B. Tech Computer Science and Engineering (Artificial Intelligence and Data Science)
Scheme of Studies/Examination (w.e.f. Session 2022-23)

Semester V

SNo.	Course No.	Subject	L:T: P	Hours / Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	PC-CS-AIDS-301A	Theory of Computation	3:0:0	3	3	75	25	0	100	3
2	PC-CS-AIDS-303A	Design and Analysis of Algorithms	3:0:0	3	3	75	25	0	100	3
3	ES-CS-AIDS-305A	Computer Network	3:0:0	3	3	75	25	0	100	3
4	PC-CS-AIDS-307A	Machine Learning with using Python	3:0:0	3	3	75	25	0	100	3
5	ES-CS-AIDS-309A	Computer Architecture	3:0:0	3	3	75	25	0	100	3
6	PC-CS-AIDS- S 311A	Artificial Neural Networks	3:0:0	3	3	75	25	0	100	3
7	PC-CS-AIDS-313LA	Artificial Neural Networks Lab	0:0:2	2	1	0	40	60	100	3
8	PC-CS-AIDS-317LA	Design and Analysis of Algorithms Lab	0:0:2	2	1	0	40	60	100	3
9	PC-CS-AIDS-315LA	Python Lab	0:0:2	2	1	0	40	60	100	3
		Total		**24**	**21**	**450**	**270**	**180**	**900**	
10	MC -904A	Energy Resources & Management	3:0:0	3	0	0	100	0	100	3
11	SIM-301A*	Seminar on Summer Internship	2:0:0	2	0	0	50	0	50	-

***Note: SIM-301A is a mandatory credit less course in which the students will be evaluated for the summer internship undergone after fourth semester and students will be required to get passing marks to qualify.**

PC-CS-AIDS-301A	Theory of Computation						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To understand the challenges for Theoretical Computer Science and its contributionto other sciences						
Course Outcomes							
CO 1	Students are able to explain and manipulate the different fundamental concepts inautomata theory and formal languages.						
CO 2	Simplify automata and context-free grammars; Prove properties of languages,grammars and automata with rigorously formal mathematical methods, minimization.						
CO 3	Differentiate and manipulate formal descriptions of push down automata, itsapplications and transducer machines.						
CO 4	To understand basic properties of Turing machines and computing with Turingmachine, the concepts of tractability and decidability.						

Unit-I

Introduction to Automata: Study and Central Concepts of Automata Theory, Applications of Finite Automata, An Introduction of Deterministic Finite Automata (DFA) and Non-Deterministic Finite Automata (NFA), Finite Automata with Epsilon (€) Transitions.

Regular Expression and Languages: Regular Expressions (RE), Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws of Regular Expressions, Closure Properties of Regular Languages, RE to NFA, DFA Conversion and DFA to RE, Equivalence and Minimization of NFA and DFA automata.

Unit-II

Context free Grammars and Languages: Parse Trees, Context Sensitive Grammar, Context Free Grammar, Regular Grammar, Applications of Context Free Grammars, Ambiguity in Grammars and Languages. Closure Properties of CFL, Chomsky Theorem, Chomsky Hierarchy, Normal forms of context free grammars: Chomsky Normal Form, Greibach Normal Form.

Pumping Lemma: Introduction to Pumping Lemma, pumping lemma for context free languages, Applications of Pumping Lemma, Minimization of Finite Automata, and Recursive Language.

Unit-III

Mealey and Moore Machines: Definitions, Representation, Equivalence of Moore and Mealey Machines and its Designing.

Push Down Automata: Introduction of Push Down Automata (PDA), Language of PDA, Equivalence of PDA's and CFG's, Deterministic Push Down Automata, Designing of PDA, Applications of PDA.

Unit-IV

Introduction to Turing Machine: The Turing Machine, Programming Techniques for Turing Machine, Extensions of Turing Machine, Restricted Turing Machines, Universal Turing Machines and Designing of Turing Machines, Time and Tape Complexity Measures of Turing machines

Decidability: Post's Correspondence Problem (PCP), Rice's Theorem, Decidability and Undecidability properties, P-NP class and completeness.

Suggested Books:

1. J. E. Hopcroft, R. Motwani and J. D. Ullman, "Introduction to Automata Theory Languages and
2. computation", Pearson Education Asia, 2001.
3. K. Krithivasan and R. Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education, 2009.
4. Peter Linz, "An Introduction to Formal Language and Automata", 4th Edition, Narosa

Publishing house, 2006.
5. M. Sipser; Introduction to the Theory of Computation; Singapore: Brooks/Cole, ThomsonLearning, 1997.
6. John. C. Martin, "Introduction to the Languages and the Theory of Computation", Third edition, Tata McGraw Hill, 2003.

PC-CS-AIDS-303A	Design and Analysis of Algorithms						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce advanced data structures and algorithms concepts involving their implementation for solving complex applications.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data Structures and their analysis.						
CO2	To study the concept of Dynamic Programming and various advanced Data Structures.						
CO3	To introduce various Graph algorithms and concepts of Computational complexities.						
CO4	To study various Flow and Sorting Networks						

Unit 1: Introduction

Review: Elementary Data Structures, Algorithms and its complexity (Time and Space), Analyzing Algorithms, Asymptotic Notations, Priority Queue, Quick Sort.

Recurrence relation: Methods for solving recurrence (Substitution, Recursion tree, Master theorem), Strassen multiplication.

Unit 2: Advanced Design and analysis Techniques

Dynamic programming: Elements, Matrix-chain multiplication, longest common subsequence,

Greedy algorithms: Elements, Activity- Selection problem, Huffman codes, Task scheduling problem, Travelling Salesman Problem.

Advanced data Structures: Binomial heaps, Fibonacci heaps, Splay Trees, Red-Black Trees.

