

MANONMANIAM SUNDARANAR UNIVERSITY

**M.Sc.,
ARTIFICIAL INTELLIGENCE**

SYLLABUS

FROM THE ACADEMIC YEAR

2023 - 2024

**TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION,
CHENNAI – 600 005**

CONTENTS

- i. PO and PSO Description
- ii. PG – Template
- iii. Methods of Evaluation & Methods of Assessment
- iv. Semester Index.
- v. Subjects – Core, Elective, Skill Enhanced, Ability Enhanced, Extension Activity, Environment, Professional Competency
 - 1) Course Lesson Box
 - 2) Course Objectives
 - 3) Units
 - 4) Learning Outcome
 - 5) Reference and Text Books
 - 6) Web Sources
 - 7) PO & PSO Mapping tables

TANSCHER REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION	
Programme	M.Sc., ARTIFICIAL INTELLIGENCE
Duration	PG - Two Years
Programme Outcomes (POs)	<p>PO1: Problem Solving Skill Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.</p> <p>PO2: Decision Making Skill Foster analytical and critical thinking abilities for data-based decision-making.</p> <p>PO3: Ethical Value Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.</p> <p>PO4: Communication Skill Ability to develop communication, managerial and interpersonal skills.</p> <p>PO5: Individual and Team Leadership Skill Capability to lead themselves and the team to achieve organizational goals.</p> <p>PO6: Employability Skill Inculcate contemporary business practices to enhance employability skills in the competitive environment.</p> <p>PO7: Entrepreneurial Skill Equip with skills and competencies to become an entrepreneur.</p> <p>PO8: Contribution to Society Succeed in career endeavors and contribute significantly to society.</p> <p>PO 9 Multicultural competence Possess knowledge of the values and beliefs of multiple cultures and a global perspective.</p> <p>PO 10: Moral and ethical awareness/reasoning Ability to embrace moral/ethical values in conducting one's life.</p>
Programme Specific Outcomes (PSOs)	<p>PSO1 – Placement To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.</p> <p>PSO 2 - Entrepreneur To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.</p> <p>PSO3 – Research and Development Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.</p> <p>PSO4 – Contribution to Business World To produce employable, ethical and innovative professionals to sustain in the dynamic business world.</p> <p>PSO 5 – Contribution to the Society To contribute to the development of the society by collaborating with stakeholders for mutual benefit.</p>

Template for P. G., Programmes

Semester-I	Credit	Hours	Semester-II	Credit	Hours	Semester-III	Credit	Hours	Semester-IV	Credit	Hours
Core-I	5	7	Core-IV	5	6	Core-VII	5	6	Core-XI	5	6
Core-II	5	7	Core-V	5	6	Core-VIII	5	6	Core-XII	5	6
Core - III	4	6	Core - VI	4	6	Core - IX	5	6	Project with viva voce	7	10
Elective -I Discipline Centric	3	5	Elective - III Discipline Centric	3	4	Core - X	4	6	Elective - VI (Industry / Entrepreneurship) 20% Theory 80% Practical	3	4
Elective-II Generic:	3	5	Elective -IV Generic:	3	4	Elective - V Discipline Centric	3	3	Skill Enhancement course / Professional Competency Skill	2	4
			Skill Enhancement I	2	4	3.6 Skill Enhancement II	2	3	Extension Activity	1	
						3.7 Internship/ Industrial Activity	2	-			
	20	30		22	30		26	30		23	30
Total Credit Points -91											

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline
Based Credits and Hours Distribution System
for all Post – Graduate Courses including Lab Hours**

First Year – Semester – I

Part	List of Courses	Credits	No. of Hours
	Core – I	5	7
	Core – II	5	7
	Core – III	4	6
	Elective – I	3	5
	Elective – II	3	5
		20	30

Semester-II

Part	List of Courses	Credits	No. of Hours
	Core – IV	5	6
	Core – V	5	6
	Core – VI	4	6
	Elective – III	3	4
	Elective – IV	3	4
	Skill Enhancement Course [SEC] – I	2	4
		22	30

Second Year – Semester – III

Part	List of Courses	Credits	No. of Hours
	Core – VII	5	6
	Core – VIII	5	6
	Core – IX	5	6
	Core (Industry Module) – X	4	6
	Elective – V	3	3
	Skill Enhancement Course – II	2	3
	Internship / Industrial Activity	2	-
		26	30

Semester-IV

Part	List of Courses	Credits	No. of Hours
	Core – XI	5	6
	Core – XII	5	6
	Project with VIVA VOCE	7	10
	Elective – VI (Industry Entrepreneurship)	3	4
	Skill Enhancement Course – III / Professional Competency Skill	2	4
	Extension Activity	1	-
		23	30

Total 91 Credits for PG Courses

METHODS OF EVALUATION		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments / Snap Test / Quiz	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
Total		100 Marks
METHODS OF ASSESSMENT		
Remembering (K1)	<p>The lowest level of questions require students to recall information from the course content</p> <p>Knowledge questions usually require students to identify information in the text book.</p>	
Understanding (K2)	<p>Understanding of facts and ideas by comprehending organizing, comparing, translating, interpolating and interpreting in their own words.</p> <p>The questions go beyond ample recall and require students to combine data together</p>	
Application (K3)	<p>Students have to solve problems by using/ applying a concept learned in the classroom.</p> <p>Students must use their knowledge to determine a exact response.</p>	
Analyze (K4)	<p>Analyzing the question is one that asks the students to break down something into its component parts.</p> <p>Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations.</p>	
Evaluate (K5)	<p>Evaluation requires an individual to make judgment on something.</p> <p>Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem.</p> <p>Students are engaged in decision-making and problem-solving.</p> <p>Evaluation questions do not have single right answers.</p>	
Create (K6)	<p>The questions of this category challenge students to get engaged in creative and original thinking.</p> <p>Developing original ideas and problem solving skills</p>	

Testing Pattern (25+75)

Internal Assessment

Theory Course: For theory courses there shall be three tests conducted by the faculty concerned and the average of the best two can be taken as the Continuous Internal Assessment (CIA) for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

Computer Laboratory Courses: For Computer Laboratory oriented Courses, there shall be two tests in Theory part and two tests in Laboratory part. Choose one best from Theory part and other best from the two Laboratory part. The average of the best two can be treated as the CIA for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

There is no improvement for CIA of both theory and laboratory, and, also for University End Semester Examination.

Written Examination : Theory Paper (Bloom's Taxonomy based)

Question paper Model

Intended Learning Skills	Maximum 75 Marks Passing Minimum: 50% Duration : Three Hours
	Part -A (10x 2 = 20 Marks) Answer ALL Questions Each Question carries 2 marks
Memory Recall / Example/ Counter Example / Knowledge about the Concepts/ Understanding	Two questions from each UNIT
	Question 1 to Question 10
	Part - B (5 x 5 = 25 Marks) Answer ALL Questions Each questions carries 5 Marks
Descriptions/ Application (problems)	Either-or Type Both parts of each question from the same UNIT
	Question 11(a) or 11(b) To Question 15(a) or 15(b)
	Part-C (3x 10 = 30 Marks) Answer any THREE questions Each question carries 10 Marks
Analysis /Synthesis / Evaluation	There shall be FIVE questions covering all the five units
	Question 16 to Question 20

Each question should carry the course outcome and cognitive level

For instance,

1. [CO1 : K2] Question xxxx
2. [CO3 : K1] Question xxxx

PROGRAMME OUTCOMES (PO) - PROGRAMME SPECIFIC OUTCOMES (PSO) MAPPING

PROGRAMME SPECIFIC OUTCOMES (PSO)					
	PO1	PO2	PO3	PO4	PO5
PSO1	3	3	3	3	3
PSO2	3	3	3	3	3
PSO3	3	3	3	3	3
PSO4	3	3	3	3	3
PSO5	3	3	3	3	3

Level of Correlation between PO's and PSO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0 – No Correlation

M. Sc., ARTIFICIAL INTELLIGENCE**SEMESTER - I**

Course status	Course Title	Credits	Hours
Core	Artificial Intelligence	4	6
Core	Fundamentals of Data Science	4	6
Elective - I	Mathematics for Data Science/ Compiler Design	3	4
Elective - II	Information security & Ethics/ Virtual and Augmented Reality	3	4
Practical	Web Development using WordPress Lab	3	5
Practical	Python Programming Lab	3	5
	Total	20	30

SEMESTER - II

Course status	Course Title	Credits	Hours
Core	Machine Learning	4	5
Core	Big Data Analytics	4	5
Elective 3	Pattern Recognition & Image Analysis / Optimization Techniques	3	4
Elective 4	Software Engineering for Data Science / Databases for Data Science	3	4
Practical	Machine Learning Lab	3	4
Practical	Big Data Analytics Lab	3	4
Skill Enhancement Course [SEC]	Social Network Analysis	2	4
	Total	22	30

