

**THIRD YEAR CSE (ARTIFICIAL INTELLIGENCE & DATA SCIENCE) - CBCS
PATTERN**

Semester V

Sr No	Course/Subject /Title	TEACHING SCHEME									EXAMINATION SCHEME														
		Theory			Tutorial			Practical			Theory				Practical			Term Work							
		Credits	No of Lecture	Hours	credits	No of Hours	Hours	credits	No of Hours	Hours	mode	Marks	Total Marks	Min	Hours	MAX	MIN	Hours	MAX	MIN					
1	PCC-AIDS-501 Statistics for Data Science	3	3	3	1	1	1				CIE	30	100	12	AS PER BOS GUIDELINES			AS PER BOS GUIDELINES	25	10					
										ESE	70	28													
2	PCC-AIDS-502 Design and Analysis of Algorithms	4	4	4	1	1	1				CIE	30	100	12								25	10		
										ESE	70	28													
3	PCC-AIDS-503 IoT	3	3	3							CIE	30	100	12								25	10		
										ESE	70	28													
4	OEC- Open Elective I	3	3	3							CIE	30	100	12											
										ESE	70	28													
5	PCC-AIDS-506 Information Security	3	3	3				1	2	2	CIE	30	100	12	AS PER BOS GUIDELINES	50	20	AS PER BOS GUIDELINES	25	10					
										ESE	70	28													
6	PCC-AIDS-507 Java Programming	3	3	3				2	4	4												50	20		
7	HM-AIDS-508 Business Communication							1	2	2												25	10		
	Total (Sem V)	19	19	19	2	2	2	4	8	8			500									125	40	175	70

CIE: Continuous Internal Evaluation
ESE: End Semester Examination

Open Elective Course I:

OEC-AIDS-504: Computer Graphics and Multimedia
OEC-AIDS-505: Fundamentals of Embedded Systems

PCC: Professional Core Course

OCE: Open Elective Course

HM: Humanities and Management

PW: Domain Specific Mini Project

**THIRD YEAR CSE (ARTIFICIAL INTELLIGENCE & DATA SCIENCE) - CBCS
PATTERN**

Semester VI

Sr No	Course/Subject /Title	TEACHING SCHEME									EXAMINATION SCHEME											
		Theory			Tutorial			Practical			Theory				Practical			Term Work				
		Credits	No of Lecture	Hours	credits	No of Hours	Hours	credits	No of Hours	Hours	mode	Marks	Total Marks	min	Hours	MAX	MIN	Hours	MAX	MIN		
1	PCC-AIDS-601 Machine Learning	3	3	3				1	2	2	CIE	30	100	12	AS PER BOS GUIDELINES	50	20	AS PER BOS GUIDELINES	25	10		
										ESE	70	28										
2	PCC-AIDS-602 Data Engineering	3	3	3	1	1	1				CIE	30	100	12						25	10	
										ESE	70	28										
3	PCC-AIDS-603 Big Data Analytics	4	4	4				1	2	2	CIE	30	100	12			50		20		25	10
										ESE	70	28										
4	OEC- Open Elective II	3	3	3							CIE	30	100	12								
										ESE	70	28										
5	PCC-AIDS-606 High Performance Computing	4	4	4	1	1	1				CIE	30	100	12					25	10		
										ESE	70	28										
6	SI-AIDS-607 Industrial Training / Internship							1											25	10		
7	PW-AIDS-608 Mini Project							1	2	2									25	10		
	Total (Sem VI)	19	19	19	2	2	2	4	8	8			500			150	60		150	60		

CIE: Continuous Internal Evaluation
ESE: End Semester Examination

Open Elective Course II:
OEC-AIDS-604: E-Commerce and Digital Marketing
OEC-AIDS-605: Image Processing

PCC: Professional Core Course
OCE: Open Elective Course
HM: Humanities and Management
PW: Domain Specific Mini Project

T. Y. CSE (Artificial Intelligence & Data Science) Sem – V
STATISTICS FOR DATA SCIENCE

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 3 Hrs. / Week	ESE: 70 CIE: 30
Tutorial: 1 Hr. / Week	Term work: 25 marks
Practical: --	Practical : --
Course Code: PCC-AIDS-501	Credits: 4

Course Outcomes:

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

1. Understand fundamental statistical concepts.
2. Apply different probability concepts.
3. Analyze hypothesis testing & apply its procedure in different contexts.
4. Evaluate the principles of linear regression.
5. Apply the principles of analysis-of-variance (ANOVA) technique in experimental design.
6. Demonstrate the application of curve fitting techniques to given data.

Unit No	Content	No. of lectures
01	Introduction to Statistics and data analysis	06
	Overview: Statistical Inference, Samples, Populations and Experimental Design, The hole of Probability, Sampling Procedure, Collection of Data, Measure of central tendency Arithmetic mean, median and mode, Measures of Variability, Statistical Modeling, Scientific Inspection, and Graphical Diagnostics, Graphical Methods and Data Description.	
02	Probability, Random Variables and Probability Distributions	06
	Sample Space, Events, Conditional Probability, Bayes' Rule, Concept of Random Variable, Discrete probability distribution, Discrete Uniform Distribution, Continuous probability distribution, Discrete Uniform Distribution, Binomial distribution, Poisson distribution, Continuous Uniform Distribution, Normal distribution, Gamma and Exponential Distributions.	
03	Hypotheses Testing	06
	Null hypothesis, Alternative hypothesis, Statistical Hypotheses, Tests of Statistical Hypotheses, One-Sided and Two-Sided Hypothesis, P-Values in Hypothesis Tests, Connection between Hypothesis Tests and Confidence Intervals, General Procedure for Hypothesis Tests, Type I and Type II errors, Level of significance, Tests on the Mean of a Normal Distribution, Variance Known, Tests on the Mean of a Normal Distribution, Variance Unknown, Tests on the Variance and Standard Deviation of a Normal Distribution, Test for goodness of fit, chi square distribution.	

04	Linear Regression and Correlation	06
	Introduction to Linear Regression, Least Squares and the Fitted Model, Properties of the Least Squares Estimators, Inferences Concerning the Regression Coefficients, Prediction, Choice of a Regression Model, Analysis-of-Variance Approach, Test for Linearity of Regression: Data with Repeated Observations, Data Plots and Transformations, Simple Linear Regression Case Study, Correlation.	
05	Design and Analysis of Single-Factor Experiments: The Analysis of Variance	06
	Analysis-of-Variance Technique, The Strategy of Experimental Design, One-Way ANOVA, Tests for the Equality of Several Variances, Single-Degree-of-Freedom Comparisons, Comparing a Set of Treatments in Blocks, Data Transformations in Analysis of Variance, Power of Analysis-of-Variance Tests, Case Study.	
06	Curve Fitting Techniques	06
	Linear curve fitting, Polynomial Curve Fitting, fitting of curve by method of least squares, fitting of exponential curve, Overfit / Underfit, Fitting of second-degree parabolic curve.	