Unit 3: Graph Algorithms

Review of graph algorithms: Traversal Methods (Depth first and Breadth first search), Topological sort, strongly connected components, Minimum spanning trees- Kruskal and Prims, Single source shortest paths, Relaxation, Dijkstras Algorithm, Bellman- Ford algorithm, Single source shortest paths for directed acyclic graphs, All pairs shortest paths- shortest paths and matrix multiplication, Floyd-Warshall algorithm.

Computational Complexity: Basic Concepts, Polynomial Vs Non-Polynomial Complexity, NP- hard and NP-complete classes.

Unit 4: Network and Sorting Algorithms

Flow and Sorting Networks Flow networks, Ford- Fulkerson method, Maximum Bipartite matching, Sorting Networks, Comparison network, the zero- One principle, Bitonic sorting network, Merging networks

Suggested Books:

1. Corman, Leiserson and Rivest: Introduction to Algorithms, 2/e, PHI.
2. Das Gupta: Algorithms, TMH.
3. Horowitz, Ellis and Sahni, Sartaj: Fundamentals of Computer Algorithms. Galgotia Publications.
4. Aho, Hopcroft and Ullman: The Design and Analyses of Computer Algorithms. Addison Wesley.
5. R. B. Patel: Expert Data Structures with C, Khanna Publications, Delhi, India, 2nd Edition 2004, ISBN 81-87325-07-0.
6. R. B. Patel and M.M.S Rauthan: Expert Data Structures with C++, Khana Publications, Delhi ,India, 2nd Edition 2004,ISBN 87522-03-8.

ES-CS-AIDS-305A	Computer Network						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce the architecture and layers of computer network, protocols used at different layers.						
Course Outcomes (CO)							
CO1	To understand the basic concept of networking, types, networking topologies and layered architecture.						
CO2	To understand data link layer and MAC sub-layer`						
CO3	To understand the network Layer functioning						
CO4	To understand the transport layer and application layer operation						

Unit -I

Introduction to Computer Networks: Data Communication System and its components, Data Flow, Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and Wired networks, broadcast and point-to-point networks, Network topologies, protocols, interfaces and services, ISO- OSI reference model, TCP/IP architecture.

Physical Layer: Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Multiplexing: Frequency Division, Time Division, Wavelength Division, Transmission Media: Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared), Switching: Circuit Switching, Message Switching, Packet Switching & comparisons, narrowband ISDN, broadband ISDN.

Unit -II

Data link layer: Error Control, Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, sliding window protocols, Selective repeat ARQ, HDLC;

Medium access sub layer: Point to point protocol, FDDI, token bus, token ring; Reservation, polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA, LLC, Traditional Ethernet, fast Ethernet, Network devices-repeaters, hubs, switches, Bridges, Router, Gateway.

Unit-III

Network layer: Addressing: Internet address, sub-netting; Routing techniques, static vs. dynamic routing, routing table, DHCP, IEEE standards 802.x, Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IGMP, IPV6; Unicast and multicast routing protocols, ATM.

Unit-IV

Transport layer: Process to process delivery; UDP; TCP, RPC, Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve QoS. **Application layer**: DNS; SMTP, SNMP, FTP, HTTP & WWW; Firewalls, Bluetooth, Email, S/MIME, IMAP **Network Security**: Cryptography, user authentication, security protocols in internet, public keyencryption algorithm, digital signatures.

Suggested Books:

1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw Hill, Fourth Edition, 2011.
2. Computer Networks, 4th Edition, Pearson Education by Andrew S. Tanenbaum.
3. Larry L. Peterson, Peter S. Davie, "Computer Networks", Elsevier, Fifth Edition, 2012.
4. William Stallings, "Data and Computer Communication", Eighth Edition, Pearson Education,2007.
5. James F. Kurose, Keith W. Ross, "Computer Networking: A Top–Down Approach Featuring the Internet", Pearson Education, 2005.

.

PC-CS-AIDS -307A	Machine Learning with using Python						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Introduction and implementation to Real-life examples of Machine learning using Python						
Course Outcomes- At the end of the course students will be able to:							
CO1	Understand basics of Python programming language.						
CO2	Explain the operation of different supervised and unsupervised algorithms and their implementation in Python.						
CO3	Implement several clustering, classification and regression algorithms, and apply asuitable learning algorithm to a range of basic problems.						
CO4	Work on Recommender Systems: Content-Based and Collaborative Filtering						
CO5	Use and Analyze Popular models: Train/Test Split, Gradient Descent, and Mean Squared Error and perform custom analysis						
CO6	Apply predictions and segmentation on real-world data sets. Interpret the output and validity of a learning algorithm.						

Unit-I

Python Basics, Data Structures and Fundamentals - First program, Types, Expressions and Variables, String Operations, Lists and Tuples Sets, Dictionaries, Conditions and Branching, Loops, Functions, Objects and Classes

Unit-II

Working with Data in Python and Introduction to Machine Learning - Reading files with open, writing files with open, loading data with Pandas, working with and Saving data with Pandas, Applications of Machine Learning, Supervised vs Unsupervised Learning, Python libraries suitable for Machine Learning

Unit-III

Regression, Classification and Unsupervised Learning - Linear Regression, Non-linear Regression, Model evaluation methods, K-Nearest Neighbor, Decision Trees, Logistic Regression, Support Vector Machines, Unsupervised Learning, K-Means Clustering, Hierarchical Clustering, Density-Based Clustering, Content-based recommender systems, Collaborative Filtering

Unit-IV

What is System ML? And Spark ML Context - Explain the purpose and the origin of SystemML, List the alternatives to SystemML**,** Compare performances of SystemML with the alternatives, Use MLContext to interact with SystemML (in Scala), Describe and use a number of SystemML algorithms.