Semester –I

Title of the Course		Artificial Intelligence					
Category	Core	Year	I	Credits	4	Course Code	
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		5	1	--	6		
Pre-requisite		knowledge of Computer Science and Mathematics					
Objectives of the Course		To explore the approaches and principles of Artificial Intelligence (AI) algorithms, and apply them to Data Science					
Course Outline		<p>UNIT-I :1.1 Artificial Intelligence The AI Problems - The Underlying Assumptions – What is an AI Technique – The Level of the Model – Criteria for Success.</p> <p>1.2 Problems, Problem Spaces & Search Defining the problem as a State Space Search – Production systems – Problem Characteristics - Production Systems Characteristics – Issues in the Design of Search Programs.</p> <p>1.3 Heuristic Search Techniques Generate and Test – Hill Climbing – Best First Search – Problem Reduction - Constraint Satisfaction – Means ends Analysis.</p>					
		<p>UNIT-II :</p> <p>2.1 Knowledge Representation Issues Representations and Mappings – Approaches to KR – Issues in KR – The Frame Problem.</p> <p>2.2 Using Predicate Logic Representing Simple Facts in Logic - Representing Instances and ISA Relationships– Computable Functions and Predicates – Resolutions – Natural Deductions.</p> <p>2.3 Representing Knowledge using Rules Procedural versus Declarative Knowledge – Logic Programming – Forward Versus Backward Reasoning – Matching – Control Knowledge.</p> <p>2.4 Statistical Reasoning Probability and Bayes Theorem - Certainty Factors and Rule based Systems – Bayesian Networks – Dempsters Shafer Theory - Fuzzy Logic.</p>					

	<p>UNIT-III :</p> <p>3.1 Learning What is Learning - Rote Learning – Learning by Taking Advice – Learning by Problem Solving – Learning from Examples: Induction – Explanation based Learning – Discovery – Analogy – Formal Learning Theory – Neural Net Learning and Genetic Learning</p> <p>3.2 Parallel and Distributed AI Psychological Modelling – Parallelism in Reasoning Systems – Distributed Reasoning Systems</p> <hr/> <p>UNIT-IV :</p> <p>4.1 Deep Learning Frameworks and AI Methodologies Working – Framework – programming Languages – applications – optimization – fuzzy inference systems – artificial creativity – additional AI methodologies – glimpse into the future</p> <p>4.2 Building DL network using MXNet, TensorFlow and Keras Core components – MXNet, TensorFlow and Keras in action – Summary and Visualization</p> <hr/> <p>UNIT-V:</p> <p>5.1 Building and optimizer based on PSO and GA Algorithm - implementation - variants - PSO and GA in action - Framework and tips</p> <p>5.2 Building an Advanced DL system CNN - RNN</p> <p>5.3 Alternative AI frameworks in DS ELMs - CapsNets - Fuzzy logic and Fuzzy inference systems</p>
Extended Professional Component	Demonstration, Case studies, Real time projects
Skills acquired from this course	AI methodologies & Techniques for data science related problems
Recommended Text	Kevin Night, Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, McGraw Hill 2008. (Unit- 1, 2, 3)
Reference Books	<p>Russell, Stuart J., and Peter Norvig. Artificial intelligence: a modern approach. Malaysia; Pearson Education Limited, 2016.</p> <p>Prolog Programming for Artificial Intelligence (International Computer Science Series), Addison-Wesley Educational Publishers Inc; 4th edition, 2011 By Ivan Bratko</p>
Website and e-Learning Source	http://www.aispace.org/index.html https://www.britannica.com/technology/artificial-intelligence https://www.sas.com/en_in/insights/analytics/what-is-artificial-intelligence.html

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understand and identify problems that are amenable to solution by AI methods
CLO2	Analyse and apply appropriate AI methods to solve a given problem.
CLO3	Analyse and formalize a given problem in the language/framework of different AI and learning methods
CLO4	Evaluate the AI methodologies and DL networks
CLO5	Develop AI framework to tackle projects in our increasingly complex world

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	2	1	1
CLO2	3	2	3	2	1	1
CLO3	3	3	2	2	1	1
CLO4	3	3	3	2	2	1
CLO5	3	3	3	3	1	1
Weightage of course contribute to each PSO	15	14	14	11	6	5

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

Title of the Course		FUNDAMENTALS OF DATA SCIENCE					
Category	Core	Year	I	Credits	4	Course Code	
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		5	1	--	6		
Pre-requisite		Basic understanding of data and process					
Objectives of the Course		To introduce the concepts and fundamentals of data science and its life cycle					
Learning Outcome		<p>Students will be able to</p> <p>CO1 : Understand the types of data and analytics , data science process, and its life cycle.</p> <p>CO 2: Apply math in data science</p> <p>CO 3: Analyze the various data intensive operations and tools</p> <p>CO 4: Evaluate the tools and methods for analyzing the data</p> <p>CO 5: Investigate the recent potential applications and development of data science with real time case studies</p>					
Course Outline		UNIT-I : INTRODUCTION OF DATA SCIENCE					
		Data Science – Data science Venn diagram - Basic terminology – Data science case studies- Types of data – levels of data- Types of data analytics - Descriptive analytics-Diagnostic analytics- Predictive analytics- Prescriptive analytics- Five steps of Data science Book 1 - Chapter 1,2,3					
		UNIT-II : MATHEMATICAL PRELIMINARIES					
		2.1 Basic Maths – mathematics as discipline – basic symbols and terminology –linear algebra 2.2 Basic Probability – definitions- probability – Bayesian vs frequentist – compound events – conditional probability – rules of probability Book 1: Unit 2.1 – Chapter 4, Unit 2.2 – Chapter 5					
		UNIT-III : DATA MINING AND DATA WAREHOUSING					
		Introduction to Data warehousing – Design consideration of data warehouse - Data loading process – case study – Data mining – Data mining techniques – Tools and platforms – case study Book 2 – Chapter 3 and 4					
		UNIT-IV : VISUALIZING DATA					
		Exploratory Data Analysis – Developing the visual aesthetic – chart types – Great visualizations – Reading graphs – Interactive visualizations Book 3 - Chapter 6					

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

	UNIT-V: Data Science – Recent Trends Applications of Data Science, recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.
Extended Professional Component	Case study on recent developments and presentation
Skills acquired from this course	Data Science Process, Fundamentals, Applications
Recommended Text	<ol style="list-style-type: none"> Ozdemir, Sinan. Principles of data science. Packt Publishing Ltd, 2016.(Unit 1- Chapter 1,2,3 Unit 2.1 – Chapter 4, Unit 2.2 – Chapter 5) Maheshwari, Anil. "Data analytics made accessible." Seattle: Amazon Digital Services, 2 nd edition (2023).(Unit 3 – Chapter 3 and 4) Skiena, Steven S. The data science design manual. Springer, 2017.(Unit 4- chapter 6)
Reference Books	<ol style="list-style-type: none"> Hadrien Jean.Education, C. (2023). Data Science. Certybox Education. Pierson, Lillian. Data science for dummies. John Wiley & Sons, 2021. Grus, Joel. Data science from scratch: first principles with python. O'Reilly Media, 2019. Blum, Avrim, John Hopcroft, and Ravindran Kannan. Foundations of data science. Cambridge University Press, 2020.
Website and e-Learning Source	https://www.analyticsvidhya.com/ https://www.simplilearn.com https://www.ibm.com/in-en/topics/data-science https://www.mygreatlearning.com/blog/what-is-data-science/

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	2
CO2	3	2	2	3	3	2
CO3	3	2	3	3	3	3
CO4	3	2	3	3	3	3
CO5	3	2	2	3	3	3
Weightage of course contributed to each PSO	15	10	12	15	15	13