TEXT BOOKS:

1. Walpole, Myers, Myers, Ye, Probability and Statistics for Engineers and Scientists, Pearson Education Inc., 8th Edition, 2007
2. Numerical Methods in Engineering and Science, by Dr. B. S. Grewal.

REFERENCE BOOKS:

1. Douglas C Montgomery, George C Runger, Applied statistics and Probability for Engineers, Wiley Asia Student Edition, 4th Edition, 2007.
2. Purna Chandra Biswal, Probability and Statistics, PHI Learning Private Limited, Eastern Economy Edition, 2007.

TERM WORK:

1. Minimum of 08 Tutorials to be conducted on six units.
2. Minimum Of 04 Tutorials must be on python implementation of Statistics concepts.

T. Y. CSE (Artificial Intelligence & Data Science) Sem – V
DESIGN AND ANALYSIS OF ALGORITHMS

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 4 Hrs. / Week	ESE: 70 CIE: 30
Tutorial: 1 Hr. / Week	Term work: 25 marks
Practical: --	Practical : --
Course Code: PCC-AIDS-502	Credits: 5

Pre-requisites: Data Structures, Discrete Mathematics

Course Outcomes:

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

1. Formulate the problem
2. analyze the asymptotic performance of algorithms
3. Decide and apply algorithmic strategies to solve given problem
4. Find optimal solution by applying various methods
5. Categorize the problem to determine polynomial and non-polynomial based on its nature
6. Understand and demonstrate basic concepts of parallel algorithms

Unit No	Content	No. of lectures
01	Divide and conquer What is algorithm, Algorithm Specification, Recurrence relations, Performance Analysis, Randomized Algorithms. Divide and Conquer: The general method, Binary search, Finding the maximum and minimum, Merge sort, Quick sort, DC Selection Algorithm, analysis of Divide and Conquer algorithms.	10
02	The Greedy Method The general method, Knapsack problem, Job sequencing with deadlines, minimum-cost spanning trees – Prim’s and Kruskal’s Algorithms, Optimal storage on tapes, Optimal merge Patterns, Single source shortest paths.	07
03	Dynamic Programming The general method, Multistage graphs, all pair shortest paths, 0/1 knapsack, Reliability design, Traveling Sales person problem.	07

04	Basic Traversal and Search Techniques and Backtracking	13
	Techniques for Binary Trees, Techniques for Graphs – Breadth First Search & Traversal, Depth First Search & Traversal, AND/OR graphs; Connected components and Spanning Trees; Bi-connected components and depth first search.	
	Backtracking - The general method, 8-queen problem, sum of subsets, Knapsack Problem, Hamiltonian Cycle, and Graph Coloring	
05	NP Hard and NP Complete Problems	04
	Basic Concepts, Introduction to NP Hard Graph Problems.	
06	Parallel Computational Model	07
	Computational Model and Fundamental Techniques and Algorithms – PRAM, MESH and HYPERCUBE.	

TEXT BOOKS:

1. Fundamentals of Computer Algorithms Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaram Universities Press, Second Edition

REFERENCE BOOKS:

1. Fundamentals of Algorithmics Gilles Brassard, Paul Bratley Pearson Education.
2. Introduction to Design and Analysis of Algorithms Anany Levitin Pearson Education.
3. The Design and Analysis of Algorithms Aho, Hopcraft, Ullman Pearson Education

TERM WORK:

1. Minimum of 08 Tutorials to be conducted on six units.

T. Y. CSE (Artificial Intelligence & Data Science) Sem – V
INTERNET OF THINGS

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 3 Hrs. / Week	ESE: 70 CIE: 30
Tutorial: --	Term work: 25 Marks
Practical: --	Practical : --
Course Code: PCC-AIDS-503	Credits: 3

Course Outcomes:

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

CO1: Understand the fundamentals of IOT

CO2: Understand basic of RFID and Sensor technology

CO3: Understand the basics of IoT systems like Raspberry Pi, Arduino, and Banana Pi.

CO4: Explain various IOT communication protocols.

Unit No	Content	No. of lectures
01	Introduction	04
	IoT, Objects / Things, The identifier in the IoT, Enabling technologies of IoT, Identification technologies.	
02	Fundamental of IoT mechanisms	06
	Identification of IoT objects and services, Structural Aspects of the IoT, Key IoT Technologies	
03	Radio Frequency Identification Technology	06
	RFID, principles of RFID, Components of an RFID system, Sensor nodes, connecting nodes, networking nodes.	
04	IoT systems	08
	Hardware and Software: Introduction to Raspberry Pi, Familiar with Raspberry Pi hardware, study of I/O ports, Programming with Raspberry Pi: Study of operating system, simple programs in C / C++, Introduction with Python programming.	
05	Communication Technologies	06
	WPAN Technologies: Introduction to IEEE 802.15.4 standard, Bluetooth, Zigbee, IEEE 802.15.6; WBANS, NFC, IEEE 802.11 WLAN, Cellular and mobile technologies.	

Smart Metering, advanced metering infrastructure, e-health / Body Area Network, City Automation (Smart City), Automotive Application, Environmental Applications, Home Automation, Control Applications.

TEXT BOOKS:

1. The Internet of Things - Connecting objects to the web Hakima Chaouchi Wiley Publications
Hakima Chaouchi Wiley Publications.
2. Building the Internet of Things Daniel Minoli Wiley Publications
3. Raspberi Pi Beginner's Guide Gareth Halfacree Raspberi Press

REFERENCE BOOKS:

1. Raspberry Pi for Dummies Sean McManus, Mike Cook A Wiley Brand
2. Architecting the Internet of Things Bernd Scholz, Reiter Springer

T. Y. CSE (Artificial Intelligence & Data Science) Sem – V
COMPUTER GRAPHICS AND MULTIMEDIA (Open Elective I)

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 3 Hrs. /Week	ESE: 70 CIE: -- 30
Tutorial: --	Term work: --
Practical: --	Practical : --
Course Code: OEC-AIDS-504	Credits: 3

Course Objectives

1. To provide knowledge to the students about basics of computer graphics and different display devices.
2. To expose students to the various 2D & 3D transformation & projection techniques.
3. To provide knowledge to the students about basics of Illumination models, surface rendering methods.
4. To make the students aware of multimedia system & Multimedia Authoring, Compression techniques.

Course Outcomes:

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

1. Express basic ideas of computer graphics and different display devices.
2. Understand & apply various transformation, projection and rendering techniques on graphical objects.
3. Identify & apply the intensity of light on graphical objects using different illumination models
4. Understand multimedia system & use of Multimedia Authoring & Compression techniques on graphical objects.

