and Physical Sensors	1
3.2	Local Event Retrieval	1
3.3	Sensor Metadata Streams	1
3.4	Sensor Metadata Streams	1
3.5	Identify Topics of Local Events	1
3.6	Identify Topics of Local Events	1
3.7	Venue Recommendation	1
3.8	Development Tools for IoT Analytics Applications	1
3.9	Development Tools for IoT Analytics Applications	1
4.0	**Data Science for IoT Analytics**	
4.1	Machine Learning	1
4.2	Feature Engineering with IoT Data	1

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4.3	Validation Methods	1
4.4	Bias, Variance	1
4.5	Comparing different Models to find the Best fit	1
4.6	Anomaly Detection, Forecasting	1
4.7	Deep Learning with IoT data	1
4.8	Strategies to organize data for Analytics	1
4.9	The Economics of IoT Analytics: Cost Considerations for IoT Analytics	1
5.0	**IoT Analytics Applications and Case Studies**	
5.1	Data Analytics in Smart Buildings	1
5.2	Data Analytics in Smart Buildings	1
5.3	Data Analytics in Smart Buildings	1
5.4	Internet-of Things Analytics for Smart Cities	1
5.5	Internet-of Things Analytics for Smart Cities	1
5.6	Internet-of Things Analytics for Smart Cities	1
5.7	Ethical IoT	1
5.8	Ethical IoT	1
5.9	Ethical IoT	1

Course Designer(s)

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70 PDS E43	Advanced Web Analytics	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the Web analytics platform, and their evolution.
- To learn about the various Data Streams Data.
- To learn about the benefit of surveys and capturing of data.
- To understand Common metrics of web as well as KPI related concepts.
- To learn about the various web analytics versions.

Pre-requisites

- Basic knowledge of Web Technology, Data Mining, Machine Learning

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the Web analytics platform, and their evolution.	Understand
CO2	Apply the various Data Streams Data.	Apply
CO3	Know how the survey of capturing of data will benefit.	Analyse
CO4	Understand Common metrics of web as well as KPI related concepts.	Analyse
CO5	Apply various web analytics versions in existence.	Analyse

Mapping with Programme Outcomes

COs	PO					
	1	2	3	4	5	6
CO1	3	2	2	2	2	-
CO2	3	3	2	2	2	-
CO3	3	3	2	2	2	-
CO4	3	3	2	2	2	-
CO5	3	2	2	2	2	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	10
Understand	30	20	60
Apply	10	10	00
Analyse	00	20	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2026								
M.Tech – Data Science								
70 PDS E43 – Advanced Web Analytics								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, On site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations.	[9]
Data Collection and Qualitative Analysis: Clickstream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing, Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic Evaluations.	[9]
Web Analytic fundamentals Capturing data: Web logs or Java Scripts tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, selecting optimal web analytic tool, understanding clickstream data quality, Identifying unique page definition, Using cookies, Link coding issues.	[9]
Web Metrics **C**ommon metrics**:** Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non e-commerce sites): Improving bounce rates, optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI.	[9]
Web analytics 2.0 Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data ,ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc. (2010), 2nd ed.
2.	Kaushik A., Web Analytics 2.0 The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. (2010),1st ed.
Reference(s):	
1.	Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons (2002),1sted
2.	Michael Beasley.,Practical Web Analytics for User Experience , How Analytics can help you Understand Your Users, 2013.
3.	Benjamin Yoskovitz, Lean Analytics: Use Data to Build a better Startup Faster, O Reilly 2013.
4.	Metriken auswerten, Website optimieren, Digital and Web Analytics, Marco Hassler 5.,

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Course Contents and Lecture Schedule

S. No.	Topics	No. of Hours
1.0	**Introduction**	
1.1	Definition, Process, Key terms	1
1.2	Site references, Keywords and Key phrases	1
1.3	building block terms	1
1.4	Visit characterization terms	1
1.5	Content characterization terms	1
1.6	Conversion metrics	1
1.7	Categories: Offsite web, On site web	1
1.8	Web analytics platform, Web analytics evolution	1
1.9	Need for web analytics, Advantages, Limitations	1
2.0	**Data Collection and Qualitative Analysis**	
2.1	Clickstream Data: Web logs, Web Beacons	1
2.2	JavaScript tags, Packet Sniffing	1
2.3	Outcomes Data: E-commerce, Lead generation	1
2.4	Brand/Advocacy and Support	1
2.5	Research data: Mindset	1
2.6	Organizational structure	1
2.7	Timing, Heuristic evaluations	1
2.8	Conducting a heuristic evaluation	1
2.9	Benefits of heuristic Evaluations.	1
3.0	**Web Analytic fundamentals**	
3.1	Capturing data: Web logs or Java Scripts tags	1
3.2	Separate data serving and data capture	1
3.3	Type and size of data	1
3.4	Integration	1
3.5	Innovation	1
3.6	selecting optimal web analytic tool	1
3.7	understanding clickstream data quality	1
3.8	Identifying unique page definition	1
3.9	Using cookies, Link coding issues.	1

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4.0	**Web Metrics**	
4.1	**C**ommon metrics**:** Hits, Page views, Visits	1
4.2	Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, new visits	2
4.3	Optimization (e-commerce, non-e-commerce sites)	1
4.4	Improving bounce rates, optimizing ad words campaigns	1
4.5	Real time report, Audience report	1
4.6	Traffic source report, Custom campaigns, Content report, Google analytics	1
4.7	Introduction to KPI, characteristics	1
4.8	Need for KPI, Perspective of KPI, Uses of KPI.	1
5.0	**Web analytics 2.0**	
5.1	Web analytics 1.0, Limitations of web analytics 1.0	1
5.2	Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data	2
5.3	ISP data, Search engine data, Hybrid data	1
5.4	Website traffic analysis	1
5.5	Comparing long term traffic trends	2
5.6	Analyzing competitive site overlap and opportunities.	2

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70 PDS E44	Business Intelligence and Analytics	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the Analytics Life Cycle
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics
- To apply analytics for different functions of a business.

Pre-requisites

- Proficiency in Python and SQL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Acquire knowledge on the real-world business problems and model with analytical solutions.	Understand
CO2	Analyse the business processes for extracting Business Intelligence	Analyse
CO3	Apply predictive analytics for business fore-casting.	Apply
CO4	Apply analytics for supply chain and logistics management.	Apply
CO5	Apply analytics for marketing and sales.	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	2	3	-	-	-
CO2	3	3	3	2	3	-
CO3	2	2	3	3	3	-
CO4	2	-	-	2	3	-
CO5	2	3	2	3	2	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	20	10
Understand	20	20	40
Apply	10	20	20
Analyse	20	00	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PDS E44 – Business Intelligence and Analytics								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction to Business Analytics * Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modelling – Validation and Evaluation – Interpretation – Deployment and Iteration	[9]
Business Intelligence* Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP – Analytic functions	[9]
Business Forecasting* Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling – Machine Learning for Predictive analytics	[9]
HR & Supply Chain Analytics* Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.	[9]
Marketing & Sales Analytics * Marketing Strategy, Marketing Mix, Customer Behaviour –Selling Process – Sales Planning – Analytics applications in Marketing and Sales - Predictive analytics for customers' behaviour in marketing and sales.	[9]
Total Hours:	**45**

Text Book(s):	
1.	R.Evans James, “Business Analytics”, 2nd Edition, Pearson, 2017
2.	R N Prasad, Seema Acharya, “Fundamentals of Business Analytics”, 2nd Edition, Wiley, 2016
Reference(s):	
1.	Philip Kotler and Kevin Keller, “Marketing Management”, 15th edition, PHI, 2016
2.	VSP RAO, “Human Resource Management”, 3rd Edition, Excel Books, 2010.
3.	Mahadevan B, “Operations Management -Theory and Practice”,3rd Edition, Pearson Education,2018

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Business Analytics**	
1.1	Analytics and Data Science	1
1.2	Analytics Life Cycle	1
1.3	Types of Analytics	1
1.4	Business Problem Definition	1
1.5	Data Collection – Data Preparation	1
1.6	Hypothesis Generation	1
1.7	Modelling – Validation and Evaluation, Interpretation	1
1.8	Deployment and Iteration	1
2.0	**Business Intelligence**	
2.1	Data Warehouses and Data Mart	1
2.2	Knowledge Management	1
2.3	Types of Decisions	1
2.4	Decision Making Process	1
2.5	Decision Support Systems	1
2.6	Business Intelligence	2
2.7	OLAP	1
2.8	Analytic functions	1
3.0	**Business Forecasting**	
3.1	Introduction to Business Forecasting	1
3.2	Predictive analytics	2
3.3	Logic and Data Driven Models	2
3.4	Data Mining	1
3.5	Predictive Analysis Modelling	1
3.6	Machine Learning for Predictive analytics	2
4.0	**HR & Supply Chain Analytics**	
4.1	Human Resources	1
4.2	Planning and Recruitment	1
4.3	Training and Development, Supply chain network	2
4.4	Planning Demand, Inventory and Supply	1
4.5	Logistics	1
4.6	Analytics applications in HR & Supply Chain	1
4.7	Applying HR Analytics to make a prediction of the demand for hourly employees for a year.	2
4.8	**Marketing & Sales Analytics**	
5.1	Marketing Strategy	1
5.2	Marketing Mix	1
5.3	Customer Behaviour	1
5.4	Selling Process	1
5.5	Sales Planning	1
5.6	Analytics applications in Marketing and Sales	2
5.7	Predictive analytics for customers' behaviour in marketing and sales.	2

