

Scheme of Instruction & Examination
B. E. - Artificial Intelligence and Data Science

AI&DS Semester - III

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P / D	Contact Hours / Week	CIE	SEE	
Theory Courses									
1	1BS305HS	Probability and Statistics	3	1	0	4	40	60	4
2	1PC301AD	Discrete Mathematics	3	0	0	3	40	60	3
3	1PC302AD	Database Management Systems	3	0	0	3	40	60	3
4	1PC303AD	Computer Organization and Microprocessor	3	0	0	3	40	60	3
5	1ES301EC	Switching Theory and Logic Design	3	0	0	3	40	60	3
6	1MC302HS	Essence of Indian Traditional Knowledge	2	0	0	2	40	60	0
Practical / Laboratory Courses									
7	1PC351AD	Database Management Systems Lab	0	0	2	2	40	60	1
8	1PC352AD	Python Programming Lab	0	0	2*2	4	40	60	2
9	1PC353AD	Computer Organization and Microprocessor Lab	0	0	2	2	40	60	1
10	1PW354AD	Skill Development Course- I	0	0	2	2	40	60	1
Total Credits						28	400	600	21

III SEMESTER

PROBABILITY & STATISTICS

Semester III	L	T	P	Credits
Subject code - 1BS305HS	3	1	0	4

Prerequisites: Basics of Differentiation, Integration and Trigonometric results.

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ Study the concepts of Probability and random variables➤ To provide the knowledge of discrete probability Distributions➤ To learn theoretical continuous probability distributions.➤ To provide the knowledge of correlation and regression.➤ To learn the concept of small sample tests and curve fitting	<ol style="list-style-type: none">1. To understand concepts of probability and random variables2. Apply various probability distributions to solve practical problems, to estimate unknown parameters of populations3. Find Mean, variance, moment generating function and statistical parameters of continuous probability distributions4. To perform a regression analysis and to compute and interpret the coefficient of correlation5. Evaluate t-distribution, F-distribution and chisquare distributions. Fitting of straight line, parabola and exponential curves.

UNIT I

Introduction of Probability, Conditional probability, Theorem of Total probability, Baye's Theorem and its applications, Random variables, Types of random variables, Probability mass function and Probability density function, Mathematical expectations.

UNIT II

Discrete probability distributions: Binomial and Poisson distributions, Mean, variance, moment generating function and evaluation of statistical parameters for these distributions, Moments, skewness and Kurtosis.

UNIT III

Continuous probability distributions, Uniform, Exponential and Normal distributions, Mean, variance, moment generating function and evaluation of statistical parameters for these distributions

UNIT IV

Correlation, regression and Rank correlation. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

UNIT V

t-Test for single mean, difference of means, f-test for ratio of variances, Chi-square test for goodness of fit and independence of attributes. Curve fitting by the method of least squares: fitting of straight lines, second degree parabolas and more general curves,

TEXT BOOKS

1. Higher.EngineeringMathematics by Dr.B.S. Grewal, KhannaPublicatins,43 Edition,2014.
2. Advance Engineering Mathematics by R.K.Jain and Iyengar, Fifth Edition, Narosa Puublications
3. EngineeringMathematics,P.Sivaramakrishna Das & C. Vijaya Kumar,Second Edition ,Pearson India Education Services Pvt.Ltd.

REFERENCE BOOKS

1. Fundamentals of Mathematical Statistics, S.C.Gupta & V.K.Kapoor, S.Chand Pub.
2. An Introduction to Probability Theory and its Applications by W. Feller, Vol. 1, Wiley, 1968

DISCRETE MATHEMATICS

Semester – III	L	T	P	Credits
Subject code - 1PC301AD	3	0	0	3

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none"> ➤ To understand the concepts of Logic, Rules of inference and Quantifiers ➤ To explain with examples, the basic terminology of functions, relations, and sets. ➤ To impart the knowledge on Groups, Normal subgroups, Rings and Field ➤ To relate the ideas of mathematical induction to recursion and recursively defined structures. ➤ To develop Graph Algorithms by using the concepts of Graphs and Trees 	<ol style="list-style-type: none"> 1. Apply mathematical logic to solve problems 2. Illustrate by examples the basic terminology of functions, relations, and sets and demonstrate knowledge of their associated operations. 3. Identify structures of algebraic nature and apply basic counting techniques to solve combinatorial problems. 4. Formulate problems and solve recurrence relations. 5. Apply Graph Theory in solving computer science problems

UNIT I

The Foundations: Logic and Proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalence, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Normal Forms, Introduction to Proofs, Proof Methods and Strategy.

UNIT II

Set Theory and Relations: Basic Concepts of Set Theory, Relations and Ordering, Properties of Binary Relations, equivalence, transitive closure, compatibility and partial ordering relations Hasse Diagram,

Functions: Composition of functions, Inverse Functions, Recursive Functions, Lattice and its Properties

UNIT III

Algebraic structures: Algebraic Systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism, Fields, Rings, Integral domains

Elementary Combinatorics: Basis of counting, Combinations & Permutations, with repetitions, Constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, the principles of Inclusion – Exclusion. Pigeon hole principles and its application.

UNIT IV

Discrete Probability: An Introduction to Discrete Probability, Probability Theory, Bayes' Theorem, Expected Value and Variance

Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion.