Unit No	Content	No of lectures
01	Unit I Basic of Computer Graphics Basic of Computer Graphics, Applications of computer graphics, Display devices: Random and Raster scan systems, Input devices, Scan Conversion techniques: RLE, Frame Buffer, Graphics software and standards.	06
02	Unit II Transformations – Basic 2D & 3D transformations - Translation, Scaling, Rotation, Reflection, Shearing, Multiple Transformations, Rotation about an axis parallel to a coordinate axis, Rotation about an arbitrary axis in space, Affine and Perspective Geometry, Orthographic projections and Axonometric projections.	06
03	Unit III Illumination models and surface rendering methods Light sources, Basic illumination models, displaying light intensities, Polygon Rendering methods, Ray tracing methods, Radiosity lighting.	04

04	Unit IV	07
	Introduction to Multimedia Multimedia: Historical perspective, multimedia data and multimedia systems, a multimedia system today, Analog and Digital Signals, Analog-to-Digital Conversion, Media Representation and Media Formats - Digital Images, Digital Video, Digital Audio.	
05	Unit V	04
	Multimedia Authoring & Compression Examples of Multimedia, Requirements for Multimedia Authoring Tools, Intramedia Processing, Intermedia Processing, Media Compression - The Need for Graphics Compression, Graphics compression in relation to other media compression, Mesh compression using connectivity encoding.	
06	Unit VI	06
	Computer Animation Introduction: Types, Key frame animation, Procedural animation, Construction of an animation sequence, Motion control methods, VFX, SFX, Introduction to Morphing, wrapping techniques, Defining virtual & Augmented reality.	

TEXT BOOKS:

1. Procedural elements for Computer Graphics - David F. Rogers (MGH International) (For Units 1)
2. Mathematical elements for Computer Graphics - David F. Rogers, J. Alan Adams (MGH Int.) (Unit 2)
3. Computer Graphics C Version second edition –Donald D. Hearn, M. Pauline Baker (Pearson) (Unit 3)
4. Multimedia systems: Algorithms, Standards & Industry Practice-Parag Havaldar & Gerard Medioni, Cengage Learning (Unit 4, 5)
5. Computer Graphics- Rajesh Maurya (WILEY India) (Unit 6) 6. Virtual & Augmented reality - Paul Mealy (Kindle Edition) (Unit 6)

T. Y. CSE (Artificial Intelligence & Data Science) Sem – V
FUNDAMENTALS OF EMBEDDED SYSTEMS (Open Elective I)

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 3 Hrs. /Week	ESE: 70 CIE: -- 30
Tutorial: --	Term work: --
Practical: --	Practical : --
Course Code: OEC-AIDS-505	Credits: 3

Course Outcomes:

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

1. Understand the architecture, components, and classifications of embedded systems.
2. Grasp the fundamentals and applications of the 8051 microcontrollers and external memory interfacing for designing embedded systems.
3. Develop skills in programming embedded systems.
4. Acquire knowledge on real-time operating systems RTOS.

Unit No	Content	No of lectures
01	<p>Introduction</p> <p>Introduction: Embedded Systems and general-purpose computer systems, history, classifications, applications and purpose of embedded systems.</p> <p>Core of embedded systems: microprocessors and microcontrollers, RISC and CISC controllers, Big endian and Little-endian processors, Application specific ICs, Programmable logic devices, COTS, sensors and actuators, communication interface, embedded firmware, other system components.</p> <p>Characteristics and quality attributes of embedded systems: Characteristics, operational and non-operational quality attributes</p>	06
02	<p>Embedded Systems – Application and Domain Specific</p> <p>Application specific – washing machine, domain specific - automotive.</p> <p>Embedded Hardware: Memory map, i/o map, interrupt map, processor family, external peripherals, memory – RAM, ROM, types of RAMS and ROM, memory testing, CRC, Flash memory.</p> <p>Peripherals: Control and Status Registers, Device Driver, Timer Driver - Watchdog Timers</p>	06
03	<p>The 8051 Microcontrollers</p> <p>Microcontrollers and Embedded processors, Overview of 8051 family. 8051 Microcontroller hardware, Input/output pins, Ports, and Circuits, External Memory.</p>	04

04 Designing Embedded System with 8051 Microcontroller 06

Factors to be considered in selecting a controller, why 8051 Microcontroller, Designing with 8051. Programming embedded systems: structure of embedded program, infinite loop, compiling, linking and debugging.

05 Real Time Operating System (RTOS) 04

Operating system basics, types of operating systems, Real-Time Characteristics, Selection Process of an RTOS.

06 Design and Development 06

Embedded system development Environment – IDE, types of files generated on cross compilation, disassembler/ de-compiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry.

TEXT BOOKS:

1. Introduction to embedded systems Shibu K V Tata Mcgraw-Hill First 2012
2. The 8051 Microcontroller and Embedded Systems Muhammad Ali Mazidi Pearson Second 2011.
3. Embedded Systems Rajkamal Tata Mcgraw-Hill

T. Y. CSE (Artificial Intelligence & Data Science) Sem – V
INFORMATION SECURITY

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 3 Hrs. / Week	ESE: 70 CIE: 30
Tutorial: --	Term work: 25 Marks
Practical: 2 Hrs. / Week	Practical : 50 Marks
Course Code: PCC-AIDS-506	Credits: 4

Course Outcomes:

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

1. Students will be able to explain fundamental concepts in information security.
2. Students will be able to apply cryptographic algorithms for information security.
3. Students will be able to analyze network security protocols and web security protocols.

Course Objectives:

1. To understand the basics of cryptography, how it has evolved, and some key encryption techniques.
2. To understand principal concepts, major issues, technologies, and basic approaches in information security.
3. To learn security policies such as authentication, integrity and confidentiality.
4. To understand major information security threats and counters measures

Unit No	Content	No. of lectures
01	Overview and Classical Encryption Techniques Overview: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines.	06
02	Data Encryption Standard and Block Ciphers Block Cipher Principles, The Data Encryption Standard (DES), A DES Example, The Strength of DES, Block Cipher Design Principles	05
03	Public Key Cryptography Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange, Recent trends in Public Key Cryptosystems, Applications of Public Key Cryptosystems.	05

04 Cryptographic Data Integrity Algorithms

08

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3

Message Authentication Code: Message Authentication Requirements, Message Authentication Functions, Message Authentication Codes and Security of MACs, MACs Based on Hash Functions: MAC, MACs

Based on Block Ciphers: DAA and CMAC

Digital Signatures: Digital Signatures, ElGamal Digital Signature Scheme, Schnorr Digital Signature Scheme, Digital Signature Standard (DSS)

05 Key Management and Distribution

06

Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure

06 Network and Internet Security: Transport-Level Security

06

Web Security Issues, Secure Sockets Layer (SSL), Transport Layer Security (TLS), HTTPS Electronic Mail Security Pretty Good Privacy (PGP), s/MIME

TEXT BOOKS:

1. Williams Stallings Cryptography and Network security pri (LPE), Seventh Edition
2. Cryptography & Network Security B.A. Forouzan McGrawHill.