Course Designer(s)

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70 PDS E45	Social Media and Network Data Analytics	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learn optimization techniques of social media data and its business value
- Understand the random graph models and network evolution patterns
- Explore the different analytics tools
- To evaluate knowledge interpretation of social media platforms
- Apply the techniques for processing and visualizing social media data

Pre-requisites

- Basic knowledge of social media

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Learn the need for social media analytics	Understand
CO2	Understanding the graphs in networks	Understand
CO3	Analyse the techniques of social media analysis	Analyse
CO4	Understanding data analysis of various social media platforms	Understand
CO5	Apply processing and visualization methods on sample social media data	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	2	2	2	-
CO2	3	3	2	2	2	-
CO3	3	3	2	2	2	-
CO4	3	3	2	2	2	-
CO5	3	2	2	2	2	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	40	20	50
Apply	00	00	00
Analyse	00	20	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2026								
M.Tech – Data Science								
70 PDS E45 – Social Media and Network Data Analytics								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction to Social Media Analytics Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas Network fundamentals and models: The social networks perspective-nodes, ties and influencers, social network and web data and methods.	[9]
Graphs and Matrices Basic measures for individuals and networks. Information visualization, Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity.	[9]
Making Connections * Analytics tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis.	[9]
Facebook Analytics Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc. Google analytics)	[9]
Processing and Visualizing Data Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Matthew Ganis, Avinash Kohirkar, Social Media Analytics: Techniques and Insights for Extracting Business Value Out of social media, Pearson 2024
2.	Jim Sterne, Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Wiley Latest edition.
Reference(s):	
1.	Oliver Blanchard, social media ROI: Managing and measuring social media efforts in your organization (Que Biz-Tech), Que publishing latest edition.
2.	Marshall Sponder, Social Media Analytics, McGraw Hill, Latest edition.
3.	Tracy L. Tuten, Michael R. Solomon, Social Media Marketing, Sage, Latest edition.
4.	Marshall Sponder, Gorah F. Khan, Digital Analytics for Marketing, Routledge, 2024, 1st Edition.

*SDG 4 – Quality of Education

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Social Media Analytics**	
1.1	Social media landscape	1
1.2	Need for SMA	1
1.3	SMA in Small and Large organizations	1
1.4	Application of SMA in different areas	1
1.5	Network fundamentals and models	1
1.6	The social networks perspective- nodes	1
1.7	Ties and influencers	1
1.8	Social network	1
1.9	Web data and methods	1
2.0	**Graphs and Matrices**	
2.1	Basic measures for individuals and networks	1
2.2	Basic measures for individuals and networks	1
2.3	Information visualization	1
2.4	Information visualization	1
2.5	Link analysis	1
2.6	Link analysis	1
2.7	Random graphs and network evolution	1
2.8	Random graphs and network evolution	1
2.9	Social contexts: Affiliation and identity	1
3.0	**Making Connections**	
3.1	Analytics tools: Clickstream analysis,	1
3.2	A/B testing	1
3.3	A/B testing	1
3.4	Online surveys	1
3.5	Online surveys	1
3.6	Web crawling and Indexing	1
3.7	Web crawling and Indexing	1
3.8	Natural Language Processing Techniques for Micro-text Analysis.	1
3.9	Natural Language Processing Techniques for Micro-text Analysis.	1

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4.0	**Facebook Analytics**	
4.1	Introduction-Parameters	1
4.2	Demographics	1
4.3	Analyzing page audience	1
4.4	Reach and Engagement analysis	1
4.5	Post- performance on FB, Social campaigns	1
4.6	Measuring and analyzing social campaigns,	1
4.7	Defining goals and evaluating outcomes	1
4.8	Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc.)	1
4.9	Google analytics	1
5.0	**Processing and Visualizing Data**	
5.1	Processing and Visualizing Data	1
5.2	Influence Maximization	1
5.3	Link Prediction	1
5.4	Collective Classification	1
5.5	Applications in Advertising and Game Analytics	1
5.6	Introduction to Python Programming	1
5.7	Collecting and analyzing social media data	1
5.8	Visualization and exploration.	1
5.9	Visualization and exploration.	1

Course Designer(s)

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70 PDS E51	Cybersecurity in AI and ML Systems	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To provide an understanding of AI and ML applications in cybersecurity
- To describe how evasion attacks manipulate ML model predictions
- To learn various privacy-preserving techniques in machine learning
- To describe how ML techniques improve intrusion detection systems
- To summarize emerging trends in AI-enhanced cybersecurity solutions

Pre-requisites

- Basic knowledge of AI/ML, Networking, and Cybersecurity

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand and outline the principles of AI/ML in Cybersecurity	Understand
CO2	Demonstrate evasion attack techniques and their countermeasures	Apply
CO3	Implement differential privacy, federated learning, and homomorphic encryption in AI models	Apply
CO4	Implement an ML-based IDS for real-time threat detection	Apply
CO5	Analyse the impact of AI advancements on cybersecurity threats	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	-	2	3	3	3
CO2	2	-	2	3	3	3
CO3	2	-	2	2	3	3
CO4	2	-	2	3	3	3
CO5	3	2	3	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	20	20	30
Apply	20	20	30
Analyse	00	00	20
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS E51- Cybersecurity in AI and ML Systems								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction* Overview of AI and ML in cybersecurity - Cyber threats and risks in AI powered systems - Attack surfaces in AI/ML models - AI vs. Traditional Cybersecurity Approaches - Case studies on AI-enabled cyber threats	[9]
Attacks on AI and ML Models * Adversarial Machine Learning: Evasion Attacks, Poisoning Attacks, Model Inversion and Extraction - Bias and Fairness Attacks - Data Privacy Threats in ML Systems - Backdoor Attacks on Neural Networks - Defence Mechanisms Against AI/ML Attacks	[9]
Securing AI/ML Models and Data * Secure Data Collection and Preprocessing - Privacy-Preserving ML Techniques: Differential Privacy, Federated Learning, Homomorphic Encryption - Robust Model Training and Validation - Model Interpretability and Explainability for Security - Secure Deployment of AI Models	[9]
AI for Cybersecurity Applications* AI-Driven Threat Detection and Prevention - Intrusion Detection Systems (IDS) using ML - Automated Vulnerability Assessment using AI - AI in Digital Forensics and Incident Response - Case Studies of AI in Cyber Defence	[9]
Regulations, Ethics, and Future Trends * Ethical Challenges in AI and Cybersecurity - AI Security Standards and Compliance (GDPR, NIST, ISO) - Governance and Risk Management in AI Security - Future Trends in AI-based Cybersecurity - Research Directions and Open Problems	[9]
Total Hours:	**45**

Text Book(s):	
1.	Gupta, Brij B., and Quan Z. Sheng, eds., “Machine learning for computer and cyber security: principle, algorithms, and practices”, CRC Press, 2019.
2.	Clarence Chio, and David Freeman, “Machine learning and security: Protecting systems with data and algorithms”, O'Reilly Media, Inc., 2018.
Reference(s):	
1.	Mike Speciner, Radia Perlman, Charlie Kaufman , “Network Security: Private Communications in a Public World”, Pearson Education, 2022.
2.	Anthony D. Joseph, Blaine Nelson, Benjamin I. P. Rubinstein, J.D. Tygar, “Adversarial Machine Learning”, Cambridge University Press, 2018.
3.	Tsai, Jeffrey JP, and S. Yu Philip, eds., “Machine learning in cyber trust: security, privacy, and reliability”, Springer Science & Business Media, 2009.
4.	Stinson, Douglas Robert, and Maura Paterson, “Cryptography: theory and practice”, CRC press, 2018.