UNIT V

Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.

Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

TEXT BOOKS

1. Discrete Mathematics and its Applications, Kenneth H. Rosen, Fifth Edition. TMH
2. Elements of Discrete Mathematics- A Computer Oriented Approach- C L Liu, D P Mohapatra. Third Edition, Tata McGrawHill.
3. Discrete Mathematics for Computer Scientists & Mathematicians, J.L. Mott, A. Kandel, T.P. Baker, Second Edition, PHI .

REFERENCE BOOKS

1. Discrete Mathematical Structures Theory and Application- Malik & Sen, First Edition, Cengage Learning.
2. Discrete Mathematics with Applications, Thomas Koshy, First Edition, Elsevier

DATABASE MANAGEMENT SYSTEMS

Semester III	L	T	P	Credits
Subject code – IPC302AD	3	0	0	3

Prerequisites: Data Structure

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ To get familiar with fundamental concepts of database management which includes database design, database languages, and database-system implementation.➤ To get familiar with data storage techniques and indexing.➤ To impart knowledge in transaction Management, concurrency control techniques and recovery techniques.➤ To master the basics of SQL and construct queries using SQL.➤ To become familiar with database storage structures and access techniques	<ol style="list-style-type: none">1. Develop the knowledge of fundamental concepts of database management and Designing a database using ER modelling approach.2. Implement storage of data, indexing, and hashing.3. Apply the knowledge about transaction management, concurrency control and recovery of database systems.4. Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data5. Apply the knowledge to retrieve database from multiple table using Sql and Pl/sql

UNIT I

Introduction to Database and System Architecture: Database Systems and their Applications, Database Vs File System, View of Data, Data Models, Database Languages- DDL and DML, Transaction Management, Database users and Administrators, Database System Structure. Introduction to Database Design: ER Diagrams, Entities, Attributes and Entity sets, Relationships and Relationship set, Extended ER Features, Conceptual Design with the ER Model, Logical database Design.

UNIT II

SQL Queries and Constraints: SQL Data Definition, Types of SQL Commands, Form of Basic SQL Query, SQL Operators, Set Operators, , Aggregate Operators, NULL values ,Functions, Integrity Constraints Over Relations, Joins, Nested Queries, Introduction to Views, Destroying / Altering Tables and Views, PL/SQL Functions and Stored procedures ,Cursors, Triggers and Active Databases.

UNIT III

Relational Model: Introduction to Relational Model, Basic Structure, Database Schema, Keys, Relational Algebra and Relational Calculus. Storage and Indexing: File Organizations and

Indexing-Overview of Indexes, Types of Indexes, Index Data Structures, Tree structured Indexing, Hash based Indexing.

UNIT IV

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Reasoning about FD, Normal Forms and Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF, Properties of Decomposition

UNIT V

Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability. Concurrency Control: Lock based Protocols, Timestamp based protocols, Recovery System: Recovery and Atomicity, Log based recovery, Shadow Paging, Recovery with concurrent Transactions, Buffer Management.

TEXTBOOKS

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, III Edition, TATA McGraw Hill.
2. Data base System Concepts, Silberschatz, Korth, V Edition, McGraw Hill.
3. Introduction to Database Systems, C.J.Date Pearson Education.

REFERENCE BOOKS

1. Database Management System, ElmasriNavate, PearsonEducation.
2. Database Management System, Mathew Leon,Leo

COMPUTER ORGANIZATION AND MICROPROCESSOR

Semester III	L	T	P	Credits
Subject code – 1PC303 AD	3	0	0	3

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none"> ➤ To explore the I/O organizations in depth. ➤ To learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design. ➤ To be familiarized with the hardware components and concepts related to the memory organization. ➤ To be familiarized with the hardware components and concepts related to the input-output organization ➤ Understand the concepts and applications of Internet of Things ,Building blocks of Internet of Things and characteristics 	<ol style="list-style-type: none"> 1. Recall and apply a basic concept of block diagram of computer (CPU) with Microprocessor processor UNIT (MPU) 2. Understand the internal architecture and register organization of 8086 3. Apply knowledge and demonstrate programming proficiency using the various addressing modes and instruction sets of 8086 4. Identify and compare different methods for computer I/O mechanisms 5. Categorize memory organization and explain the function of each element of a memory hierarchy 6. Apply knowledge and demonstrate interfaces with 8086 with outside world

UNIT I

Basic Computer Organization: Functions of CPU, I/O UNITS, Memory: Instruction: Instruction Formats- One address, two addresses, zero addresses and three addresses and comparison; addressing modes with numeric examples: Program Control- Status bit conditions, conditional branch instructions, Program Interrupts: Types of Interrupts

UNIT II

8086 CPU Pin Diagram: Special functions of general purpose registers, Segment register, concept of pipelining, 8086 Flag register, Addressing modes of 8086

Pipelining: Introduction, processors, performance, hazards, super scalar operations and performance considerations

UNIT III

8086-Instruction formats: assembly Language Programs involving branch & Call instructions, sorting, evaluation of arithmetic expressions.