REFERENCE BOOKS:

1. Handbook of Applied Cryptography - Menezes, A. J., P. C. Van Oorschot, and S. A. Vanstone
2. Cryptography and network security Atul Kahate (TMGH)

TERM WORK:

1. Minimum of 10 Experiments to be performed from the list given below.
2. Implementation can be in C/C++ Programming Language
3. Practical should include the implementation and use of the following mechanisms/Algorithms/Tools /Techniques

EXPERIMENT LIST:

1. GCD Using Euclidean algorithm/Computing Multiplicative inverses/ Prime number and modular arithmetic operations.
2. Substitution/Transposition/ Product Cipher and their Analysis
3. Single round of DES algorithm/Double DES/ Triple DES and its analysis
4. RSA Algorithm to provide Confidentiality and Authentication services or any other Public-Key Algorithm.
5. Diffie–Hellman or any other key exchange Algorithm.
6. Implementation and use of any authentication functions / algorithm.
7. Generation and use of Digital Signature for real world situation.
8. Usage of PGP security package and S/MIME features.
9. Experimenting with SSL/TLS/E-Commerce Applications and identifying their

Vulnerabilities.

10. Experimentation on identifying non-cryptographic Protocol Vulnerabilities and remedies thereon.
11. Experimenting on identifying software Vulnerabilities using various tools/techniques and their analysis.
12. Any other 4 Implementation/Demo/Experimentation based on the topics of syllabus.

T. Y. CSE (Artificial Intelligence & Data Science) Sem – V
JAVA PROGRAMMING

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 3 Hrs. /Week	ESE: -- CIE: --
Tutorial: --	Term work: 50 Marks
Practical: 4 Hrs. / Week	Practical : 50 Marks
Course Code: PW-AIDS-507	Credits: 5

Course Outcomes:

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

1. Explain different concepts of Java.
2. Design an object-oriented solution for given problem using Java.
3. Implement program using Java.

Unit No	Content	No of lectures
01	<p>Introduction</p> <p>Introduction: The Java Buzzwords, The Java Programming Environment JVM, JIT Compiler, Byte Code Concept, HotSpot. A Simple Java Program, Source File Declaration Rules, Comments, Data Types, Variables, Operators, Strings, Input and Output, Control Flow, Big Numbers, Arrays- Jagged Array.</p> <p>Objects and Classes: Object-Oriented Programming Concepts, Declaring Classes, Declaring Member Variables, Defining Methods, Constructor, Passing.</p>	07
02	<p>Interface, Inheritance and Packages</p> <p>Interfaces: Defining an Interface, Implementing an Interface, Using an Interface as a Type, Evolving Interfaces, Default Methods.</p> <p>Inheritance: Definition, Superclasses, and Subclasses, Overriding and hiding methods, Inheritance Hierarchies, Polymorphism, Super keyword, Final Classes and Methods, Abstract Classes and Methods, casting, Design Hints for Inheritance, Nested classes & Inner Classes, finalization and garbage collection.</p> <p>Packages: Class importing, creating a Package, naming a Package, Using Package Members, Managing Source and Class Files.</p>	07
03	<p>Exception and I/O Streams</p> <p>Exception: Definition, Dealing with Errors, The Classification of Exceptions, Declaring Checked Exceptions, Throw an Exception, Creating Exception Classes, Catching Exceptions, Catching Multiple Exceptions, Re-throwing and Chaining Exceptions, finally clause, Advantages of Exceptions, Tips for Using Exceptions.</p> <p>I/O Streams: Byte Stream – Input Stream, Output Stream, Data Input Stream, Data Output Stream, File Input Stream, File Output Stream, Character Streams, Buffered Stream, Scanner, Random File Access File</p>	04

04 Graphical User Interfaces using Swing and Multithreading 06

Introduction to the Swing, Swing features, Swing Top Level Containers- Creating a Frame, positioning a Frame, Displaying Information in a Panel, The Model-View-Controller Design Pattern, The JComponent Class.

Layout Management: Introduction to Layout Management, APIs for Border Layout, Flow Layout, Grid Layout

Event Handling: Basics of Event Handling, The AWT Event Hierarchy, Semantic and Low- Level Events in the AWT, Low Level Event Types

User Interface Components: Text Input, Choice Components, Menus, Dialog Boxes Setting the Look and Feel of UI, Introduction to JApplet

Multithreading: Processes and Threads, Runnable Interface and Thread Class, Thread Objects, Defining and Starting a Thread, Pausing Execution with Sleep, Interrupts, Thread States, Thread Properties, Joins, Synchronization

05 Collection and Database Programming 06

Collections: Collection Interfaces, Concrete Collections- List, Queue, Set, Map, the Collections Framework

Database Programming: The Design of JDBC, The Structured Query Language, JDBC Installation, Basic JDBC Programming Concepts, Query Execution, Scrollable and Updatable Result Sets, Metadata, Row Sets, Transactions

06 Networking and Web 06

Networking: Overview of Networking, Networking Basics, Working with URLs, creating a URL, parsing a URL, Reading Directly from a URL, connecting to a URL, reading from and Writing to a URL Connection, Sockets, reading from and Writing to a Socket, Writing the Server Side of a Socket, Datagram, Writing a Datagram Client and Server.

Java 8 Feature Introduction: Lambda Expression, Functional Interface, Default & Static Methods, Reference Constructor References, Date & Time API Changes, Stream API, Optional Class, Spliterator.

TEXT BOOKS:

1. Core Java- Volume I Fundamentals: Cay Horstmann and Gary Cornell, Pearson, Eight edition.
2. Core Java- Volume II Advanced Features: Cay Horstmann and Gary Cornell, Pearson, Eight edition.
3. Java Servlet Programming, Jason Hunter O'Reilly Publication, 2nd Edition.
4. Core-Servlet and Java Server Pages Volume – 1 Marty Hall, Larry Brown Pearson Education

REFERENCE BOOKS:

1. JAVA-The Complete Reference: Herbert Schildt, Oracle Press, Mcgraw Hill, Ninth edition.
2. JAVA™ HOW TO PROGRAM, By Deitel Paul, Deitel Harvey.10th Edition, Publisher: PHI Learning
3. Core JAVA An Integrated approach: Dr.R.Nageswara Rao, Dreamtech Press.
4. Head First Java Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra, O'Reilly Publication 3rd edition.

TERM WORK:

1. 25 marks for performance in practical and experiments as part of continuous evaluation.
2. 25 marks for Practical Test and oral / Project to be conducted at the end of semester before POE.
3. It should consist of minimum 15 experiments based on following topics. The Continuous Internal Evaluation (CIE) is based on regular practical performance and final internal practical oral examination.