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

Title of the Course		MATHEMATICS FOR DATA SCIENCE					
Category	Core	Year	I	Credits	3	Course Code	
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4		--	4		
Pre-requisite		UG level Mathematics					
Objectives of the Course		To build the mathematical background necessary to understand and implement in data science practical/research work					
Learning Outcome		<p>Students will be able to</p> <p>CO1: Demonstrate understanding of basic mathematical concepts in data science, relating to linear algebra</p> <p>CO2: Describe properties of linear systems using vectors, perform and interpret matrix operations.</p> <p>CO3: Describe and compute orthogonality and determinants</p> <p>CO4: Solve linear differential equations</p> <p>CO5: Understand and apply the concept of Linear transformations</p>					
Course Outline		<p>UNIT-I:</p> <p>1.1 Vectors and Matrices Vectors and Linear Combinations-Lengths and Angles from Dot Products-Matrices and Their Column Spaces-Matrix Multiplication AB and CR</p> <p>1.2 Solving Linear Equations $Ax = b$ Elimination and Back Substitution-Elimination Matrices and Inverse Matrices-Matrix Computations and $A = LU$-Permutations and Transposes</p>					
		<p>UNIT-II:</p> <p>2.2 The Four Fundamental Subspaces Vector Spaces and Subspaces-Computing the Nullspace by Elimination: $A = CR$-The Complete Solution to $Ax = b$-Independence, Basis, and Dimension-Dimensions of the Four Subspaces</p>					
		<p>UNIT-III:</p> <p>3.1 Orthogonality Orthogonality of Vectors and Subspaces-Projections onto Lines and Subspaces-Least Squares Approximations-Orthonormal Bases and Gram-Schmidt-The Pseudoinverse of a Matrix</p> <p>3.2 Determinants 3 by 3 Determinants and Cofactors-Computing and Using Determinants-Areas and Volumes by Determinants</p>					
		<p>UNIT-IV :</p> <p>4.1 Eigenvalues and Eigenvectors Introduction to Eigenvalues : $Ax = \lambda x$ - Diagonalizing a Matrix-Symmetric Positive Definite Matrices-Complex Numbers and Vectors and Matrices-Solving Linear Differential Equations</p>					
		<p>UNIT-V:</p> <p>5.1 The Singular Value Decomposition (SVD) Singular Values and Singular Vectors-Image Processing by Linear Algebra-Principal Component Analysis (PCA by the SVD)</p> <p>5.2 Linear Transformations The Idea of a Linear Transformation-The Matrix of a Linear Transformation-The Search for a Good Basis</p>					

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

Extended Professional Component	Problems related to the above topics to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency
Recommended Text	[1] Gilbert Strang, Introduction to Linear Algebra, Wellesley - Cambridge Press, Sixth Edition, 2023
Reference Books	[1] David Lay, Steven Lay, Judi McDonald, Linear Algebra and Its Applications 5th Edition, Pearsons [2] Sheldon Axler, Linear Algebra Done Right (Undergraduate Texts in Mathematics) 3rd ed., Springer, 2015 Edition [3] Jim Hefferon, Linear Algebra, Fourth edition [4] Jeff M Philips, Mathematical Foundations for Data Analysis
Website and e-Learning Source	https://joshua.smcvt.edu/linearalgebra/

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	3
CO2	3	3	2	3	3	3
CO3	3	2	3	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	2	3	3	3
Weightage of course contributed to each PSO	15	13	11	15	15	15

Title of the Course		COMPILER DESIGN					
Paper Number		ELECTIVE I (EC1)					
Category	Elective	Year	I	Credits	3	Course Code	
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4		-	4		
Pre-requisite		Basic knowledge in one of the programming language and data structures					
Objectives of the Course		To acquire the knowledge about the compiler design and to understand the different phases of Compiler					
Course Outline		<p>UNIT-I : Compilers & Translators, Need of Translators, Structure of a Compiler, Phases, Lexical Analysis, Syntax Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Book Keeping, A Symbol Table in brief, Semantic Analysis, L-value, r-values, Error Handling</p>					
		<p>UNIT-II : Rules of Lexical Analyser, Need for Lexical Analysis, Input Buffering, Preliminary Scanning, A simple Approach to the Design of Lexical Analysers, Transition Diagrams, Regular Expression, String & Languages, Finite Automata, Non-deterministic Automata, Deterministic Automata, From regular Expression to Finite Automata, Context free Grammars, Derivations & Parse Trees, Parsers, Shift Reduce Parsing, Operator-Precedence Parsing</p>					

	<p>UNIT-III : Symbol Table Management, Contents of a Symbol Table, Names & Symbol table records, reusing of symbol table spaces, array names, Indirection in Symbol Table entries, Data Structures for Symbol Tables, List, Self Organizing Lists, Search Trees, Hash Tables, Errors, Reporting Errors, Sources of Errors Syntactic Errors, Semantic Errors, Dynamic Errors, Lexical Phase Errors, Minimum Distance Matching, Syntactic Phase Error, Time of Detection, Ponic mode, Case study on Lex and Yacc</p>
	<p>UNIT-IV :Principal Sources of Optimization, Inner Loops, Language Implementation Details Inaccessible to the User. Further Optimization, Algorithm Optimization, Loop Optimization , Code Motion, Induction Variables, Reduction in Strength, Basic Blocks, Flow Graphs, DAG Representation of Basic Blocks, Value Numbers & Algebraic Laws, Global Data Flow Analysis, Memory Management Strategies , Fetch Strategy, Placement Strategies, Replacement Strategies, Address Binding, Compile Time, Load Time, Execution Time, Static Loading, Dynamic Loading, Dynamic Linking</p>

	UNIT-V: Problems in Code Generation, a Simple Code Generator, Next-Use Information, Register Descriptors, Address Descriptors, Code Generation Algorithm, Register Allocation & Assignment, Global Register Allocation, Usage Counts, Register Assignment for Outer Loops, Register Allocation by Graph Coloring, Code Generation from DAG's, Peep-Hole Optimization, Redundant Loads & Stores, Un-Reachable Code, Multiple Jumps, Algebraic Simplifications, Use of Machine Idioms
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Compilers: Principles, Techniques & Tools, Second Edition by A. V. Aho, Monicas. Lam, Ravi Sethi, J. D. Ullman
Reference Books	<ol style="list-style-type: none"> 1. Dhamdhare D.M., “Compiler Construction: Theory and Practice”, McMillan India Ltd., 1983 2. Holub Allen, “Compiler Design in C”, Prentice Hall of India, 1990
Website and e-Learning Source	<ol style="list-style-type: none"> 1. https://www.geeksforgeeks.org/compiler-design-tutorials/ 2. https://www.tutorialspoint.com/compiler_design/ 3. https://www.javatpoint.com/compiler-tutorial 4. https://onlinecourses.nptel.ac.in/noc19_cs01/prview 5. http://ecomputernotes.com/compiler-design

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Identify the major phases of compilation and the functionality of LEX and YACC
CLO2	Describe the functionality of compilation process and symbol table management
CLO3	Apply the various parsing, optimization techniques and error recovery routines to have a better code for code generation
CLO4	Analyze the techniques and tools needed to design and implement compilers.
CLO5	Test a compiler and experiment the knowledge of different phases in compilation

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	2	2	3	2
CLO2	3	2	2	2	3	3
CLO3	3	2	3	3	2	3
CLO4	3	3	3	3	2	3
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	12	13	13	13	14

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

Title of the Course		Information Security and Ethics					
Paper Number							
Category	Elective	Year	I	Credits	3	Course Code	
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		4			--	4	
Pre-requisite		Knowledge of Computer Basics					
Objectives of the Course		To introduce and familiarize the students to security issues in computing, core concepts and vocabulary of computer security					
Course Outline		<p>UNIT-I : 1.1 Security Problem in Computing Meaning of "Secure" – Attacks - Meaning of Computer and information Security - Computer Criminals - Methods of Defense 1.2 Cryptography Terminology and Background - Principles of Cryptography - Cryptography tools - Substitution Ciphers - Transpositions (Permutations) – Making "Good" Encryption Algorithms - The Data Encryption Standard (DES) – The AES Encryption Algorithm - Public Key Encryption - The Uses of Encryption - Digital Signatures and Certificates - Hybrid Cryptography Systems - Steganography - Protocols for secure communication</p>					
		<p>UNIT-II : 2.1 Program Security Secure Programs - Nonmalicious Program Errors - Viruses and Other Malicious Code - Targeted Malicious Code - Controls against Program Threats 2.2 Security Issues in Social Networking Acceptable Use Policies - Reasons for social media being hazardous to the corporate network - Balancing Security and Social Networking in business - Precautions that can be taken to secure the private information</p>					
		<p>UNIT-III : 3.1 Database and Data Mining Security Introduction to Databases - Security Requirements - Reliability and Integrity – Sensitive Data - Inference - Multilevel Databases - Proposals for Multilevel Security – Data Mining 3.2 Security in Networks Network Concepts - Threats in Networks - Network Security Controls - Firewalls – Intrusion Detection Systems - Secure E-Mail</p>					