UNIT IV

Input-Output Organizations I/O Vs Memory Bus, Isolated Vs Memory-Mapped I/O, Asynchronous data Transfer Techniques, Asynchronous Serial transfer- Asynchronous Communication interface (8251), Modes of transfer Programmed I/O, Interrupt Initiated I/O, DMA; DMA Controller (8257), IOP-CPU-IOP Communication, Intel 8089 IOP

UNIT V

Memory Organizations: Memory hierarchy, Main Memory, RAM, ROM Chips, Memory Address Map, Memory Connection to CPU, associate memory, Cache Memory, Data Cache, Instruction cache, Miss and Hit ratio, Access time, associative, set associative, mapping, waiting into cache, Introduction to virtual memory

TEXTBOOKS

1. Computer system Architecture: Morris Mano, Third Edition,
2. Computer Organization and Architecture–William Stallings, Sixth Edition, Pearson/PHI.
3. Advanced Micro Processor and Peripherals- Hall/ A K Ray

REFERENCE BOOKS

1. Computer Organization V. Carl Hamacher, Safwat G. Zaky, Zvonko Vranesic, Zvonko G Vranesic, Fifth Edition
2. Microprocessor Architecture, Programming, Applications with 8085, Ramesh S Gaonkar, Fifth Edition, Prentice Hall, 2002

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Semester III	L	T	P	Credits
Subject code – 1MC302HS	2	0	0	0

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ To reinforce the students understanding with the pan-Indian heritage in terms of culture, traditions and knowledge.➤ To impart understanding of the importance of the roots of the traditional knowledge and types.➤ To impart basic knowledge on the evolution of the multiple languages that highlight India's diversity.➤ To know Indian Languages, Philosophies, Religion, Literature, Fine arts and Technology.➤ To explore the Ancient Science, Scientists, in Medieval and Modern India; the education system.	<ol style="list-style-type: none">1. Understand the concepts of Indian culture and Traditions and their importance.2. Distinguish the Indian languages and literature3. Learn the philosophy of ancient, medieval and modern India.4. Acquire the information about the fine arts in India5. Know the contribution of scientists of different eras, interpret the concepts and the importance to protect Intellectual property of the nation.

UNIT I

Dawn of human civilization and evolution of various cultures, Introduction to Culture: Civilization, Culture and heritage, General characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT II

Indian Languages, Culture and Literature: Indian Languages and Literature-I: the evolution and role of Sanskrit, significance of scriptures to current society -Indian philosophies, other Sanskrit literature, literature of south India. Indian Languages and Literature-II: -Northern Indian languages & literature

UNIT III

Religion and Philosophy: -Religion and Philosophy in ancient India -Religion and Philosophy in medieval India -Religious reform movements in modern India (selected movements only)

UNIT IV

Fine Arts in India (Art, Technology & Engineering): -Indian Painting, Indian handicrafts, Music: Divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India: development of science in ancient, medieval and modern India. Their relation in terms of modern scientific perspective, Protection of traditional knowledge, significance, value to economy, role of government in protection of indigenous knowledge and technology, protection of traditional knowledge bill, 2016.

UNIT V

Education System in India: Education in ancient, medieval and modern India, Aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TEXTBOOKS

1. Indian Knowledge Systems (2 Vols-Set), Kapil Kapoor and Avadhesh Kumar Singh; ISBN 10: 8124603367 / ISBN 13: 9788124603369, Published by D K Print world, Publication Date: 2007
2. Science in Samskrit, Samskrita Bharati, Published by Samskrita Bharati, New Delhi, India, 2007; ISBN 10: 8187276339 / ISBN 13: 9788187276333.
3. Traditional Knowledge System and Technology in India, Book by Basanta Kumar Mohanta and Vipin K. Singh, originally published: 2012 Publication Date: 2012; ISBN 10: 8177023101 ISBN 13: 9788177023107.
4. 1.7-Position paper, National Focus Group on Arts, Music, Dance and Theatre NCERT, March 2006, ISBN 81-7450-494-X, NCERT, New Delhi, 2010.
5. Indian Art and Culture, 4th Edition, By Nitin Singhania, ISBN: 9354601804 · 9789354601804, © 2022 | Published: December 20, 2021
6. 'Education and Examination Systems in Ancient India, written/authored/edited by S. Narain', published 2017, English-Hardcover, ISBN 9789351282518 publisher: Kalpaz Publications.
7. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, New Delhi, 1989
8. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, New Delhi, 2005

DATABASE MANAGEMENT SYSTEMS LAB

Semester III	L	T	P	Credits
Subject code – IPC351AD	0	0	2	1

Prerequisites: C Language

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ To practice various DDL, DML commands in SQL➤ To write simple and Complex queries in SQL➤ To practice various Functions, Jons &sub queries in SQL➤ To write PL/SQL using cursors and collections➤ To write PL/SQL using Stored Procedures	<ol style="list-style-type: none">1. Design and implement a database schema for a given problem2. Develop the query statements with the help of structured query language.3. Populate and query a database using SQL and PL/SQL4. Develop multi-user database application5. Design and implement E-R model for the given requirements

List of Programs:

1. Creation of database Tables (exercising the all SQL commands)
2. Simple and complex condition query creation using SQL Plus
3. Creation of database Tables using Integrity constraints and Functions
4. Simple and complex condition query creation using Joins
5. Simple and complex condition query creation using Sub queries and set operators
6. Creation of Views (exercising the all types of views)
7. Writing PL/SQL function and cursors
8. Writing PL/SQL stored procedure and triggers
9. Creation of Forms and reports for student Information, library information, Pay roll etc.
10. Case Study: Design Database for Bank
 - => Collect the information Related with Bank organization
 - => Draw E-R Diagrams for Bank
 - => Reduce E-R Diagrams to tables
 - => Normalize your Database up to 3rd Normal form
 - => Retrieve Bank information using SQL commands

PYTHON PROGRAMMING LAB

Semester III	L	T	P	Credits
Subject code – 1PC352 AD	0	0	4	2

Prerequisites: Experience with a high-level language (C/C++, Java, MATLAB)

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ To learn how to design and program using lists, tuples, and dictionaries.➤ To learn how to use indexing and slicing to access data in Python programs.➤ To learn structure and components of a Python and to read and write files.➤ To learn how to design object-oriented programs with Python classes and Exception handling techniques.➤ To learn how to design and build the GUI applications using python	<ol style="list-style-type: none">1. Develop solutions to simple computational problems using Python programs.2. Solve problems using conditionals and loops in Python.3. Develop Python programs by defining functions and calling them.4. Use Python lists, tuples and dictionaries for representing compound data.5. Develop Python programs for GUI applications

List of Programs:

1. Develop program to demonstrate different number datatypes in python
2. Develop program to understand the control structures of python
3. Develop program on String manipulation
4. Develop program to perform various operations on files
5. Develop programs to learn different types of structures (list, dictionary, tuples) in python
6. Develop programs to learn concept of functions scoping, recursion and list mutability
7. Develop program to demonstrate classes and OOP principles
8. Develop programs to understand working of exception handling and assertions
9. Develop event driven GUI programs
10. Explore different debugging methods in Python: A Case Study

TEXTBOOKS

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2nd Edition, 2017, Cengage Learning
2. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India

REFERENCE BOOKS / LINKS

1. Mark Summerfield. —Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist,,,,, 2nd edition, Updated for Python 3, Shroff/O,,Reilly Publishers, 2016
3. NPTEL Course, Programming, Data Structures and Algorithms using Python,

Link: <https://nptel.ac.in/courses/106106145>

4. NPTEL Course, The Joy of Computing using Python,

Link: <https://nptel.ac.in/courses/106106182>

5. FOSSEE, Python, Link: <https://python.fossee.in/>

COMPUTER ORGANIZATION AND MICROPROCESSOR LAB

Semester III	L	T	P	Credits
Subject code – IPC353 AD	0	0	2	1

Prerequisites: C Language

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ Provide practical hands on experience with Assembly Language Programming.➤ Familiar with the architecture and Instruction set of Intel 8086 microprocessor.➤ Familiarize the students with interfacing of various peripheral devices with 8086 microprocessors.➤ Identify a detailed s/w & h/w structure of the Microprocessor.➤ Develop the programs for microprocessor based applications.	<ol style="list-style-type: none">1. Interpret the principles of Assembly Language Programming, instruction set in developing microprocessor based applications2. Develop Applications such as:8-bit Addition, Multiplication, and Division, array operations, swapping, negative and positive numbers.3. Build interfaces of Input-output and other units4. Understand working of instruction set and addressing modes5. Analyze the function of traffic light controller.

List of Programs:

1. Tutorials with 8086 kit / MASM software tool.(Data transfer instructions)
2. Arithmetic operations
3. Addressing modes
4. Branch instructions
5. Logical instructions
6. Searching.
7. Sorting
8. Display a string of characters using 8279.
9. Interfacing seven-segment LED using 8255.
10. A case study on traffic light signal controller.

SKILL DEVELOPMENT COURSE-I

Semester III	L	T	P	Credits
Subject code – 1PW354 AD	0	0	2	1

Guidelines for Evaluation of Skill Development

1. Continuous Evaluation method is adopted for skill development courses of all semesters and 40 marks are allocated for CIE.

At the end of each module, the student is evaluated by allocating marks as given under.

Observation- 10 marks

Continuous Performance and Execution -20 marks

Viva-Voce—10marks

Average of marks obtained in all experiments is considered as the marks obtained in CIE

2. The Semester End Examination shall be conducted with an external examiner and the internal examiner for 60 marks. The external examiner shall be appointed by the Principal from the panel of examiners recommended by Controller of Evaluation and Board of Studies.

Quiz/ Skill Test/Assignment/ Mini Project– 40 marks

Viva-voce-20 marks

CISCO INTRODUCTION TO INTERNET OF THINGS (IoT)

Semester –III	L	T	P	Credits
Subject code – 1PW354AD	0	0	2	1

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ Learn how digital transformation turns information into action, creating unprecedented economic opportunity.➤ Understand how the IoT brings together operational technology and information technology systems.➤ Discover how business processes for evaluating and solving problems are being transformed.➤ Learn the security concerns that must be considered when implementing IoT solutions.➤ Practice what you learn using Cisco Packet Tracer, a network configuration simulation tool	<ol style="list-style-type: none">1. Explain the meaning and impact of Digital Transformation. •2. Apply basic programming to support IoT devices.3. Explain how data provides value to Digital Business and Society.4. Explain the benefits of automation in the digitized world.5. Explain the need for enhanced security in the digitized world and discover opportunities provided by digital transformation.