Suggested Books

1. Ethem Alpaydin, Introduction to Machine Learning, Second Edition.
2. Introduction to Machine Learning with Python: A Guide for Data Scientists 1st Edition by Andreas C.
3. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 1st Edition by Aurélien Géron.
4. Stephen Marsland, Machine Learning: An Algorithmic Perspective.
5. Christopher M. Bishop, Pattern Recognition and Machine Learning.
6. Tom Mitchell, Machine Learning.

ES-CS-AIDS- 309A	Computer Architecture						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Student will be able to understand the basic concepts of computer architecture and organization, and understand the key skills of constructing cost-effective computer systems.						
Course Outcomes (CO)							
CO1	Be familiar with the internal organization and operations of a computer.						
CO2	Be familiar with the design trade-offs in designing and constructing a computer processor.						
CO3	Be aware with the CPU design including the RISC/CISC architectures.						
CO4	Be acquainted with the basic knowledge of I/O devices and select the appropriate interfacing standards for I/O devices.						

Unit- I

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and architecture, Von Neumann Architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non-restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Unit-II

Basic Computer organization and Design: Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Microprogrammed Control organization, Control Memory, address sequencing, Micro program Example, micro instructionformat, Horizontal Vs Vertical micro-programming, design of control Unit, microprogram sequencer, Hardwired v/s Micro-programmed Control Unit.

Unit-III

Central Processing Unit: General register organization, stack organization, instruction formats (Zero, One, Two and Three Address Instruction), addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing, Parallel Processing, Flynn's taxonomy, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

Unit-IV

Input-output organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor, CPU-IOP communication, Serial communication.

Suggested Books:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003.
2. Morris Mano, M., "Computer System Architecture," 3/e, Pearson Education, 2005.
3. John P. Hayes, "Computer Architecture and Organization," 3/e, TMH, 1998.
4. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Third Edition, Elsevier, 2005.
5. V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson Education, 2004.
6. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization",5th Edition,TMH, 2002.

PC-CS-AIDS-311A	Artificial Neural Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	The objective of this course is to provide students with a basic understanding of the fundamentals and applications of artificial neural networks.						
Course Outcomes - At the end of the course students will be able to:							
CO1	Understand basic principles of neuron structure.						
CO2	Understand and explain the mathematical foundations of neural network models						
CO3	Understand and apply the methods of training neural networks;						
CO4	Implement and analyze different algorithms for learning.						
CO5	Formalize the problem to solve it by using a neural network. via implementation ofthese techniques in MATLAB.						

Unit-I

Introduction and ANN Structure: Biological neurons and artificial neurons. Model of an ANN. Activation functions used in ANNs. Typical classes of network architectures. Mathematical Foundations and Learning mechanisms: Re-visiting vector and matrix algebra. State-space concepts. Concepts of optimization. Error-correction learning. Memory-based learning. Hebbian learning. Competitive learning. Building a simple ANN in python.

Unit-II

Feedforward ANN: Structures of Multi-layer feedforward networks with implementation in Python. Back propagation algorithm. Back propagation – training and convergence. Functional approximation with back propagation. Practical and design issues of back propagation learning.

Radial Basis Function Networks: Pattern separability and interpolation. RegularizationTheory. Regularization and RBF networks. RBF network design and training. Approximation properties of RBF.

Unit-III

Associative memories network -Linear Association, Pattern Association, Hebb and Delta rule for pattern association with its implementation in Python, Extended delta rule, Recurrent Auto associative memory: retrieval algorithm, storage algorithm; Bi-directional associative memory, Architecture, Association encoding & decoding, Stability.

Unit-IV

Self-organizing networks -UN supervised learning of clusters, winner-take-all learning, recallmode, Initialization of weights, separability limitations. Design SOM in python.

Perceptron Network- Perceptron neural algorithm with its implementation in Python, Multi-Layer perceptron, Adaline Network, Madaline network

Neural network projects with MATLAB: Brain maker to improve Hospital treatment using ADALINE, Breast cancer treatment using ART Network face recognition using BPN, data compression using BPN.

Suggested Books:

1. Simon Haykin; Neural Networks: A Comprehensive Foundation; Prentice Hall; ISBN-13: 978-0131471399; 2008.
2. Dan Simon; Evolutionary Optimization Algorithms; Wiley; ISBN-13: 978-0470937419;2013.
3. Daniel Graupe; Principles of Artificial Neural Networks; World Scientific Publishing Company; ISBN-13: 978-9814522731; 2013.

PC-CS-AIDS-313LA	Artificial Neural Networks Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	To gain a broad understanding of implementing neural networks using MATLAB						
Course Outcomes - At the end of this course students will be able to:							
CO1	Implement cognitive tasks and processing of sensorial data such as vision, image- and speech recognition, control, robotics, expert systems.						
CO2	Design single and multi-layer feed-forward neural networks						
CO3	Understand and implement supervised and unsupervised learning concepts & understand unsupervised learning using Kohonen networks						
CO4	Implement training of recurrent Hopfield networks and associative memory concepts.						

List of Practicals

1. Write a MATLAB program to plot a few activation functions that are being used in neural networks.
2. Generate ANDNOT function using McCulloch-Pitts neural net by a MATLAB program.
3. Generate XOR function using McCulloch-Pitts neuron.
4. Write a MATLAB program for perceptron net for an AND function with bipolar inputs and targets.
5. With a suitable example simulate the perceptron learning network and separate the boundaries. Plot the points assumed in the respective quadrants using different symbols for identification.
6. With a suitable example demonstrate the perceptron learning law with its decision regions using MATLAB. Give the output in graphical form.
7. Write a MATLAB program to show Back Propagation Network for XOR function with Binary Input and Output.
8. Write a MATLAB program to show Back Propagation Network for XOR function with Bipolar Input and Output.
9. Write a MATLAB program to recognize the number 0, 1, 2, 39. A 5 * 3 matrix forms the numbers. For any valid point it is taken as 1 and invalid point it is taken as 0. The net has to be trained to recognize all the numbers and when the test data is given, the network has to recognize the particular numbers.
10. Write a MATLAB program to illustrate ART neural network.

