Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: IV**
Subject: Computer Network **Subject Code: B127471(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 Minimum Marks in ESE: 35

UNIT– I: INTRODUCTION:
Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet, Connection oriented network - X.25, frame relay. THE PHYSICAL LAYER: Theoretical basis for communication, guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system.

UNIT– II: THE DATA LINK LAYER:
Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer in the internet. THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth.

UNIT– III: THE NETWORK LAYER:
Network layer design issues, routing algorithms, Congestion control algorithms, Internetworking, the network layer in the internet (IPv4 and IPv6), Quality of Service.

UNIT– IV: THE TRANSPORT LAYER:
Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP.

UNIT– V: THE APPLICATION LAYER:
Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http. APPLICATION LAYER PROTOCOLS: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

TEXT BOOKS:
1. A. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi, India.

REFERENCE BOOKS:
1. Behrouz A. Forouzan (2006), Data communication and Networking, 4th Edition, McGraw-Hill, India.
2. Kurose, Ross (2010), Computer Networking: A top down approach, Pearson Education, India.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: IV**
Subject: Artificial Intelligence: Principles and Applications **Subject Code: B127472(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 Minimum Marks in ESE: 35

Prerequisites: Basic concepts in design of algorithms, including hashing, sorting, searching, and complexity analysis of algorithms.

1. **Fundamental Issues in Intelligent Systems**
    a. Describe Turing test and Chinese Room Thought Experiment
    b. Definitions of AI; Difference between optimum reasoning/behavior and human-like behavior/reasoning
2. **Basic Search Strategies**
    a. Formulate efficient problem/search spaces for a number of problems
    b. Combinatorial explosion of search spaces in most problems of interest
    c. Usefulness of heuristics, completeness, optimality, time/space complexity during search
    d. Uninformed search algorithms
    e. Informed Search Algorithms, admissibility, monotonicity, Design a solution using A* search
    f. Constraint satisfaction problems, algorithms for their solution
    g. Game playing and game tree search, minimax, alpha-beta search
    h. Intro to Game Theory
    i. Genetic Algorithms as search, hill climbing, simulated annealing, gradient descent as paradigms for search
3. **Basic Knowledge Representation**
    a. Introduction to First Order Predicate Calculus (FOPC)
    b. Representation of simple English sentences in FOPC
    c. Convert FOPC formulas into clauses
    d. Inference rules for FOPC, Resolution, Resolution-refutation, answer-extraction
4. **Reasoning with uncertainty**
    a. Probabilistic reasoning
    b. Bayes theorem
    c. Bayesian Networks
    d. Temporal Probability Models; Hidden Markov Models
    e. Fuzzy sets and reasoning
5. **Basic Machine Learning**
    a. Differences between supervised, unsupervised, and reinforcement learning
    b. Classification tasks
    c. Naïve Bayes classifier, overfitting, performance of a classifier
    d. Introduction to clustering, scalability issues in learning
    e. Descriptive Data Summarization; Central tendency (Mean, median, mode), measures of dispersion (variance, box-plots, quartiles, normal and skewed distributions).
6. **Reinforcement Learning**

7. **Data Visualization**
    a. Visualization of data dispersion, box-plot analysis, quantile-plot, quantile-quantile plots, scatter plot, simple regression, Loess curve fitting, demo for these ideas using available standard toolboxes.
    b. Visual exploration and analysis of spatial, temporal, multidimensional relational data.

Text Book:

- Artificial Intelligence – A Modern Approach, 3rd edition. Author: Stuart Russell and Peter Norvig, Publisher: Prentice Hall.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: IV**
Subject: Operating System **Subject Code: B127473(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 **Minimum Marks in ESE: 35**

UNIT – I: INTRODUCTION

Operation System objective and function, The Evolution of operating Systems, time sharing and real time Systems, Protection. Operating System Structure, System Components, operating system service, System structure. Distributed Computing, The Key Architecture Trend; Parallel Computation.

UNIT – II: CONCURRENT PROCESSES

Process concept: Introduction, Definitions of "Process", Process States, Process State Transitions, The process Control Block, Operations on Processes, Interrupt Processing. Mutual Exclusion, the Producer / Consumer problem, the critical section problem, Semaphores, Classical problems in concurrency, inter process communication. Asynchronous Concurrent Process: introduction, parallel Processing, A Control Structure for indicating parallelism. CPU scheduling: concepts, performance criteria, and scheduling Algorithms. Algorithm evaluation, Multiprocessor scheduling.

UNIT – III: DEADLOCKS

System model, Deadlock characterization. Prevention, Avoidance and Detection, Recovery from deadlock, Combined approach.

UNIT – IV: MEMORY MANAGEMENT

Base machine, resident Monitor, multiprogramming with fixed partition, Multiprogramming with variable Partitions, Paging, Segmentation, paged - segmentation, virtual Memory concepts, Demand paging, performance, page Replacement algorithms, Allocation of frames, Thrashing, cache memory organization impact on performance.

UNIT – V: I/O MANAGEMENT &DISK SCHEDULING

I/O device and the organization of the I/O function, I/O Buffering, Disk I/O, Operating system Design issues. File system: File Concepts – File organization and Access mechanism.