MODULE 1: Everything is Connected

Digital Transformation: Explain how digital transformation affects business, industry, and our daily lives, explain how digital transformation enables innovation, explain how networks provide the platform for Digital Business and society.

Devices that Connect to the IoT: Configure an IoT device to connect to the network, describe the exponential growth of connected IoT devices, configure devices to communicate in the IoT

MODULE 2: Everything Becomes Programmable

Apply Basic Programming to Support IoT Devices: Use Python to create programs that accept user input and read and write to external files, Describe basic programming variables and fundamentals. Apply basic programming variables and fundamentals in Blockly. Apply basic programming variables and fundamentals using Python

Prototyping Your Idea: Explain prototyping and its purpose, Describe Prototyping, Describe the various tools and materials to use to prototype.

MODULE 3: Everything Generates Data

Big Data: Explain the concept of Big Data, Describe the sources of Big Data, Explain the challenges and solutions to Big Data storage, Explain how Big Data analytics are used to support Business.

MODULE 4: Everything Can be Automated

What Can be Automated?: Explain how digitization allows business processes to embrace automation, Describe automation Explain how artificial intelligence and machine learning impact automation. Explain how intent-based networking adapts to changing business needs.

MODULE 5: Everything Needs to be Secured

Security in the Digitized World: Explain why security is important in the digitized world. Explain the need for security in the digitized world, explain how to help secure the corporate world, and explain how to secure personal data and devices.

REFERENCES

1. Introduction to IoT by CISCO Network Academy, Version 2.0, July 2018

IV SEMESTER

Scheme of Instruction & Examination
B. E. - Artificial Intelligence and Data Science

AI&DS Semester - IV									
S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P / D	Contact Hours / week	CIE	SEE	
Theory -Courses									
1	1PC404AD	Operating Systems	3	0	0	3	40	60	3
2	1PC405AD	Statistical Analytics and Computing	3	0	0	3	40	60	3
3	1PC406AD	Foundations of Artificial Intelligence	3	1	0	4	40	60	4
4	1PC407AD	Software Engineering	3	0	0	3	40	60	3
5	1HS403HS	Human Values and Professional Ethics	3	0	0	3	40	60	2
Practical / Laboratory Courses									
6	1PC455AD	Operating Systems Lab	0	0	2	2	40	60	1
7	1PC456AD	Java Programming Lab	0	0	2*2	4	40	60	2
8	1PC457AD	Statistical Analytics and Computing using Python Lab	0	0	2	2	40	60	1
9	1PW458AD	Skill Development Course - II	0	0	2	2	40	60	1
Total Credits						26	360	540	20

OPERATING SYSTEMS

Semester – IV	L	T	P	Credits
Subject code - 1PC404 AD	3	0	0	3

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none"> ➤ To learn the fundamentals of Operating Systems. ➤ To learn the mechanisms of OS to handle processes and threads and their communication. ➤ To learn the mechanisms involved in memory management in contemporary OS. ➤ To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection. ➤ To know the components and management aspects of concurrency management 	<ol style="list-style-type: none"> 1. Describe the concepts of OS structure and Process synchronization 2. Evaluate and design different process scheduling algorithms 3. Identify the rationale behind various memory management techniques along with issues and challenges of main memory and virtual memory 4. Compare different file allocation methods and decide appropriate file allocation strategies 5. Describe the mechanisms available in OS to control access to resources and provide system security.

UNIT-I

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.

UNIT-II

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling Criteria, Scheduling algorithms, multiprocessor scheduling

UNIT-III

Process Synchronization: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Peterson's Solution, classical problems of synchronization: The Bounded buffer problem, Producer\Consumer Problem, reader's & writer problem, Dining philosopher's problem. Semaphores, Event Counters, Monitors, Message Passing,

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Methods for Handling: Deadlocks: Deadlock prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT-IV

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation, fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, structure of page table, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms, Trashing

UNIT-V

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software,

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management, directory implementation, efficiency and performance.

Secondary-Storage Structure: Disk structure, Disk scheduling algorithms, Disk Management, RAID structure

TEXTBOOKS

1. Abraham Silberschatz, Peter B Galvin, Greg Gagne, Operating System Concepts Essentials, 9th Edition, Wiley Asia Student Edition, 2017.
2. William Stallings, Operating Systems: Internals and Design Principles, 5th Edition, Prentice Hall of India, 2016.
3. Andrew S. Tanenbaum (2007), Modern Operating Systems, 2nd edition, Prentice Hall of India, India.

REFERENCE BOOKS

1. Maurice Bach, Design of the Unix Operating Systems, 8th Edition, Prentice-Hall of India, 2009.
2. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly and Associates.