*SDG 9 – Industry Innovation and Infrastructure
*SDG 3 – Good Health and Well Being

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction**	
1.1	Overview of AI and ML in cybersecurity	1
1.2	Cyber threats and risks in AI powered systems	2
1.3	Attack surfaces in AI/ML models	2
1.4	AI vs. Traditional Cybersecurity Approaches	2
1.5	Case studies on AI-enabled cyber threats	2
2.0	**Attacks on AI and ML Models**	
2.1	Adversarial Machine Learning: Evasion Attacks	1
2.2	Poisoning Attacks, Model Inversion and Extraction	2
2.3	Bias and Fairness Attacks	2
2.4	Data Privacy Threats in ML Systems	2
2.5	Backdoor Attacks on Neural Networks	1
2.6	Defense Mechanisms Against AI/ML Attacks	1
3.0	**Securing AI/ML Models and Data**	
3.1	Secure Data Collection and Preprocessing	1
3.2	Privacy-Preserving ML Techniques: Differential Privacy	2
3.3	Federated Learning	1
3.4	Homomorphic Encryption	1
3.5	Robust Model Training and Validation	1
3.6	Model Interpretability and Explainability for Security	1
3.7	Secure Deployment of AI Models	2
4.0	**AI for Cybersecurity Applications**	
4.1	AI-Driven Threat Detection and Prevention	2
4.2	Intrusion Detection Systems (IDS) using ML	2
4.3	Automated Vulnerability Assessment using AI	2
4.4	AI in Digital Forensics and Incident Response	1
4.5	Case Studies of AI in Cyber Defense	2
5.0	**Regulations, Ethics, and Future Trends**	
5.1	Ethical Challenges in AI and Cybersecurity	1
5.2	AI Security Standards and Compliance (GDPR, NIST, ISO)	2
5.3	Governance and Risk Management in AI Security	2
5.4	Future Trends in AI-based Cybersecurity	2
5.5	Research Directions and Open Problems	2

Course Designer(s)

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70 PDS E52	Financial Analytics and Risk Management	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To Understand the fundamental concepts of financial analytics and risk management.
- To Apply statistical and machine learning techniques to analyse financial risks.
- To Utilize data analytics tools for investment, credit risk, and market risk assessment.
- To Explore financial derivatives and hedging techniques for risk mitigation
- To Develop models for financial forecasting and risk assessment.

Pre-requisites

- Mathematics and Software Engineering

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the fundamental concepts of financial analytics and risk management frameworks	Remember
CO2	Apply statistical and machine learning techniques for risk assessment and predictive analytics.	Understand
CO3	Utilize portfolio management techniques for optimizing risk-return trade-offs.	Apply
CO4	Analyse derivative instruments and hedging strategies for financial risk mitigation.	Analyse
CO5	Explore the role of FinTech in modern risk management.	Understand

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	-	2	3	3	-
CO2	2	-	3	3	3	-
CO3	3	2	2	3	1	-
CO4	3	2	3	3	3	-
CO5	3	1	2	3	3	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	10
Understand	40	20	20
Apply	00	10	20
Analyse	00	10	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech-Data Science								
70 PDS E52 – Financial Analytics and Risk Management								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction to Financial Analytics and Risk Management Basics of Financial Analytics and Data-Driven Decision Making-Financial Markets and Risk Types (Market Risk, Credit Risk, Operational Risk)-Risk Management Frameworks and Regulatory Guidelines (Basel III, IFRS)-Data Sources in Finance (Stock Market, Economic Indicators, Real-Time Data)-Introduction to Financial Modeling and Quantitative Analysis	[9]
Statistical and Machine Learning Techniques for Risk Analysis Exploratory Data Analysis (EDA) in Financial Risk-Probability Distributions, Regression, and Time-Series Analysis-Machine Learning in Risk Analytics: Logistic Regression, Decision Trees, SVM Predictive Analytics for Stock Market and Credit Risk Sentiment Analysis and Text Mining in Financial Markets	[9]
Risk Assessment and Portfolio Management* Portfolio Theory and Optimization (Markowitz Model, CAPM)-Value at Risk (VaR) and Expected Shortfall Models-Stress Testing and Scenario Analysis Credit Scoring Models and Default Prediction Application of AI in Financial Risk Assessment	[9]
Financial Derivatives and Hedging Techniques* Overview of Derivatives: Futures, Options, Swaps Option Pricing Models: Black-Scholes Model, Binomial Model Hedging Strategies Using Derivatives Risk Mitigation Techniques in Foreign Exchange and Interest Rate Risks Algorithmic Trading and Risk in High-Frequency Trading	[9]
Advanced Risk Management Fraud Detection and Prevention Using Big Data Analytics-Smart Contracts and Decentralized Finance (DeFi)- Financial Risk Compliance with RegTech-Case Studies on Risk Analytics in Banking, Insurance, and Investments	[9]
Total Hours:	**45**

Text Book(s):	
1.	Nga Thi Hong Nguyen, Shivani Agarwal, Ewa Ziemba Analytics in Finance and Risk Management ,Information Technology, Management and Operations Research Practices, 1st Edition,2023
2.	Steven Allen, Financial Risk Management: A Practitioner's Guide to Managing Market and Credit Risk 4th Edition,2022
1.	Michel Crouhy, Dan Galai, and Robert Mark ,"The Essentials of Risk Management" by Michel Crouhy, Dan Galai, and Robert Mark, 2008
2.	Thomas S. Coleman, Bob Litterman," Quantitative Risk Management: A Practical Guide to Financial Risk",Wiley 1st Edition,2012
3.	Victoria Lemieux, "Financial Analysis and Risk Management Data Governance, Analytics and Life Cycle Management",Springer,1st edition,2013
4.	Steven Allen, Financial Risk Management: A Practitioner's Guide to Managing Market and Credit Risk 2nd Edition,2012

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to Financial Analytics and Risk Management**	
1.1	Basics of Financial Analytics and Data	1
1.2	Driven Decision Making	1
1.3	Financial Markets and Risk Types (Market Risk, Credit Risk, Operational Risk)	1
1.4	Risk Management Frameworks and Regulatory Guidelines (Basel III, IFRS)	2
1.5	Data Sources in Finance (Stock Market, Economic Indicators, Real-Time Data)-	2
1.6	Introduction to Financial Modeling and Quantitative Analysis	2
2.0	**Statistical and Machine Learning Techniques for Risk Analysis**	
2.1	Exploratory Data Analysis (EDA) in Financial Risk	1
2.2	Probability Distributions	1
2.3	Regression, and Time-Series Analysis	1
2.4	Machine Learning in Risk Regression, Decision Trees	1
2.5	Logistic	2
2.6	SVM Predictive Analytics for Stock Market and Credit Risk	2
2.7	Sentiment Analysis and Text Mining in Financial Markets	1
3.0	**Risk Assessment and Portfolio Management**	
3.1	Portfolio Theory and Optimization (Markowitz Model, CAPM	1
3.2	Value at Risk (VaR)	1
3.3	Shortfall Models	1
3.4	Expected -Stress Testing	2
3.5	Scenario Analysis Credit Scoring Models	2
3.6	Default Prediction Application of AI in Financial Risk Assessment	2
4.0	**Financial Derivatives and Hedging Techniques**	
4.1	Overview of Derivatives: Futures	1
4.2	Options	1
4.3	Swaps Option Pricing Models: Black-Scholes Model,	1
4.4	Binomial Model Hedging Strategies Using Derivatives Risk Mitigation Techniques in Foreign Exchange	2
4.5	Interest Rate Risks Algorithmic Trading	2
4.6	Risk in High-Frequency Trading	2
5.0	**Evaluating Recommender System**	
5.1	Fraud Detection and Prevention Using Big Data Analytics	1
5.2	Smart Contracts	1
5.3	Decentralized Finance (DeFi)	1
5.4	Risk Compliance with RegTech	2
5.5	Case Studies on Risk Analytics in Banking	1
5.6	Case Studies on Risk Analytics in Insurance	2
5.7	Case Studies on Risk Analytics in Investments	1

Course Designer(s)

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70 PDS E53	Edge Computing for Data Science	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To develop a foundational understanding of AI and Edge Computing, their interconnection
- To explore ML algorithm architecture, data preparation, and applications.
- To analyse Edge Computing integration with IoT, networking, and security.
- To study neural networks for advancing Edge AI applications.
- To examine the future trends and applications of Edge Computing

Pre-requisites

- Programming, Mathematics, Machine Learning, Networking.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand key concepts, principles, and industrial applications.	Remember
CO2	Apply ML algorithms, data processing, and optimization techniques.	Apply
CO3	Analyse networking, security, and connectivity in edge systems.	Analyse
CO4	Utilize CNNs, RNNs, and generative models for Edge AI solutions.	Apply
CO5	Explore advancements in smart cities, healthcare, and automation.	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	-	-	-	-
CO2	3	-	3	2	3	-
CO3	2	3	-	3	3	2
CO4	-	-	3	-	3	3
CO5	-	-	-	-	2	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	00	00	00
Understand	40	00	00
Apply	20	20	66
Analyse	00	40	34
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS E53 - Edge Computing for Data Science								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Foundation of AI and Edge Computing Introduction to AI & Edge Computing - Relational Model of AI and Edge Computing - AI Principles and Products - Edge Devices in IoT - Edge AI vs. Cloud AI - 'TinyML' - A Cutting-Edge Field - Case Study - Edge AI Practices in Industrial Applications using python	[9]
Fundamentals of Machine Learning (ML) Algorithms ML Algorithms Architecture - Big Data in Machine Learning - ML Types & Algorithm - ML Strategies for Business Improvement - Data Preparation for Production Optimization – Supervised and Unsupervised ML Algorithms - Reinforcement Learning - Neural Network Fundamentals and algorithms	[9]
Edge Computing* Introduction to Edge Computing - Edge Devices, Sensors, and IoT Integration - Networking and Connectivity in Edge Computing - Edge AI and Machine Learning at the Edge - Security and Privacy Challenges - Applications of Edge Computing	[9]
Edge Computing Development Model** Fundamentals and Architecture of Neural Networks - Neural Network Implementation - Shallow Neural Networks in Agriculture - Principles and Measurement in Sigmoid Activation Function - Unstable Gradients in Complex Networks - Convolutional Neural Networks (CNNs) - Applications of CNNs - Generative Neural Networks - Recurrent Neural Networks (RNNs) - Properties and Construction of RNNs - RNNs in Natural Language Processing (NLP) - Recommendation Systems and its real world applications	[9]
Edge Computing in Future*** Edge Computing in Smart Cities and Urban Development - Industrial IoT (IIoT) and Manufacturing Applications - Healthcare and Remote Patient Monitoring - Autonomous Vehicles and Transportation - Retail and E-Commerce Innovations - Real-Time Video Analytics and Surveillance - Edge AI and Intelligent Systems	[9]
Total Hours:	**45**