LIST OF EXPERIMENTS:

1. Write a program to find out day of the given date using command line argument.
2. Write a program to implement matrix operations.
3. Write a program to develop class employee with constructor to initialize instance variables. Provide Set method and Get method for instance variables. Also provide a method to raise salary of each employee by 10%.
4. Write a program to demonstrate single inheritance by creating a superclass Room and subclass Bedroom.
5. Write a program to develop class student having instance variable rn and method getno and putno. Create class Test derived from Student having instance variable as part1, part2 and method getmarks and putmarks. Define an Interface Sport having constant variable sportwt and method putwt. Derive Class Result from Test which implements this interface having data members as total. Display the result.
6. Write a program to create an area interface. Develop two different classes that implements these interface and compute area.
7. Write a program to implement mathematical package for arithmetic, statistical and trigonometric operations.
8. Write a program to develop java package for the stack and queue classes.
9. Write a class having two integer data members. Provide facility to add, subtract, multiply and divide these numbers. If addition goes above 1000, it generates Too Long Addition exception. If subtraction is below 0, it generates Negative Answer exception. If multiplication is above 5000, it generates Too Long Multiplication exception.
10. Write a program to remove whitespaces from a text file. Name of the file is given using command line
11. Write a program to accept a file name from user and perform read, write/append operations on it
12. Take Employee information such as name, employee id, department, designation, age, city, phone from user and store it in the file using DataOutputStream and FileOutputStream and Retrive data using DataInputStream and FileInputStream and display the result.
13. Write a program to develop Swing GUI based standard calculator.
14. Write a program to demonstrate key and mouse event.
15. Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
16. Write a program for bouncing ball application using multithreading in swing GUI.
17. Write a program to demonstrate collection and generics.

T. Y. CSE (Artificial Intelligence & Data Science) Sem – V
BUSINESS COMMUNICATION

TEACHING SCHEME	EXAMINATION SCHEME
Theory: --	ESE: -- CIE: --
Tutorial: --	Term work: 25 Marks
Practical: 2 Hrs. / Week	Practical : 25 Marks
Course Code: PW-AIDS-508	Credits: 1

Pre-requisites:

1. Knowledge of functional grammar and vocabulary in English
2. Knowledge of the importance of business English in their career path
3. Knowledge of linguistic competence and understand intricacies involved in technical communication

Course Objectives:

1. Develop basic skills to deal with people in business situations
2. Increase their knowledge of key business concepts worldwide
3. Write and read basic business reports, letters, e-mails etc
4. Expand vocabulary related to general business situations
5. Develop confidence to deal with people and basic issues in the business world

Course Outcomes

1. Learn to communicate with others in practical, business-oriented situations
2. Learn to express themselves in English with greater fluency, accuracy and confidence
3. Learn to handle themselves in English in a variety of business contexts, from negotiating, to using the telephone, to making presentations, to socializing
4. Enhance the skills of listening, speaking, pronunciation skills, as well as business vocabulary
5. Acquire the communicative competencies crucial for appropriate workplace behavior

**Unit
No**

Content

01 Getting acquainted with professional culture

First day at work, Induction program, Company hierarchy, Behavior pruning

02 Vocabulary building and Reading comprehension

Reading techniques and comprehension skills, Synonyms and antonyms, One-word substitution, Prefixes and Suffixes, Idioms and phrases, Homonyms and homographs, Irregular verbs like (write, wrote, written), Situational vocabulary

03 Effective vocal Communication

04

Effective Meetings, Video Conferencing, Effective Telephonic Communication
Breaking Bad news

04 Effective written Communication

06

Business letters, Resume Writing, E-mail writing, Report writing, Minutes of meeting, Memo writing

05 Public speaking and Presentation Skills 06

Preparing and conducting presentation, Body language, Overcoming stage fear,
Best practices, Interviewing and being interviewed

06 Miscellaneous 06

Group Discussion, Handling Complains, Negotiation Skills, Business Etiquettes

TEXT BOOKS:

1. Technical Communication Ashraf Rizvi Tata McGraw Hill, 2005
2. Effective Business Communication M. V Rodriques Concept Publishing Company Pvt. Ltd. 2013.
3. English for Technical Communication K. R. Laxminarayan SCITECH 2nd Edition 2014.
4. Technical English Dr. M. Hemamalini Wiley, 2014.
5. Business English T. Thomson Heinle & Heinle 2004.\
6. Business Communication the Real World and Your Career Senguin J South-Western 1999

TERM WORK:

1. Individual Performance or Presentation to be Evaluated Continuously
2. Group Activity Performance to be Evaluated in the Batch
3. Assignments or write up (Minimum 10).

ASSIGNMENT LIST:

1. Case study of organizational hierarchy
2. Match the following on antonyms & synonyms
3. Irregular verb list (like choose, chose, chosen)
4. Word building by using prefixes suffixes (eg. ir-regular, im-possible)
5. Minutes of Meeting – writing
6. Report writing (any report)
7. Comprehension/paragraph writing
8. Business letter / resume writing / email writing
9. PPT presentation on any non-technical topic. PPT handout should be attached
10. Do's & Dont's of group discussion & Business etiquettes.

T. Y. CSE (Artificial Intelligence & Data Science) Sem – VI
MACHINE LEARNING

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 3 Hrs. /Week	ESE: 70 CIE: 30
Tutorial: --	Term work: 25 Marks
Practical: 2 Hrs. /Week	Practical: 50 Marks
Course Code: PCC-AIDS-601	Credits: 4

Prerequisite: Statistics, Probability Theory.

Course Outcomes:

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

1. Explain Machine Learning concepts.
2. Analyze the Machine Learning model.
3. Design solution using Machine Learning techniques.
4. To tackle real world problems in domain of data mining, information retrieval.

Unit No	Content	No of lectures
01	Introduction to Machine Learning Definition, Terminology, Types of Machine learning, Challenges of Machine Learning, Machine learning architecture, process, Lifecycle, Performance measures, tools and framework, Overfitting and Underfitting, The Bias-Variance Trade-off	06
02	Regression Simple regression – Cost function, parameter learning with gradient descent, learning rate, Gradient Descent for linear regression, examples, simple regression in matrix form. Multivariate Linear Regression – Multiple features, hypothesis functions, Gradient Descent for multiple variables, Feature scaling, polynomial regression	06
03	Classification Logistic Regression – Definition, Hypothesis representation, decision boundary, cost function, Gradient Descent for Logistic Regression. Multiclass Classification. Regularization - Over fitting & Under fitting, cost function, Regularized Linear Regression, Regularized Logistic Regression, Conditional probability and Naïve Bayes Classifier. Instance-based classifier – K- Nearest Neighbor Classifier, Bayesian Network, Hidden Markov Model.	07

04 Decision trees and Support Vector Machine 06

Decision trees: definition, terminology, the need, advantages, and limitations. Constructing and understanding Decision trees, common problems with Decision trees, Decision tree algorithms, random forest, examples.

