III SEMESTER

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**

Course Code	Course Title						Core / Elective
1BS305HS	PROBABILITY & STATISTICS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	1	-	-	40	60	4

COURSE OBJECTIVES:

1. The objective of this course is to make the student to
2. Study the concepts of Probability and random variables
3. To provide the knowledge of discrete probability Distributions
4. To learn theoretical continuous probability distributions.
5. To provide the knowledge of correlation and regression.
6. To learn the concept of small sample tests and curve fitting

COURSE OUTCOMES: After the completion of course the students will be able to:

1. To understand concepts of probability and random variables
2. Apply various probability distributions to solve practical problems, to estimate unknown parameters of populations
3. Find Mean, variance, moment generating function and statistical parameters of continuous probability distributions
4. To perform a regression analysis and to compute and interpret the coefficient of correlation
5. Evaluate t-distribution, F-distribution and chi-square 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 Puoblications
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

Course Code	Course Title						Core / Elective
1PC301AD	DISCRETE MATHEMATICS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. The objective of this course is to make the student to
2. To understand the concepts of Logic, Rules of inference and Quantifiers
3. To explain with examples, the basic terminology of functions, relations, and sets.
4. To impart the knowledge on Groups, Normal subgroups, Rings and Field
5. To relate the ideas of mathematical induction to recursion and recursively defined structures.
6. To develop Graph Algorithms by using the concepts of Graphs and Trees

COURSE OUTCOMES:

After the completion of course the students will be able to:

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

Course Code	Course Title						Core / Elective
1PC302AD	DATABASE MANAGEMENT SYSTEMS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To get familiar with fundamental concepts of database management which includes database design, database languages, and database-system implementation.
2. To get familiar with data storage techniques and indexing.
3. To impart knowledge in transaction Management, concurrency control techniques and recovery techniques.
4. To master the basics of SQL and construct queries using SQL.
5. To become familiar with database storage structures and access techniques

COURSE OUTCOMES:

Aft er the completion of course the students will be able to:

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 data
5. 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: INF,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

Course Code	Course Title						Core / Elective
1PC303 AD	COMPUTER ORGANIZATION AND MICROPROCESSOR						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To explore the I/O organizations in depth.
2. To learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.
3. To be familiarized with the hardware components and concepts related to the memory organization.
4. To be familiarized with the hardware components and concepts related to the input-output organization
5. Understand the concepts and applications of Internet of Things, Building blocks of Internet of Things and characteristics

COURSE OUTCOMES:

After the completion of course the students will be able to:

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, ZvonkoVranesic, Zvonko G Vranesic,Fifth Edition
2. Microprocessor Architecture, Programming, Applications with 8085, Ramesh S Gaonkar, Fifth Edition, Prentice Hall,2002

Course Code	Course Title						Core / Elective
1MC302HS	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	2	-	-	-	40	60	0

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To reinforce the students understanding with the pan-Indian heritage in terms of culture, traditions and knowledge.
2. To impart understanding of the importance of the roots of the traditional knowledge and types.
3. To impart basic knowledge on the evolution of the multiple languages that highlight India's diversity.
4. To know Indian Languages, Philosophies, Religion, Literature, Fine arts and Technology.
5. To explore the Ancient Science, Scientists, in Medieval and Modern India; the education system.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the concepts of Indian culture and Traditions and their importance.
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India
5. 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

Course Code	Course Title						Core / Elective
1PC351AD	DATABASE MANAGEMENT SYSTEMS LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To practice various DDL, DML commands in SQL
2. To write simple and Complex queries in SQL
3. To practice various Functions, Joins &sub queries in SQL
4. To write PL/SQLusing cursors and collections
5. To write PL/SQL using Stored Procedures

COURSE OUTCOMES:

1. After the completion of course the students will be able to:
2. Design and implement a database schema for a given problem
3. Develop the query statements with the help of structured query language.
4. Populate and query a database using SQL and PL/SQL
5. Develop multi-user database application
6. 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

Course Code	Course Title						Core / Elective
1PC352 AD	PYTHON PROGRAMMING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	4	40	60	2

COURSE OBJECTIVES:

The objective of this course is to make the student to

1.To learn how to design and program using lists, tuples, and dictionaries.
2.To learn how to use indexing and slicing to access data in Python programs.
3.To learn structure and components of a Python and to read and write files.
4.To learn how to design object-oriented programs with Python classes and Exception handling techniques.
5.To learn how to design and build the GUI applications using python

COURSE OUTCOMES:

After the completion of course the students will be able to:

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/

Course Code	Course Title						Core / Elective
1PC353 AD	COMPUTER ORGANIZATION AND MICROPROCESSOR LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student to

1.Provide practical hands on experience with Assembly Language Programming.

2.Familiar with the architecture and Instruction set of Intel 8086 microprocessor.

3.Familiarize the students with interfacing of various peripheral devices with 8086 microprocessors.

4.Identify a detailed s/w & h/w structure of the Microprocessor.

5.Develop the programs for microprocessor based applications.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Interpret the principles of Assembly Language Programming, instruction set in developing microprocessor based applications
2. 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 units
4. Understand working of instruction set and addressing modes
5. 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

Course Code	Course Title						Core / Elective
1PW354AD	CISCO INTRODUCTION TO INTERNET OF THINGS (IoT)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

1. Learn how digital transformation turns information into action, creating unprecedented economic opportunity.
2. Understand how the IoT brings together operational technology and information technology systems.
3. Discover how business processes for evaluating and solving problems are being transformed.
4. Learn the security concerns that must be considered when implementing IoT solutions.
5. Practice what you learn using Cisco Packet Tracer, a network configuration simulation tool.

COURSE OUTCOMES:

After the completion of course the students will be able to:

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**

Course Code	Course Title						Core / Elective
1PC404 AD	OPERATING SYSTEMS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	2	40	60	3

COURSE OBJECTIVES:

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication.
3. To learn the mechanisms involved in memory management in contemporary OS.
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection.
5. To know the components and management aspects of concurrency management.

COURSE OUTCOMES:

After the completion of course the students will be able to:

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 is 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 Statetransitions, 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, Dinning 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 Replacementalgorithms, 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.

Course Code	Course Title						Core / Elective
1PC405 AD	STATISTICAL ANALYSIS AND COMPUTING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	2	40	60	3

COURSE OBJECTIVES:

1. To understand Statistical parameters for data analytics
2. To use Numpy for organizing and analyzing data
3. To use pandas for summarizing and analysis of data
4. To use of statistical methods for cleaning and preparation of data
5. To performs aggregation of data and understand analysis of time series data.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand Statistical parameters for data analytics
2. Use Numpy for organizing and analyzing data
3. Use pandas for summarizing and analysis of data
4. Use of statistical methods for cleaning and preparation of data
5. 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

Course Code	Course Title						Core / Elective
1PC406 AD	FOUNDATIONS OF ARTIFICIAL INTELLIGENCE						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	1	-	-	40	60	4

COURSE OBJECTIVES:

1. To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state.
2. To introduces different knowledge representation methods in AI Programs.
3. To introduce different design techniques for Game Playing Programs.
4. To introduce the AI Agents their design, planning and learning techniques.
5. To introduce the natural language processing and expert systems

COURSE OUTCOMES:

After the completion of course the students will be able to:

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 Edition2010
3. Artificial Intelligence, Saroj Kaushik Cengage Learning, First Edition2011

REFERENCES

1. Artificial Intelligence, Partick Henry Winston Addison Wesley Latest Edition2012
2. Artificial Intelligence George Luger Pearson Education Latest Edition2010

Course Code	Course Title						Core / Elective
1PC407 AD	SOFTWARE ENGINEERING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Describe and compare various software development methods and understand the context in which each approach might be applicable
2. To impart knowledge on various phases, methodologies and practices of software development
3. To apply the project management and analysis principles to software project development
4. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metric
5. To apply the design & testing principles to software project development.

COURSE OUTCOMES:

After the completion of course the students will be able to:

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 exerting
4. Concede product quality through testing techniques employing appropriate metrics by understanding the practical challenges associated with the development of a significant software system
5. 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. PankajJalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 200

Course Code	Course Title						Core / Elective
1PC455 AD	OPERATING SYSTEMS LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

1. To Learn various system calls in Linux
2. To Learn different types of CPU scheduling algorithms.
3. To Demonstrate the usage of semaphores for solving synchronization problem
4. To Understand memory management techniques and different types of fragmentation.
5. To Learn various disk scheduling algorithms

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Use different system calls for writing application programs
2. Evaluate the performance of different types of CPU scheduling algorithms.
3. Implement producer-consumer problem, reader-writer's 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).

Course Code	Course Title						Core / Elective
1PC456 AD	JAVA PROGRAMMING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	4	40	60	2

COURSE OBJECTIVES:

1. To implement various java concepts.
2. To write java programs to solve mathematics, science and engineering problems.
3. To identify compile time and runtime errors, syntax and logical errors
4. To import the essentials of java class library and user defined packages.
5. To develop skills in internet programming using applets and swings

COURSE OUTCOMES:

After the completion of course the students will be able to:

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 2: Subject 3: …. SGPA : CGPA :	Subject 1: Subject 2: Subject 3: …. SGPA : CGPA :	Subject 1: Subject 2: Subject 3: …. SGPA : CGPA :

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

Course Code	Course Title						Core / Elective
1PC457 AD	STATISTICAL ANALYSIS AND COMPUTING USING PYTHON LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

1. Install Numpy and Pandas
2. Work with 1D and 2D array in Numpy
3. Explore multi-dimensional arrays in Numpy
4. Perform statistical analysis using Numpy
5. Perform statistical analysis using Pandas

COURSE OUTCOMES:

After the completion of course the students will be able to:

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 od 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 suceeding 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

Course Code	Course Title						Core / Elective
1PW458AD	CISCO CCNA MODULE I						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

1. Explain the advances in modern network technologies, configure IP address, passwords etc
2. Explain how network protocols enable devices to access local and remote network resources
3. Explain how routers use network layer protocols and services to enable end-to-end connectivity
4. Implement IPv4 and IPv6 addressing scheme
5. Configure a switch port to be assigned to a VLAN based on requirements.