	<p>UNIT-IV : 4.1 Administering Security Security Planning - Risk Analysis - Organisational Security Policies - Physical Security 4.2 The Economics of Cyber security Making a Business Case - Quantifying Security - Modeling Cyber security</p>
	<p>UNIT-V: 5.1 Privacy in Computing Privacy Concepts - Privacy Principles and Policies - Authentication and Privacy – Data Mining - Privacy on The Web - E-Mail Security - Impacts on Emerging Technologies 5.2 Legal and Ethical Issues in Computer Security Protecting Programs and Data - Information and the Law - Rights of Employees and Employers - Redress for Software Failures - Computer Crime - Ethical Issues in Computer Security - Case Studies of Ethics</p>
Extended Professional Component	Demonstration on computer security Case Studies (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Pfleeger ,Charles P and Shari Lawrence Pfleeger. Security in Computing, Released January 2015, Pearson, ISBN: 9780134085074
Reference Books	Bahadur ,Gary. Securing the Clicks Network Security in the Age of Social Media. 1st ed. McGraw-Hill, 2012. Daswani, Neil, Christoph Kern and Anita Kesavan. Foundations of Security: What Every Programming Needs to Know. Apress, 2007
Website and e-Learning Source	http://www.trendmicro.fr/media/wp/securityguide-social-networks-whitepaper-en.pdf http://paper.ijcsns.org/07_book/201306/20130619.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understand all aspects of computer security, including users, software, devices, operating systems, networks, law, and ethics

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

CLO2	Apply cryptography an essential tool that is critical to computer security
CLO3	Analyse the different aspects of computer security and privacy
CLO4	Evaluate the aspects of computer security
CLO5	Develop a system that uses user authentication, prevents malicious code execution, encrypts the data, protects privacy, implements firewall, detects intrusion, and more.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	2	1	1
CLO2	3	3	3	2	1	1
CLO3	3	3	3	2	1	1
CLO4	3	3	3	2	1	1
CLO5	3	3	3	2	1	1
Weightage of course contribute to each PSO	15	15	15	10	5	5

Title of the Course		VIRTUAL AND AUGMENTED REALITY					
Paper Number		ELECTIVE					
Category	Elective	Year	I	Credits	3	Course Code	
		Semester	I				
Instructional Hours per week	Lecture	Tutorial		Lab Practice		Total	
	4			-		4	
Pre-requisite		Basic knowledge of computer graphics					
Objectives of the Course		To provide knowledge on basic principles of virtual & augmented reality and have the ability to use its technology as a platform for real-world applications.					
Course Outline		<p style="text-align: center;">UNIT-I :</p> <p>Virtual Reality: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System – Input Devices: Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces</p>					
		<p style="text-align: center;">UNIT-II :</p> <p>Output Devices: Graphics Displays – Sound Displays – Haptic Feedback - Computer Architecture for VR: The Rendering Pipeline- PC Graphics Architecture - VR Programming: Toolkits and Scene Graphs – Traditional and Emerging Applications of VR</p>					
		<p style="text-align: center;">UNIT-III :</p> <p>Augmented Reality: Introduction – Augmented Reality Concepts: Working Principle of AR –Concepts related to AR-Ingredients of an Augmented Reality Experience</p>					
		<p style="text-align: center;">UNIT-IV :</p> <p>Augmented Reality Hardware– Augmented Reality Software– Software to create content for AR Application – Tools and Technologies</p>					

	<p>UNIT-V:</p> <p>Augmented Reality Content: Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - Mobile Augmented Reality: Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality</p>
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	<ol style="list-style-type: none"> 1. Grigore C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Wiley Student Edition , Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9) 2. Alan B. Craig(2013), "Understanding Augmented Reality: Concepts and Applications"(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8) 3. Jon Peddie (2017), "Augmented Reality: Where We Will All Live", Springer, Ist Edition (Unit IV: Chapter 7 (Tools & Technologies)
Reference Books	<ol style="list-style-type: none"> 1. Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann(2009), "Developing Virtual Reality Applications: Foundations of Effective Design", Elsevier(Morgan Kaufmann Publishers) 2. Paul Mealy (2018), "Virtual and Augmented Reality",Wiley 3. Bruno Arnaldi & Pascal Guitton & Guillaume Moreau(2018), "Virtual Reality and Augmented Reality: Myths and Realities", Wiley
Website and e-Learning Source	<ol style="list-style-type: none"> 1. Manivannan, M., (2018), "Virtual Reality Engineering," IIT Madras, https:// nptel.ac.in/ courses/121106013 2. Dube, A., (2020), "Augmented Reality - Fundamentals and Development," NPTEL Special Lecture Series, https:// www.youtube.com /watch?v=MGuSTaqlZ9Q 3. http://msl.cs.uiuc.edu/vr/ 4. http://www.britannica.com/technology/virtual-reality/Living-in-virtual-worlds 5. https://mobidev.biz/blog/augmented-reality-development-guide

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the basic terminologies, techniques and applications of VR and AR
CLO2	Describe different architectures and principles of VR and AR systems
CLO3	Use suitable hardware and software technologies for different varieties of virtual and augmented reality applications
CLO4	Analyze and explain the behavior of VR and AR technology relates to human perception and cognition
CLO5	Assess the importance of VR/AR content and interactions to implement for the real-world problem

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	1	2	2	2
CLO2	3	2	2	2	2	2
CLO3	3	2	2	3	3	3
CLO4	3	2	2	3	3	2
CLO5	3	2	3	3	3	3
Weightage of course contribute to each PSO	15	9	10	13	13	12

WEB DEVELOPMENT USING WORD PRESS - PRACTICAL

Semester : I Credits : 3 Lab Hours: 5

Learning Objective: The primary course objective of this paper is to learn the fundamentals of basic web concepts, HTML, DHTML, JavaScript and Word Press.

Course Outcomes: On successful completion of this course, the students will be able to:

- CO1 :** [K2] Identify the tools which will be suitable for the requirement of the webpage.
- CO2 :** [K3] Implement Java script and Style Sheets effectively in the Web Pages
- CO3 :** [K4] Analyze the different tools and built-in functions available to be applied in the webpage.
- CO4 :** [K5] Rate the design and effectiveness of the Web Pages created.
- CO5 :** [K6] Design and publish a website using Word press.

Unit I

Introduction to HTML - Lists - Adding Graphics to HTML Documents - Tables - Linking Documents - Frames- Developing HTML Forms

Exercises:

1. Creating ordered and unordered Lists using simple tags
2. Creating Tables
3. Creating Hyperlinks
4. Creating Frames

Unit II

Dynamic HTML - Cascading Style Sheets - Use of SPAN Tag - External Style Sheets -Use of DIV Tag - Developing Websites

Exercises:

1. Creating Embedded style sheet
2. Use of External style sheet
3. Creating Inline style sheet

Unit III

Introduction to JavaScript - JavaScript in Web Pages - Advantages - Writing JavaScript into HTML - Basic Programming Techniques - Operators and Expressions- JavaScript Programming Construct: Conditional Checking, Controlled Loops, Functions: Built-in Functions, User-Defined Functions - Placing Text in a Browser - Dialog Boxes.

Exercises:

1. Using Conditional checking
2. Using Looping constructs
3. Using Arrays and Functions
4. Creating Dialog Box

Unit IV

JavaScript Document Object Model: Introduction - Understanding Objects in HTML - Handling Events using JavaScript. Forms used by a Website: Form Object - Built-in Objects.

Exercises:

1. Handling Events

2. Creating Forms
3. Form Validation for Name, E-Mail Id and Password
4. Form Validation for Date, Month and Year
5. Using Built-in Objects

Unit V

Word Press: Installation - Stetting and administration- Word press: Theming basics - Our First Word Press Website - Theme Foundation - Menu and navigation - Home page - Dynamic Sidebars and Widgets - Page - archive Page results - Testing and Launching.

Exercises:

Case Study: Design a complete website using word press and prepare it for publishing.

Text Books:

1. Ivan N. Bayross, (2005), Web Enabled Commercial Applications Development Using HTML, DHTML, JavaScript, perlCGI, 3rd Edition, BPB Publications. (Unit I, II, III and IV)
2. Jesse Friedman,(2012), Web Designer's Guide to WordPress: Plan, Theme, Build, Launch (Voices That Matter), 1st Edition , New Riders. (Unit V)

Reference Books:

1. N.P. Gopalan, J. Akilandeswari, (2009), Web Technology: A Developer’s Perspective, Eastern Economy Edition, PHI Learning Private Limited.
2. Deitel&Deitel, (2000), Internet and World Wide Web How to program, Prentice Hall.
3. Jon Duckett, (2004), Beginning Web Programming with HTML, XHTML, and CSS, Wiley Publishing, Inc.