PC-CS-AIDS- 317LA	Design and Analysis of Algorithms Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	The student should be made to Learn the algorithm analysis techniques, become familiar with the different algorithm design techniques and understand the limitations of Algorithm power.						

Course Outcomes (CO)	
CO1	The student should be able to Design algorithms for various computing problems.
CO2	The student should be able to Analyse the time and space complexity of algorithms.
CO3	The student should be able to Critically analyse the different algorithm design techniques for a given problem.
CO4	The student should be able to Modify existing algorithms to improve efficiency.

LIST OF PRACTICALS

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Using Open, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. a. Obtain the Topological ordering of vertices in a given digraph.
   b. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kristal's algorithm.
7. a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
   b. Check whether a given graph is connected or not using DFS method.
8. Find a subset of a given set S = {sl, s2, ..., sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions{1,2,6}and{1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using Open and determine the speed-up achieved.
12. Implement N Queen's problem using Back Tracking.
13. Use divides and conquers method to recursively implement Binary Search.

PC-CS-AIDS-315LA	Python Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	To implement the concepts of Python and its advanced functions.						
Course Outcomes - At the end of the course students will be able to:							
CO1	Implement Python programming basics and paradigm.						
CO2	Implement python looping, control statements, string manipulations and functions.						
CO3	Implement Data Analysis & visualization –using NumPy, panda matplotlib etc.						
CO4	Implement Object Oriented Skills in Python.						

LIST OF PRACTICALS

1. Write and run a Python program that outputs the value of each of the following expressions:

5.0/9.0, 5.0/9, 5/9.0, 5/9, 9.0/5.0, 9.0/5, 9/5.0, 9/5

Based on your results, what is the rule for arithmetic operators when integers and floating-point numbers are used?

2. Write and run a Python program that asks the user for a temperature in Celsius and converts and outputs the temperature in Fahrenheit. (Use the formula given in the example above and solve for tempFin terms of tempC.)

3.Here is an algorithm to print out n! (n factorial) from 0! to 19!:
1. Set f = 1

2. Set n = 0

3. Repeat the following 20 times:

a. Output n, "! = ", f

b. Add 1 to n

c. Multiply f by n

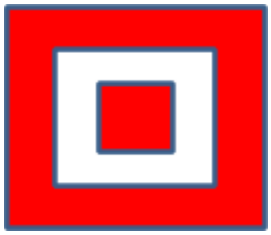
Using a for loop, write and run a Python program for this algorithm.

3(a). Modify the program above using a while loop so it prints out all of the factorial values that are less than 1 billion.

3(b). Modify the first program so it finds the minimum in the array instead of the maximum.

3(c). (Harder) Modify the first program so that it finds the **index** of the maximum in the array rather than the maximum itself.

4. Draw the Target symbol (a set of concentric Squares, alternating red and white) in a graphics window that is 200 pixels wide by 200 pixels high. Hint: Draw the largest circle first in red, then draw the next smaller circle in white, then draw the next smaller circle in red. Graphical objects drawn later appear "on top of" graphical objects drawn earlier



5. Try entering the following literal values at the prompt. (Hit ENTER after each)
-5
-4.2
4.5
4.14
0.90

Something odd should occur. *Describe it on paper.*

- Reading from a CSV file of the given data using pandas library.

6. For the given data, plot the scatter matrix for males only, and for females only. Do you think that the 2 sub-populations correspond to gender?

- For the given data, using python environment, apply, 1-sample t-test: testing the value of a population mean.

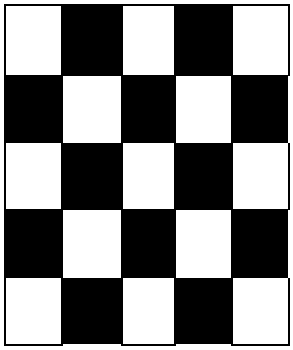
For the given data, using python environment, apply, 2-sample t-test: testing for difference across populations.

7. Generate simulated data from python, apply simple linear and multiple linear regression analysis.
Retrieve the estimated parameters from the model above. Hint: use tab-completion to find the relevant attribute.

8. Going back to the brain size + IQ data, test if the VIQ of male and female are different after removing the effect of brain size, height and weight.

9. Using matplotlib, visualize the simulated data with suitable statistical measures.

10. Create a 5 X 5 rectangle whose top left corner is at (*row**5, *col**5). (Where is the bottom right corner?) If the sum of the *row* and *col* numbers is even, set the fill color of the rectangle to white, otherwise set it to black. Then draw the rectangle.



MC-904 A	Energy Resources & Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**0**	**0**	**100**	**100**	**3 Hrs.**
Purpose	To make the students conversant with the basic concepts and conversion ofvarious form of Energy						
COURSE OUTCOMES							
CO1	An overview about Energy Resources, Conventional and Non-conventional Sources.						
CO2	Understand the Layout and working of Conventional Power Plants.						
CO3	Understand the Layout and working of Non-Conventional Power Plants.						
CO4	To understand the Energy Management, Audit and tariffs, Role of Energy inEconomic development and Energy Scenario in India.						

UNIT-I

Introduction: Types of energy, Conversion of various forms of energy, Conventional and Non- conventional sources, Need for Non-Conventional Energy based power generation.

UNIT-II

Conventional Energy sources: Types of Conventional Energy sources, Selection of site**,** working of Thermal, Hydro, Nuclear and Diesel power plants and their schematic diagrams & their comparative advantages/ disadvantages.