COURSE OUTCOMES:

After the completion of course the students will be able to:

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 network
4. 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

V SEMESTER

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

AI&DS Semester - V									
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	1PC508AD	Design and Analysis of Algorithms	3	1	0	4	40	60	4
2	1PC509AD	Data Science	3	0	0	3	40	60	3
3	1ES501CS	Digital Image Processing	3	0	0	3	40	60	3
4	1PE5(01 to 05) AD	Professional Elective – I	3	0	0	3	40	60	3
5	OE	Open Elective – I	3	0	0	3	40	60	3
6	1MC503HS	Indian Constitution	3	0	0	3	40	60	0
Practical / Laboratory Courses									
7	1PC559AD	Data Science Lab	0	0	2	2	40	60	1
8	1ES551CS	Digital Image Processing Lab	0	0	2	2	40	60	1
9	1HS553HS	Soft Skills Lab - I	0	0	2	2	40	60	1
10	1PW560AD	Skill Development Course - III	0	0	2	2	40	60	1
		Total Credits				**25**	**400**	**600**	**20**

Professional Elective – I

1	1PE501AD	Mobile Computing
2	1PE502AD	Data Mining
3	1PE503AD	Software requirements and Estimation
4	1PE504AD	Principles of Programming Languages
5	1PE505AD	Advanced Databases

Open Elective – I

1OE50XXX	**Open Elective - I**	**Offered by**
1	Disaster Mitigation	CIVIL
2	Oops using JAVA	CSE
3	Artificial Intelligence	AI&DS
4	Renewable Energy Systems	EEE
5	Basics of Electronic Communication	ECE
6	Energy Science and Engineering	MECH

Course Code	Course Title						Core / Elective
1PC508AD	DESIGN AND ANALYSIS OF ALGORITHMS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	1	-	-	40	60	4

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Analyze the asymptotic performance of algorithms and correctness proofs for algorithms
2. Demonstrate a familiarity with major algorithms and data structures
3. Apply important algorithmic design paradigms and methods of analysis
4. Familiarizing students with specific algorithms for a number of important computational problems like sorting, searching, and graphs, etc,
5. Introducing the concept of NP-complete problems and different techniques to deal with them

COURSE OUTCOMES: After the completion of course the students will be able to:

1. Understand the basic notation for analyzing the performance of the algorithms.
2. Use divide-and-conquer techniques for solving suitable problems
3. Use greedy approach to solve an appropriate problem for optimal solution.
4. Apply dynamic programming approach to solve suitable problems
5. Understand the limitations of algorithm power and study how to cope with the limitations of algorithm power for various problems

UNIT I

Introduction & Elementary Data Structures: Introduction, Fundamentals of algorithm (Line Count, Operation Count), Analysis of algorithms (Best, Average, Worst case), Asymptotic Notations (O, Ω, Θ) Recursive Algorithms, Analysis using Recurrence Relations, Master's Theorem.

Review of elementary data structures–Graphs: BFS, DFS, Articulation points, Bi-Connected Components. Sets: representation, UNION, FIND operations.

UNIT II

Divide-and-Conquer Method: The general method, Binary search, Finding maximum and minimum, Merge sort, Quick sort.

Brute Force: Knapsack, Travelling salesman problem, Convex-Hull

UNIT III

Greedy Method: Knapsack problem, Minimum spanning trees, Single source shortest path, Job sequencing with deadlines, Optimal storage on tapes, Optimal merge pattern

Dynamic programming method: All pairs shortest paths, Optimal binary search tress, 0/1 Knapsack problem, Reliability design, Travelling salesman problem,

UNIT IV

Back tracking*:* N-queens problem, Graph coloring , Hamiltonian cycles

Branch-and-bound: FIFO & LC branch and Bound methods, 0/1 Knapsack problem, Travelling sales person

UNIT V

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem, Proofs for NP Complete Problems: Clique, Vertex Cover.

TEXT BOOKS

1. Fundamentals of Computer Algorithms, Horowitz E, Sahni S, II Edition, Universities Press, 2007,
2. "Introduction to Algorithms", Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, III Edition , PHI Learning Private Limited, 2012 ,

REFERENCE BOOKS

1. Algorithm Design: Foundations, Analysis and Internet Examples, Michael T. Goodrich, Roberto Tamassia, I Edition, John Wiley & Sons,2002
2. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, II Edition, Pearson education.

Course Code	Course Title						Core / Elective
1PC509AD	DATA SCIENCE						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Learn fundamental knowledge on basics of data science and R programming
2. Learn basics of R Programming environment: R language, R- studio and R packages
3. Understand various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
4. Learn fundamentals of how to obtain, store, explore, and model data efficiently.
5. Understand the concepts of classification and clustering.

COURSE OUTCOMES: After the completion of course the students will be able to:

1. Recognize the different levels of Data Science concepts for visualization of data.
2. Demonstrate the data visualization and statistical techniques, for describing data structure property.
3. Analyze the basics of probability and statistics models for data exploration
4. Make use of Hypothesis testing for statistical analytics for destroying target based on the mission requirements.
5. Demonstrate numerous open source data science tools to solve real-world problems through industrial case studies

UNIT I

Data Science: Introduction to data science, Data Science process, Need for Data Science, Linear Algebra for data science, Linear equations, Distance, Eigen values, Eigenvectors

UNIT II

Descriptive statistics, data preparation. Exploratory Data Analysis data summarization, data distribution, measuring asymmetry. Sample and estimated mean, variance and standard score. Statistical Inference frequency approach, variability of estimates, hypothesis testing using confidence intervals, using p-values.

UNIT III

Introduction to R Programming, getting started with R: Installation of R software and using the interface, Variables and data types, R Objects, Vectors and lists, Arrays, Classes, R-Programming Structures, Operations: Arithmetic, Logical and Matrix operations, Data frames, functions, Control structures, Debugging and Simulation in R

UNIT–IV

Predictive Modeling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Logistic regression, Simulation in R.

UNIT–V

Classification: performance measures, Logistic regression implementation in R, K-Nearest neighbours (KNN), K-Nearest neighbours implementation in R, Clustering: K-Means Algorithm, K Means implementation in R. Time Series Analysis using R, Social Network Analysis, Reading data from relational databases- MySQL, Reading data from NoSQL databases- MongoDB

TEXT BOOKS

1. Practical Data Science with R, Nina Zumel, II Edition, Manning Publications, 2014.
2. Practical Statistics for Data Scientists, Peter Bruce and Andrew Bruce, II Edition, O'Reilly, 2017.
3. R for Data Science, Hadley Wickham and Garrett Grolemund ,II Edition, O'Reilly, 2017

REFERENCE BOOKS

1. R Programming for Data science, Roger D Peng, Lean Publishing, 2016.
2. Introduction to Data Science, Rafael A Irizarry, Lean Publishing,2016.
3. R Data Analysis cookbook, Vishwa Vishwanathan and Shanthi Vishwanathan 2015

Course Code	Course Title						Core / Elective
1ES501CS	DIGITAL IMAGE PROCESSING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To provide a approach towards image processing and introduction about 2D transforms
2. To expertise about enhancement methods in time and frequency domain
3. To expertise about segmentation and compression techniques
4. To understand the Morphological operations on an image

COURSE OUTCOMES:

After the completion of course the students will be able to:

1.Explore the fundamental relations between
2.pixels and utility of 2-D transforms in image
3.processer.
4.Implement the various Morphological operations on an image
5.Describe different techniques employed for the enhancement of images.
6.Understand different causes for image degradation and overview of image restoration techniques.
7.Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.

UNIT I

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.
Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT II

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering.
Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT III

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT IV

Image Segmentation: Detection of Discontinuities, Edge Linking And Boundary Detection, thresholding, Region Oriented Segmentation.
Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation.

UNIT V

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

TEXTBOOKS

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, III Edition, Pearson, 2008
2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- TMH, 2010, II Edition

REFERENCE BOOKS

1. Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools - Scotte Umbaugh, II Edition, CRC Press, 2011
2. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, II Edition, TMH, 2010.
3. Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle- Cengage Learning (Indian edition) 2008.
4. Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, II Edition, BS Publication, 2008.

Course Code	Course Title						Core / Elective
1PE501AD	MOBILE COMPUTING						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1.To make the student understand the concept of mobile computing paradigm, its novel applications and limitations.
2.To understand the typical mobile networking infrastructure through a popular GSM protocol
3.To understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer
4.To understand the database issues in mobile environments & data delivery models.
5.To understand the ad hoc networks and related concepts.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1.Develop new mobile application.
2.Understand new technical issue related to this new paradigm and come up with a solution(s).
3.Develop new adhoc network applications and/or algorithms/ protocols.
4.Understand & develop any existing or new protocol related to mobile environment

UNIT I

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.
GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

UNIT II

(Wireless) Medium Access Control (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11), 5G

Mobile Network Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.

UNIT III

Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.
Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process & QoS Issues.

UNIT IV

Data Dissemination and Synchronization: Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols

UNIT V

Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc., Mobile Agents, Service Discovery.

TEXTBOOKS

1. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition.
2. Raj Kamal, "Mobile Computing", OXFORD UNIVERSITY PRESS.
3. Asoke K Talukder, et al, "Mobile Computing", Tata McGraw Hill, 2008.

REFERENCE BOOKS

1. Dr. Sunilkumar, et al "Wireless and Mobile Networks: Concepts and Protocols", Wiley India.
2. Matthew S.Gast, "802.11 Wireless Networks", SPD O'REILLY.
3. Ivan Stojmenovic , "Handbook of Wireless Networks and Mobile Computing", Wiley, 2007. Kumkum Garg, "Mobile Computing", Pearson.
4. Handbook of Security of Networks, Yang Xiao, Frank H Li, Hui Chen, World Scientific, 2011.

Course Code	Course Title						Core / Elective
1PE502AD	DATA MINING						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1.Introduce the basic concepts of Data Warehouse and Data Mining
2.Introduce current trends in data mining
3.Identify data mining problems and implement the data warehouse
4.Write association rules for a given data pattern.
5.Choose between classification and clustering solution.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1.Understand the principles of Data Warehousing and Data Mining.
2.Implementing data warehouse architecture and its applications.
3.Organize and prepare the data needed for data mining using preprocessing techniques
4.Implement the appropriate data mining methods like classification, association and clustering on a given data set.
5.Understanding the importance of data mining application and using the most appropriate approach for the realistic strategy

UNIT I

Data Warehousing & Modeling:

Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.

Data warehouse implementation: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP

UNIT II

Introduction: What is data mining, Challenges, Data Mining Tasks, Major issues in data mining.
Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity

UNIT III

Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns. Correlation Analysis– Constraint based Association mining.

UNIT IV

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines. Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor.

UNIT V

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

TEXTBOOKS

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson, First impression,2014.
2. Data Mining -Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, III Edition, Morgan Kaufmann Publisher, 2012.

REFERENCE BOOKS

3. Data Warehousing in the Real World, Pearson, Sam Anahory, Dennis Murray, X Impression,2012.
4. Mastering Data Mining, Michael. J. Berry, Gordon. S. Linoff, Wiley Edition, II edtion,2012

Course Code	Course Title						Core / Elective
1PE503AD	SOFTWARE REQUIREMENTS AND ESTIMATION						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1.To introduce good practices for requirements engineering
2.To understand requirements elicitation and elicitation techniques
3.To learn the usage of analysis models and software quality attributes
4.To acquire knowledge on software estimation, size estimation, effort, schedule and cost estimation

COURSE OUTCOMES:

After the completion of course the students will be able to:

1.Gain knowledge about software requirements, requirements management, their principles and practices
2.Analyze requirement elicitation techniques and prototyping
3.Analyze use-case modelling and different data diagrams
4.Estimate software in terms of size, cost, effort and schedule

UNIT I

Software Requirements: What and Why: Essential Software requirement, Good practices for requirements engineering, Improving requirements processes, Software requirements and risk management.
Software Requirements Engineering: Requirements elicitation, requirements analysis documentation, review, elicitation techniques, analysis models, Software quality attributes, risk reduction through prototyping, setting requirements priorities, verifying requirements quality.