Text Book(s):	
1.	**Rajkumar Buyya & Satish Narayana Srirama**,"Fog and Edge Computing: Principles and Paradigms", *Wiley, 2019.*
2.	**Ian Goodfellow, Yoshua Bengio, & Aaron Courville** , "*Deep Learnin"*, MIT Press, 2016.
Reference(s):	
1.	**H. Kaushik & R. Patel**," *Artificial* Intelligence and Edge Computing: Applications and Challenges", Springer, 2023.
2.	**Joseph K. Kearney & Harshit Sharma**," *Machine Learning for IoT, Edge & Cloud Computing"*, CRC Press, 2022.
3.	***Zhang, Qi, et al, "***Edge Intelligence in the Internet of Things: AI Techniques and Applications", Springer, 2022.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 7 – Affordable and Clean Energy
**SDG 3: Good Health and Well-being

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Approved Passed in BoS Meeting held on 23/11/2024
Academic Council Meeting held on 21/12/2024

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Foundation of AI and Edge Computing**	
1.1	Introduction to Artificial Intelligence and Edge Computing	1
1.2	Relational Model of AI and Edge Computing	1
1.3	AI Principles and Products	1
1.4	Edge Devices in IoT	1
1.5	Edge AI vs. Cloud AI	1
1.6	'TinyML' - A Cutting-Edge Field	1
1.7	Case Study on Edge AI Practices in Industrial Applications	1
1.8	Implementing Edge AI with Python	1
1.9	Future Trends in Edge AI and Its Industrial Impact	
2.0	**Fundamentals of Machine Learning (ML) Algorithms**	
2.1	Machine Learning Algorithms and Architecture	2
2.2	Big Data in Machine Learning	2
2.3	Types of Machine Learning and Their Algorithms	1
2.4	ML Strategies for Business Improvement	1
2.5	Data Preparation for Production Optimization	1
2.6	Supervised and Unsupervised Learning Algorithms	1
2.7	Reinforcement Learning: Concepts and Applications	1
2.8	Neural Network Fundamentals and Algorithms	2
3.0	**Edge Computing**	
3.1	Introduction to Edge Computing	1
3.2	Edge Devices, Sensors, and IoT Integration	1
3.3	Networking and Connectivity in Edge Computing	1
3.4	Edge AI and Machine Learning at the Edge	2
3.5	Security and Privacy Challenges in Edge Computing	1
3.6	Applications of Edge Computing Across Industries	1
3.7	Performance Optimization in Edge Computing	1
3.8	Future Trends and Innovations in Edge Computing	1
4.0	**Edge Computing Development Model**	
4.1	Fundamentals and Architecture of Neural Networks	1
4.2	Neural Network Implementation	1
4.3	Shallow Neural Networks in Agriculture	1
4.4	Principles and Measurement in Sigmoid Activation Function	1
4.5	Addressing Unstable Gradients in Complex Networks	1
4.6	Convolutional Neural Networks (CNNs) and Their Applications	1
4.7	Generative Neural Networks and Their Use Cases	1
4.8	Recurrent Neural Networks (RNNs): Properties and Construction	2
4.9	RNNs in Natural Language Processing (NLP) and Recommendation Systems	1

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5.0	**Edge Computing in Future**	
5.1	Edge Computing in Smart Cities and Urban Development	1
5.2	Industrial IoT (IIoT) and Manufacturing Applications	1
5.3	Healthcare and Remote Patient Monitoring	1
5.4	Autonomous Vehicles and Transportation	1
5.5	Retail and E-Commerce Innovations	1
5.6	Real-Time Video Analytics and Surveillance	1
5.7	Edge AI and Intelligent Systems	1
5.8	Energy Efficiency and Sustainable Edge Computing	1
5.9	Future Trends and Challenges in Edge Computing	1

Course Designer(s)

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70 PDS E54	Next Generation Databases	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To review the database revolutions and data storage techniques
- To understand NoSQL and document databases
- To understand column databases and in memory databases
- To understand distributed database patterns and consistency models
- To study database models, storage and disruptive database technologies

Pre-requisites

- Basic knowledge of Database Technologies and Data Models

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explore the differences between Relational and NoSQL databases.	Understand
CO2	Analyse NoSQL databases to Store the big data for useful business applications.	Analyse
CO3	Apply the different data models to suit various data representation and storage needs.	Apply
CO4	Design distributed databases.	Apply
CO5	Implement graph data bases like NEO4J and other trending technologies	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	2	3	3	2	2
CO2	2	2	3	3	2	2
CO3	2	2	3	3	2	2
CO4	2	2	3	3	2	2
CO5	2	2	3	3	2	2
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	10
Understand	20	20	20
Apply	10	20	20
Analyse	10	00	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech-Data Science								
70 PDS E54 – Next Generation Databases								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Database Revolutions Database Revolutions: System Architecture- Relational Database- Database Design-Data Storage Transaction Management- Data warehouse and Data Mining- Information Retrieval.	[9]
Document Databases Big Data Revolution: CAP Theorem- Birth of NoSQL- Document Database — XML Databases JSON Document Databases- Graph Databases.	[9]
Column and Memory Databases Column Databases: Data Warehousing Schemes- Columnar Alternative- Sybase IQ- C Store and Vertica-Column Database Architectures- SSD and In-Memory Databases— In-Memory Databases-Berkeley Analytics Data Stack and Spark.	[9]
Distributed Database Patterns Distributed Database Patterns: Distributed Relational Databases- Non-relational Distributed Databases-MongoDB - Sharing and Replication- HBase- Cassandra-Consistency Models Types of Consistency-Consistency MongoDB- HBase Consistency- Cassandra Consistency.	[9]
Data Models and Storage Data Models and Storage: SQL- NoSQL APIs- Return SQL- Advance Databases- Postgre SQL Riak-CouchDB- NEO4J - Redis- Future Databases - Revolution Revisited-Counter revolutionaries Oracle HQ Other Convergent Databases- Disruptive Database Technologies.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Guy Harrison, ‘Next Generation Databases – NoSQL, NewSQL and Big Data’, Apress, 2018.
2.	Abraham Silberschatz,Henry F. Korth, S.Sudarshan, ‘Database System Concepts’, McGraw Hill, Seventh Edition, 2017
1.	Alain Issa & Francis Schieldz, ‘Couch,DB Document oriented databases’ ,ULB, 2017
2.	Eric Redmond, Jim R, Wilson ‘Seven Databases in Seven Weeks’, O’Reilly, Second Edition, 2018
3.	Dan Sullivan, ‘NoSQL for Mere Mortals’, Addison-Wesley, O’Reilly, Second Edition, 2015.
4.	Adam Fowler, ‘NoSQL for Dummies’, John Wiley & Sons, Second Edition, 2015.

*SDG 4 – Quality in Education

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Database Revolutions**	
1.1	Database Revolutions	1
1.2	System Architecture	1
1.3	Relational Database	1
1.4	Database Design	1
1.5	Data Storage	1
1.6	Transaction Management	1
1.7	Data warehouse	1
1.8	Data Mining	1
1.9	Information Retrieval	1
2.0	**Document Databases**	
2.1	Big Data Revolution	1
2.2	CAP Theorem	1
2.3	Birth of NoSQL	1
2.4	Document Database	1
2.5	XML Databases	2
2.6	JSON Document Databases	2
2.7	Graph Databases	1
3.0	**Hough Transform**	
3.1	Column Databases	1
3.2	Data Warehousing Schemes	1
3.3	Columnar Alternative	1
3.4	Sybase IQ	1
3.5	Store and Vertica	1
3.6	Column Database Architectures- SSD	1
3.7	In-Memory Databases	1
3.8	Berkeley Analytics	1
3.9	Data Stack and Spark	1
4.0	**Column and Memory Databases**	
4.1	Distributed Database Patterns	1
4.2	Distributed Relational Databases	1
4.3	Non-relational Distributed Databases	1
4.4	MongoDB - Sharing and Replication	1
4.5	HBase- Cassandra	1
4.6	Consistency Models Types of Consistency	1
4.7	Consistency MongoDB	1
4.8	HBase Consistency	1
4.9	Cassandra Consistency	1

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5.0	**Data Models and Storage**	
5.1	Data Models and Storage	1
5.2	SQL- NoSQL APIs	1
5.3	Return SQL- Advance Databases	1
5.4	Postgre SQL Riak	1
5.5	CouchDB- NEO4J	1
5.6	Redis- Future Databases	1
5.7	Revolution Revisited & Counter revolutionaries	1
5.8	Oracle HQ and Other Convergent Databases	1
5.9	Disruptive Database Technologies	1
	Total	45

Course Designer(s)

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70 PDS E55	GPU Computing	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand the GPU Architecture and terminology used in GPU computing
- To learn memory allocation techniques and programming models
- To explore the knowledge on synchronization and memory consistency
- To develop a parallel algorithm for debugging GPU Programs
- To analyse an algorithm to provide parallel solutions to computationally challenging problems.