UNIT-III

Non-Conventional Energy sources: Types of Non-Conventional Energy sources, Basic principle, site selection of Solar energy power plant, photovoltaic technologies, PV Systems and their components, Wind energy power plant, Bio energy plants, Geothermal energy plants and Tidal energy plants.

UNIT-IV

Energy Management: General Principles of Energy Management, Energy Management Strategy, Modern trends and developments towards Computerizations of Power System.

Energy Audit: Need, Types, Methodology and Approach.

Energy Scenario: Lay out of power system, Role of Energy in Economic development, energy demand, availability and consumption, Indian energy scenario, long term energy scenario, energy sector reforms in India, energy strategy for the future.

Suggested Books:

1. Energy Studies-Wiley Dream Tech India.
2. Non-conventional energy resources- Shobhnath Singh, Pearson.
3. Electrical Power Systems: Soni, Gupta, Bhatnagar – Dhanpat Rai &Sons.
4. NEDCAP: Non-Conventional Energy Guide Lines.
5. Non-conventional energy sources: G. D. Roy.
6. Non-Conventional energy resources: B H Khan – McGraw Hill.
7. Applied Solar Energy: Meinel A B - Addison Wesley Publications.
8. Direct Energy Conversion George: Sutton-McGraw.

B. Tech Computer Science and Engineering (Artificial Intelligence and Data Science)
Scheme of Studies/Examination (w.e.f. Session 2022-23)
Semester VI

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	PC-CS-AIDS-302A	Compiler Design	3:0:0	3	3	75	25	0	100	3
2	ES-CS-AIDS-304A	Applied Statistical Analysis for AI	3:0:0	3	3	75	25	0	100	3
3	PC-CS-AIDS-306A	Big Data Analytics	3:0:0	3	3	75	25	0	100	3
4	PC-CS-AIDS-308A	Applied Machine Learning	3:0:0	3	3	75	25	0	100	3
5	OEC	OEC Elective-I	3:0:0	3	3	75	25	0	100	3
6	PC-CS-AIDS-310A	Soft Computing	3:0:0	3	3	75	25	0	100	3
7	PC-CS-AIDS-312LA	Applied Machine Learning Lab	0:0:2	2	1	0	40	60	100	3
8	PC-CS-AIDS-314LA	Big Data Analytics Lab	0:0:2	2	1	0	40	60	100	3
9	ES-CS-AIDS-316LA	Applied Statistical Analysis for AI Lab	0:0:2	2	1	0	40	60	100	3
		Total		**24**	**21**	**450**	**270**	**180**	**900**	

OEC Elective-I
Soft Skills and Interpersonal Communication: OE-CS-AIDS-302
Management Information System: OE-CS- AIDS-304
Enterprise Resource Planning: OE-CS- AIDS-306

***The students will choose any One Open Elective course out of the given elective list in VI Semester.**

PC-CS-AIDS- 302A	Compiler Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce complier design concepts and their implementation.						
Course Outcomes (CO)							
CO1	To understand the role and designing of a lexical analyzer.						
CO2	To analyze the role and designing of syntax analyzer or parser.						
CO3	To identify the role of semantic analyzer and intermediate code generation.						
CO4	To explore the design importance of optimization of codes and error detection.						

UNIT-I

Introduction to Language Processing System, Compiling Analysis of the Source Program, Phases of a Compiler, Compiler Construction Tools. Lexical Analysis –Regular Expression, Introduction to Finite Automata and Regular Expression, Conversion of Regular Expression to NFA, Role ofLexical Analyzer, Specification of Tokens.

UNIT-II

Syntax Analysis: Role of the Parser, Abstract Syntax Trees, Ambiguity in Context-Free Grammars, Types of Parsing: Top Down Parsing, Recursive Descent Parsing, LL Parser, Back Tracking, Bottom Up Parsing, SLR Parser, Canonical LR Parser, LALR Parser.

UNIT-III

Semantic Analysis: Semantic Errors, Attribute Grammar, Synthesized attributes, Static Allocation, Stack Allocation, Heap Allocation, Activation Trees, Symbol Table, Intermediate Code Generation and Code Intermediate languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, DAG representation of Basic Blocks, A simple Code generator from DAG, Issues in the Design of Code Generator.

UNIT-1V

Code Optimization and Run Time Environments, Principal Sources of Optimization, Machine-independent Optimization, Machine-dependent Optimization, Optimization of Basic Blocks, Loop Optimization, Peephole Optimization, Introduction to Global Data Flow Analysis, Storage Organization, Static Storage Management, Heap Storage management, Parameter Passing. Error Recovery, Panic mode, Statement mode, Global correction.

Suggested Books:

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, “Compilers Principles, Techniques and Tools”, Pearson Education Asia, 2018.
2. Allen I. Holub “Compiler Design in C”, Prentice Hall of India, 2003.
3. C. N. Fischer and R. J. LeBlanc, “Crafting a compiler with C”, Benjamin Cummings, 2003.
4. V Raghavan, “Principles of Compiler Design”, Second Edition, Tata McGraw-Hill, 2018.
5. Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”,PHI, 2001.
6. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003.

ES-CS-AIDS-304A	Applied Statistical Analysis for AI						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To gain a broad understanding of the statistical analysis in Artificial Intelligence.						
Course Outcomes - At the end of this course students will be able to:							
CO1	Explore the Statistical Analysis concepts with their relationships and process.						
CO2	Explain the concept of describing, transforming and summarizing data using various statistical methods and apply them to solve real world problems.						
CO3	Understand and apply testing hypothesis with real life data sets.						
CO4	Examine and analyze the relationships to find the correlation and regression and their applications in real life.						
CO5	Explore the advanced techniques with applications of decision trees, neural networks.						

UNIT – I

Introduction to basic concepts of Statistics, The Scientific Method, Basic Steps of the Research Process, Experimental Data and Survey Data, Populations and Samples, Census and Sampling Method, Parameter and Statistic, Independent and Dependent Variables, Examining Relationships, Introduction to SPSS Statistics.