UNIT II

Software Requirements Management: Requirements management Principles and practices, Requirements attributes, Change Management Process, Requirements Traceability Matrix, Links in requirements chain
Software Requirements Modeling: Use Case Modeling, Analysis Models, Dataflow diagram, state transition diagram, class diagrams, Object analysis, Problem Frames

UNIT III

Software Estimation: Components of Software Estimations, Estimation methods, Problems associated with estimation, Key project factors that influence estimation.
Size Estimation: Two views of sizing, Function Point Analysis, Mark IIFPA, Full Function Points, LOC Estimation, Conversion between size measures.

UNIT IV

Effort, Schedule and Cost Estimation: What is Productivity? Estimation Factors, Approaches to Effort and Schedule Estimation, COCOMO II, Putnam Estimation Model, Algorithmic models, Cost Estimation

UNIT V

Tools for Requirements Management and Estimation

Requirements Management Tools: Benefits of using a requirements management tool, commercial requirements management tool, Rational Requisite pro, Caliber – RM, implementing requirements management automation.
Software Estimation Tools: Desirable features in software estimation tools, IFPUG, USC's COCOMO II, SLIM (Software Life Cycle Management) Tools.

TEXTBOOKS

1. Software Requirements and Estimation , Swapna Kishore,Rajesh Naik, I Edition, Tata Mc Graw Hill, 2001
2. Software Requirements, Karl E. Weigers, II Edition, Microsoft Press, 2003

REFERENCE BOOKS

1. Managing Software Requirements, Dean Leffingwell & Don Widrig, Pearson Education, 2003.
2. Mastering the requirements process, II Edition, Suzanne Robertson & James Robertson, Pearson Education, 2006.
3. Estimating Software Costs, II Edition, Capers Jones, TMH, 2007.
4. Practical Software Estimation, M.A. Parthasarathy, Pearson Education, 2007

Course Code	Course Title						Core / Elective
1PE504AD	PRINCIPLES OF PROGRAMMING LANGUAGES						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1.To understand the fundamental concepts of principles
2.of language design, formal syntax and semantic, BNF.
3.To understand different data types, variables, expressions, types of statements, different types of control statements and iterations.
4.To understand the concept of Sub programs and blocks, operator overloading, and co-routines.
5.To understand the concept of Abstract data types, concurrency, exception handling of different programming languages and logic programming languages
6.To understand Functional Programming Languages like FPL, LISP, ML languages

COURSE OUTCOMES:

After the completion of course the students will be able to:

1.Ability to express syntax and semantics in formal notation.
2.Ability to apply suitable programming paradigm for the application.
3.Gain Knowledge and comparison of the features programming languages
4.Program in different language paradigms and evaluate their relative benefits.
5.Identify and describe semantic issues associated with variable binding, scoping rules, parameter passing, and exception handling.

UNIT I

Preliminary Concepts: Reasons for studying, concepts of programming languages, Programming domains, Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms – Imperative, Object Oriented, functional Programming, Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments. Syntax and Semantics: general Problem of describing Syntax and Semantics, formal methods of describing syntax - BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, attribute grammars, denotation semantics and axiomatic semantics for common programming language features.

UNIT II

Data types: Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, type compatibility, named constants, variable initialization. Expressions and Statements: Arithmetic relational and Boolean expressions, Short circuit evaluation mixed mode assignment, Assignment Statements, Control Structures – Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, guarded commands

UNIT III

Software Estimation: Components of Software Estimations, Estimationmethods, Problems

Subprograms Blocks and Fundamentals of sub-programs: Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms , local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are subprogram names, design issues for functions user defined overloaded operators, co routines.

UNIT IV

Abstract Data Types: Abstractions and Encapsulation, Introduction to Data Abstraction, Design Issues, Object Oriented Programming in C++, Java,Ada 95.
Exception Handling: Exceptions, Exception Propagation, Exception Handler in Ada, C++ and Java.
Logic Programming Language: Introduction and Overview of Logic Programming, Basic Elements of Prolog, Application of Logic Programming.

UNIT V

Functional Programming Languages: Introduction, fundamentals of FPL, LISP,ML application of Functional Programming Languages and comparison of functional and imperative Languages. Key Concepts, Case Study: Python – Values and Types, Variables, Storage and Control, Bindings and Scope, Procedural Abstraction, Data Abstraction, Separate Compilation, Module Library.

TEXTBOOKS

1. Concepts of Programming Languages Robert .W. Sebesta ,VIII Edition, Pearson Education, 2008.
2. Programming Languages Design Concepts, D. A. Watt, Wiley Dreamtech, rp – 2007

REFERENCE BOOKS

1. Programming languages, A. B. Tucker, R E Noonan, II Edition, TMH
2. Programming Languages, K C Louden, II Edition, Thomson, 2003.
3. LISP Patric Henry Winston and Paul Horn Pearson Education.
4. Programming in PROLOG W F Clocksin& C S Mellish, V Edition, Springer

Course Code	Course Title						Core / Elective
1PE505AD	ADVANCED DATABASES						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1.To understand different data models that can be used for these databases.
2.To get familiarized with transaction management of the database
3.To develop in-depth knowledge about web and intelligent database.
4.To provide an introductory concept about the way in which data can be stored in geographical information systems etc

COURSE OUTCOMES:

After the completion of course the students will be able to:

1.Understand the concept of Distributed DBMS and concurrency control.
2.Acquire the knowledge on Object Oriented Databases.
3.Design web application by using markup language.
4.Understand advanced applications and active databases.
5.Understand mobile database and multimedia databases.

UNIT I

Distributed DBMS Concepts and Design – Introduction –Functions and Architecture of DDBMS – Distributed Relational Database Design – Transparency in DDBMS – Distributed Transaction Management – Concurrency control – Deadlock Management – Database recovery – The X/Open Distributed Transaction Processing Model – Replication servers – Distributed Query Optimization - Distribution and Replication in Oracle.

UNIT II

Object Oriented Databases – Introduction – Weakness of RDBMS – Object Oriented Concepts Storing Objects in Relational Databases – Next Generation Database Systems – Object Oriented Data models – OODBMS Perspectives – Persistence – Issues in OODBMS – Object Oriented Database Management System Manifesto – Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group – Object Database Standard ODMG – Object Relational DBMS –Postgres - Comparison of ORDBMS and OODBMS.

UNIT III

Web Technology And DBMS – Introduction – The Web – The Web as a Database Application Platform – Scripting languages – Common Gateway Interface – HTTP Cookies – Extending the Web Server – Java – Microsoft's Web Solution Platform – Oracle Internet Platform – Semi structured Data and XML – XML Related Technologies – XML Query Languages

UNIT IV

Enhanced Data Models For Advanced Applications – Active Database Concepts And Triggers – Temporal Database Concepts – Deductive databases – Knowledge Databases

UNIT V

Mobile Database – Geographic Information Systems – Genome Data Management – Multimedia Database – Parallel Database – Spatial Databases - Database administration – Data Warehousing and Data Mining

TEXTBOOKS

3. Database Systems - A Practical Approach to Design , Implementation , and Management", Thomas M. Connolly, Carolyn E. Begg, III Edition , Pearson Education, 2003

4. Patrick Valduriez M. TamerOzsu, Principles of Distributed Database Systems, II Edition, Prentice Hall, 1999.

REFERENCE BOOKS

1. "Fundamentals of Database Systems", Ramez Elmasri & Shamkant B.Navathe, IV Edition , Pearson Education , 2004.
2. "Principles of Distributed Database Systems", M.Tamer Ozsu , Patrick Ualduriel, II Edition, Pearso nEducation, 2003.

Course Code	Course Title						Core / Elective
1OE501AD	ARTIFICIAL INTELLIGENCE						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state.
2. To introduces different knowledge representation methods in AI Programs.
3. To introduce different design techniques for Game Playing Programs.
4. To introduce the AI Agents their design, planning and learning techniques.
5. To introduce the natural language processing and expert systems

COURSE OUTCOMES:

After the completion of course the students will be able to:

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. 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 Edition2010
3. Artificial Intelligence, Saroj Kaushik Cengage Learning, First Edition2011

REFERENCES

1. Artificial Intelligence, Partick Henry Winston Addison Wesley Latest Edition2012
2. Artificial Intelligence George Luger Pearson Education Latest Edition2010

Course Code	Course Title						Core / Elective
1PC559AD	DATA SCIENCE LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Understand the R Programming Language.
2. Understand and apply the data analytics technique for visualization
3. Understand pull data from different sources (small dataset and large datasets), clean and manipulate data
4. Understand the classification and regression model.
5. Exposure on solving of data science real world problems.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the concept of Setup R Programming Environment.
2. Develop programming logic using R-data types, R-Data Structures and R – Packages.
3. Analyze data sets using R – programming capabilities.
4. Apply various classification and regression models.
5. Apply various clustering techniques on different data sets

List of Programs

1. R AS CALCULATOR APPLICATION
    a. Using with and without R objects on console
    b. Using mathematical functions on console
    c. Write an R script, to create R objects for calculator application and save in a specified location in disk.
2. DESCRIPTIVE STATISTICS IN R
    a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.
    b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset
3. READING AND WRITING DIFFERENT TYPES OF DATASETS
    a. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.
    b. Reading Excel data sheet in R.
    c. Reading XML dataset in R

4. VISUALIZATIONS
    a. Find the data distributions using box and scatter plot.
    b. Find the outliers using plot.
    c. Plot the histogram, bar chart and pie chart on sample data
5. CORRELATION AND COVARIANCE
    a. Find the correlation matrix.
    b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
    c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data
6. REGRESSION MODEL
   Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS)
7. MULTIPLE REGRESSION MODEL
   Apply multiple regressions, if data have a continuous Independent variable. Apply on above dataset
8. REGRESSION MODEL FOR PREDICTION
   Apply regression Model techniques to predict the data on above dataset.
9. CLASSIFICATION MODEL
    a. Install relevant package for classification.
    b. Choose classifier for classification problem.
    c. Evaluate the performance of classifier.
10. CLUSTERING MODEL
    a. Clustering algorithms for unsupervised classification.
    b. Plot the cluster data using R visualizations.
11. Write R program to find all elements of a given list that are not in another given list.
12. Write a R program to show plot using the mosaicplot() function.
13. Write a R program to show plot using stripchart() and QQ Plots

Course Code	Course Title						Core / Elective
1ES551CS	DIGITAL IMAGE PROCESSING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To introduce the concepts of image processing and basic analytical methods to be used in image processing.
2. To familiarize students with image enhancement and restoration techniques,
3. To explain different image compression techniques.