Web Reference Books:

1. http://www.sergey.com/web_course/content.html
2. <http://www.pageresource.com/jscrip/index.html>
3. <http://www.peachpit.com/guides/content.aspx>
4. <https://www.tutorialspoint.com/wordpress/index.htm>

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	3
CO2	3	3	2	3	3	3
CO3	3	2	3	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	2	3	3	3
Weightage of course contributed to each PO/PSO	15	13	11	15	15	15

L T P C
0 0 5 3

PYTHON PROGRAMMING LAB

1. Program using Strings - Program to Sort Words in Alphabetic Order
2. Program to perform various list operations, such as:
 - Insert an element (include appending also)
 - Search an element
 - Modify an existing element
 - Delete an existing element (position & Value)
 - Sort the list
3. Program using Tuples - swap two numbers without using a temporary variable.
4. Program using Dictionaries - count the number of times a character appears in a given string
5. Write a function to convert number into corresponding number in words
For eg, if the input is 876 then the output should be 'Eight Seven Six'.
6. Program using Inheritance.
7. Program using Interfaces.
8. Program involving Overloading
9. Program using Regular Expressions.
10. Working with Widgets.
11. Program to Insert, Delete and Update in Database.
12. Program to create and perform operations using Data Frames.
13. Program to implement Data Visualization.
14. Reading and Writing Text Files and Binary Files
15. Combining and Merging Data Sets
16. Data Aggregation and GroupWise Operations

Course Outcome:

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

1. Appreciate programming concepts in Python
2. Work with Widgets.
3. Insert, Delete and Update in Database.
4. Create and perform operations using Data Frames.
5. Implement Data Visualization

CO - PO - PSO Mapping

PYTHON PROGRAMMING LAB											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 2
CO 2	H	H	M	H	H	H	H	H	H	H	K - 3
CO 3	H	H	M	H	H	H	H	H	H	H	K - 2
CO 4	H	H	M	H	H	H	H	H	H	H	K - 6
CO 5	H	H	M	H	H	H	H	H	H	H	K - 5

Strongly Correlated - H, Moderately Correlated - M, Weekly Correlated - L

Semester II

Title of the Course		Machine Learning				
Category	Core	Year	I	Credits	4	Course Code
		Semester	II			
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	
		4	1	--	5	
Pre-requisite		Basic Programming Skill and Data Knowledge				
Objectives of the Course		To understand the different types, steps and algorithms involved in Machine Learning Process				
Learning Outcome		<p>CO1: Describe the data, essential steps for creating a typical ML model and the fundamentals of pattern classification</p> <p>CO2: Able to examine different ML algorithms and unprocessed data and features</p> <p>CO3: Implement the essential techniques to reduce the number of features in a dataset and test the performance of predictive models</p> <p>CO4: Select multiple algorithms, combine and produce ensembles, discuss the essential techniques for modeling linear relations</p> <p>CO5: Discuss the clustering algorithms, develop a Web application embedding a ML model</p>				
Course Outline		<p>UNIT-I : Data Analytics with pandas and NumPy - NumPy and basic stats - Matrices - pandas library - Working with data - Null Values - Creating statistical graphs Book 1, Chapter -10</p> <p>Giving Computers the ability to learn from data - Introduction - Building intelligent systems to transform data into knowledge - The three different types of Machine Learning(ML) - Introduction to basic terminology and notations - A roadmap for building ML systems - Using Python for ML Book 2, Chapter - 1</p> <p>Training Simple ML Algorithms for Classification - Early History of ML - Implementing a Perceptron learning algorithm - Adaptive linear neurons and the convergence of learning Book 2, Chapter – 2</p> <p>UNIT-II : ML Classifiers using scikit-learn - Choosing a classification algorithm - Training a perceptron - Modeling class probabilities via logistic regression - Maximum margin classification with support vector machines(SVM) - Solving nonlinear problems using a kernel SVM - Decision tree learning - K-nearest neighbours: a lazy learning algorithm Book 2 Chapter 3</p> <p>Data Preprocessing - Missing data - Categorical data - Partitioning a dataset into separate training and test datasets - Bringing features onto the same scale - Selecting meaningful features - Assessing feature importance with random forests Book 2 Chapter – 4</p>				

	<p>UNIT-III : Compressing Data via Dimensionality Reduction - Unsupervised dimensionality reduction via principal component analysis - Supervised data compression via linear discriminant analysis - Using kernel principal component analysis for nonlinear mappings Book 2, Chapter - 5</p> <p>Learning Best Practices for Model Evaluation and Hyperparameter Tuning - Streamlining workflows with pipelines - Using k-fold cross-validation to assess model performance - Debugging algorithms with learning and validation curves - Fine-tuning ML models via grid search - Looking at different performance evaluation metrics Book 2, Chapter – 6</p> <p>UNIT-IV : Combining different models for ensemble learning - Learning with ensembles - Combining classifiers via majority vote - Bagging: building an ensemble of classifiers from bootstrap samples - Leveraging weak learners via adaptive boosting Book 2, Chapter - 7</p> <p>Predicting Continuous Target Variables with Regression Analysis - Introducing Linear regression - Implementing an ordinary least squares linear regression model - Fitting a robust regression model using RANSAC - Evaluating the performance of linear regression models - Using regularised methods for regression - Turning a linear regression model into a curve - polynomial regression - Dealing with nonlinear relationships using random forests Book 2, Chapter – 10</p> <p>UNIT-V: Working with Unlabelled Data – Grouping objects by similarity using k-means - Organising clusters as a hierarchical tree - Locating regions of high density via DBSCAN Book 2, Chapter - 11</p> <p>Introduction to Embedding a ML model into a Web Application - Serialising fitted scikit-learn estimators - Setting up an SQLite database for data storage - Developing a web application with Flask - Turning any classifier into a web application - Deploying the web application to a public server Book 2, Chapter – 9</p>
Extended Professional Component	Mini project applying ML concepts in existing / real time data(is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Preprocessing, ML steps, Prediction and Performance evaluation , Embedding ML model into a web application
Recommended Text	<ol style="list-style-type: none"> 1. Corey Wade et al, Vahid Mirjalili, The Python Workshop, 2nd Edition, packs publishing, 2022 2. Sebastian Raschka and Vahid Mirjalili, Python Machine Learning, 3rd Edition, packt publishing, 2019

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

Reference Books	<ol style="list-style-type: none">1. Andreas C. Mueller, Sarah Guido. Introduction to Machine Learning with Python. O'Reilly Media, Inc., 2016.2. Ethem Alpaydin, Introduction to Machine Learning, 2nd Edition, http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=12012, 20103. Wes McKinney. Python for Data Analysis. O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, second edition, 2018
Website and e-Learning Source	<ol style="list-style-type: none">1. https://data-flair.training/blogs/machine-learning-tutorial/2. https://www.geeksforgeeks.org/machine-learning/

Course Outcome

Upon completion of the course, the student will be able to

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2
CO2	3	3	2	3	3	2
CO3	3	2	3	2	3	3
CO4	3	2	3	2	3	3
CO5	3	3	3	3	3	3
Weightage of course contributed to eachPSO	15	13	13	12	14	13

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

Title of the Course		BIG DATA ANALYTICS					
Category	Core	Year	I	Credits	4	Course Code	
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4	1	--	5		
Pre-requisite		Basic understanding of programming and logical thinking					
Objectives of the Course		To introduce the concepts of big data analytics and developing a real time applications					
Learning Outcome		<p>Students will be able to</p> <p>CO 1: Understand the basic concepts of big data analytics and technologies</p> <p>CO 2: Apply the concept of HDFS, Map reduce for storing and processing of Big data</p> <p>CO 3: Analyze and perform different operations on data using Pig, Hive, and Hbase</p> <p>CO 4: Evaluate tools and methods for analyzing Big data analytics model</p> <p>CO 5: Develop real time big data analytics applications</p>					
Course Outline		<p>UNIT-I : INTRODUCTION TO BIG DATA ANALYTICS Classification of Digital Data, Structured and Unstructured Data - Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Why Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop Environment Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments. Book 1 - Chapter 1,2,3</p> <p>UNIT-II : BIG DATA TECHNOLOGY LANDSCAPE NoSQL, Comparison of SQL and NoSQL, Hadoop -RDBMS Versus Hadoop - Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem Book 1: Chapter 4, 5</p> <p>UNIT-III : HADOOP AND HDFS Introduction to Hadoop – RDBMS vs Hadoop- distributed computing challenges - A Brief History of Hadoop- The Hadoop Distributed Filesystem- Processing Data with Hadoop - Anatomy of a MapReduce Works - Anatomy of a MapReduce Job Run- Job Scheduling- Shuffle and Sort- Task Execution Book 2 – Chapter 1, 3,6</p>					