Pre-requisites

- Operating System

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Describe GPU architectures and terminology used in GPU computing	Understand
CO2	Analyse the programming models for memory allocation in GPU Computing	Analyse
CO3	Implement the programs for concept of synchronization and data structure	Apply
CO4	Develop an efficient parallel algorithm for debugging GPU Programs	Apply
CO5	Apply algorithms to provide parallel solutions to computationally challenging problems	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	3	3	3	2	2
CO2	3	3	3	3	2	2
CO3	3	3	2	3	2	2
CO4	3	3	3	3	2	2
CO5	3	3	3	3	2	2
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	20	20	30
Apply	10	20	30
Analyse	10	00	20
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech-Data Science								
70 PDS E55-GPU Computing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction: History, GPU Architecture, Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel Programming, CUDA OpenCL / Open ACC, Kernels, Launch parameters, Thread hierarchy, Warps/Wave fronts, Thread blocks/Workgroups, Streaming multiprocessors, 1D/2D/3D thread mapping, Device properties, Simple Programs.	[9]
Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories	[9]
Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Work lists, Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions	[9]
Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.	[9]
Advanced Topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing. Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning.	[9]
Total Hours:	**45**

Text Book(s):

1.	Benedict R Gaster, Lee Howes, David, R. Kaeli, Perhaad Mistry and Dana Schaa, 'Heterogeneous Computing with Open CL', Elsevier, 2013.
2.	David Kirk, Wen-mei Hwu, Morgan Kaufman, 'Programming Massively Parallel Processors: A Hands-on Approach',2010 (ISBN: 978-0123814722)
1.	Shane Cook, Morgan Kaufman,CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, 2012
2.	Aaftab Munshi, Benedict Gaster, Timothy G. Mattson, James Fung & Dan Ginsburg, 'OpenCL Programming Guide', Addison-Wesley Professional, 2011.
3.	RyojiTsuchiyama, Takashi Nakamura, Takurolizuka & Akihiro Asahara, 'The OpenCL Programming Book', Fixstars Corporation, 2010.
4.	Matthew Scarpio, 'OpenCL in Action: How to Accelerate Graphics and Computations', Manning Publications, 2011.

*SDG 4 – Quality in Education

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Course Contents and Lecture Schedule

S.No.	Topics	No. of Hours
1.0	**Introduction: History**	
1.1	GPU Architecture	1
1.2	Clock speeds	1
1.3	CPU / GPU comparisons	1
1.4	Heterogeneity, Accelerators	1
1.5	Parallel Programming, CUDA OpenCL / OpenACC	1
1.6	Kernels, Launch parameters	1
1.7	Thread hierarchy, Warps/Wavefronts	1
1.8	Threadblocks/Workgroups, Streaming multiprocessors	1
1.9	1D/2D/3D thread mapping, Device properties, Simple Programs	1
2.0	**Memory**	
2.1	Memory hierarchy	1
2.2	DRAM / global, local / shared, private / local	1
2.3	textures, Constant Memory	1
2.4	Pointers, Parameter Passing	1
2.5	Arrays and dynamic Memory	1
2.6	Multi-dimensional Arrays, Memory Allocation	1
2.7	Memory copying across devices	1
2.8	Programs with matrices	1
2.9	Performance evaluation with different memories	1
3.0	**Synchronization**	
3.1	Memory Consistency,	1
3.2	Barriers (local versus global)	1
3.3	Atomics, Memory fence	1
3.4	Prefix sum, Reduction	1
3.5	Programs for concurrent Data Structures such as Worklists, Linked-lists	1
3.6	Synchronization across CPU	1
3.7	GPU Functions: Device functions, Host functions, Kernels functions	1
3.8	Using libraries (such as Thrust)	1
3.9	developing libraries	
4.0	**Support**	
4.1	Debugging GPU Programs	1
4.2	Profiling, Profile tools	1
4.3	Performance aspects Streams	1
4.4	Asynchronous processing	1
4.5	tasks, Task-dependence	1
4.6	Overlapped data transfers	1
4.7	Default Stream, Synchronization with streams	1
4.8	Events, Event-based- Synchronization	1
4.9	Overlapping data transfer and kernel execution, pitfalls	1
5.0	**Design of RTS- General Introduction**	
5.1	Dynamic parallelism	1
5.2	Unified Virtual Memory	1
5.3	Multi-GPU processing	1
5.4	Peer access, Heterogeneous processing	1
5.6	Image Processing	1
5.7	Graph algorithms	1
5.8	Simulations	1
5.9	Deep Learning	1
	Total	**45**

Course Designers

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70 PDS E61	AI for Augmented and Virtual Reality	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To understand AI Fundamentals for AR/VR
- To develop AI-Driven Computer Vision for AR/VR
- To Integrate Natural Language Processing & Conversational AI
- To Enhance Interactivity and Personalization with AI
- To Optimize Rendering, Simulation, and Content Generation

Pre-requisites

- Mathematics & Computer Science Basics
- Programming & Development
- Computer Vision & Image Processing

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Apply AI Techniques to AR/VR Environments	Apply
CO2	Develop AI-Powered Interactive Systems	Apply
CO3	Implement AI-Driven Personalization & Adaptive Learning	Analyse
CO4	Optimize AR/VR Graphics and Simulations Using AI	Analyse
CO5	Design and Evaluate AI-Augmented AR/VR Applications	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	2	-	3	-
CO2	3	2	2	1	3	-
CO3	3	3	2	2	3	-
CO4	3	3	3	2	3	-
CO5	3	3	3	2	3	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	40	20	30
Apply	-	10	30
Analyse	-	10	20
Evaluate	-	-	-
Create	-	-	-
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS E61 & AI for Augmented and Virtual Reality								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Unit I : Fundamentals of AI IN AR/VR Introduction to Artificial Intelligence, Machine Learning, and Deep Learning - Overview of Augmented Reality (AR) and Virtual Reality (VR) - Role of AI in enhancing AR/VR experiences - AI-driven computer vision for AR/VR - Case studies of AI-powered AR/VR applications	[9]
UNIT 2: Computer Vision & Object Recognition In AR/VR Basics of computer vision and image processing - Object detection and tracking in AR/VR-AI-powered face recognition and gesture detection- Scene understanding and depth estimation using AI - Tools and frameworks: OpenCV, TensorFlow, Mediapipe	[9]
UNIT 3: Natural Language Processing & Conversational AI IN AR/VR Introduction to NLP and speech recognition - Voice assistants and AI-powered chatbots in AR/VR - Sentiment analysis and real-time translation -AI-driven subtitles and audio synthesis for immersive experiences - NLP frameworks: spaCy, NLTK, Google Dialogflow	[9]
UNIT 4: AI for Real-Time Interaction & Human-Computer Interfaces AI-driven behavior modeling and adaptive learning - Reinforcement Learning (RL) for dynamic user interactions - Emotion recognition and AI-powered avatars - AI-enhanced haptic feedback and gesture-based controls - Case studies of AI in interactive gaming and simulations	[9]
UNIT 5: AI-Driven Rendering, Simulation & Personalization In AR/VR AI for real-time rendering and graphics enhancement - Neural networks for realistic textures and environments - AI-driven content personalization in AR/VR experiences - Generative AI for world-building (GANs, Stable Diffusion) - Ethical considerations and future trends in AI-powered AR/VR	[9]
Total Hours:	**45**

Text Book(s):	
1.	Vladimir Geroimenko,"Augmented Reality and Artificial Intelligence: The Fusion of Advanced Technologies (Springer Series on Cultural Computing)", Springer International Publishing AG,May 2024
2	Ange Anderson,"Virtual Reality, Augmented Reality and Artificial Intelligence in Special Education: A Practical Guide to Supporting Students with Learning Differences" 1st Edition, Routledge Publisher, 20 March 2019
Reference(s):	
1.	M. Claudia tom Dieck and Timothy Jung,"Augmented and Virtual Reality: New Trends in Immersive Technology",1st ed. 2021, Springer Nature Switzerland AG Publisher, 5 May 2021