Support Vector Machine: What is SVM, Kernel Trick, Cost Function, Decision Trees vs. Support Vector Machine.

05 Unsupervised learning 04

Clustering, K Means clustering, Hierarchical clustering, Association Rule mining.

06 Recommendation System & Dimensionality Reduction 06

Popularity based recommender engines, Content based recommendation engines, Classification based recommendation engine, Collaborative filtering. Dimensionality Reduction, Principal Components Analysis, Factor Analysis Multidimensional Scaling, Linear Discriminant Analysis, Isomap, Locally Linear Embedding

TEXT BOOKS:

1. Machine Learning with Python- an approach to applied ML, by Abhishek Vijayvargia, BPB publications.
2. Practical Machine Learning by Sunila Gollapudi Packt Publishing Ltd.
3. Machine Learning by Tom M. Mitchell, McGraw Hill Education; First edition

REFERENCE BOOKS:

1. Machine Learning for dummies John Paul Muller, Willey Publication
2. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013

LIST OF EXPERIMENTS:

It should consist of minimum 10 experiments based on following topics. The Continuous Internal Evaluation (CIE) is based on regular practical performance and final internal practical oral examination.

1. Study and implementation of Simple Linear Regression
2. Write a program to implement Multiple Linear Regression
3. Write a program to implement Logistic Regression.
4. Write a program to implement Multi-class Classification
5. Write a program to implement Decision Tree and KNN.
6. Write a program to implement SVM.
7. Write a program to implement Random Forest.
8. Write a program to implement K-means Clustering
9. Write a program to implement association rule mining
10. Write a simple program to identify next point of time series analysis
11. Write a program to build naïve bay's classifier for text data
12. Demonstrate simple recommendation system.

T. Y. CSE (Artificial Intelligence & Data Science) Sem – VI

DATA ENGINEERING

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 3 Hrs. /Week	ESE: 70 CIE: 30
Tutorial: 1 Hrs. /Week	Term work: 25 Marks
Practical: --	Practical: --
Course Code: PCC-AIDS-602	Credits: 4

Prerequisite: Database Management Systems.

Course Outcomes:

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

1. Explain Data Engineering Lifecycle and select suitable Data Architecture
2. Identify data sources and select suitable data storage technologies
3. Explain data Ingestion process
4. Apply Data Modeling and Data Transformations suitable for Data Analytics.

Unit No	Content	No of lectures
01	Introduction to Data Engineering Basics Data Engineering, Data Engineering Skills and Activities, Lifecycle of Data Engineering, Major Undercurrents Across the Data Engineering Lifecycle.	06
02	Data Architecture Concepts of Data Architecture, Principles of Good Data Architecture, Major Architecture Concepts, Examples and Types of Data Architecture, Choosing Technologies Across the Data Engineering Lifecycle, Team Size and Capabilities, Speed to Market, Interoperability, Location, Monolith Versus Modular, Server less Versus Servers, Undercurrents and Their Impacts on Choosing Technologies	07
03	Data Generation in Source Systems Sources of Data: Data Creation, Source Systems: Main Ideas, Source System Practical Details, Under currents and Their Impact on Source Systems, Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering Storage Abstractions.	07

04	Data Ingestion	06
	What Is Data Ingestion? Key Engineering Considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data.	
05	Data Modeling and Transformation	06
	Queries, Data Modeling, Techniques for Modeling Batch Analytical Data, Modeling Streaming Data, Transformations, Batch Transformations, Materialized Views, Federation, and Query Virtualization Streaming Transformations and Processing.	
06	Serving Data for Analytics	06
	General Considerations for Serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Machine Learning, what a Data Engineer Should Know About ML, Ways to Serve Data for Analytics and ML, Reverse ETL	

TEXT BOOKS:

1. Joe Reis, Matt Housley,” Fundamentals of Data Engineering”, O’Reilly Media, Inc

REFERENCE BOOKS:

1. Paul Crickard (2020). Data Engineering with Python. Birmingham, UK Packt Publishing Ltd.
2. Andreas Kretz. The Data Engineering Cookbook
3. Ralph Kimball The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, 3rd Edition, Wiley

TERM WORK:

1. Minimum of 08 Tutorials to be conducted on six units.

T. Y. CSE (Artificial Intelligence & Data Science) Sem – VI

BIG DATA ANALYTICS

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 4 Hrs. /Week	ESE: 70 CIE: 30
Tutorial: --	Term work: 25 Marks
Practical: 2 Hrs. /Week	Practical: 50 Marks
Course Code: PCC-AIDS-603	Credits: 5

Prerequisite: Database Management Systems.

Course Outcomes:

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

1. Analyze several key technologies used in manipulating, storing, and analyzing big data.
2. Acquire clear understanding of R & Hadoop.
3. Acquire clear understanding of Integrating R & Hadoop and Acquire clear understanding of Hadoop Streaming and its importance.
4. Manage Big Data and analyze Big Data.
5. Apply tools and techniques to analyze Big Data

Unit No	Content	No of lectures
01	Introduction To Big Data	07
	Big Data and its Importance – Four V’s of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications, Architecture Components, Massively Parallel Processing (MPP) Platforms, Unstructured Data Analytics and Reporting, Big Data and Single View of Customer/Product, Data Privacy Protection, Real-Time Adaptive Analytics and Decision Engines.	
02	Introduction To R &Hadoop	07
	Getting Ready to Use R and Hadoop, Installing R, Installing R Studio, Understanding the features of R language, Installing Hadoop, Understanding Hadoop features, Learning the HDFS and MapReduce architecture, Writing Hadoop MapReduce Programs, Introducing Hadoop MapReduce, Understanding the Hadoop MapReduce fundamentals, Writing a Hadoop MapReduce example, Learning the different ways to write Hadoop MapReduce in R, Hadoop Ecosystem, Hadoop YARN, Hbase, Hive, Pig and Pig latin, Sqoop, ZooKeeper, Flume, Oozie.	
03	Integration Of R & Hadoop	07
	Integrating R and Hadoop, Introducing RHIPE, Understanding the architecture of RHIPE, Understanding RHIPE samples, Understanding the RHIPE function reference, Introducing RHadoop, Understanding the architecture of RHadoop, Understanding RHadoop examples, Understanding the RHadoop function reference. HADOOP STREAMING WITH R Using Hadoop Streaming with R -	

Introduction, Understanding the basics of Hadoop Streaming, understanding how to run Hadoop streaming with R, understanding a MapReduce application, Exploring the Hadoop Streaming R package

04 Data Analytics with R And Hadoop 07

Understanding the data analytics project life cycle – Introduction, Identifying the problem, designing data requirement, preprocessing data, performing analytics over data, visualizing data, understanding data analytics problems, exploring web pages categorization Case Studies: Computing the frequency of stock market change, Predicting the sale price of blue book for bulldozers.