4. To introduce segmentation and morphological processing techniques

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand how the images are read as grayscale and RGB
2. Understand how the images are getting converted in different forms
3. Understand the processing and implement different image filtering techniques
4. Implement Edge detection
5. Compare the different DFT, DCT and DWT techniques

List of Programs:

1. Open CV installation
2. Reading, Writing and Storing Images
3. Reading an Image as Grayscale
4. Reading Image as RGB
5. Image Conversion - Colored Images to GrayScale
6. Image Conversion - Colored Image to Binary
7. Processing – Blur – Averaging, Gaussian
8. Image Filtering - Bilateral Filter, Box Filter, Erosion
9. Thresholding – Simple, Adaptive
10. Sobel Operator
11. DFT, DCT, DWT
12. Edge Detection

Course Code	Course Title						Core / Elective
1PW560AD	SKILL DEVELOPMENT COURSE III						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Able to identify the basic components of an Android app, such as activities, layouts, and views.
2. Be able to use layouts to arrange your user interface elements in a logical and efficient way.
3. Be able to store data in the app's internal storage, or in a cloud-based storage service.
4. Able to add that feature to an existing Android app.
5. Able to deploy that app to the Google Play Store.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the basics of Android development, including the Android Studio IDE, the Android SDK, and the AndroidManifest.xml file.
2. Create an app with multiple activities that can communicate with each other using intents.
3. Create a variety of user interface elements, such as buttons, text fields, and checkboxes.
4. Use layouts to arrange their user interface elements in a logical and efficient way.
5. Understand how to store data in Android apps, using both local and remote storage options.

List of Programs:

1. **Portable Devices Overview**

1.1. Introduction to SW development for portable devices

1.2. Overview of Portable Devices

1.3. HW & SW for Portable Devices

1.4. Applications of Portable Devices

1.5. Portable devices - Understanding HW platforms

1.5.1. HW Platforms (Processors, Peripheral devices, Sensors etc)

1.5.2. HW Platforms – Mobile Phones + Wireless

1.5.3. HW Platforms – Internet of things (IoT) + Wireless
1.5.4. Example - Rasberry Pi
1.5.5. Sensors in Portable devices
1.5.6. Generic HW platforms

2. Overview of SW Platforms & Development

2.1. Mobile OS

2.1.1. Architecture and Framework of different mobile platforms
2.1.2. Development platforms and development tools
2.1.3. Programming languages
2.1.4. Simulator and emulator
2.1.5. SDK and Development Environments
2.1.6. Development Life Cycle of Application

2.2. Creating Applications and Activities

2.2.1. Introducing the Application Manifest File
2.2.2. Creating Applications and Activities
2.2.3. Architecture Patterns (MVC)
2.2.4. Review of other Architecture and Design patterns
2.2.5. The Android Application Lifecycle

3. User Interface Design; Intents and Broadcasts

3.1. Fundamental Android UI Design
3.2. Introducing Layouts
3.3. Introducing Fragments
3.4. Introducing Intents
3.5. Creating Intent Filters and Broadcast Receivers

4. Background Services and Using Internet Resources

4.1. Introducing Services
4.2. Using Background Threads
4.3. Parsing Internet Resources
4.4. Using the Download Manager
4.5. Using Internet Services
4.6. Connecting to Google App Engine
4.7. Best Practices for Downloading Data Without Draining the Battery

5. Files, Saving States and Preferences

5.1. Shared Preferences
5.2. Introducing the Preference Framework and the Preference Activity
5.3. Static Files as Resources

5.4. Working with the File System

6. **Database and Content Providers**

6.1. Introducing Android Databases

6.2. Introducing SQLite

6.3. Content Values and Cursors

6.4. Working with SQLite Databases

6.5. Creating Content Providers

6.6. Using Content Providers

6.7. Case Study: Native Android Content Providers

7. **Location Based Services, Telephony and SMS**

7.1. Using Location-Based Services

7.2. Using the Emulator with Location-Based Services

7.3. Selecting a Location Provider

7.4. Using Proximity Alerts

7.5. Using the Geocoder

7.6. Example: Map-based activity

7.7. Hardware Support for Telephony

7.8. Using Telephony

7.9. Introducing SMS and MMS

8. **Hardware Support and Devices (AUDIO, VIDEO, AND USING THE CAMERA)**

8.1. Using Sensors and the Sensor Manager

8.2. Monitoring a Device's Movement and Orientation

8.3. Introducing the Environmental Sensors

8.4. Playing Audio and Video

8.5. Using Audio Effects

8.6. Using the Camera

8.7. Recording Video

8.8. Adding Media to the Media Store

TEXTBOOKS

1. Professional Android 4 Application Development, by Reto Meier, WROX Press, Wiley Publishing

REFERENCE BOOKS

1. Android Application Development, Programming with the Google SDK, by, Rick Rogers, John Lombardo, Zigurd Mednieks, Blake Meike, SPD, Oreilly, ISBN10: 81-8404-733-9, ISBN13:978-81-8404-733-2

2. Hello Android, Introducing Google's Mobile Development Platform, 3rd Edition, by Ed Burnette, Pragmatic Programmers, LLC.ISBN-10: 1-934356-56-5, ISBN-13: 978-1-934356-56-2

Course Code	Course Title						Core / Elective
OE501CE	Disaster Mitigation						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

Upon completion of this course, students will beable to:

1. Define disaster and explain the different types ofdisasters.
2. Describe the disaster management cycle and therole of NDMA in disaster management.
3. Analyze the legal aspects of disastermanagement.
4. Develop disaster mitigation plans.
5. Participate in disaster response and recoveryactivities.

COURSE OUTCOMES:

After the completion of course the students will be able to:

After completion of the course, the student willbe able to

CO 1. Demonstrate the concepts of disastermanagement

CO 2. Identify different types of disasters

CO 3. Explain the disaster management cycle

CO 4. Illustrate the role of NDMA in disastermanagement

CO 5. Explain the development of disastermitigation plan

Unit-I:

Introduction to Disaster Management: Definition of disaster, Types of disasters, History of disaster management in India, National Disaster Management Authority (NDMA) and its role in disaster management, Disaster management cycle.Case studies of disasters in India and the world

Unit II:

Disaster Mitigation: Mitigation measures for different types of disasters, Use of technology in disaster mitigation, Disaster risk assessment, Disaster preparedness, Exercises and simulations on disaster mitigation.

Unit III:

Disaster Response: Search and rescue operations, Medical relief, Food and shelter, Restoration of essential services, Rehabilitation and reconstruction,

Unit IV:

Disaster Law and Policy: Disaster management acts of India, Disaster management policies of India, Legal aspects of disaster management

Unit V:

Disaster Communication and Public Awareness: Importance of communication in disaster management, Methods of disaster communication, Public awareness programs, Case studies of disaster communication and public awareness in India and the world

Text Books:

T1. R.Subramanian, Disaster Management, Vikas Publishing House, 2018.T2. M. M. Sulphey, Disaster Management, PHI Learning, 2016.

Reference Books:

R1. S. C. Sharma, Disaster Management: Concepts, Approaches and Techniques, Khanna Book PublishingHouse, 2017.

R2. G. K. Ghosh, Disaster Management: Theory and Practice, APH Publishing Corporation, 2018.

Course Code	Course Title						Core / Elective
3OE501CS	OOPS USING JAVA						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. The Java programming language: its syntax,idioms, patterns and styles.
2. Object oriented concepts in Java and applyfor solving the problems.
3. How exception handling and multithreadingmakes Java robust.
4. Explore java Standard API library such asio, util, applet, awt.
5. Building of applications using Applets andSwings.

COURSE OUTCOMES:

1. Understand the concept of OOP and analyze relationships among classes, objects.
2. Develop programs using concepts likeinheritance, packages, interfaces, Java I/O streams and strings
3. Utilize exception handling andMultithreading concepts to develop Javaprograms
4. Interpret the Java Collection API, Java utility classes, concept of files and serialization
5. Design GUI applications using concepts like AWT controls and Swings and client server programs using networking concepts

UNIT I

Object Oriented Programming: Principles, Benefits of Object Oriented Programming. Introduction to Java: Java buzzwords, bytecode. Java Programming Fundamentals: Applet and Application program using simple java program, data types, variables, arrays, operators, expressions, control statements, type conversion and casting, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, introducing access control, static, final, nested and inner classes, exploring string class, using command-linear arguments.

Inheritance: Inheritance concept, types of inheritance, Member access rules, use of superand final.

Polymorphism - dynamic binding, method overriding, abstract classes and methods.

UNIT II

Interfaces: Defining an interface, implementing interfaces, extending interface.

Packages: Defining, Creating and Accessing a Package, importing packages

Exception handling: Benefits of exception handling, classification, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re throwing exceptions, built in exceptions, creating own exception sub classes

Multithreading: Java Thread Model, The Main Thread, creating a Thread, creating multiple threads, using is Alive and join, thread priorities, synchronization, inter thread communication, deadlock

UNIT III

Collections: Overview of Java Collection frame work, commonly used Collection classes – Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection via iterator, working with Map. Legacy classes and interfaces – Vector, Hash table, Stack, Dictionary, Enumeration interface.

Other Utility classes: String Tokenizer, Date, Calendar, Gregorian Calendar, Scanner Java Input/Output: exploring java.io, Java I/O classes and interfaces, File, Stream classes, bytestream, character stream, serialization..

UNIT IV

GUI Programming with java: The AWT class hierarchy, MVC architecture.

Applet Revisited: Basics,architecture and skeleton, simple applet program.

Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. Handling mouse and keyboard events, Adapter classes.

Database Programming using JDBC: Introduction to JDBC, JDBC Drivers & Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.

UNIT V

Exploring Swing: JLabel, Image Icon, J Text Field, the Swing buttons, J Tab bed pane, JScroll Pane, J List, J Combo Box.

Servlet: Life cycle, using tomcat, simple servlet, servlet API, javax.servlet package, readingservlet parameters, javax.servlet. http package, handling HTTP requests and responses

TEXTBOOKS

1. Java: The Complete Reference, X Edition, Herbert Schildt, McgrawHill.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and Dale Skrien,TMH.
3.Java for Programming, P.J.Dietel X Edition, PearsonEducation

REFERENCE BOOKS

1. TheJavaProgramming Language, Ken Arnold, David Holmes, James Gosling, Prakash Goteti, III Edition, Pearson 2008
2. An Introduction to OOP, T. Budd, IIIEdition, Pearson Education.
3. Introduction to Java Programming, Y
4. Daniel Liang, X Edition, Pearson Education

Course Code	Course Title						Core/Elective
5OE501EC	**Basics of Electronic Communication**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
BEE	3	-	-	-	40	60	3

Course Objectives:

1. To provide an introduction to fundamental concepts in the understanding of communications systems.
2. To describe the network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
3. To discuss the evolution of wireless systems and current wireless technologies.