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Fundamentals of AI in AR/VR**	
1.1	Introduction to Artificial Intelligence	1
1.2	Machine Learning, and Deep Learning	1
1.3	Overview of Augmented Reality (AR) and Virtual Reality (VR)	1
1.4	Role of AI in enhancing AR/VR experiences	1
1.5	AI-driven computer vision for AR/VR	1
1.6	Case studies of AI-powered AR/VR applications	1
2.0	**Computer Vision & Object Recognition in AR/VR**	
2.1	Basics of computer vision and image processing	1
2.2	Object detection and tracking in AR/VR-AI-powered face recognition and gesture detection	1
2.3	Scene understanding and depth estimation using AI	1
2.4	Tools and frameworks: OpenCV	1
2.5	TensorFlow	1
2.6	Mediapipe	1
3.0	**Natural Language Processing & Conversational AI in AR/VR**	
3.1	Introduction to NLP and speech recognition	1
3.2	Voice assistants and AI-powered chatbots in AR/VR	1
3.3	Sentiment analysis and real-time translation	1
3.4	AI-driven subtitles and audio synthesis for immersive experiences	1
3.5	NLP frameworks: SPACY	1
3.6	NLTK, Google Dialogflow	1
4.0	**AI for Real-Time Interaction & Human-Computer Interfaces**	
4.1	AI-driven behavior modeling and adaptive learning	1
4.2	Reinforcement Learning (RL) for dynamic user interactions	1
4.3	Emotion recognition	1
4.4	AI-powered avatars	1
4.5	AI-enhanced haptic feedback and gesture-based controls	1
4.6	Case studies of AI in interactive gaming and simulations	1
5.0	**AI-Driven Rendering, Simulation & Personalization in AR/VR**	
5.1	AI for real-time rendering and graphics enhancement	1
5.2	Neural networks for realistic textures and environments	1
5.3	AI-driven content personalization in AR/VR experiences	1
5.4	Generative AI for world-building (GANs, Stable Diffusion)	2
5.5	Ethical considerations and future trends in AI-powered AR/VR	1

Course Designer(s)

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70 PDS E62	Theoretical and Computational Neuroscience	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To familiarize fundamentals of neuroscience
- To widen the knowledge about neural encoding and decoding process
- To learn the concept of neuro electronics and network models
- To develop the skills in various learning techniques of neuroscience
- To understand the model of computational neuroscience and neural networks

Pre-requisites

- Basic knowledge of Neural Network and Machine Learning

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend about neuroscience and nervous system	Understand
CO2	Apply appropriate encoding and decoding techniques for neural system	Apply
CO3	Classify the electrical properties of neuron with the aid of necessary network models	Analyse
CO4	Differentiate a mixture of learning techniques	Apply
CO5	Recognize the use of computational neuroscience with neural network concept	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	2	3	3	2	-
CO2	2	2	3	3	2	-
CO3	2	2	3	3	2	-
CO4	2	2	3	3	2	-
CO5	2	2	3	3	2	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	20	20
Understand	20	20	30
Apply	20	10	30
Analyse	00	10	20
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS E62 - Theoretical and Computational Neuroscience								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Fundamentals of Neuro science Introduction, General Features and Cells of the Nervous System, Neural Signaling, Synaptic Transmission, Chemical Senses, The Auditory System, The Visual System, Cognition and Memory, Development of the Nervous System	[9]
Neural Encoding and Decoding Firing Rates and Spike Statistics - Introduction, Spike Trains and Firing Rates, Spike-Train Statistics, The Neural Code, Reverse Correlation and Visual Receptive Fields - Introduction, Estimating Firing Rates, Reverse-Correlation Methods: Simple Cells, Static Nonlinearities: Complex Cells, Receptive Fields in the Retina and LGN, Constructing V1 Receptive Fields, Neural Decoding - Encoding and Decoding, Discrimination, Population Decoding, Spike-Train Decoding	[9]
Neurons and Neural Circuits Neuro electronics - Introduction, Electrical Properties of Neurons, Single-Compartment Models, Integrate-and-Fire Models, Voltage-Dependent Conductances, Modeling Channels, Synaptic Conductances, Synapses on Integrate-and-Fire Neurons, Conductances and Morphology - Levels of Neuron Modeling, Conductance - Based Models, The Cable Equation, Multi-compartment Models, Network Models	[9]
Adaptation and Learning Plasticity and Learning - Introduction, Synaptic Plasticity Rules, Unsupervised Learning, Supervised Learning, Classical Conditioning and Reinforcement Learning - Introduction, Classical Conditioning, Static Action Choice, Sequential Action Choice, Representational Learning - Introduction, Density Estimation, Causal Models for Density Estimation.	[9]
Computational Neuroscience and Neural networks Introduction, Mathematical Preliminaries, Organization of nervous system and Neuro anatomy, Hodgkin Huxley model, Biophysical models of Single neuron, Simplified neuron models, Introduction to Neural networks, basic neurons, multilayer perceptron, Back propagation algorithm. Hopfield network	[9]
Total Hours:	**45**

Text Book(s):	
1.	Peter Dayan and Larry F. Abbott," Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems', The MIT Press, 2001.ISBN 0-262-04199-5
2	P. Millerm, An Introductory Course in Computational Neuroscience', MIT Press (2018), 1st edition. ISBN 978-0-262038256
Reference(s):	
1.	G. B. Ermentrout & D. H. Terman ,"Mathematical Foundations of Neuroscience",Springer (2010), 1st edition. ISBN 978-0-387-87707-5
	'Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting', by Eugene M. Izhikevich. The MIT Press, 2007. ISBN 0-262-09043-8
	Patricia Churcland & Terence Sejnowski,Computaional Brain,MIT Press
	Christof Koch, Biophysics of computation: information processing in single neurons, Oxford University Press, 2005

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Fundamentals of Neuroscience**	
1.1	Introduction	1
1.2	General Features and Cells of the Nervous System	1
1.3	Neural Signaling	1
1.4	Synaptic Transmission	1
1.5	Chemical Senses	1
1.6	The Auditory System	1
1.7	The Visual System	
1.8	Cognition and Memory	
1.9	Development of the Nervous System	
2.0	**Neural Encoding and Decoding**	
2.1	Firing Rates and Spike Statistics - Introduction	1
2.2	Spike Trains and Firing Rates, Spike-Train Statistics	1
2.3	The Neural Code	1
2.4	Reverse Correlation and Visual Receptive Fields - Introduction	1
2.5	Estimating Firing Rates, Reverse-Correlation Methods: Simple Cells, Static Nonlinearities: Complex Cells	1
2.6	Receptive Fields in the Retina and LGN	1
2.7	Constructing V1 Receptive Fields, Neural Decoding - Encoding and Decoding	1
2.8	Discrimination, Population Decoding	1
2.9	Spike-Train Decoding	1
3.0	**Neurons and Neural Circuits**	
3.1	Neuroelectronic - Introduction, Electrical Properties of Neurons	1
3.2	Single-Compartment Models	1
3.3	Integrate-and-Fire Models, Voltage-Dependent Conductances	1
3.4	Modeling Channels, Synaptic Conductances	1
3.5	Synapses on Integrate-and-Fire Neurons	1
3.6	Conductances and Morphology - Levels of Neuron Modeling	1
3.7	Conductance - Based Models	
3.8	The Cable Equation	
3.9	Multi-compartment Models, Network Models	
4.0	**Adaptation and Learning**	
4.1	Plasticity and Learning - Introduction	1
4.2	Synaptic Plasticity Rules	1
4.3	Unsupervised Learning, Supervised Learning	1
4.4	Classical Conditioning and Reinforcement Learning - Introduction	1
4.5	Classical Conditioning	1
4.6	Static Action Choice, Sequential Action Choice	1
4.7	Representational Learning - Introduction	1
4.8	Density Estimation	1

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4.9	Causal Models for Density Estimation.	1
5.0	**AI-Driven Rendering, Simulation & Personalization in AR/VR**	
5.1	**Computational Neuroscience and Neural networks**	1
5.2	Introduction, Mathematical Preliminaries	1
5.3	Organization of nervous system and Neuroanatomy	1
5.4	Hodgkin Huxley model	2
5.5	Biophysical models of Single neuron	1
5.7	Simplified neuron models	1
5.8	Introduction to Neural networks	1
5.9	basic neurons, multilayer perceptron	1

Course Designer(s)

Dr.C.Nallusamy (nallusamyc@ksrct.ac.in)

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70 PDS E63	Fog Computing	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To learn the basic concepts of fog computing
- To familiarize the management of Network Slices in 5G, Fog, Edge, and Clouds
- To provide the requirements of fog computing when applied to IoT
- To develop the application of fog computing in health monitoring
- To implement software defined networking application