05 Spark For Big Data Analytics 07

The advent of Spark, Limitations of Hadoop, Overcoming the limitations of Hadoop, Theoretical concepts in Spark: Resilient distributed datasets, Directed acyclic graphs, SparkContext, Spark DataFrames, Actions and transformations, Spark deployment options, Spark APIs, Core components in Spark: Spark Core, Spark SQL, Spark Streaming, GraphX, MLlib, The architecture of Spark.

06 Understanding Big Data Analysis with Machine Learning 06

Introduction to machine learning, Types of machine-learning algorithms, Supervised machine learning algorithms, Unsupervised machine learning algorithm, Recommendation algorithms, Steps to generate recommendations in R, Generating recommendations with R and Hadoop.

TEXT BOOKS:

1. Big Data Analytics: Disruptive Technologies for Changing the Game: Arvind Sathi IBM Corporation, 2012
2. Big Data Analytics with R and Hadoop, Vignesh Prajapati, Packt Publishing 2013
3. Practical Big Data Analytics, Nataraj Dasgupta, Packt Publishing 2018

REFERENCE BOOKS:

1. Big Data (Black Book)
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business
3. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics
4. Hadoop: The Definitive Guide

EXPERIMENT LIST:

Minimum 12 experiments should be conducted based on above topics and covering following list. at least two experiments should be conducted on each unit in the syllabus.

1. Installation of Hadoop.
2. Building Hadoop MapReduce application for counting frequency of word/phrase in simple text file.
3. Study and demonstration of Hadoop YARN Administration command and User commands.
4. Configure Hive demonstrate following • Write and execute a Hive query • Define Hive External table • Define Partitioned Hive Table

5. Demonstrate following on Hive • Load data into Hive table from HDFS • Update row in Hive table • Delete row from a Hive Table
6. Working with operators in Pig - FOREACH, ASSERT, FILTER, GROUP, ORDERBY, DISTINCT, JOIN, LIMIT, SAMPLE, SPLIT, FLATTEN.
7. Write and execute a Pig scrip
 - Load data into a Pig relation without a schema
 - Load data into a Pig relation with a schema
 - Load data from a Hive table into a Pig relation
8. Installation of R studio and demonstration of following
 - R basic Syntax.
 - Exploring basic R Data Types
 - Drawing Pie chart, Bar Chart, Histogram, etc.
 - R array and Vector.
9. Working with R with data sets- create, read, write and R Tables- create, read, write.
10. Manipulating and processing data in R - merging datasets, sorting data, putting data into shape, managing data using matrices managing data using data frames.
11. Study of RHIPE (R and Hadoop Integrated Programming Environment)
 - Installing Hadoop.
 - Installing R.
 - Installing protocol buffers.
 - Setting up environment variables.
 - Installing rJava.
 - Installing RHIPE.
12. Identifying the frequency of all the words that are present in the provided input text files using RHIPE Environment.
13. Installation and configuration of Apache Spark on Local Machine.
14. Write an application to Read multiple text files into single RDD using Spark.
15. Implementation of Linear regression with R and Hadoop.
16. Case studies should consist of but not limited to following: Big Data Analytics in Healthcare, Big Data Analytics in Immunology: A Knowledge-Based Approach, Big Data Analytics Embedded Smart City Architecture for Performance Enhancement Through Real-Time Data Processing and Decision-Making.
17. Case Study How Data Science Helped in development COVID-19 Vaccine.

T. Y. CSE (Artificial Intelligence & Data Science) Sem – V
E-COMMERCE AND DIGITAL MARKETING (Open Elective II)

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 3 Hrs. /Week	ESE: 70 CIE: -- 30
Tutorial: --	Term work: --
Practical: --	Practical : --
Course Code: OEC-AIDS-604	Credits: 3

Course Objectives

1. To learn the fundamental concepts of Digital Image Processing
2. To study basic image processing operations.
3. To cover the basic analytical methods which are widely used in image processing.

Course Outcomes:

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

1. Identify the importance of the e-commerce and digital marketing for business success.
2. Create a digital marketing plan, starting from the SWOT analysis and defining a target group.
3. Identifying digital channels, business tools used in social networking.
4. Demonstrate the optimization of web site using business tools.

Unit No	Content	No of lectures
01	Introduction to E-commerce, frameworks & architectures The term “E-Commerce”, Business models related to E-Commerce, Technical and economic challenges Frameworks and architectures: Actors and stakeholders, Fundamental sales process, Technological elements	04
02	B2C business, B2B business B2C Business: The process model and its variants, The pricing challenge, The fulfillment challenge, The payment challenge, B2Cbusiness and CRM, B2C software systems B2B business: The process model and its variants, B2B software systems	05
03	Introduction to Digital Marketing How digital technologies transformed marketing, Definitions digital marketing and multichannel marketing- Paid, owned and earned media, the growing range of digital marketing platform, digital marketing strategy-key features of digital marketing strategy, applications of digital marketing, benefits of digital marketing, alternative digital business models, difference between e-commerce and e-business, challenges in developing and managing digital marketing strategy,	06

04 Online marketplace analysis & macro environment Introduction 08

situation analysis for digital marketing, the digital marketing environment, understanding customer journeys, online consumer behavior and implications for marketing, business models for e-commerce Online macro environment: Technological forces, economic forces, political forces, Legal forces, social forces and cultural forces

05 Digital Marketing Strategy and relationship marketing 06

Digital Marketing strategy development: how to structure digital marketing strategy, strategy implementation

Relationship marketing using digital platforms: Introduction, the challenge of customer engagement, customer lifecycle management

06 Marketing Communications 07

Marketing Communications using digital media channels: Introduction, search engine marketing, online public relations, email marketing and mobile text messaging, social media and viral marketing, offline promotion techniques. Case study: How the ministry of food processing took to social media or world food India 2017.

TEXT BOOKS:

1. Introduction to E-commerce: Combining Business & Information Technology 1st Edition, (2016) Martin Kutz. & bookboon.com
2. Digital Marketing: Strategy, Implementation and Practice, 6th Edition by Dave Chaffey, Fiona Ellis-Chadwick, Pearson Education.

REFERENCE BOOKS:

1. The Beginner's Guide to Digital Marketing (2015). Digital Marketer. Pulizzi, J.(2014) Epic Content Marketing, McGraw Hill Education.
2. "Electronic Commerce", Jeffrey F Rayport and Bharat Bhasker, Tata McGraw Hill.