Course Outcomes: At the end of the course, the students will be able to

1. Understand the working of analog and digital communication systems.
2. Explain the OSI network model and the working of data transmission.
3. describe the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.
4. Differentiate between analog and digital modulation techniques
5. Understand the optical fiber communication link, structure, propagation and transmission properties.

UNIT – I

Introduction to Communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels.

Signal Transmission Concepts: Baseband transmission and Broadband transmission, Communication Parameters: Transmitted power, Channel bandwidth and Noise, Need for modulation **Signal Radiation and Propagation:** Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT – II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT – III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNIT-IV

Telecommunication Systems: Telephones, Telephone system, Optical Communications: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT-V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

TEXT BOOKS:

1. Louis E. Frenzel, "Principles of Electronic Communication Systems", 3rd edition, McGrawHill, 2008.
2. George Kennedy, Bernard Davis, "Electronic Communication systems", 4th edition, McGrawHill, 1999.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th edition, TMH, 2012.
2. Rappaport T.S., "Wireless communications", 2nd edition, Pearson Education, 2010.
3. Wayne Tomasi, "Advanced Electronic Communications Systems", 6th edition, PearsonEducation.

OPEN ELECTIVE –I (V SEM)

Course code	Course Title	Core/Electiveve					
		Elective					
		L	T	P/D	Credits	CIE	SEE
4OE501EE	RENEWABLE ENERGY SYSTEMS (OPEN ELECTIVE – I)	3	0	0	3	40	60

Course Objectives: The objectives of this course is to impart knowledge of

1. To understand the concepts and Importance of renewable energy sources such as solar, wind, biomass, tidal power.
2. To make the students understand the advantages and disadvantages of different renewable energy sources

Course Outcomes: At the end of the course students will be able to

1. Explain the advantages, disadvantages and applications of different conventional and non- conventional sources.
2. Acquire the knowledge of various components, principle of operation and present scenario of different conventional and non-conventional sources**..**

UNIT-I

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non- conventional energy sources - Fuel Cells - Principle of operation with special reference to H2 °2Cell - Classification and Blockdiagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells — Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT-II

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond - Application of Solar Pond - Applications of solar energy, V-I and P-V curves and the concept of MPPT.

UNIT-III

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS - Classification of WECS - Site selection considerations - Advantages and disadvantages of WECS - Wind energy collectors - Wind electric generating and control systems - Applications of Wind energy - Environmental aspects.

UNIT-IV

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation - Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

UNIT-V

Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -Thermal gasification of biomass -Biomass gasifiers.

TEXTBOOKS:

1. Rai G.D, Non-Conventional Sources of Energy, Khandala Publishers, New Delhi, 2011.
2. David M Buchla and Thomas E Kissell ,Renewable Energy Systems, 1st Edition by, Pearson India.

REFERENCES/SUGGESTEDREADING:

1. M.M.El-Wakil, Power Plant Technology, McGraw Hill, 1984.
2. John Twidell, Tony Weir, Renewable Energy R73esources, 3rd Edition, Taylor and Francis.

Course Code	Course Title						Core/Elective
6OE501ME	START- UP ENTREPRENEURSHIP						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

Students should be able to understand

1. To motivate students to take up entrepreneurship in future.
2. To learn nuances of starting an enterprise & project management.
3. To understand project formulation and choice Technology in Enterprise.
4. To understand Intellectual properties, patents, Start-ups.

COURSE OUTCOMES: After the completion of course the students will be able to:

1. Understand Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms of enterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and their sources.
3. Practice the principles of project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis.
4. Understand the concept of Intellectual Property Rights and Patents
5. Comprehend the aspects of Start-Ups.

Unit -1

Entrepreneurship: Definition, functions of Entrepreneurship, Characteristics and qualities of entrepreneurs, Entrepreneur vs. entrepreneur, need of innovation, Economic growth. Small Scale Industry in India, Linkage among small, medium and heavy industries.

Unit – II

Indian Industrial Environment: Competence, Opportunities and Challenges, Emergence of First generation entrepreneurs, women entrepreneurs. Conception and evaluation of ideas and their sources. Types of enterprises. Collaborative interaction for Technology development. Corporate Social Responsibility

Unit – III

Project formulation: Introduction, Elements of Business Plan and its salient features, Analysis of market demand, Financial and profitability analysis and Technical analysis.

Unit -IV

Intellectual Property Rights: Meaning, Nature, Classification and protection of Intellectual Property, the main forms of Intellectual Property, Concept of Patent, Patent document, Invention protection, granting of patent, Rights of a patent, Licensing, Transfer of technology.

Unit -V

Aspects of Start-Up: What is Start-Up, Start-up Policy, start-up strategy, Progress of startups in India, Principles of future organizations, start-up sectors and action plan for start-ups by Govt. of India.

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", HimalayaPublishing House,
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review",Tata McGraw-Hill Publishing Company Ltd.
3. Ajit Parulekar and Sarita D'Souza, Indian Patents Law – Legal & Business Implications,MacmillanIndia Ltd.

Reference Books:

1. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and SchusterPublication.
2. G.S. Sudha, "Organizational Behaviour".
3. Robert D.Hisrich, Michael P. Peters, "Entrepreneurship", Tata Me Graw Hill PublishingCompany Ltd., 5lh Ed.
4. G.B. Reddy, Intellectual Property Rights and the Law 5th Ed. Gogia Law Agency.

VI SEMESTER

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

AI&DS Semester - VI									
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	1PC610AD	Computer Networks	3	0	0	3	40	60	3
2	1PC611AD	Machine Learning	3	0	0	3	40	60	3
3	1PC612AD	Automata Languages and Compiler Design	3	0	0	3	40	60	3
4	1PE6(06 to 10) AD	Professional Elective – II	3	0	0	3	40	60	3
5	OE	Open Elective – II	3	0	0	3	40	60	3
6	1HS652HS	Effective Technical Communication	2	0	0	2	40	60	2
Practical / Laboratory Courses									
7	1PC661AD	Machine Learning Lab	0	0	2	2	40	60	1
8	1PC662AD	Data Visualization Lab	0	0	2*2	4	40	60	2
9	1PW663AD	Mini Project	0	0	2	2	40	60	1
		Total Credits				**26**	**360**	**540**	**21**

Professional Elective – II

1	1PE606AD	Digital Forensics
2	1PE607AD	Information Retrieval Systems
3	1PE608AD	Software Project Management
4	1PE609AD	Web Technology
5	1PE610AD	Distributed Databases

Open Elective – II

1OE60XXX	**Open Elective - II**	**Offered by**
1	Green Building Technologies	CIVIL
2	Software Engineering	CSE
3	Deep Learning	AI&DS
4	Electric Vehicle Technology	EEE
5	Fundamentals of IOT	ECE
6	3D Printing	MECH

Course Code	Course Title						Core / Elective
1PC610AD	COMPUTER NETWORKS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

1. To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture.
2. To study the principles of network protocols and internetworking
3. To understand the Network security and Internet applications.
4. To understand the performance of data link layer protocols for error and flow control.
5. To understand various routing protocols and network security.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand and explain the concept of Data Communication and networks, layered architecture and their applications
2. Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction
3. Interpret the network layer, routing protocols and analyse how to assign the IP addresses for the given network
4. Examine the Transport layer services and protocols.
5. Comprehend the functionality of application layer

UNIT I

Introduction to Data communication: Representation of data communication, flow of networks, Network Types: LAN, WAN, MAN. Network Topologies: Bus, Star, Ring, Hybrid. Line configurations. Reference Models: OSI, TCP/IP, Transmission media

Techniques for Bandwidth utilization: Multiplexing –Frequency division, time division and wave division, Asynchronous and synchronous transmission

UNIT II

Data Link Layer: Framing, Error Detection and Correction: Fundamentals, Block coding, Hamming Distance, CRC

Flow Control and Error Control Protocols: Stop and Wait, go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, HDLC

Multiple Access Protocols: ALOHA, CSMA, CSMA/CD, CSMA/CA.

UNIT III

The Network Layer in Internet: IPV4, IPV6, IP Addressing, NAT.

Internet Networking: Tunnelling, Fragmentation, Congestion Control (Leaky Bucket and Token Bucket Algorithm), and Internet control protocols: ARP, RARP and DHCP

UNIT IV

Network Layer: Switching Techniques (Circuit and Packet) concept, Network layer Services, Sub-netting concepts

Routing algorithms: Shortest Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing

UNIT V

Transport Layer: Transport Services, Elements of Transport Layer, Connection management, TCP and UDP protocols, QoS improving techniques.

Application Layer: Domain Name System, SNMP, SMTP, HTTP, Bluetooth

TEXTBOOKS

1. "Computer Networks," Andrew S Tanenbaum, V Edition, Pearson Education, 2011.
2. "Data Communication and Networking," Behrouz A. Forouzan, IV Edition, TMH, 2008.
3. "Data and Computer Communications," William Stallings, VIII Edition, PHI, 2004.

REFERENCE BOOKS

1. "Computer Networks and Internet", Douglas EComer, Pearson Education Asia, 2000.
2. "Data Communications and Computer Networks", PrakashC. Gupta, PHI learning, 2013

Course Code	Course Title						Core / Elective
1PC611AD	MACHINE LEARNING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To learn the concepts of machine learning and types of learning along with evaluation metrics.
2. To study various supervised learning algorithms.
3. To learn ensemble techniques and various unsupervised learning algorithms.
4. To explore Neural Networks and Deep learning basics.
5. To learn reinforcement learning and study applications of machine learning

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Extract features that can be used for a particular machine learning approach in various applications.
2. Compare and contrast pros and cons of various machine learning techniques and to get an insight when to applyparticular machine learning approach.
3. Understand different machine learning types along with algorithms.
4. Understand how to apply machine learning in various applications.
5. Apply ensemble techniques for improvement of classifiers

UNIT I

Introduction: Representation and Learning: Feature Vectors, Feature Spaces, Learning Problem Formulation

Types of Machine Learning Algorithms: Parametric and Non-parametric Machine Learning Algorithms, Supervised, Unsupervised, Semi-Supervised and Reinforced Learning.

UNIT II

Supervised Algorithms:

Regression: Linear Regression, Logistic Regression, Evaluation Measures: SSE, RMSE, R2.
Classification: Decision Tree, Naïve Bayes, K-Nearest Neighbors, Support Vector Machines, Overfitting, Training, Testing, and Validation Sets
Accuracy Metrics: The Confusion Matrix, precision, recall, F-Score, Receiver Operator Characteristic (ROC) Curve.

UNIT III

Feature Selection and Dimensionality Reduction
Ensemble Algorithms: Bagging, Random Forest, Boosting
Unsupervised Learning: Cluster Analysis: Similarity Measures, categories of clustering algorithms, k- means, Hierarchical, Expectation-Maximization Algorithm, Fuzzy c-means algorithm

UNIT IV

Neural Networks: Multilayer Perceptron, Activation Functions,
Training strategies: Back-propagation algorithm, Gradient Descent
Radial basis functions, Hopfield network, Recurrent Neural Networks.