UNIT – II

Introduction, Types of Data, Data Transformation, Summarizing Data: Graphical Methods, Summarizing Data: Measures of Central Tendency, Summarizing Data: Measures of Dispersion, Levels of Measurement, Random Variables and Probability Distributions, Discrete and Continuous Random Variable, Making Inferences about Populations from samples, Estimator and Estimate, Confidence Interval for Population Mean (Large Sample).

UNIT – III

Introduction, Null and Alternative Hypothesis, Type I and Type II Error, The Procedure of Hypothesis Testing; Hypothesis Testing of a Population Mean: Sample, a proportion (One Sample), Population Variance, Population Mean: Two Independent Samples(), Dependent Samples (Paired Samples), Two Population Proportion, Two Population Variances; Analysis of Variance (ANOVA).

UNIT – IV

Introduction, Types of Correlation, Karl Pearson Coefficient Correlation, Spearman's Rank Order Correlation, Partial Correlation, Residuals and Plots, Simple Linear Regression, MultipleRegression Model, Repeated Measures, Non-linear Regression, Polynomial Regression Models, Decision Trees, Neural Networks, Cluster Analysis, Factor Analysis.

Suggested Books:

1. Probability for Statistics and Machine Learning: Anirban Das Gupta – 2011.
2. An Introduction to Statistics with Python With Applications in the Life Sciences By Thomas Haslwanter, 2016.
3. Applied Statistics: A handbook of techniques- Zenon Reynarowych, springer verlag.
4. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media Media.
5. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.
6. Applied Statistics-principles and Examples-D. R. Cox and E. J. Snell.
7. Applied statistical methods, Irving W. Burr, Academic press.
8. Probability, Statistics and Random process, Dr. K. Murugesan & P. Gurusamy by Anuradha Agencies, Deepthi publications.
9. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi.
10. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers.

PC-CS-AIDS-306A	Big Data Analytics						
L	**T**	**P**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hour**
Purpose	The course provides grounding in basic and advanced methods to big data technology and tools.						
Course Outcomes - At the end of this course students will be able to:							
CO1	Understand Big Data and its analytics in the real world.						
CO2	Analyze the Big Data framework like Hadoop and NOSQL to efficiently store and process Big Data to generate analytics.						
CO3	Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm 3 4						
CO4	Design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics.						
CO5	Implement Big Data Activities using Hive.						

UNIT-I

Introduction To Big Data - Distributed file system, Big Data and its importance, Four Vs, Drivers for Big data, big data analytics, big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

UNIT-II

Introduction To Hadoop- Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

UNIT- III

Hadoop Architecture - Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH &Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

UNIT-IV

Hadoop Ecosystem And Yarn -Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features- NameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

Suggested Books:

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.
2. Chris Eaton, Dirk deroos, et al., “Understanding Big data”, McGraw Hill, 2012.
3. Tom White, “HADOOP: The definitive Guide”, O Reilly 2012.
4. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packet Publishing 2013.
5. Tom Plunkett, Brian Macdonald et al, “Oracle Big Data Handbook”, Oracle Press, 2014.

PC-CS-AIDS-308A	Applied Machine Learning						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Objective of this course is to learn conceptually how machine learning algorithms work and interact with data; the emphasis will be on effective methodology for using machine learning to solve practical problems.						
Course Outcomes - At the end of this course students will be able to:							
CO1	Identify overfit regression models.						
CO2	Compare different regularized regression algorithms and decision tree ensemble algorithms.						
CO3	Explain the confusion matrix and its relation to the ROC curve.						
CO4	Construct training data sets, testing data sets, and model pipelines.						

Unit-I

Introduction- towards intelligent machines, well-posed machine learning problems, examples of applications in diverse fields, data representation, domain knowledge for productive use of machine learning, diversity of data: structured/unstructured, forms of learning, machine learning and data mining, basic linear algebra in machine learning techniques, relevant resources for machine learning. **Statistical learning**-machine learning and inferential statistical analysis, descriptive statistics in learning techniques, Bayesian reasoning: a probabilistic approach to inference.

Unit-II

Supervised learning: rationale and basics, learning from observations, bias and variance, why learning works: computational learning theory, occam's razor principle and overfitting avoidance, heuristic search in inductive learning, estimating generalization errors, metrics for assessing regression (numeric prediction) accuracy, metrics for assessing classification (pattern recognition) accuracy, an overview of the design cycle and issues in machine learning.

Learning with support vector machines (SVM) and Random Forests-introduction, linear discriminant functions for binary classification, perceptron algorithm, linear maximal margin classifier for linearly separable data, linear soft margin classifier for overlapping classes, nonlinear classifier, regression by support vector machines, , Decision tree learning, Building a decision tree, combining weak to strong learners via random forest, choosing a split with information gain.

Unit-III

Unsupervised learning - Data clustering and data transformations, engineering the data, overview of basic clustering methods, k-means clustering, fuzzy k-means clustering, expectation-maximization (EM) algorithm and gaussian mixtures clustering, some useful data transformations, entropy–based method for attribute discretization, principal components analysis (PCA) for attribute reduction, rough sets-based methods for attribute reduction. k-nearest neighbor (k-nn) classifier, discriminant functions and regression functions, linear regression with least square error criterion, logistic regression for classification tasks, fisher's linear discriminant and thresholding for classification, minimum description length principle.