T. Y. CSE (Artificial Intelligence & Data Science) Sem – V
IMAGE PROCESSING (Open Elective II)

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 3 Hrs. /Week	ESE: 70 CIE: -- 30
Tutorial: --	Term work: --
Practical: --	Practical : --
Course Code: OEC-AIDS-605	Credits: 3

Course Outcomes:

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

1. Describe the basic issues and the scope of image processing, and the roles of image processing and systems in a variety of applications.
2. Explore different techniques in image acquisition and color transformation
3. Understand how digital images are represented
4. Evaluate the mathematical principles of digital image enhancement
5. Explore and apply the concepts of Edge detection, segmentation and object recognition.

Unit No	Content	No of lectures
01	Introduction Concept of Digital Image Processing, Steps in Image Processing, Components of Image Processing System, Applications areas, Image representation, grey scale and color images.	06
02	Image Enhancement and Processing Basic Grey level transformation, Histogram Processing techniques, Color Fundamentals, color models, Pseudo color image processing.	06
03	Image Restoring and Reconstruction Noise models, Noise Reduction, Inverse filtering, MMSE filtering.	04
04	Image Compression Fundamental of Redundancies, Basic Compression Methods, Huffman coding, Arithmetic coding, LZW coding, JPEG, compression, Standard.	05
05	Image Segmentation Detection of Discontinuities, Point, Line and Edge detection, Thresholding, Region based Segmentation. compression in relation to other media compression, Mesh compression using connectivity encoding.	06

Biometric Pattern Recognition, Face Recognition. Preprocessing of Signature Patterns, Lung Disease Identification.

TEXT BOOKS:

1. Digital Image Processing R.C.Gonzalez and R.E.Woods Pearson Edition

REFERENCE BOOKS:

1. Digital Image Processing A.K.Jain PHL
2. Image processing, Analysis and Machine vision M.Sonka, V.Hlavac, and R.Boyle Thomson Asia pvt. Ltd

T. Y. CSE (Artificial Intelligence & Data Science) Sem – VI
HIGH PERFORMANCE COMPUTING

TEACHING SCHEME	EXAMINATION SCHEME
Theory: 4 Hrs. /Week	ESE: 70 CIE: 30
Tutorial: 1 Hrs. /Week	Term work: 25 Marks
Practical: --	Practical: --
Course Code: PCC-AIDS-606	Credits: 5

Course Outcomes:

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

1. Describe different parallel architectures, inter-connect networks, programming models
2. Develop an efficient parallel algorithm to solve given problem
3. Analyze and measure performance of modern parallel computing systems
4. Build the logic to parallelize the programming task

Unit No	Content	No of lectures
01	Introduction Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Scalable design principles, Architectures: N-wide superscalar architectures, Multicore architecture.	08
02	Parallel Programming Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, The Age of Parallel Processing, the Rise of GPU Computing, A Brief History of GPUs, Early GPU.	08
03	Basic Communication Operations- One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.	08

04 Analytical Models of Parallel Programs 08

Analytical Models: Sources of overhead in Parallel Programs, Performance Metrics for Parallel Systems, and the effect of Granularity on Performance, Scalability of Parallel Systems, Minimum execution time and minimum cost, optimal execution time. Dense

Matrix Algorithms: Matrix Vector Multiplication, Matrix-Matrix Multiplication.

05 Parallel Algorithms 08

Sorting and Graph Issues in Sorting on Parallel Computers, Bubble Sort and its Variants, Parallelizing Quick sort, All-Pairs Shortest Paths, Algorithm for sparse graph, Parallel Depth-First Search, Parallel Best First Search.

06 CUDA Architecture 08

CUDA Architecture, Using the CUDA Architecture, Applications of CUDA Introduction to CUDA C-Write and launch CUDA C kernels, Manage GPU memory, Manage communication and synchronization, Parallel programming in CUDA- C.

TEXT BOOKS:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Jason sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0-13-138768-3

REFERENCE BOOKS:

1. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984
2. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884
3. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann,1999, ISBN 978-1-55860-343-1
4. Rod Stephens, " Essential Algorithms", Wiley, ISBN: ISBN: 978-1-118-61210-1

TERM WORK:

1. Minimum of 08 Tutorials to be conducted on six units.

T. Y. CSE (Artificial Intelligence & Data Science) Sem – VI
INDUSTRIAL TRAINING / INTERNSHIP

TEACHING SCHEME	EXAMINATION SCHEME
Theory: NA	Mode of Evaluation: Internship Report, Presentation and Project Review.
Tutorial: NA	
Practical: Minimum 4 Weeks Duration	Term work: 25 Marks
Course Code: SI-AIDS-607	Credits: 1

Prerequisite: Completion of minimum of Five semesters, Knowledge of Basic Programming Languages, Database Software.

Course Objectives:

1. The course is designed to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes:

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

1. Have an exposure to industrial practices and to work in teams
2. Communicate effectively
3. Understand the impact of engineering solutions in a global, economic, environmental, and societal context
4. Develop the ability to engage in research and to involve in life-long learning
5. Comprehend contemporary issues
6. Engage in establishing his/her digital footprint

Duration: Minimum 4 Weeks to be completed after Semester V and before commencement of Semester VI

Details:

1. Four weeks of work at industry site.
2. Supervised by an expert at the industry.

Term Work

1. Mode of Evaluation: Internship Report, Presentation and Project Review.
2. Collect the Internship Completion Letter given by authorized industry.
3. Assess the work based on progress report (signed by industry expert).

T. Y. CSE (Artificial Intelligence & Data Science) Sem – VI

MINI PROJECTS

TEACHING SCHEME	EXAMINATION SCHEME
Theory: --	ESE: -- CIE: --
Tutorial: --	Term work: 25 Marks
Practical: 2 Hrs. /Week	Practical: 50 Marks
Course Code: PW-AIDS-608	Credits: 1

Prerequisite: Software Engineering Concepts, Object Oriented Concepts

Course Objectives:

1. To expose the students to use engineering approach to solve domain specific real time problem.
2. To use the appropriate and newer technologies while developing the project.
3. To learn the skills of team building and team work.

Course Outcomes:

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

1. Identify specific problem statement from a selected domain.
2. Analyze the problem and prepare SRS and design document.
3. Write code and carry out testing.
4. Write a report covering details of the project and give presentation on a project.

Contents:

The students should form group of 4 to 5 students and every group is supposed to choose a specific domain to do the mini project. Further the group should identify the relevant problem in the selected domain and propose the solution, which can be implemented as a mini-project using suitable technology. The mini-project work should be evaluated by a team of teachers appointed by the department. The evaluation and marking should include Continuous Internal Evaluation (CIE) and End Semester Evaluation (ESE) during which the group should give presentation and demonstration of their work done. Care should be taken to avoid out-sourcing of the work.