UNIT V

Reinforcement Learning: overview, example: getting lost, State and Action Spaces, The Reward Function, Discounting, Action Selection, Policy, Markov decision processes Q-learning, uses of Reinforcement learning Applications of Machine Learning in various fields: Text classification, Image Classification, Speech Recognition

TEXTBOOKS

1. Machine Learning & Pattern Recognition (2014) Tom Mitchell, Machine Learning, McGraw- HillScience/ Engineering/ Math;(1997).
2. Stephen Marsland, Machine Learning: An Algorithmic Perspective, Second Edition Chapman & Hall/CRC Press

REFERENCE BOOKS

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012

Course Code	Course Title						Core / Elective
1PC612AD	AUTOMATA LANGUAGES AND COMPILER DESIGN						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Introduce the concept of formal specification of languages and different classes of formal languages
2. Discuss automata models corresponding to different levels of Chomsky hierarchy
3. Analyze and explain the behavior of push-down automata and TM.
4. To teach concepts of language translation and phases of compiler design
5. To inculcate knowledge of parser by parsing LL parser and LR parser

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Explain finite state machines for modeling and their power to recognize the languages.
2. Summarize the concept of Regular languages and context free languages.
3. Construct PDA and Turing machines for the given set of languages.
4. Build the lexical and Syntax analyser phases of compiler.
5. Model SDD's using Intermediate Representations

UNIT I

Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Finite automata with output – Moore and Mealy machines, conversion of Moore to Mealy and Mealy to Moore

UNIT II

Context Free grammars and parsing: Context free grammars, derivation, parse trees, ambiguity, Leftmost and rightmost derivation of strings and Sentential forms, Ambiguity, left recursion and left factoring in context free grammars, Minimization of context free grammars, Normal forms for context free grammars, Chomsky normal form

Pushdown Automata: Introduction to Pushdown automata, Acceptance of context free languages, Acceptance by final state and acceptance by empty state and its equivalence, Equivalence of context free grammars and pushdown automata.

UNIT III

Turing Machine: Introduction to Turing Machine, Design of Turing machines, Types of Turing machines.
Introduction to Compiling: Overview of Compilers, Phases of a Compiler.
Lexical Analysis: The Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, LEX tool.

UNIT IV

Syntax Analysis: The role of the Parser, First and Follow, Predictive Parsing
Bottom up parsing: Shift reduce parsing, LR Parsers-SLR, Canonical LR, LALR, Parser Generator(YACC).
Semantic Analysis: Syntax directed translation, S-attributed and L-attributed grammars
Intermediate code generation – abstract syntax tree, Three address code, Implementations

UNIT V

Run time storage: Storage organization, storage allocation strategies
Code optimization: Optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.
Code generation: Machine dependent code generation, Register allocation and assignment. Using DAG representation of Block.

TEXT BOOKS

1. "Introduction to Automata Theory Languages and Computation", John E Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, ,III Edition, Pearson Education, 2011.
2. "Compilers- Principles Techniques and Tool", Alfred Aho,Monica S Lam, RaviSethi, JeffreyD.Ullman,II Edition, Pearson Education India, 2013.

REFERENCE BOOKS

1. "An introduction to Formal Languages and Automata", Peter Linz, VI Edition, Jones & Bartlett, 2016
2. "Principles of Compiler Design", V.Raghavan, ,I Edition,McGrawHillEducation,2017.
3. "Theory of Computer Science – Automata Languages andComputation", Mishra and Chandrashekaran, III Edition, PHI, 2009
4. "Formal Languages and Automata Theory", K.V.N.Sunitha , N.Kalyani, I Edition, TMH, 2010
5. "Introduction to Theory of Computation", Michel Sipser, II Edition, Thomson, 2012

Course Code	Course Title						Core / Elective
1PE606AD	DIGITAL FORENSICS						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
2. To understand how to examine digital evidences such as the data acquisition, identification analysis.
3. Understand the processing crimes and incident scenes
4. Understand the latest computer forensic tools.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Apply forensic analysis tools to recover important evidence for identifying computer crime.
2. Understand computing investigation
3. Understand the perspective of data acquisition tools
4. Understand the process of digital crimes
5. Understand the latest computer forensic tools.

UNIT I

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

UNIT II

Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

UNIT III

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

UNIT IV

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

UNIT V

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations-investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

TEXTBOOKS

1. "Computer Forensics: Incident Response Essentials", Warren G. Kruse II and Jay G. Heiser, ,Addison Wesley, 2002.
2. "Guide to Computer Forensics and Investigations, Nelson, B, Phillips, A, Enfinger, F, Stuart, C., II Edition, Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

REFERENCE BOOKS

1. Computer Forensics, Computer Crime Scene Investigation, Vacca, J,II Edition, Charles River Media, 2005, ISBN: 1-58450-389

Course Code	Course Title						Core / Elective
1PE607AD	INFORMATION RETRIEVAL SYSTEMS						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To learn the different models for information storage and retrieval
2. To learn about the various retrieval utilities
3. To understand indexing and querying in information retrieval systems
4. To expose the students to the notions of structured and semi structured data
5. To learn about web search

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understands to store and retrieve textual documents using appropriate models
2. Uses the various retrieval utilities for improving search
3. Understands the indexing and compressing documents to improve space and time efficiency formulates SQL like queries for unstructured data
4. Understands issues in web search

UNIT I

Introduction, Retrieval Strategies: Vector space model, Probabilistic retrieval strategies: Simple term weights, Non binary independence model, Language Models.

UNIT II

Retrieval Utilities: Relevance feedback, Clustering, N-grams, Regression analysis, Thesauri.

UNIT III

Retrieval Utilities: Semantic networks, Parsing
Cross-Language Information Retrieval: Introduction, Crossing the language barrier.

UNIT IV

Efficiency: Inverted index, Query processing, Signature files, Duplicate document detection.

UNIT V

Integrating Structured Data and Text: A Historical progression, Information retrieval as a relational application, Semi-structured search using a relational schema
Distributed Information Retrieval: A Theoretical model of distributed retrieval, Web search.

TEXTBOOKS

1. Information Retrieval – Algorithms and Heuristics, Springer, David A. Grossman, Ophir Frieder ,II Edition (Distributed by Universities Press),

REFERENCE BOOKS

1. Information Storage and Retrieval Systems, Gerald J Kowalski, Mark T Maybury, Springer, 2000
2. Mining the Web: Discovering Knowledge from Hypertext Data, Soumen Chakrabarti, Morgan-Kaufmann Publishers, 2002
3. An Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, Cambridge University Press, Cambridge, England, 2009

Course Code	Course Title						Core / Elective
1PE608AD	SOFTWARE PROJECT MANAGEMENT						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To understand software project planning and evaluation techniques
2. To plan and manage projects at each stage of the software development life cycle(SDLC)
3. To learn about the activity planning and risk management principles
4. To acquire skills to manage various phases involved in project management and people management

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the basic project management concepts,framework and the process models
2. Apply appropriate software process model and software effort estimation techniques
3. Estimate risks involved in various project activities, staff and issues related to people management
4. Analyze checkpoints, project reporting structure, project progress and trackingmechanisms using project management principles

UNIT I

PROJECT EVALUATION AND PROJECT PLANNING

Importance of Software Project Management – Activities – Methodologies –Categorization of Software Projects – Setting objectives – Management Principles –Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning

UNIT II

PROJECT LIFE CYCLE AND EFFORT ESTIMATION

Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model

UNIT III

ACTIVITY PLANNING AND RISK MANAGEMENT

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification –Assessment – Risk Planning – Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT IV

PROJECT MANAGEMENT AND CONTROL

Framework for Management and control – Collection of data – Visualizing progress –Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking –Change control – Software Configuration Management – Managing contracts – ContractManagement

UNIT V

STAFFING IN SOFTWARE PROJECTS

Managing people – Organizational behavior – Best methods of staff selection – Motivation– The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership

TEXTBOOKS

1. Software Project Management, Bob Hughes, Mike Cotterell and Rajib Mall, V Edition Tata McGraw Hill, New Delhi, 2012
2. Effective Software Project Management, Robert K. Wysocki, Wiley Publication,2011

REFERENCE BOOKS

1. Software Project Management, Walker Royce, Addison-Wesley, 1998
2. Managing Global Software Projects, Gopalaswamy Ramesh, McGraw Hill Education (India), Fourteenth Reprint 2013

Course Code	Course Title						Core / Elective
1PE609AD	WEB TECHNOLOGY						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To understand the technologies used in Web Programming.
2. To know the importance of object-oriented aspects of Scripting.
3. To understand creating database connectivity using JDBC.
4. To learn the concepts of web-based application using sockets.

COURSE OUTCOMES:

After the completion of course the students will be able to:

. Apply the concepts of PHP in creating web pages and connecting to database (My sql)

2. Apply the concepts of XML for structuring the web pages.

3. Make use of Servlets to create dynamic web pages in client-server architecture.

4. Make use of JSP to develop interactive web pages.

5. Apply the techniques of Java script in client side scripting

UNIT I

HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets.
Client-side Scripting: Introduction to Javascript, Javascript language – declaring variables, scope of variables, functions. Event handlers (onclick, onsubmit etc.), Document Object Model, Form validation.

UNIT II

XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.

UNIT III

Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls like text boxes, radio buttons, lists etc.,
Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.

UNIT IV

Introduction to Servlets: Common Gateway Interface (CGt), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

UNIT V

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP

TEXT BOOKS

1. Internet and World Wide Web: How to Program, Harvey Deitel, Abbey Deitel, V Edition.
2. Java - The Complete Reference, Herbert Schildt, VII Edition. Tata McGraw- Hill Edition.
3. XML Unleashed, Michael Morrison, Tech media SAMS.

REFERENCE BOOKS

1. Javascript - A Beginners Guide, John Pollock,III Edition – Tata McGraw-Hill Edition.
2. Gateway to Java Programmer Sun Certification, Keyur Shah,Tata McGraw Hill, 2002.

Course Code	Course Title						Core / Elective
1PE610AD	DISTRIBUTED DATABASES						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To introduce data base system and need of distributed database technology.
2. To acquire the knowledge on Database design and query processing.
3. To learn Distributed Concurrency control mechanism and algorithms.
4. To understand the concept of Distributed Database reliability and Distributed Object Database Management

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. . Able to identify various design issues and architectural models.
2. Able to analyse the query to process the data.
3. Able to understand the concurrency control algorithms.
4. Able to understand the reliability protocols of distributed database.
5. Able to improve application programmer productivity

UNIT I

Distributed Data Processing, Distributed Database Systems, Promises of DDBSs, Distributed Database Design, Distributed Directory Management, Distributed Query Processing, Distributed Concurrency Control, Distributed Deadlock Management, ANSI/SPARC Architecture, A Generic Centralized DBMS Architecture , Architectural Models for Distributed DBMSs

UNIT II

Distributed Database Design, Distribution Design Issues, Fragmentation, Allocation, Data Directory, Data and Access Control, Query Processing, Objectives of Query Processing, Characterization of Query Processors, Layers of Query Processing, Query Decomposition.