Pre-requisites

- Basic knowledge of Data Science, Cloud Computing IoT

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explore the fundamentals of fog computing	Understand
CO2	Explain the management of Network Slices in 5G, Fog, Edge, and Clouds	Analyse
CO3	Analyse fog computing requirements in IoT	Analyse
CO4	Utilize fog computing in health monitoring applications	Apply
CO5	Implement software defined networking application in fog computing	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	2	2	2	3	1	1
CO2	2	2	2	3	1	1
CO3	2	2	2	3	1	1
CO4	2	2	2	3	1	1
CO5	2	2	2	3	1	1
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	10	20
Understand	20	20	30
Apply	10	10	20
Analyse	10	20	30
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2025								
M.Tech – Data Science								
70 PDS E63 & Fog Computing								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction to Fog Computing Fog Computing, Characteristics, Application Scenarios, Issues and challenges. Fog Computing Architecture: Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles. Fog Computing Communication Technologies: Introduction, IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.	[9]
Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds Introduction, Background, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog, Middleware for Fog and Edge Computing, Need for Fog and Edge Computing Middleware, Clusters for Lightweight Edge Clouds, IoT Integration, Security Management for Edge Cloud Architectures. Fog Computing Realization for Big Data Analytics Introduction to Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation.	[9]
Fog computing requirements when applied to IoT Scalability, Interoperability, Fog-IoT architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, Data Management, filtering, Event Management, Device Management, Cloudification, virtualization, security and privacy issues. Integrating IoT, Fog, and Cloud Infrastructures: Methodology, Integrated C2F2T Literature by Modeling Technique by Use-Case Scenarios, Integrated C2F2T Literature by Metrics.	[9]
Exploiting Fog Computing in Health Monitoring An Architecture of a Health Monitoring IoT Based System with Fog Computing, Fog Computing Services in Smart E-Health Gateways, Discussion of Connected Components. Fog Computing Model for Evolving Smart Transportation Applications: Introduction, Data-Driven Intelligent Transportation Systems, Fog Computing for Smart Transportation Applications Case Study: Intelligent Traffic Lights Management (ITLM) System	[9]
Software Defined Networking and application in Fog Computing Open Flow Protocol, Open Flow Switch, SDN in Fog Computing, Home Network using SDN. Security and Privacy issues: Trust and privacy issues in IoT Network, web Semantics and trust Management for Fog Computing, Machine Learning based security in Fog Computing, Cyber- Physical Energy Systems over Fog Computing**.**	[9]
Total Hours:	**45**

Text Book(s):

1.	Assad Abbas, Samee U. Khan, Albert Y. Zomaya , “Fog Computing: Theory and Practice”, John Wiley & Sons, 2020
2	Rajkumar Buyya, Satish Narayana Srirama , “Fog and Edge Computing: Principles and Paradigms”, Wiley publication, 2019,

Reference(s):

1.	SudipMisra , Subhadeep Sarkar , Subarna Chatterjee,”Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things “. CRC Press 2019.
2.	K.G. Srinivasa , Pankaj Lathar , G.M. Siddesh,”The Rise of Fog Computing in the Digital Era “,IGI Global,2018.
3.	Ravi Tomar, Avita Katal, Susheela Dahiya, Niharika Singh, Tanupriya Choudhury, “Fog Computing Concepts, Frameworks, and Applications “, Taylor & Francis , 2022.
4.	https://github.com/CLoudslab/iFogSimTutorials

*SDG 9 – Industry Innovation and Infrastructure
**SDG 3 – Good Health and Well Being
***SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Fundamentals of AI in AR/VR**	
1.1	Introduction to Artificial Intelligence	1
1.2	Machine Learning, and Deep Learning	1
1.3	Overview of Augmented Reality (AR) and Virtual Reality (VR)	1
1.4	Role of AI in enhancing AR/VR experiences	1
1.5	AI-driven computer vision for AR/VR	1
1.6	Case studies of AI-powered AR/VR applications	1
2.0	**Computer Vision & Object Recognition in AR/VR**	
2.1	Basics of computer vision and image processing	1
2.2	Object detection and tracking in AR/VR-AI-powered face recognition and gesture detection	1
2.3	Scene understanding and depth estimation using AI	1
2.4	Tools and frameworks: OpenCV	1
2.5	TensorFlow	1
2.6	Mediapipe	1
3.0	**Natural Language Processing & Conversational AI in AR/VR**	
3.1	Introduction to NLP and speech recognition	1
3.2	Voice assistants and AI-powered chatbots in AR/VR	1
3.3	Sentiment analysis and real-time translation	1
3.4	AI-driven subtitles and audio synthesis for immersive experiences	1
3.5	NLP frameworks: SPACY	1
3.6	NLTK, Google Dialogflow	1
4.0	**AI for Real-Time Interaction & Human-Computer Interfaces**	
4.1	AI-driven behavior modeling and adaptive learning	1
4.2	Reinforcement Learning (RL) for dynamic user interactions	1
4.3	Emotion recognition	1
4.4	AI-powered avatars	1
4.5	AI-enhanced haptic feedback and gesture-based controls	1
4.6	Case studies of AI in interactive gaming and simulations	1
5.0	**AI-Driven Rendering, Simulation & Personalization in AR/VR**	
5.1	AI for real-time rendering and graphics enhancement	1
5.2	Neural networks for realistic textures and environments	1
5.3	AI-driven content personalization in AR/VR experiences	1
5.4	Generative AI for world-building (GANs, Stable Diffusion)	2
5.5	Ethical considerations and future trends in AI-powered AR/VR	1

Course Designer(s)

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70 PDS E64	AI in Social Impact and Governance	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To explore the role of AI in solving social challenges and improving governance.
- To understand ethical, legal, and policy implications of AI applications.
- To analyse case studies of AI-driven social impact initiatives.
- To examine AI's role in decision-making, policy implementation, and service delivery.
- To develop critical thinking on the risks and opportunities of AI in governance.

Pre-requisites

- Awareness of Social Science and Public Policy principles.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Explain the fundamental concepts of AI for social good and its applications in various sectors.	Understand
CO2	Recall the fundamental concepts of AI in governance, decision-making, and public administration.	Remember
CO3	Analyse the ethical, legal, and regulatory frameworks governing AI and their implications.	Analyse
CO4	Assess AI-driven innovations in healthcare, education, sustainability, and crisis management.	Apply
CO5	Discuss the future trends, challenges, and global governance of AI.	Apply

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	-	-	2	3
CO2	3	3	2	2	-	3
CO3	3	-	2	3	3	3
CO4	3	3	3	3	3	3
CO5	3	-	2	3	3	3
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	20	00	10
Understand	40	10	20
Apply	00	20	30
Analyse	00	30	40
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2026								
M.Tech – Data Science								
70 PDS E64 - AI in Social Impact and Governance								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Introduction to AI for Social Good Fundamentals of AI and its applications in society - AI for solving global social challenges - AI in Sustainable Development Goals (SDGs) - AI and ethical implications in social sectors -Role of AI in Non-Governmental Organizations (NGOs) - AI-driven disaster response and risk management-AI for inclusivity: Accessibility solutions - AI for improving quality of life - Case studies: AI in global social impact initiatives.	[9]
AI in Governance and Public Administration* AI-driven decision-making in governance - AI in law enforcement and public safety - AI applications in public healthcare management - E-Governance and AI-based policy formulation - Predictive analytics in governance and resource allocation - AI for smart cities and urban planning - Challenges of AI in governance: Bias and transparency - AI in citizen engagement and public services - Case studies: AI in government policy implementation.	[9]
AI and Legal, Ethical, and Regulatory Frameworks Principles of AI ethics: Fairness, accountability, and transparency - AI and human rights concerns - Data privacy laws and AI compliance - Bias and discrimination in AI models - Global AI regulatory frameworks - National policies and AI governance strategies - AI in cybersecurity and digital trust - Explainable AI (XAI) and ethical AI modelling - Future of AI regulations and responsible AI practices.	[9]
AI for Social Good – Case Studies and Innovations AI in healthcare: Disease prediction and diagnostics - AI for personalized education and smart classrooms - AI applications in environmental sustainability - AI for financial inclusion and social welfare - AI in crisis management and humanitarian efforts - AI-powered agricultural solutions for food security - AI in disaster prediction and climate change mitigation - AI-driven accessibility for people with disabilities - Case studies: Successful AI projects for social good.	[9]
Future of AI in Social Impact and Governance** Emerging AI trends in social impact and governance - AI in shaping international policies and laws - AI's impact on democracy and political systems - Future risks: AI and misinformation in governance - AI and employment: Automation vs. job creation - The role of AI in future public administration - AI and global governance: Challenges and opportunities - AI-powered policymaking and ethical dilemmas - Preparing for an AI-driven society: Policies and strategies.	[9]
Total Hours:	**45**

Text Book(s):

1.	Fadi Farra and Sir Christopher Pissarides, "Quantum Governance: Rewiring the Foundation of Public Policy", Emerald Publishing Limited, 2023.
2.	Joshua Cowls and Markus D. Dubber,"Artificial Intelligence for Social Good",Springer,2022.

Reference(s):

1.	Kate Crawford, "Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence", Yale University Press, 2021.
2.	Nick Bostrom, "Superintelligence: Paths, Dangers, Strategies", Oxford University Press, 2016.
3.	Stuart Russell, "Human Compatible: Artificial Intelligence and the Problem of Control", Viking, 2019.
4.	Patrick Lin et al., "Robot Ethics 2.0: From Autonomous Cars to Artificial Intelligence", Oxford University Press, 2017.