	<p>UNIT-IV : HADOOP ECO SYSTEM Hive: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub-Query – Joins – Aggregations - Group by and Having - RCFile Implementation - Hive User Defined Function - Serialization and Deserialization. Pig: Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution - Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive Hbase - HBasics, Concepts. Book 1 - Chapter 9, 10 Book 2 - Chapter 11, 12,13</p> <p>UNIT-V: Case Studies Hadoop Usage at Last.fm - Hadoop and Hive at Facebook- Nutch Search Engine- Log Processing at Rackspace – Cascading - TeraByte Sort on Apache Hadoop 601 - Using Pig and Wukong to Explore Billion-edge Network Graphs - Recent Trends in Big Data Analytics Book 2 - Chapter 16</p>
Extended Professional Component	Case study on recent developments and presentation (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired	Developing application using big data analytic techniques
Recommended Text	1. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, First Edition, 2015, Wiley. 2. Tom White, Hadoop: The Definitive Guide, O’Reilly Media Inc., 2015.
Reference Books	1. Lublinsky, Boris, Kevin T. Smith, and Alexey Yakubovich. Professional hadoop solutions. John Wiley & Sons, 2013. 2. Big Data Analytics, RadhaShankarmani, M Vijayalakshmi, Second Edition, 2017, Wiley 3. Hadoop Essentials: A Quantitative Approach, Henry H. Liu, First Edition, 2012, PerfMath Publishers
Website and e-Learning Source	https://www.ibm.com/analytics/big-data-analytics https://www.simplilearn.com/what-is-big-data-analytics-article https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-big-data-analytics

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3
CO2	3	3	2	3	3	3
CO3	3	3	2	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	2	3	3	3
Weightage of course contributed to each PO/PSO	15	15	10	15	15	15

	L	T	P	C
PATTERN RECOGNITION AND IMAGE ANALYSIS	4	0	0	3

Course Objective:

To be familiar with processing of images, recognition of the pattern and their applications

Unit I: Introduction to Image Processing: Image formation, image geometry perspective and other transformation, stereo imaging elements of visual perception. Digital Image- sampling and quantization serial & parallel Image processing.

Unit II: Image Restoration: Constrained and unconstrained restoration Wiener filter , motion blur remover, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone image compression, block coding, run length coding, and contour coding.

Unit III: Segmentation Techniques-thresh holding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications, Shape Analysis - Gestalt principles, shape number, moment Fourier and other shape descriptors, Skelton detection, Hough transform, topological and texture analysis, shape matching.

Unit IV: Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations - Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi square test.

Unit V: Statistical Pattern Recognition -Bayesian Decision Theory, Classifiers, Normal density and discriminant functions, Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM),Gaussian mixture models.

Course Outcome:

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

1. Get acquainted with image processing
2. Apply basic algorithms in image processing
3. Grasp basics of knowledge representation
4. Analyze the texture of images
5. Recognize patterns

CO - PO - PSO MAPPING

PATTERN RECOGNITION AND IMAGE ANALYSIS											
CO	PO					PSO					COGNITIVE LEVEL
	1	2	3	4	5	1	2	3	4	5	
CO 1	H	H	H	M	H	H	H	M	H	H	K - 1
CO 2	H	H	M	H	H	H	H	H	H	H	K - 2
CO 3	H	H	M	H	H	H	H	H	H	H	K - 3
CO 4	H	H	M	H	H	H	H	H	H	H	K - 4
CO 5	H	H	M	H	H	H	H	H	H	H	K - 5

Strongly Correlated - H, Moderately Correlated - M, Weekly Correlated - L

TEXT BOOKS

1. Digital Image Processing - Gonzalez and Wood, Addison Wesley, 1993.
2. Fundamental of Image Processing - Anil K. Jain, Prentice Hall of India.
3. Pattern Classification - R.O. Duda, P.E. Hart and D.G. Stork, Second Edition John Wiley, 2006

REFERENCE BOOKS

1. Digital Picture Processing - Rosenfeld and Kak, vol.I & vol.II, Academic,1982
2. Computer Vision - Ballard and Brown, Prentice Hall, 1982
3. An Introduction to Digital Image Processing - Wayne Niblack, Prentice Hall, 1986
4. Pattern Recognition and Machine Learning - C. M. Bishop, Springer, 2009.
5. Pattern Recognition - S. Theodoridis and K. Koutroumbas, 4th Edition, Academic Press,2009

Title of the Course		Optimization Techniques					
Category	Elective	Year	I	Credits	3	Course Code	
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		4		--	4		
Pre-requisite		Fundamentals of optimization and Linear algebra					
Objectives of the Course		To study of model formulation and apply the mathematical results and numerical techniques of optimization theory to real world problems					
Course Outline		UNIT-I: 1.1 Modelling with Linear programming Two variable LP model – Graphical LP solution – Applications. 1.2 Simplex method and sensitivity analysis Simplex method- Artificial starting solution - Special cases in simplex method- Graphical sensitivity analysis.					
		UNIT-II: 2.1 Duality and post-optimal Analysis Definition of Dual problem - Primal-Dual Relationships-Additional Simplex algorithms- Post optimal analysis 2.2 Advanced Linear Programming Simplex method fundamentals-Revised Simplex Method, Bounded-Variable Algorithm, Duality, Parametric programming					
		UNIT-III: 3.1 Goal Programming Goal programming formulation - Goal Programming algorithms 3.2 Integer Programming Formulation and Applications-Cutting Plane Algorithm-Branch and Bound Method					
		UNIT-IV: 4.1 Heuristic Programming Greedy Heuristics- Meta heuristic - Tabu Search algorithm - Constraint programming 4.2 Deterministic dynamic programming Recursive nature of Dynamic programming computations - Forward and backward recursion- Selected DP applications - Knapsack/Fly-away kit/cargo-loading model- Investment models-Inventory models					

	<p>UNIT-V:</p> <p>5.1 Queuing Systems Pure birth and Pure death models- Generalized Poisson queuing model, single server models.</p> <p>5.2 Classical optimization theory Unconstrained problems - Constrained problems</p>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>Implement Lab Exercises in python and solve problems related to the above topics</p> <p>(To be discussed during the Tutorial hour)</p>
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	[1] Hamdy A.Taha, Operations Research- An Introduction, 10 th Edition, Pearson Education – 2017.
Reference Books	[1] L.R.Foulds, Optimization Techniques , Springer ,Utm , 1981 [2] Garrido José M. Introduction to Computational Models with Python. CRC Press, 2016.
Website and e-Learning Source	<p>https://www.pre-scient.com/knowledge-center/optimization-problems/optimization-problems.html</p> <p>https://www.shsu.edu/~eco_dgf/web_chapter_a.pdf</p>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Explain the fundamental knowledge of Linear Programming

CLO2: Use classical optimization techniques and numerical methods of optimization.

CLO3: Enumerate fundamentals of Integer programming technique and apply different techniques to solve various optimization problems

CLO4: Describe the basics of different Heuristic algorithms and solve dynamic programming problems.

CLO5: Understand Queuing systems and understand constrained and unconstrained problems

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	2	1	1
CLO2	3	3	3	2	1	1
CLO3	3	3	3	2	1	1

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

CLO4	3	3	3	2	1	1
CLO5	3	3	3	2	1	1
Weightage of course contribute to each PSO	15	15	15	10	5	5

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

Title of the Course		Software Engineering for Data Science				
Paper Number		Elective				
Category	Year	I	Credits	3	Course Code	
	Semester	II				
Instructional Hours per week	Lecture	Tutorial		Lab Practice	Total	
	4			--	4	
Pre-requisite		Basic Knowledge in Programming				
Objectives of the Course		To understand the software engineering principles and ensure software quality				
Course Outline		<p>UNIT-I : Software and Software Engineering: The nature of software - Software Engineering - The Software Process - Software Engineering Practice - Software Myths Chapter 1 Process Models : A Generic Process Model - Process Assessment and Improvement - Prescriptive Process Models - Product and Process Chapter 2 Agile Development : Introduction - Agility and Cost of Change - Agile Process - Scrum - Other Agile Frameworks Chapter 3</p>				

	<p>UNIT-II : Recommended Process Model : Requirements Definition - Preliminary Architectural Design - Resource Estimation - First Prototype Construction - Prototype Evaluation - Prototype Evolution - Prototype Release - Maintain Release Software</p> <p>Chapter 4</p> <p>Human Aspects of Software Engineering: Characteristics of a Software Engineer - The Psychology of Software Engineer - The Software Team - Team Structures - The impact of Social Media - Global Teams</p> <p>Chapter 5</p> <p>Principles that guide practice : Core Principles - Principles that guide each Framework Activity - Communication Principles - Planning Principles - Modeling Principles - Construction Principles - Deployment Principles</p> <p>Chapter 6</p>
	<p>UNIT-III :</p> <p>Understanding Requirements: Requirements Engineering - Establishing the groundwork - Requirements Gathering - Developing Use Cases -Building the Analysis Model - Negotiating Requirements - Requirements Monitoring - Validating Requirements</p> <p>Chapter 7</p> <p>Requirements Modeling - A Recommended Approach: Requirements Analysis - Scenario-Based Modeling - Class-Based Modeling - Functional Modeling - Behavioural Modeling</p> <p>Chapter 8</p>