UNIT III

Transaction Management, Properties, Types of Transactions, Distributed Concurrency Control, Taxonomy of Concurrency Control Mechanisms, Locking-Based Concurrency Control Algorithms, Timestamp-Based Concurrency Control Algorithms, Optimistic Concurrency Control Algorithms

UNIT IV

Distributed DBMS Reliability, Reliability Concepts and Measures, Failures in Distributed DBMS, Local Reliability Protocols, Distributed Reliability Protocols, Network Partitioning.

UNIT V

Distributed Object Database Management, Fundamental Object Concepts and Object Models, Object Distribution Design, Architectural Issues, Object Management, Object Query Processing.

TEXT BOOKS

1. Principles of Distributed Database Systems, M. Tamer OZSU and Patrick Valduriez, Springer III Edition. 2010.
2. Distributed Databases, Stefano Ceri and Giuseppe Pelagatti, McGraw Hill.

REFERENCE BOOKS

1. Database system concepts', Abraham Silberschatz, Henry Korth, S, Sudarshan, VI Edition ,McGraw Hill International

Course Code	Course Title						Core / Elective
1OE602AD	DEEP LEARNING						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Develop and Train Deep Neural Networks.
2. Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition
3. Build and train RNNs, work with NLP and Word Embedding
4. The internal structure of LSTM and GRU and the differences between them

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. . Feature Extraction from Image and Video Data
2. Implement Image Segmentation and Instance Segmentation in Images
3. Implement image recognition and image classification using a pertained network (Transfer Learning)
4. Traffic Information analysis using Twitter Data
5. Auto encoder for Classification & Feature Extraction

UNIT I

Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modelling. Early Neural Networks. How Deep Learning different from Machine Learning. Scalars. Vectors. Matrixes, Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data. Video Data.

UNIT II

About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Overfitting and Under fitting. Hyper parameters.

UNIT III

About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. Backpropagation Through the Convolutional Layer. Filters and Feature Maps. Backpropagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions.Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, Microsoft ResNet Model. RCNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO

UNIT IV

About NLP & its Toolkits. Language Modeling . Vector Space Model (VSM). Continuous Bag of Words (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Cooccurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe. Backpropagation Through Time. Bidirectional RNNs (BRNN) . Long Short Term Memory (LSTM). Bi-directional LSTM. Sequence-to-Sequence Models (Seq2Seq). Gated recurrent unit GRU.

UNIT V

About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy GradientMethods. Actor-Critic Algorithm. About Autoencoding. Convolutional Auto Encoding. Variational

TEXT BOOKS

1. Deep Learning A Practitioner's Approach Josh Patterson and Adam Gibson O'Reilly Media, Inc.2017
2. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
3. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

REFERENCE BOOKS

1. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017
2. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017

Course Code	Course Title						Core / Elective
1PC661AD	MACHINE LEARNING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

1. Demonstration of different classifiers on different data.
2. Demonstrate ensembling of classifiers for solving real world problems.
3. Make use of real world data to implement machine learning models

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Apply machine learning algorithms: dataset preparation, model selection, model building etc.
2. Evaluate various Machine Learning approaches.
3. Use scikit-learn, Keras and Tensorflow to apply ML techniques.
4. Design and develop solutions to real world problems using ML techniques.
5. Apply unsupervised learning and interpret the results

List of Programs

1. Installation of python environment/Anaconda IDE for machine learning: installingpython modules/Packages like scikit-learn, Keras and Tensorflow etc.
2. Programs involving pandas, Numpy and Scipy libraries.
3. Build models using linear regression and logistic regression
4. Build Models using Decision tree
5. Build Models using K nearest neighbour
6. Build Models using Naïve bayes
7. Build Models using Support vector machine
8. Demonstrate Clustering using k-means and Interpret the clusters obtained.
9. Demonstrate Clustering using Hierarchical algorithms (agglomerativeand divisive) and Interpret the clusters obtained.
10. Demonstrate ensemble techniques like boosting, bagging and random forest
11. Build a classifier, compare its performance with an ensemble technique like random forest.
12. Evaluate various classification algorithms performance on a dataset using various measures like TruePositive rate, False positive rate, precision, recall etc
13. Case study on supervised/unsupervised learning algorithm using Weka tool

Course Code	Course Title						Core / Elective
1PC662AD	DATA VISUALIZATION LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2*2	40	60	2

COURSE OBJECTIVES:

1. Learn the basics of data visualization and Tableau Desktop.
2. To Create common visualizations such as bar charts, line charts, and pie charts.
3. Create simple calculations in Tableau.
4. Add interactivity to your visualizations with text and visual tooltips.
5. Create more advanced chart types such as maps, scatter plots, and treemaps

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the basics of data visualization and the best practices for creating effective visualizations.
2. Be able to connect to data sources and create basic visualizations in Tableau Desktop.
3. Be able to create more advanced visualizations and dashboards using table calculations, filters, and actions.
4. Be able to tell data stories using Tableau by creating interactive visualizations and dashboards that communicate insights to an audience.
5. Be familiar with the Tableau ecosystem and be able to find further learning opportunities

Module-1: Introduction to Tableau

- Dataviz best practices
- Getting started with Tableau Desktop
- Connecting to the tutorial dataset
- Creating the first charts
- Filtering and sorting data

Module--2: Common charts

- Creating common visualizations (bar charts, line charts etc.)
- Assembling a dashboard layout
- Using dashboard filters

Module--3: Transform the data

- Dataviz best practices
- Creating simple calculations in Tableau
- Using table calculations

Module--4: Interactions

- Interactivity with text and visual tooltips
- Interactivity with actions (filter, highlight, URL)
- Drilldown between dashboards

Module--5: Advanced visualizations

- Dataviz best practices
- Creating more advanced chart types

- Using multiple source tables

Module--6: Data Storytelling

- Intro to data storytelling
- Creating a data story in Tableau
- Overview of the Tableau ecosystem
- Further learning opportunities

System Requirements:

• System requirements are listed here under Tableau Desktop and Tableau Prep: https://www.tableau.com/products/techspecs
• The latest version of Tableau Desktop as well as Tableau Prep should be downloaded and installed from here: https://www.tableau.com/tft/activation

TEXTBOOK

1. Visualization Analysis & Design by Tamara Munzner (2014) (ISBN 9781466508910)

REFERENCES BOOKS

1. Interactive Data Visualization for the Web by Scott Murray II Edition (2017)
2. D3.js in Action by Elijah Meeks II Edition (2017)
3. Semiology of Graphics by Jacques Bertin (2010)
4. The Grammar of Graphics by Leland Wilkinson
5. ggplot2 Elegant Graphics for Data Analysis by Hadley Wickham

Course Code	Course Title						Core / Elective
1PW663AD	MINI PROJECT						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	-	-	-	2	40	60	1

COURSE OBJECTIVES:

1. To enhance practical and professional skills.
2. To familiarize tools and techniques of systematic literature survey and documentation
3. To expose students to industry practices and teamwork
4. To encourage students to work with innovative and entrepreneurial data

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Demonstrate the ability to synthesize and apply knowledge and skills acquired in the academic program to real world problems
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management
4. 4. Develop and test the solution

Guidelines for Mini Project

1. The mini-project is a team activity having maximum of 3 students in a team. This is software based design work.

2. The mini project may be a combination of hardware and software

3. Mini Project should cater to a small system required in laboratory or real life.

4 After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.

6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.

7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.

8.Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.

Course Code	Course Title						Core / Elective
1OE602AD	DEEP LEARNING						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Develop and Train Deep Neural Networks.
2. Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition
3. Build and train RNNs, work with NLP and Word Embeddings
4. The internal structure of LSTM and GRU and the differences between them

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. . Feature Extraction from Image and Video Data
2. Implement Image Segmentation and Instance Segmentation in Images
3. Implement image recognition and image classification using a pretrained network (Transfer Learning)
4. Traffic Information analysis using Twitter Data
5. Auto encoder for Classification & Feature Extraction

UNIT I

Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modelling. EarlyNeural Networks. How Deep Learning different from Machine Learning. Scalars. Vectors. Matrixes,Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data.Video Data.

UNIT II

About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. LossFunctions. Data Pre-processing for neural networks, Feature Engineering. Overfitting andUnderfitting. Hyperparameters.

UNIT III

About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutional neuralnetwork. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. BackpropagationThrough the Convolutional Layer. Filters and Feature Maps. Backpropagation Through the PoolingLayers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions.Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. TransferLearning using Inception Oxford VGG Model, Google Inception Model, Microsoft ResNet Model. RCNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO

UNIT IV

About NLP & its Toolkits. Language Modeling . Vector Space Model (VSM). Continuous Bag ofWords (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Cooccurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for WordRepresentation GloVe. Backpropagation Through Time. Bidirectional RNNs (BRNN) . Long ShortTerm Memory (LSTM). Bi-directional LSTM. Sequence-to- Sequence Models (Seq2Seq). Gatedrecurrent unit GRU.

UNIT V

About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy GradientMethods. Actor-Critic Algorithm. About Autoencoding. Convolutional Auto Encoding. Variational

TEXT BOOKS

1. Deep Learning A Practitioner's Approach Josh Patterson and Adam Gibson O'Reilly Media,
Inc.2017
2. Learn Keras for Deep Neural Networks, JojoMoolayil, Apress,2018
3. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

REFERENCE BOOKS

1. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTERISLAND,2017
2. Pro Deep Learning with TensorFlow, SantanuPattanayak, Apress,2017

Course Code	Course Title						Core / Elective
OE602CE	Green BuildingTechnologies						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To impart knowledge of the principles behind the green building technologies
2. To know the importance of sustainable use of natural resources and energy.
3. To understand the principles of effective energy and resources management in buildings
4. To bring awareness of the basic criteria in the green building rating systems
5. To understand the methodologies to reduce, recycle and reuse towards sustainability.

COURSE OUTCOMES:

After the completion of course the students will be able to:

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

CO 1. Define a green building, along with its features,benefits and rating systems

CO 2. Describe the criteria used for site selection andwater efficiency methods

CO 3. Explain the energy efficiency terms andmethods used in green building practices

CO 4. Select materials for sustainable built environment & adopt waste management methods

CO 5. Describe the methods used to maintain indoor environmental quality

Unit-I:

Introduction to Green Buildings: Definition of green buildings and sustainable development, typical featuresof green buildings, benefits of green buildings towards sustainable development. Green building rating systems
– GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

Unit-II:

Site selection and planning: Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc.

Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

Unit-III:

Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy, operationalenergy and life cycle energy.

Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

Unit-IV:

Building materials: Methods to reduce embodied energy in building materials: (a) Use of local buildingmaterials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks,
(c) use of materials with recycled content such as blended cements, pozzolona cements, fly ash bricks, vitrifiedtiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials

Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management

Unit-V:

Indoor Environmental Quality for Occupant Comfort and Wellbeing: Daylighting, air ventilation, exhaustsystems, low VOC paints, materials & adhesives, building acoustics.
Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

Text Books

T1. Michael Bauer, Peter Mösle and Michael Schwarz "Green Building – Guidebook for SustainableArchitecture" Springer, 2010.

T2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment

Reference Books:

R1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green BuildingCouncil Publishers.

R2. 'Alternative building materials and technologies' by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.

Course Code	Course Title						Core / Elective
3OE602CS	SOFTWARE ENGINEERING						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ATD	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Describe and compare various software development methods and understand the context in which each approach might be applicable
2. To impart knowledge on various phases, methodologies and practices of software development
3. To apply the project management and analysis principles to software project development
4. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metric
5. To apply the design & testing principles to software project development.

COURSE OUTCOMES:

After the completion of course the students will be able to:

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 exerting
4. Concede product quality through testing techniques employing appropriate metrics by understanding the practical challenges associated with the development of a significant software system
5. Apply the software engineering principles in realtime 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, Personaland Team Process Models, Process Technology, Product and Process.

UNIT II

SoftwareEngineeringPrinciples:SEPrinciples,CommunicationPrinciples,PlanningPrincip l es,ModellingPrinciples, ConstructionPrinciples, Deployment.

Software Requirement Analysis and Specification: System and software requirements, Types of software requirements, Elicitation and analysis of requirements, Requirement validation, Requirements 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, VII Edition,McGraw Hill, 2009
2. Software Engineering by IanSommerville,VIIedition,Addison-Wesley.
3. Fundamentals of SoftwareEngineeringbyRajibMall

REFERENCE BOOKS

1. Ali Behforooz and Frederick J. Hudson, Software Engineering Fundamentals, OxfordUniversity Press, 1996
2. PankajJalote, An Integrated Approach to Software Engineering, III Edition, NarosaPublishing House, 2000

Course Code	Course title						Core/Elective
5OE602EC	**Fundamentals of IOT**						Elective
Prerequisite	Contact Hours per Week				CIE	SIE	Credits
Controllers, Communication protocols, web services	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives:

1. To introduce the fundamentals, applications and requisite infrastructure of IoT.
2. To describe Internet principles and communication technologies relevant to IoT.
3. To discuss hardware and software aspects of designing an IoT system.
4. To explain the concepts of cloud computing and data analytics.
5. To illustrate the business models and manufacturing strategies of IoT products.

Course Outcomes:

1. Understand the various applications of IoT and other enabling technologies.
2. Comprehend various protocols and communication technologies used in IoT.
3. Construct simple IoT systems with requisite hardware and p ython programming.
4. Understand the relevance of cloud computing and data analytics to IoT.
5. Apply the business model of IoT from developing a prototype to launching a product.

UNIT-I

Introduction to Internet of Things: Introduction to Internet of Things: Physical Design of IoT: Things in IoT, IoT protocols, Logical Design of IoT: IoT functional Blocks, Communication Models, APIs, IoT enabling technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, IoT Applications: Smart Home, Smart Cities, SmartEnvironment, Smart Energy, Smart Retail and logistics, Smart Agriculture and Industry,Smart Industry and smart Health

UNIT-II

Internet Principles and communication technology: Internet Communications: An Overview –IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses TCP and UDP Ports, Application Layer Protocols – HTTP, HTTPS,

UNIT-III

Prototyping and Programming: Cost Vs Ease of Production, Prototypes and Production, Open-Source Vs Closed Source. Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling

Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations., Classes, Python packages for IoT, IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

UNIT-IV

Cloud computing and Data analytics: Introduction to Cloud storage models -SAAS, PAAS,IAAS. Communication APIs, Amazon web services for IoT, Skynet IoT Messaging Platform. Introduction to Data Analytics for IoT - Apache Hadoop- Map reduce job execution workflow.

UNIT-V

IoT Case Studies: Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation, Business model for IoT product manufacturing, IoT Startups, Mass manufacturing, Ethical issues in IoT.

TEXT BOOKS:

1. Internet of Things - Converging Technologies for smart environments andintegrated ecosystems, River Publishers.
2. Adrian McEwen (Author), Hakim Cassimally, "Designing the Internet ofThings", Wiley India Publishers.

REFERENCE BOOKS:

1. Fundamentals of Python, Kenneth A Lambert and B.L. Juneja, Cenage Learning.
2. Internet of Things (A Hands-on-Approach), Vijay Madisetti , Arshdeep Bahga,VPT Publisher, 1st Ed., 2014.

OPEN ELECTIVE –II (VI SEM)

Course code	Course Title	Core/Elective					
4OE602EE	ELECTRIC VEHICLES TECHNOLOGY (OPEN ELECTIVE – II)	Elective					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

Course Objectives : The objective of this course is to make the student

1 Know the history of electric hybrid electric vehicles (EV & HEV) and emphasize the need and importance of EV-HEV forsustainable future.
2 Introduce the fundamental concepts and principles of electric and hybrid electric vehicles drive train topologies
3 Develop a thorough understanding of the key elements of EV/HEV: Electric Machines for Propulsion Applications andEnergy Sources.

Course Outcomes :At the end of the course students will be able to

1. To identify and describe the history and evolvement of electric & hybrid electric vehicles to emphasize on the need andimportance of EV/HEV for sustainable future.
2. To identify and describe the principles of various EV/HEVs drive train topologies along with their power flow control andfuel efficiency estimation.
3. To design and select electric propulsion system components for EV/HEV drives suitability for the desirable performanceand control.
4. To compare and evaluate various energy sources and energy storage components for EV and HEV applications.

UNIT-I

Introduction : History of electric vehicles (EV) and hybrid electric vehicles (HEV), need and importance of EV and HEV, Power/Energy supplies requirements for EV/HEV applications, vehicle power source characterization, and transmission characteristics. Vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion.

UNIT II

Drive-Train Topologies: Series, Parallel, Series -Parallel and Complex configurations of HEV, basics of hybrid traction system, various hybrid drive-train topologies, power flow control in drive-train topologies, fuel efficiency analysis.

UNIT III

Electrical Machines and Power Converters for Hybrid and Electric Vehicles: Electric system components for EV/HEV, suitability of DC and AC machines for EV/HEV applications, AC and DC Motor drives. Permanent magnet and switch reluctance machines, configuration and control of drives. Power Converters-Converters for EV and HEV applications.

UNIT IV

Energy Sources for EV/HEV: Requirements of energy supplies and storage in EV/HEV, Review of batteries, fuel cells, flywheels and ultra-capacitors as energy sources for EV/HEV, characteristics and comparison of energy sources for EV/HEV, hybridization of different energy sources.

UNIT V

Electric Vehicles Charging Station: Type of Charging station, Selection and Sizing of charging station, Components of charging Station and Single line diagram of charging station. Contactless inductive charging- Stationary Inductive charging, resonant and compensation circuit topologies.

TEXTBOOKS:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiely, USA, 2012.
2. Iqbal Hussain, Electric & Hybrid Vehicles – Design Fundamentals, 2nd Edition, CRC Press, 2011.

REFERENCES/SUGGESTEDREADING:

1. Chris Mi, M. Abdul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with PracticalPerspective, Wiely, 2011
2. Simora Onori, Hybrid Electric Vehicles Energy Management Strategies, Springer.

Course Code	Course Title						Core / Elective
6OE602ME	3D PRINTING TECHNOLOGIES						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To understand the fundamental concepts of 3D Printing, its advantages &limitations.
2. To know the various types of STL file errors and other data formats used in additive manufacturing Technology.
3. To know the working principle, advantages, disadvantages & applications of liquid,solid and powder based 3D Printing technologies.
4. To know the diversified applications of 3D Printing technologies and explore themin different industrial sectors.

COURSE OUTCOMES: After the completion of course the students will be able to:

1. Describe the fundamentals of 3D printing, classify and explain advantages and disadvantages of 3D Printing technologies.
2. Select thesuitable CAD data formats and software used in 3D Printing technology.
3. Describe the operating principles, capabilities and limitations of liquid, solid & powder based 3D Printing Technologies.
4. Compare different 3D printing technologies based on their process capabilities and applications.
5. Apply the capabilities and knowledge of 3D printing in different industrial sectors.

Unit-I

Prototyping Fundamentals: Historical Development, Fundamentals of 3D Printing, Advantages and Limitations of 3D Printing, commonly used terms, 3D Printing Process Chain, 3D Modelling, Data conversion and transmission, Checking & Preparing, Building, Post processing, Classification of 3D Printing processes, Fundamental Automated Processes, Distinction between 3D Printing and Conventional Machining Processes.

Data Formats & Software: Data formats; conversion and transmission, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs, Newly Proposed Formats. Software's Features: Magics, Mimics, Solid View, Cura, ITK Snap.

Unit-II

Liquid based Systems: Stereo Lithography Apparatus (**SLA**): Models and Specifications, Process, working principle, photopolymers, photo polymerization, Layering Technology,laser and laser scanning, Applications, Advantages and Disadvantages. **Poly jet:** Models and Specifications, Process, working principle, Applications, Advantages and Disadvantages.**Solid ground curing** (**SGC**): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

Unit-III

Solid-based Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages. **Fused Deposition Modelling (FDM):** Models and specifications, Process, working principle, Applications, Advantages and Disadvantages. **Multi Jet Modelling (MJM):** Models and specifications, Process, Working principle, Applications, Advantages and Disadvantages.

Unit-IV

Powder Based Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages. **Three Dimensional Printing (3DP):** Models and Specifications, Process, working principle, Applications, Advantages and Disadvantages. **Laser Engineered Net Shaping (LENS):** Models and specifications, Process, working principle, Applications, Advantages and Disadvantages**.**

Unit-V

Applications of 3D Printing : Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Electronic Industry, Jewellery Industry, Coin Industry, GIS application, Construction field, Arts and Architecture, Pattern for investment and vacuum casting, Medical Models and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production Medical Devices, Forensic Science and Anthropology and Web Based Rapid Prototyping Systems.

Text Books:

1. Chee Kai Chua and Kah Fai Leong, "3D Printing and Additive Manufacturing Principles and Applications" Fifth Edition, World scientific
2. 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing" Springer, Second Edition.

Reference Books:

1. Ian Gibson, David W Rosen, Brent Stucker, "Additive Manufacturing Technologies:
2. Frank W. Liou, "Rapid Prototyping & Engineering Applications"- CRC Press, Taylor & Francis Group.
3. Rafiq Noorani, "Rapid Prototyping: Principles and Applications in Manufacturing", John Wiley & Sons.