*SDG 9 – Industry, Innovation, and Infrastructure
**SDG 8 – Decent Work and Economic Growth

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Academic Council Meeting held on 21/12/2024

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Introduction to AI for Social Good**	
1.1	Fundamentals of AI and its applications in society	1
1.2	AI for solving global social challenges	1
1.3	AI in Sustainable Development Goals (SDGs)	1
1.4	AI and ethical implications in social sectors	1
1.5	Role of AI in Non-Governmental Organizations (NGOs)	1
1.6	AI-driven disaster response and risk management	1
1.7	AI for inclusivity: Accessibility solutions	1
1.8	AI for improving quality of life	1
1.9	Case studies: AI in global social impact initiatives.	1
2.0	**AI in Governance and Public Administration***	
2.1	AI-driven decision-making in governance	1
2.2	AI in law enforcement and public safety	1
2.3	AI applications in public healthcare management	1
2.4	E-Governance and AI-based policy formulation	1
2.5	Predictive analytics in governance and resource allocation	1
2.6	AI for smart cities and urban planning	1
2.7	Challenges of AI in governance: Bias and transparency	1
2.8	AI in citizen engagement and public services	1
2.9	Case studies: AI in government policy implementation.	1
3.0	**AI and Legal, Ethical, and Regulatory Frameworks**	
3.1	Principles of AI ethics: Fairness, accountability, and transparency	1
3.2	AI and human rights concerns	1
3.3	Data privacy laws and AI compliance	1
3.4	Bias and discrimination in AI models	1
3.5	Global AI regulatory frameworks	1
3.6	National policies and AI governance strategies	1
3.7	AI in cybersecurity and digital trust	1
3.8	Explainable AI (XAI) and ethical AI modelling	1
3.9	Future of AI regulations and responsible AI practices.	1
4.0	**AI for Social Good – Case Studies and Innovations**	
4.1	AI in healthcare: Disease prediction and diagnostics	1
4.2	AI for personalized education and smart classrooms	1
4.3	AI applications in environmental sustainability	1
4.4	AI for financial inclusion and social welfare	1
4.5	AI in crisis management and humanitarian efforts	1
4.6	AI-powered agricultural solutions for food security	1
4.7	AI in disaster prediction and climate change mitigation	1
4.8	AI-driven accessibility for people with disabilities	1

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4.9	Case studies: Successful AI projects for social good	1
5.0	**Future of AI in Social Impact and Governance**	
5.1	Emerging AI trends in social impact and governance	1
5.2	AI in shaping international policies and laws	1
5.3	AI's impact on democracy and political systems	1
5.4	Future risks: AI and misinformation in governance	1
5.5	AI and employment: Automation vs. job creation	1
5.6	The role of AI in future public administration	1
5.7	AI and global governance: Challenges and opportunities	1
5.8	AI-powered policymaking and ethical dilemmas	1
5.9	Preparing for an AI-driven society: Policies and strategies.	1

Course Designer(s)

1. S. Pavithra – spavithra@ksrct.ac.in

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70 PDS E65	Quantum Computing for Data Science	Category	L	T	P	Credit
		PE	3	0	0	3

Objectives

- To know the background of classical computing and quantum computing
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum
- computation.
- To learn the basics of quantum computational complexity and error.

Pre-requisites

- Algebra, Gates and Circuits, Cryptography

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the basics of quantum computing.	Remember
CO2	Understand the background of Quantum Mechanics.	Apply
CO3	Analyse the computation models.	Analyse
CO4	Apply the model circuits using quantum computation, environments and frameworks.	Apply
CO5	Analyse the quantum operations such as noise and error–correction.	Analyse

Mapping with Programme Outcomes

COs	POs					
	1	2	3	4	5	6
CO1	3	2	2	2	-	-
CO2	3	2	2	2	-	-
CO3	3	3	3	3	2	-
CO4	3	3	3	3	3	-
CO5	3	3	2	3	-	-
3 - Strong; 2 - Medium; 1 - Some						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	20	20
Understand	30	20	30
Apply	20	10	40
Analyse	00	10	10
Evaluate	00	00	00
Create	00	00	00
Total	60	60	100

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Syllabus

K.S. Rangasamy College of Technology – Autonomous R2025								
M.TECH – Data Science								
70 PDS E65 – Quantum Computing for Data Science								
Semester	**Hours/Week**			**Total Hours**	**Credit**	**Maximum Marks**		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

Foundation* Overview of traditional computing – Church-Turing thesis – circuit model of computation – reversible computation – quantum physics – quantum physics and computation – Dirac notation and Hilbert Spaces – dual vectors – operators – the spectral theorem – functions of operators – tensor products – Schmidt decomposition theorem.	[9]
Qubits and Quantum Model of Computation State of a quantum system – time evolution of a closed system – composite systems – measurement – mixed states and general quantum operations – quantum circuit model – quantum gates – universal sets of quantum gates – unitary transformations – quantum circuits.	[9]
Quantum Algorithms – I Superdense coding – quantum teleportation – applications of teleportation – probabilistic versus quantum algorithms – phase kick-back – the Deutsch algorithm – the Deutsch- Jozsa algorithm – Simon's algorithm – Quantum phase estimation and quantum Fourier Transform – eigenvalue estimation.	[9]
Quantum Algorithms – II Order-finding problem – eigenvalue estimation approach to order finding – Shor's algorithm for order finding – finding discrete logarithms – hidden subgroups – Grover's quantum search algorithm – amplitude amplification – quantum amplitude estimation – quantum counting – searching without knowing the success probability.	[9]
Quantum Computational Complexity and Error Correction ** Computational complexity – black-box model – polynomial method – block sensitivity – classical error correction – classical three-bit code – fault tolerance – quantum error correction – three- and nine-qubit quantum codes – fault-tolerant quantum computation.	[9]
Total Hours:	**45**

Text Book(s):	
1.	Kaye P, Laflamme R, and Mosca M, “An introduction to Quantum Computing”, Oxford University Press, 2020.
2.	Sahni V, “Quantum Computing”, Tata McGraw-Hill Publishing Company, 2021.
3.	Parag K Lala, Mc Graw Hill Education, “Quantum Computing, A Beginners Introduction”, First edition (1 November 2020).
Reference(s):	
1.	Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, Tenth Edition, Cambridge University Press, 2019
2.	Scott Aaronson, “Quantum Computing Since Democritus”, Cambridge University Press, 2020.
3.	David Mermin N, “Quantum Computer Science: An Introduction”, Cambridge University Press, 2018.
4.	Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), “Quantum Computing for Everyone”.

*SDG 9 – Industry Innovation and Infrastructure
**SDG 7 – Affordable and Clean Energy

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Course Contents and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Foundation**	
1.1	Overview of traditional computing	1
1.2	Church-Turing thesis – circuit model of computation	1
1.3	Reversible computation	1
1.4	Quantum physics – quantum physics and computation	1
1.5	Dirac notation and Hilbert Spaces	1
1.6	Dual vectors	1
1.7	Operators – the spectral theorem – functions of operators	1
1.8	Tensor products	1
1.9	Schmidt decomposition theorem.	1
2.0	**Qubits and Quantum Model of Computation**	
2.1	State of a quantum system	1
2.2	Time evolution of a closed system	1
2.3	Composite systems- measurement	1
2.4	Mixed states and general quantum operations	1
2.5	Quantum circuit model	1
2.6	Quantum gates	1
2.7	Universal sets of quantum gates	1
2.8	Unitary transformations	1
2.9	Quantum circuits.	1
3.0	**Quantum Algorithms – I**	
3.1	Superdense coding	1
3.2	Quantum teleportation	1
3.3	Applications of teleportation	1
3.4	Probabilistic versus quantum algorithms	1
3.5	Phase kick-back – the Deutsch algorithm	1
3.6	The Deutsch- Jozsa algorithm	1
3.7	Simon's algorithm	1
3.8	Quantum phase estimation and quantum Fourier Transform	1
3.9	Eigenvalue estimation.	1
4.0	**Quantum Algorithms – II**	
4.1	Order-finding problem	1
4.2	Eigenvalue estimation approach to order finding	1
4.3	Shor's algorithm for order finding	1
4.4	Finding discrete logarithms	1
4.5	Hidden subgroups- Grover's quantum search algorithm	1
4.6	Amplitude amplification	1
4.7	Quantum amplitude estimation	1
4.8	Quantum counting	1

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4.9	Searching without knowing the success probability	1
5.0	**Quantum Computational Complexity and Error Correction**	
5.1	Computational complexity	1
5.2	Black-box model	1
5.3	Polynomial method - block sensitivity	1
5.4	Classical error correction	1
5.5	Classical three-bit code	1
5.6	Fault tolerance	1
5.7	Quantum error correction	1
5.8	Three- and nine-qubit quantum codes	1
5.9	Fault-tolerant quantum computation.	1

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