	<p>UNIT-IV : Design Concepts: Design within the context of Software Engineering - The Design Process - Design Concepts - The Design Model</p> <p>Chapter 9 Quality and Security : Introduction - Software Quality - The Software Quality Dilemma - Achieving Software Quality</p> <p>Chapter 15 Software Quality Assurance: Background Issues - Elements of Software Quality Assurance - SQA Process and Product Characteristics - SQA Tasks, Goals and Metrics - Formal Approaches - Statistical SQA - Software Reliability - ISO 9000 Quality standards - SQA Plan</p> <p>Chapter 17</p>
	<p>UNIT-V: Software Testing -Component Level: A Strategic Approach to Software Testing - Planning and RecordKeeping - Test-Case Design - White-box Testing - Black-Box Testing - Object-oriented Testing</p> <p>Chapter 19 Software Testing - Integration Level: Software Testing Fundamentals - Integration Testing - Artificial Intelligence and Regression Testing - Integration Testing in the OO context - Validation Testing - Testing Patterns</p> <p>Chapter 20 Data Science for Software Engineers Appendix 2</p>
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Case Studies (To be discussed during the Tutorial hour)</p>
<p>Skills acquired from this course</p>	<p>Software Engineering approaches for tradition software and Data Science</p>

Recommended Text	1. Pressman, Roger S., and Bruce R. Maxim. Software Engineering: A Practitioner’s Approach, Ninth Edition, 2020.
Reference Books	<ol style="list-style-type: none"> 1. Martin, Robert C. Agile software development: principles, patterns, and practices. Prentice Hall, 2002. 2. Schach, Stephen R. Object-oriented software engineering. McGraw-Hill, 2008. 3. Sommerville, Ian. "Software engineering 9th Edition." ISBN-10 137035152 (2011).
Website and e-Learning Source	https://www.d.umn.edu/~gshute/softeng/principles.html

Course Outcomes

On successful completion of the course, the student will be able:

CLO1: To describe the Software Engineering Principles

CLO2: To apply Software Life Cycle Models for Software Development

CLO3: To use Requirements Engineering skills and gather Requirements

CLO4: To develop a quality Software

CLO5: To apply appropriate testing methodologies

	PSOs					
	1	2	3	4	5	6
CLO1	3	3	1	2	2	1
CLO2	3	3	1	2	2	3
CLO3	3	3	1	2	2	2
CLO4	3	3	3	2	2	2
CLO5	3	3	1	2	2	2

Title of the Course		Databases for Data Science					
Category	Elective	Year	I	Credits	3	Course Code	
		Semester	II				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	
			4		--		
Pre-requisite		Fundamental computer knowledge including computer storage and hardware					
Objectives of the Course		To provide fundamentals of database design, modeling systems, data storage, world of data warehousing and NoSQL					
Learning Outcome		<p>Students will be able to</p> <p>CO1: Understand and discuss the importance of relational data modeling and conceptual modelling</p> <p>CO2: Experiment with various database and compose effective queries</p> <p>CO3: Analyse the process of OLAP system construction</p> <p>CO4: Evaluate the use of NOSQL and its approach to the database</p> <p>CO5: Develop applications using Relational and NoSQL databases</p>					
Course Outline		<p>Unit 1: 1.1 Fundamental Concepts of Database Management Applications of Database Technology - Key Definitions - File versus Database Approach to Data Management - Elements of a Database System - Advantages of Database Systems and Database Management - Architecture and Categorization of DBMSs</p> <p>1.2 Conceptual Data Modeling using the ER Model and UML Class Diagram Phases of Database Design - The Entity Relationship Model - UML Class Diagram</p>					
		<p>Unit 2: 2.1 Types of Database Systems Legacy Databases - Relational Databases: The Relational Model - Normalization</p> <p>2.2 Relational Databases Structured Query Language - SQL Data Definition Language - SQL Data Manipulation Language</p>					

	<p>Unit 3: 3.1 Data Warehousing and Business Intelligence Operational versus Tactical/Strategic Decision-Making - Data Warehouse Definition - Data Warehouse Schemas - The Extraction, Transformation, and Loading (ETL) Process - Data Marts - Virtual Data Warehouses and Virtual Data Marts - Operational Data Store - Data Warehouses vs Data Lakes - Business Intelligence</p> <p>3.2 Introduction of NO SQL Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points Comparison of relational databases to new NoSQL stores, Mongo DB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, AggregateOriented Databases. sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer replication, Combining Sharding and Replication.</p>
	<p>Unit 4 4.2 Key Value Data Stores NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.</p>
	<p>Unit 5: 5.1 Document Oriented Database Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.</p> <p>5.2 Data Modeling with Graph Comparison of Relational and Graph Modeling, Property Graph Model Graph Analytics: Link analysis algorithm- Web as a graph, Page RankMarkov chain, page rank computation, Topic specific page rank Page Ranking Computation techniques iterative processing, Random walk distribution Querying Graphs</p>
<p>Extended Professional Component</p>	<p>Case studies to understand the limitations of Relational DBMS and the need for NoSQL database Mini project - create a data store and process the data</p>

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

Skills acquired from this course	Database designer, Data owner of different types of data, Data Scientist fluent in data, Business Professional
Recommended Text	Lemahieu, W., Broucke, S.vanden and Baesens, B. (2018) Principles of database management: The Practical Guide to storing, managing and analyzing big and small data. Cambridge, United Kingdom: Cambridge University Press. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition, 2022
Reference Books	1. SQL for Data Scientists: A Beginner's Guide for Building Datasets for Analysis Renee M. P. Teate 2. SQL for Data Science: Data cleaning, wrangling and analytics with relational databases, Antonio Badia 3. Guy Harrison, Next Generation Database: NoSQL & big data, Apress
Website and e-Learning Source	https://www.geeksforgeeks.org/introduction-to-nosql/

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	3	3
CO2	2	3	2	2	3	3
CO3	2	3	2	2	3	3
CO4	3	3	2	2	3	3
CO5	3	3	2	2	3	3
Weightage of course contributed to each PSO	12	15	10	10	15	15

Title of the Course	Machine Learning – Lab					
Category	Year	I	Credits	3	Course Code	
	Semester	II				
Instructional Hours per week	Lecture	Tutorial		Lab Practice	Total	
				4	4	
Pre-requisite	Basic Programming Skill and Data Knowledge					
Objectives of the Course	To preprocess the data and build ML models using appropriate techniques and evaluate the model					
Learning Outcome	<p>Upon completion of the course, the student will be able to</p> <p>CO1: Apply pandas, NumPy and Matplotlib to read in , process and visualise data, implement linear classification algorithms</p> <p>CO2: Compare classifiers with linear and non-linear decision boundaries, select relevant features for the model construction</p> <p>CO3: Apply data compression and best practices for model evaluation and hyper parameter tuning</p> <p>CO4: Select appropriate algorithms and ensemble</p> <p>CO5: Apply clustering algorithms on unlabelled data, construct a web application embedding a ML model</p>					
Course Outline	UNIT-I :					
	<ol style="list-style-type: none"> 1. Programs using NumPy and pandas 2. Visualising using graphs 3. Perceptron learning algorithm 4. Adaline 					
	UNIT-II :					
	<ol style="list-style-type: none"> 5. Training a perceptron 6. Modeling class probabilities via logistic regression 7. Maximum margin classification with support vector machines(SVM) 8. Solving nonlinear problems using a kernel SVM 9. Decision tree 					
UNIT-III :						
<ol style="list-style-type: none"> 10. Unsupervised dimensionality reduction via principal component analysis 11. Supervised data compression via linear discriminant analysis 12. Using k-fold cross-validation to assess model performance 13. Debugging algorithms with learning and validation curves 14. Fine-tuning ML models via grid search 15. Implementing different performance evaluation metrics 						
UNIT-IV :						
<ol style="list-style-type: none"> 16. Ensemble Learning 17. Ordinary least squares linear regression model 18. Evaluating the performance of linear regression models 19. Regularised methods for regression 20. Nonlinear relationships using random forests 						