STATISTICAL ANALYSIS AND COMPUTING

Semester IV	L	T	P	Credits
Subject code – 1PC405 AD	3	0	0	3

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ To understand Statistical parameters for data analytics➤ To use Numpy for organizing and analyzing data➤ To use pandas for summarizing and analysis of data➤ To use of statistical methods for cleaning and preparation of data➤ To performs aggregation of data and understand analysis of time series data	<ol style="list-style-type: none">1. Understand Statistical parameters for data analytics2. Use Numpy for organizing and analyzing data3. Use pandas for summarizing and analysis of data4. Use of statistical methods for cleaning and preparation of data5. Performs aggregation of data and understands analysis of time series data

Unit I

Python Language Basics, IPython, and Jupyter Notebooks: The Python Interpreter, IPython Basics, Python Language Basics

Built-in Data Structures, Functions, and Files: Data Structures and Sequences, Functions, Files and the Operating System

Unit II

NumPy Basics: Arrays and Vectorized Computation: The NumPy ndarray: A Multidimensional Array Object, Universal Functions, Array-Oriented Programming with Arrays, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number Generation, Example: Random Walks

Unit III

PANDAS: Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics, Reading and Writing Data in Text Format, Binary Data Formats, Interacting with Web APIs, Interacting with Databases

Unit IV

Data Cleaning and Preparation: Handling Missing Data, Data Transformation, String Manipulation

Data Wrangling: Join, Combine, and Reshape: Hierarchical Indexing, Combining and Merging Datasets, Reshaping and Pivoting

Unit V

Data Aggregation and Group Operations: GroupBy Mechanics, Data Aggregation, Apply: General split-apply-combine, Pivot Tables and Cross-Tabulation

Time Series: Date and Time Data Types and Tools, Time Series Basics, Date Ranges, Frequencies, and Shifting, Periods and Period Arithmetic, Resampling and Frequency Conversion, Moving Window Functions

TEXTBOOKS

1. Wes McKinney, Python for Data Analysis- DATA WRANGLING WITH PANDAS, NUMPY, AND IPYTHON, O-Reilly, 2018
2. Fabio Nelli, Python Data Analytics, Apress, 2015

REFERENCE BOOKS

1. Peters Morgan, Data Analysis From Scratch With Python Step By Step Guide, AI Sciences
2. Andrew Park, Python for Data Analysis: A Step-By-Step Guide to Master the Basics of Data Science and Analysis in Python Using Pandas, Numpy And Ipython

FOUNDATIONS OF ARTIFICIAL INTELLIGENCE

Semester – IV	L	T	P	Credits
Subject code - 1PC406 AD	3	1	0	4

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state.➤ To introduces different knowledge representation methods in AI Programs.➤ To introduce different design techniques for Game Playing Programs.➤ To introduce the AI Agents their design, planning and learning techniques.➤ To introduce the natural language processing and expert systems	<ol style="list-style-type: none">1. Understand fundamental AI concepts and identify a range of symbolic and non symbolic AI techniques.2. Demonstrate an understanding of various searching algorithms such as adversarial search and game-playing commonly used in artificial intelligence software.3. Use different knowledge representation techniques used in AI Applications.4. Demonstrate an understanding of agent based AI architectures, Planning and logic based agents.5.Exploring Expert systems.

UNIT I

Introduction: Artificial Intelligence and its applications, Artificial Intelligence Techniques

Problem solving techniques: State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, AO* search, Constraint satisfaction problem, Agenda Driven Search, Mean-end analysis, Min- Max Search, Alpha-Beta Pruning, Iterative Deepening.

UNIT II

Knowledge representation: Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Weak and Strong filler structures.

UNIT III

Non Monotonic and Statistical Reasoning: on monotonic Logic, Default Logic, Circumscription, Bayes Theorem, Bayesian Network, Dempster Shafer Theory, Fuzzy sets, Fuzzy Logic, Defuzzification.

UNIT IV

Planning and Learning Agents: Intelligent Agents, Nature and structure of Agents, Learning Agents, Introduction to different Forms of Learning, The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

UNIT V

Introduction to Learning and Expert system: Expert systems, Expert system examples, Expert System Architectures, Rule base Expert systems, Non Monotonic Expert Systems, Decision tree base Expert Systems.

TEXTBOOKS

1. AI: A Modern Approach Stuart J. Russel, Peter Norvig Pearson Education Latest Edition, 2012
2. Artificial Intelligence Elaine Rich, Knight McGraw Hill Third Edition 2010
3. Artificial Intelligence, Saroj Kaushik Cengage Learning, First Edition 2011

REFERENCES

1. Artificial Intelligence, Partick Henry Winston Addison Wesley Latest Edition 2012
2. Artificial Intelligence George Luger Pearson Education Latest Edition 2010

SOFTWARE ENGINEERING

Semester IV	L	T	P	Credits
Subject code – 1PC407 AD	3	0	0	3

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ Describe and compare various software development methods and understand the context in which each approach might be applicable➤ To impart knowledge on various phases, methodologies and practices of software development➤ To apply the project management and analysis principles to software project development➤ To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metric➤ To apply the design & testing principles to software project development.	<ol style="list-style-type: none">1. Acquired working knowledge of alternative approaches and techniques for each phase of SDLC.2. Judge an appropriate process model(s) for software project attributes and analyze requirements for project development.3. Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting4. Concede product quality through testing techniques employing appropriate metrics by understanding the practical challenges associated with the development of a significant software system5. Apply the software engineering principles in real time project development.

UNIT I

Introduction to Software: What is software? Types of software, Characteristics of Software Attributes of good software.

Software Engineering: What is software engineering, Software engineering costs? What are the key challenges facing software engineering, Systems engineering & software Engineering, SDLC.

Software Development Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

UNIT II

Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modelling Principles, Construction Principles, Deployment.