Unit-IV

Learning with neural networks - towards cognitive machine, neuron models, network architectures, perceptron, linear neuron and the widrow-hoff learning rule, the error-correction delta rule, multi-layer perceptron (MLP) networks and the error-backpropagation algorithm, multi-class discrimination with MLP networks, radial basis functions (RBF) networks, genetic-neural systems

Fuzzy inference systems-introduction, cognitive uncertainty and fuzzy rule-base, fuzzy quantification of knowledge, fuzzy rule-base and approximate reasoning, Mamdani model for fuzzy inference systems, takagi-sugeno fuzzy model, neuro-fuzzy inference systems, genetic-fuzzy systems

Suggested Books:

1. M. Gopal, Applied Machine learning, McGraw-Hill Education
2. David Forsyth, Applied Machine learning, Springer
3. Pascal Bugnion, Patrick R. Nicolas, Alex Kozlov, Scala: Applied Machine Learning, Packt.

OE-CS-AIDS-302	Soft Skills and Interpersonal Communication						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To Develop broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets.						
Course Outcomes (CO): By the end of the course, the students should be able to:							
CO1	Develop effective communication skills (spoken and written).						
CO2	Develop effective presentation skills.						
CO3	Conduct effective business correspondence and prepare business reports which produce results.						
CO4	Become self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.						

Unit-I

Introduction, Need for Communication, Process of Communication - Written and Verbal Communication, Visual communication, Signs, Signals and Symbols, Silence as a Mode of Communication - Inter-cultural, Intra-cultural, Cross-cultural and International communication - Communications skills, Communication through Questionnaires, Business Letter Writing, Electronic Communication. Barriers to Communication Improving Communication Skills -Preparation of Promotional Material -Non-verbal communication -Body language -Postures and gestures -Value of time -Organizational body language - Importance of Listening -Emotional Intelligence.

Unit II

Business Cases and Presentations, Letters within the Organizations, Letters from Top Management, Circulars and Memos - Business Presentations to Customers and other stakeholders, presenting a Positive Image through Verbal and Non-verbal Cues, Preparing and Delivering the Presentations, Use of Audio-visual Aids - Report Writing.

Unit III

Individual Interaction and skills Basic Interaction Skills –Within family, Society Personal and interpersonal intrapersonal skills Types of skills; conceptual, supervisory, technical, managerial and decision-making skills. Problem Solving, Lateral Thinking Self Awareness and Self Esteem Group Influence on Interaction Skills Human relations examples through role – play and cases.

Unit IV:

Leadership Skills Working individually and in a team Leadership skills 15 Lectures Leadership Lessons through Literature Team work & Team building Interpersonal skills – Conversation, Feedback, Feed forward Interpersonal skills – Delegation, Humor, Trust, Expectations, Values, Status, Compatibility and their role in building team – work Conflict Management – Types of conflicts, how to cope with them, small cases including role – plays will be used as teaching methodology. **Negotiation Skills** (To be Taught through Role Plays and Cases) Types of Negotiation Strategies Selling skills – Selling to customers Selling to Superiors Selling to peer groups, team mates & subordinates Conceptual selling, Strategic selling skills – Body language.

Suggested Books:

1. A Practical Guide to Soft Skills Communication, Psychology, and Ethics for Your Professional Life by Richard Almonte, Taylor & Francis.
2. Soft Skills for Interpersonal Communication, By Jeypaul Jesudoss, T. Ravindran, OXFORDUniversity Press.

OE-CS- AIDS-304	Management Information System						
L	**T**	**P**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hour**
Purpose	**To familiarize the students with Management Information System.**						
	Course Outcomes						
CO1	To provide introduction to relational model.						
CO2	To learn about ER diagrams and SQL.						
CO3	To understand about the concept of functional dependencies.						
CO4	To understand about Query Processing and Transaction Processing.						

UNIT-I

Introduction: Definition information system, role and impact of MIS, the challenges of Information system, Nature of MIS, Characteristics of MIS, Myths regarding MIS, Requirements of MIS, Problems & Solutions in implementing MIS, Benefits of MIS, Limitations of MIS, Significance of MIS, Components of MIS. Role of MIS, Major Management challenge to building and using information system in Organization, functions of management.

UNIT-II

Information system and Organizations: The relationship between Organization and Information System, Information needs of different organization levels: Information concept as quality product, classification and value of information, methods of data and information collection. Strategic role of information system, Salient features of Organization, Information, management and decision making, How Organization affect Information Systems, How Information system affect Organization, Ethical and Social impact of information system.

UNIT-III

Business application of Information System: Foundation Concepts Information systems in Business: Information system and technology, Business Applications, Development and Management. The internetworked E-business Enterprise: Internet, and Extranet in business. Electronic Commerce System: Electronics commerce Fundamentals, Commerce Application and issues. E-business Decision Support: Decision support in E-Business, Artificial Intelligence Technologies in business.

UNIT-IV

Technical Foundation of Information System: Computers and information processing, Computer Hardware, Computer software, Managing data resources, Telecommunication, Enterprise: wide computing and networking.

Strategic and Managerial Implications of Information Systems: Strategic Information System: Introduction, Characteristics of Strategic Information Systems, Strategic Information Systems (SISP), Strategies for developing an SIS, Potential Barriers to developing a Strategic Information System (SIS), Decision Support System (DSS): Decision making concepts, methods, tools andprocedures. Managing Information Resources: Introduction, IRM, Principal of Managing Information Resources, IRM functions, Computer Security: Introduction, Computer Security, Types of Computer Security, Disaster Recovery Plan.

Suggested Books:

1. W.S. Jawadakar, “Management Information System”, McGraw Hill.
2. J. O. Brien, “Management Information System”, TMH, New Delhi.
3. Uma G. Gupta, “Management Information System” Fifth Edition TMH.
4. Kenneth C. Laudon, “Management Information System Organization and Technology” TMH.