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

	UNIT-V: 21. Grouping objects by similarity using k-means 22. Organising clusters as a hierarchical tree 23. Locating regions of high density via DBSCAN 24. Embedding a ML model into a Web Application
Extended Professional Component	1. Mini project applying ML concepts in existing / real time data 2. Comparing the performance of different ML algorithms on a given dataset
Skills acquired from this course	Preprocessing, ML steps, Prediction and Performance evaluation , Embedding ML model into a web application
Recommended Text	1. Corey Wade et al, Vahid Mirjalili, The Python Workshop, 2nd Edition, packs publishing, 2022 2. Sebastian Raschka and Vahid Mirjalili, Python Machine Learning, 3rd Edition, packt publishing, 2019
Reference Books	1. Andreas C. Mueller, Sarah Guido. Introduction to Machine Learning with Python. O’Reilly Media, Inc., 2016. 2. Ethem Alpaydin, Introduction to Machine Learning, 2nd Edition, http://mitpress.mit.edu/catalog/item/default.asp?type=2&tid=12012 , 2010 3. Wes McKinney. Python for Data Analysis. O’Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, second edition, 2018
Website and e-Learning Source	1. https://machinelearningmastery.com/machine-learning-in-python-step-by-step/ 2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm 3. https://pythonprogramming.net/machine-learning-tutorial-python-introduction/

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3
CO2	3	3	2	3	2	2
CO3	3	2	3	3	2	2
CO4	3	2	3	2	3	2
CO5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	13	12	14	13	11

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

Title of the Course		BIG DATA ANALYTICS LAB				
Category	Year	I	Credits	3	Course Code	
	Semester	II				
Instructional Hours per week	Lecture	Tutorial		Lab Practice	Total	
	-	-		4	4	
Pre-requisite		Basic understanding of programming and logical thinking				
Objectives of the Course		To introduce the concepts of big data analytics and developing a real time applications				
Learning Outcome		<p>Students will be able to</p> <p>CO 1: Configure Hadoop and perform File Management</p> <p>CO 2: Apply Map Reduce program to real time issues.</p> <p>CO 3: Critically analyze huge data set using Hadoop distributed file systems and MapReduce</p> <p>CO 4: Experimenting different data processing tools like Pig, Hive.</p> <p>CO 5: Develop real time big data analytics applications</p>				
Course Outline		<p>UNIT-I :</p> <ol style="list-style-type: none"> 1. Install Apache Hadoop 2. Perform setting up and Installing Hadoop in its three operating modes: <ul style="list-style-type: none"> • Standalone • Pseudo Distributed • Fully Distributed 3. To use Web Based Tools to Manage Hadoop Set-up 4. Implement the following file management tasks in Hadoop: <ul style="list-style-type: none"> Adding files and directories Retrieving files & Deleting Files <p>UNIT-II :</p> <ol style="list-style-type: none"> 4. Develop a MapReduce program to calculate the frequency of a given word in a given file. 5. Develop a MapReduce program to find the maximum temperature in each year. 6. Develop a MapReduce program to find the grades of student's. 7. Develop a MapReduce program to implement Matrix Multiplication. 8. Develop a MapReduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year. 				

	<p>UNIT-III :</p> <p>9. Develop a MapReduce to analyze weather data set and print whether the day is shiny or cool day. (National Climatic Data Centre (NCDC) Data set)</p> <p>10. Develop a MapReduce program to find the number of products sold in each country by considering sales data containing fields like Transaction _Date Product Price Payment_Type Name City\State Country Account_Created Last_Login Latitude Login</p> <p>11. Data sets from different sources as Input</p> <p>12. Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data. (https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset)</p> <p>12. Sorting the data using MapReduce</p> <p>13. Count the number of missing and invalid values through joining two large given datasets.</p>
	<p>UNIT-IV : 14. Install and Run Pig then write Pig Latin scripts to sort, group, join, project and filter the data.</p> <p>15. Install and Run Hive then use Hive to Create, alter and drop databases, tables, views, functions and Indexes.</p> <p>16. Develop a program to calculate the maximum recorded temperature by year wise for the weather dataset in Pig Latin</p> <p>17. Develop a program to calculate the maximum recorded temperature by year wise for the weather dataset in Pig Latin</p> <p>18. Write queries to sort and aggregate the data in a table using HiveQL</p> <p>19. Develop a MapReduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year.</p> <p>20. Write a program to implement combining and partitioning in hadoop to implement a custom partitioner and Combiner</p>
	<p>UNIT-V:</p> <p>21. Analyze the sentiment for product reviews, this work proposes a MapReduce technique provided by Apache Hadoop</p> <p>22. Trend Analysis based on Access Pattern over Web Logs using Hadoop.</p> <p>23. Implementation of decision tree algorithms using MapReduce.</p> <p>24. Implementation of K-means Clustering using MapReduce.</p> <p>25. Generation of Frequent Itemset using MapReduce.</p>
<p>Extended Professional Component</p>	<p>Mini Project – Application development (is a part of internal component only, Not to be included in the External Examination question paper)</p>
<p>Skills acquired from this course</p>	<p>Developing application using big data analytic techniques</p>
<p>Recommended Text</p>	<p>1. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, First Edition, 2015, Wiley. 2. Tom White, Hadoop: The Definitive Guide, O'Reilly Media Inc., 2015.</p>

MSU / 2023-24 / PG – Colleges / M.Sc. CS with AI

Reference Books	<p>1. Lublinsky, Boris, Kevin T. Smith, and Alexey Yakubovich. Professional hadoop solutions. John Wiley & Sons, 2013.</p> <p>2. Big Data Analytics, RadhaShankarmani, M Vijayalakshmi, Second Edition, 2017, Wiley</p> <p>3. Hadoop Essentials: A Quantitative Approach, Henry H. Liu, First Edition, 2012, PerfMath Publishers</p>
Website and e-Learning Source	<p>https://www.ibm.com/analytics/big-data-analytics</p> <p>https://www.simplilearn.com/what-is-big-data-analytics-article</p> <p>https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-big-data-analytics</p>

Course Learning Outcome (for Mapping with POs and PSOs)

	PSOs						
	1	1	2	3	4	5	6
CO1	3	3	3	3	2	1	1
CO2	3	3	3	3	2	1	1
CO3	3	3	3	3	2	1	1
CO4	3	3	3	3	2	1	1
CO5	3	3	3	3	2	1	1
Weightage of course contributed to each PO/PSO	15	15	15	15	10	5	5

Title of the Course		SOCIAL NETWORK ANALYSIS					
Category	Skill	Year	I	Credits	2	Course Code	
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		4			--	4	
Pre-requisite		Basic understanding of social networks					
Objectives of the Course		To introduce the concepts and fundamentals of social network components and analysis					
Course Outline		UNIT-I: INTRODUCTION TO SEMANTIC WEB AND SOCIAL NETWORKS					
		Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis- Brief history of Social network analysis Book 1- Chapter 1,2,3 Book 2: Chapter 1					
		UNIT-II: MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION					
		Knowledge Representation on the semantic web- Ontology and their role in the Semantic Web - Ontology languages for the Semantic Web- Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations Book 1: Chapter 4,5,6					
		UNIT-III: DATA COLLECTION					
		Boundary specification – Data collection process- Information bias and issue of reliability – Archival data – Understanding SNA data – Managing SNA data Book2 : Chapter 2					

	<p>UNIT-IV : METHODS IN SOCIAL NETWORK ANALYSIS</p> <p>Descriptive methods – Graph – Density- Centrality – cliques – MDS- structural equivalence – Two mode networks – Inferential methods – QAP- ERGM</p> <p>Book 2- Chapter 3, 4</p> <hr/> <p>UNIT-V: CASE STUDIES</p> <p>Case studies – Evaluation of web-based social network extraction – semantic – based social network analysis in the sciences – emergent semantics</p> <p>Book 1: Chapter 7,8,9</p>
<p>Extended Professional Component</p>	<p>Case study on recent developments and presentation</p>
<p>Skills acquired from this course</p>	<p>Apply social network in real time applications</p>
<p>Recommended Text</p>	<p>1. Peter Mika, “Social Networks and the Semantic Web”, Springer 2007.</p> <p>2. Yang, Song, Franziska B. Keller, and Lu Zheng. Social network analysis: Methods and examples. Sage Publications, 2016.</p>
<p>Reference Books</p>	<p>1. Guandong Xu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.</p> <p>2. Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.</p>
<p>Website and e-Learning Source</p>	<p>https://bookdown.org/chen/snaEd/ch4.html</p> <p>https://www.sciencedirect.com/topics/social-sciences/social-network-analysis</p> <p>https://www.publichealth.columbia.edu/research/population-health-methods/social-network-analysis</p> <p>https://www.ibm.com/docs/en/spss-modeler/18.0.0?topic=analysis-about-social-network</p>

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understand the fundamentals of social web and elements of social network analysis.
CLO2	Apply and visualize the knowledge representation in social network.
CLO3	Analyse the various methods in social network analysis.
CLO4	Evaluate the tools and methods for analysing the social network data.
CLO5	Investigate the recent potential applications and development of social network with real time case studies.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	2	1	1
CLO2	3	3	3	2	1	1
CLO3	3	3	3	2	1	1
CLO4	3	3	3	2	1	1
CLO5	3	3	3	2	1	1
Weightage of course contribute to each PSO	15	15	15	10	5	5