Software Requirement Analysis and Specification: System and software requirements, Types of software requirements, Elicitation and analysis of requirements, Requirement validation, Requirement specification, Feasibility

UNIT III

Building the Analysis Model: Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling.

Design Engineering: Design Process and Quality, Design Concepts, the Design Model,

Performing User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT IV

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design.

Coding: Programming languages and development tools, Selecting languages and tools, Good programming practices, Coding Standards

UNIT V

Software Testing and Quality Assurance: Verification and validation Techniques of testing Black-box and White-box testing Inspections Levels of testing Unit testing, Integration Testing, Interface testing, System testing, Alpha and beta testing, Regression testing Design of test cases, Quality management activities: Product and process quality Standards, ISO900, Capability Maturity Model (CMM), Risk management

Debugging: Debugging Techniques, The Art of Debugging.

Current trends in Software Engineering Software Engineering for projects and products

TEXTBOOKS

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, McGraw Hill, 2009
2. Software Engineering by Ian Sommerville, 7th edition, Addison-Wesley.
3. Fundamentals of Software Engineering by Rajib Mall

REFERENCE BOOKS

1. Ali Behforooz and Frederick J. Hudson, Software Engineering Fundamentals, Oxford University Press, 1996
2. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2000

OPERATING SYSTEMS LAB

Semester – IV	L	T	P	Credits
Subject code - 1PC455 AD	0	0	2	1

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ To Learn various system calls in Linux➤ To Learn different types of CPU scheduling algorithms.➤ To Demonstrate the usage of semaphores for solving synchronization problem➤ To Understand memory management techniques and different types of fragmentation.➤ To Learn various disk scheduling algorithms	<ol style="list-style-type: none">1. Use different system calls for writing application programs2. Evaluate the performance of different types of CPU scheduling algorithms.3. Implement producer-consumer problem, reader-writers problem, Dining philosopher's problem.4. Simulate Banker's algorithm for deadlock avoidance.5. Implement paging replacement and disk scheduling techniques

List of Programs (preferred programming language is C)

Perform a case study by installing and exploring various types of operating systems on a physical or logical (virtual) machine

1. Write C programs to implement UNIX system calls and file management system calls.
2. Write C programs to demonstrate various process related concepts.
3. Write C programs to demonstrate various thread related concepts.
4. Write C programs to simulate CPU scheduling algorithms: FCFS, SJF, Round Robin
5. Write C programs to simulate Intra & Inter-Process Communication (IPC) techniques: Pipes, Messages Queues, Shared Memory.
6. Write C programs to simulate solutions to Classical Process Synchronization Problems: Dining Philosophers, Producer-Consumer, Readers-Writers
7. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
8. Write C programs to simulate Page Replacement Algorithms: FIFO, LRU
9. Write C programs to simulate implementation of Disk Scheduling Algorithms: FCFS, SSTF.
10. Shell programming: creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, and commands).

JAVA PROGRAMMING LAB

Semester – IV	L	T	P	Credits
Subject code - 1PC456 AD	0	0	4	2

Prerequisite: Programming in C

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none"> ➤ To implement various java concepts. ➤ To write java programs to solve mathematics, science and engineering problems. ➤ To identify compile time and runtime errors, syntax and logical errors ➤ To import the essentials of java class library and user defined packages. ➤ To develop skills in internet programming using applets and swings 	<ol style="list-style-type: none"> 1. To understand the use of OOPs concepts. 2. Develop Java program using packages, inheritance and interface. 3. Develop java programs to implement error handling techniques using exception handling. 4. Develop graphical user interface using AWT. 5. Demonstrate event handling mechanism

List of Programs

1. Implement the concept of classes and objects.
2. Implement Arrays to a given application.
3. Use String and String Tokenizer classes and develop a java programs.
4. Develop a java programs Using interfaces and packages.
5. Develop Java Programs using inheritance.
6. Develop Java programs using Method overloading and method overriding.
7. Develop java programs using Exception handling (using try, catch, throw, throws and finally).
8. Develop java programs using Multithreading (using Thread class and Runnable interface, synchronization).
9. Develop java programs using collections (using list, set, Map and generics).
10. CASE STUDY: Develop a program to calculate SGPA & CGPA of a student and display the progress report.

INPUT:

INPUT		
ROLL NO	NAME	HOW MANY SEMESTERS? Semester wise : Subject Code, Subject Name And Marks

OUTPUT:

Progress report of <NAME>

Roll No:

Program(BE/ME)

Branch:

College Code and Name:

Year of joining:

Semester-I Grades	Semester-II Grades	Semester-III Grades
Subject 1:	Subject 1:	Subject 1:
Subject 2:	Subject 2:	Subject 2:
Subject 3:	Subject 3:	Subject 3:
....
SGPA :	SGPA :	SGPA :
CGPA :	CGPA :	CGPA :

Note: The above experiments can be implemented using any IDE.