OE-CS-AIDS-306	Enterprise Resource Planning						
L	**T**	**P**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 hrs**
Purpose	To describe the concept of ERP and the ERP model; define key terms; explain the transition from MRP to ERP; identify the levels of ERP maturity and is to explain how ERP is used to integrate business processes; define and analyze a process; create a process map and improve and/or simplify the process; apply the result to an ERP implementation.						
Course Outcomes (CO)							
CO1	Design model for ERP for large projects and to design model for E-commerce architecture for any application						
CO2	Describe the advantages, strategic value, and organizational impact of utilizing an ERP system for the management of information across the functional areas of a business: sales and marketing, accounting and finance, human resource management, and supply chain.						
CO3	Demonstrate a working knowledge of how data and transactions are integrated in an ERP system to manage the sales order process, production process, and procurement process.						
CO4	Evaluate organizational opportunities and challenges in the design system within a business scenario.						

UNIT-I

Introduction: ERP, Origin, Benefits, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Management (PLM), LAP, Supply chainManagement.

UNIT-II

ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications.

UNIT-III

ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.

UNIT-IV

ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture. Using ERP tool: either SAP or ORACLE format to case study.

Suggested Books:

1. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning Concepts and Practice”, PHI.
2. Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise Resource Planning”, Thompson Course Technology.
3. Alexis Leon, “ERP Demystified”, Tata McGraw Hill.
4. Rahul V. Altekar “Enterprise Resource Planning”, Tata McGraw Hill.
5. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning – A Concepts and Practice”, PHI.
6. Mary Summer, “Enterprise Resource Planning”- Pearson Education.

PC-CS-AIDS-310A	Soft Computing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Soft Computing is a consortia of methodologies which collectively provide a body of concepts and techniques for designing intelligent systems.						
Course Outcomes (CO)							
CO1	The main objective of the Soft Computing Techniques to Improve Data Analysis						
CO2	To strengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields						
CO3	To develop Solutions and generate mutual improvement activities						
CO4	To develop practical data analysis skills, which can be applied to practical problems						

Unit-I

Introduction: What is Soft Computing. Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

Unit-II

Neural Network, Learning rules and various activation functions, Single layer Perceptron, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.

Unit-III

Fuzzy Systems: Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicatelogic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification. Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems, Fuzzy Backpropagation Networks: LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of FuzzyBP Networks, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

Unit-IV

Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.GA based Backpropagation Networks: GAbased Weight Determination, K - factor determination in Columns.

Suggested Books:

1. Principles of Soft Computing by S. N. Sivanandam & S. N. Deepa by Wiley, India edition.
2. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S. Rajasekaran, G. A. Vijayalakshami, PHI.
3. Genetic Algorithms: Search and Optimization, E. Goldberg.
4. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.
5. Build_Neural_Network_With_MS_Excel_sample by Joe choong.

PC-CS-AIDS-312LA	Applied Machine Learning Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	To understand and implement advanced Machine Learning operations in Python.						
Course Outcomes - At the end of this course students will be able to:							
CO1	Perform advanced data cleaning, exploration, and visualization						
CO2	Engineer features based on conditional relationships between existing features						
CO3	Build and finalize a machine learning classifier						
CO4	Build machine learning applications in different domains						

List of Practicals

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

PC-CS-AIDS-314LA	Big Data Analytics Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	To understand and implement advanced Big Data operations in Hadoop architecture.						
Course Outcomes - At the end of this course students will be able to:							
CO1	**Demonstrate** the knowledge of big data analytics and implement different file management task in Hadoop.						
CO2	**Understand** Map Reduce Paradigm and develop data applications using variety of systems.						
CO3	**Analyze** and perform different operations on data using Pig Latin scripts.						
CO4	**Illustrate** and apply different operations on relations and databases using Hive.						

List of Practicals

1. To Study of Big Data Analytics and Hadoop Architecture.
2. Installation of Single Node Hadoop Cluster on Ubuntu
3. Hadoop Programming: Word Count MapReduce Program Using Eclipse
4. Implementing Matrix Multiplication Using One Map-Reduce Step.
5. Implementing Relational Algorithm on Pig.
6. Implementing database operations on Hive.
7. Implementing Bloom Filter using Map-Reduce
8. Implementing Frequent Item set algorithm using Map-Reduce.
9. Implementing Clustering algorithm using Map-Reduce
10. Implementing Page Rank algorithm using Map-Reduce
11. Mini Project:

    Few topics for Projects:

    a. Twitter data analysis

    b. Fraud Detection

    c. Text Mining d. Equity Analysis etc.

Few websites for sample data: www.data.gov.in www.nseindia.in www.censusindia.gov.in www.importexportdata.in.

ES-CS-AIDS-316LA	Applied Statistical Analysis for AI Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	To implement statistical analysis functions in R language.						
Course Outcomes - At the end of this course students will be able to:							
CO1	Implement basic Statistical operations in R language.						
CO2	Implement regression techniques.						
CO3	Implement hypothesis testing with real time applications.						
CO4	Implement and evaluate various probability distributions for real world problems.						

List of Practicals

1. Calculation of coefficient of correlation.
2. Calculation spearman rank correlation.
3. Simple linear regression, residuals, estimate of intercept, regression coefficients.
4. Residual plots, regression diagnostics.
5. Multiple linear regression and regression estimates.
6. Calculation of multiple correlation and partial correlation.
8. Polynomial regression and regression estimates.
9. Calculation of Type I and Type II error probabilities.
10. Calculation of size of critical region, power of the test for the mean of a normal distribution with known and unknown variance and plotting graph of the power function.
11. Calculation of size of most powerful critical region (NP lemma).
12. Evaluating shortest confidence interval for mean of normal distribution when variance is known/unknown.
13. Evaluating shortest confidence interval for variance of normal distribution when mean is known/unknown.
14. Calculation of power of the test for the Bernoulli distribution with probability (p) in case of simple hypothesis and power curves and plotting the graph of the power function.
15. Calculation of likelihood ratio test (LRT) for simple hypothesis and composite hypothesis.