STATISTICAL ANALYSIS AND COMPUTING USING PYTHON LAB

Semester IV	L	T	P	Credits
Subject code -1PC457 AD	0	0	2	1

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none"> ➤ Install Numpy and Pandas ➤ Work with 1D and 2D array in Numpy ➤ Explore multi-dimensional arrays in Numpy ➤ Perform statistical analysis using Numpy ➤ Perform statistical analysis using Pandas 	<ol style="list-style-type: none"> 1. Install Numpy and Pandas 2. Work with 1D and 2D array in Numpy and process data in arrays 3. Explore multi-dimensional arrays in Numpy and perform conversions 4. Perform statistical analysis using Numpy by calculating measures of central tendency, deviation, distances and correlation 5. Perform statistical analysis using Pandas

List of Programs

1. Installing Numpy
2. Working with arrays
 - a. Create a 1D array
 - b. Create a boolean array
 - c. Extract items that satisfy a given condition from 1D array
 - d. Replace items that satisfy a condition with another value in numpy array
 - e. Replace items that satisfy a condition without affecting the original array
 - f. Reshape an array
 - g. Extract all numbers between a given range from a numpy array
3. Multiple arrays
 - a. Stack two arrays vertically
 - b. Stack two arrays horizontally
 - c. Get the common items between two python numpy arrays
 - d. Remove from one array those items that exist in another
 - e. Get the positions where elements of two arrays match
4. Multi-dimensional arrays
 - a. Convert an array of arrays into a flat 1d array
 - b. Swap two columns in a 2d numpy array
5. Statistical analysis
 - a. Compute the mean, median, standard deviation of a numpy array
 - b. Find the percentile scores of a numpy array
 - c. compute the euclidean distance between two arrays
 - d. Find the correlation between two columns of a numpy array
 - e. Probabilistic sampling in numpy
 - f. compute the moving average of a numpy array
6. Data Cleaning
 - a. Find the position of missing values in numpy array
 - b. Drop rows that contain a missing value from a numpy array
 - c. Replace all missing values with 0 in a numpy array
 - d. Drop all missing values from a numpy array

7. Data Transformation
 - a. Normalize an array so the values range exactly between 0 and 1
 - b. Compute the min-by-max for each row for a numpy array 2d
8. Pandas Basics
 - a. Installing Pandas
 - b. Import pandas and check the version
 - c. Create a series from a list, numpy array and dict
 - d. Convert the index of a series into a column of a dataframe
 - e. Combine many series to form a dataframe
9. Statistical analysis in pandas
 - a. Get the minimum, 25th percentile, median, 75th, and max of a numeric series
 - b. Get frequency counts of unique items of a series
 - c. Bin a numeric series to 10 groups of equal size
 - d. Compute the euclidean distance between two series
10. Data Preparation in pandas
 - a. Normalize all columns in a dataframe
 - b. Compute the correlation of each row with the succeeding row
 - c. Compute the autocorrelations of a numeric series

SKILL DEVELOPMENT COURSE-II

Semester IV	L	T	P	Credits
Subject code – 1PW458AD	0	0	2	1

Guidelines for Evaluation of Skill Development

1. Continuous Evaluation method is adopted for skill development courses of all semesters and 40 marks are allocated for CIE.

At the end of each module, the student is evaluated by allocating marks as given under.

Observation- 10 marks

Continuous Performance and Execution -20 marks

Viva-Voce—10marks

Average of marks obtained in all experiments is considered as the marks obtained in CIE

2. The Semester End Examination shall be conducted with an external examiner and the internal examiner for 60 marks. The external examiner shall be appointed by the Principal from the panel of examiners recommended by Controller of Evaluation and Board of Studies.

Quiz/ Skill Test/Assignment/ Mini Project– 40 marks

Viva-voce-20 marks

CISCO CCNA MODULE I

Semester – IV	L	T	P	Credits
Subject code - 1PW458AD	0	0	2	1

Course Objectives:	Course Outcomes:
<ul style="list-style-type: none">➤ Explain the advances in modern network technologies, configure IP address, passwords etc➤ Explain how network protocols enable devices to access local and remote network resources➤ Explain how routers use network layer protocols and services to enable end-to-end connectivity➤ Implement IPv4 and IPv6 addressing scheme➤ Configure a switch port to be assigned to a VLAN based on requirements.	<ol style="list-style-type: none">1. Build simple LANs, perform basic configurations for routers and switches,2. Implement IPv4 and IPv6 addressing schemes.3. Implement VLANs and trunking in a switched network4. Implement DHCPv4 to operate across multiple LANs and explain how WLANs enable network connectivity.5. Develop critical thinking and problem-solving skills using real equipment and Cisco Packet Tracer.

MODULE I:

Networking today: Network Affect our Lives, Network Components, Network topologies, Types of Networks

Basic Switch and End Device Configuration: IOS Access, Command Structure, basic device configuration, Ports and addresses, configuring IP address, protocols and models

MODULE II:

Physical Layer: Introduction to cables, Number Systems

Data Link Layer: Topologies, Data Link frame

Ethernet Switching :Ethernet Frame, MAC Address Table

MODULE III:

Network layer : IPv4 and IPv6 packet , addressing of IPv4 and IPv6

Address Resolution: MAC & IP, ARP, IPv6 Neighbour Discovery

MODULE IV:

ICMP, Transport layer : TCP & UDP

Application Layer: Web and email protocols, IP Addressing Services

MODULE V:

Network Security Fundamentals: Network Attacks, Device Security

REFERENCES

CCNA ROUTING & SWITCHING BY CISCO PRESS