Text Books/ Reference Books:

1. Operating System concepts by Silberscatz A and Peterson, J.L, PE-LPE.
2. Operating System Design & Implementation by Tanenbaum, A.S., PHI.
3. Operating system concepts Galvin by Silberscatz, John Weiley & Sons.
4. Operating systems by H.M. Deital, Pearson Education.
5. Operating System in Depth Design and Programming by Thomas Doeppner, Wiley India.
6. Operating System Concept & Design, Milenkovic M, McGraw Hill.
7. Operation System, Stalling William, Maxwell MCMillan International Editions.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: IV**
Subject: Theory of Computation **Subject Code: B127474(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 **Minimum Marks in ESE: 35**

UNIT – I:
Introduction: Automata, Computability, and Complexity, Strings and languages: symbol, alphabet, string/ word. Language - Definition, language states, difference between natural and formal language.
FSM without output: Definition and Construction-DFA, NFA, NFA with epsilon-Moves, Minimization Of FA, Equivalence of NFA and DFA, Conversion of NFA with epsilon moves to NFA, Conversion of NFA With epsilon moves to DFA. FSM with output: Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines.

UNIT – II:
Definition and Identities of Regular Expressions, Construction of Regular Expression of the given L, Construction of Language from the RE, Construction of FA from the given RE using direct method, Conversion of FA to RE using Arden's Theorem, Pumping Lemma for RL, Closure properties of RLs, Applications of Regular Expressions.

UNIT – III:
Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, derivation trees, Context Free Languages, Ambiguous CFG, Removal of ambiguity, Simplification of CFG, Normal Forms, Chomsky Hierarchy, Regular grammar, equivalence of RG (LRG and RLG) and FA.

UNIT – IV:
Push Down Automata: Introduction and Definition of PDA, Construction (Pictorial/ Transition diagram) of PDA, Instantaneous Description and ACCEPTANCE of CFL by empty stack and final state, Deterministic PDA Vs Nondeterministic PDA, Closure properties of CFLs, pumping lemma for CFL. Post Machine- Definition and construction.

UNIT – V:
Formal definition of a Turing machine, Recursive Languages and Recursively Enumerable Languages, Design of Turing machines, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine, Nondeterministic Turing machines. Comparisons of all automata.

Text Books :
1. Michael Sipser, Introduction to the Theory of Computation, CENGAGE Learning, 3rd edition ISBBN 13:978-81-315-2529-6.
2. John E Hopcroft, Rajeev Motwani, J D Ullman, "Introduction to Automata theory, Languages, and Computations", Pearson Education Publisher, 3rd edition, 2009.
3. Vivek Kulkarni, Theory of Computation, Oxford University Press, ISBN-13: 978-0-19-808458-7.

Reference Books:
1. E. V. Krishnamurthy, "Theory of computer science", Affiliated East Press Publications, 2004.
2. Dexter C. Kozen, Automata and Computability, Springer Verlag Publications, 1997.
3. Harry Lewis, Christos H. Papadimitriou, "Elements of the Theory of Computation," Prentice-Hall Publications, 2nd edition, 1997.
4. John Martin, "Introduction to Languages and Theory of Computations", McGraw-Hill Publications, 4th edition, 2010.India, ISBN: 9788126520107.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: IV**
Subject: R for Data Science **Subject Code: B127475(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 Minimum Marks in ESE: 35

UNIT– I: OVERVIEW OF R:

History and Overview of R- Basic Features of R-Design of the R System- Installation of R- Console and Editor Panes-Comments- Installing and Loading R Packages- Help Files and Function Documentation-Saving Work and Exiting R-Conventions- R for Basic Math- Arithmetic- Logarithms and Exponentials-E-Notation- Assigning Objects- Vectors-Creating a Vector- Sequences, Repetition, Sorting, and Lengths- Subsetting and Element Extraction- Vector-Oriented Behaviour.

UNIT– II: MATRICES AND ARRAYS:

Defining a Matrix – Defining a Matrix- Filling Direction- Row and Column Bindings- Matrix Dimensions-Sub setting- Row, Column, and Diagonal Extractions- Omitting and Overwriting- Matrix Operations and Algebra- Matrix Transpose- Identity Matrix- Matrix Addition and Subtraction- Matrix Multiplication-Matrix Inversion-Multidimensional Arrays- Subsets, Extractions, and Replacements.

UNIT– III: NON-NUMERIC VALUES:

Logical Values- Relational Operators- Characters- Creating a String- Concatenation- Escape Sequences-Substrings and Matching- Factors- Identifying Categories- Defining and Ordering Levels- Combining and Cutting.

UNIT– IV: LISTS AND DATA FRAMES:

Lists of Objects-Component Access-Naming-Nesting-Data Frames-Adding Data Columns and
Combining Data Frames-Logical Record Subsets-Some Special Values-Infinity-NaN-NA-NULL Attributes-Object-Class-Is-Dot Object-Checking Functions-As-Dot Coercion Functions.

UNIT– V: BASIC PLOTTING:

Using plot with Coordinate Vectors-Graphical Parameters-Automatic Plot Types-Title and Axis Labels-Color-Line and Point Appearances-Plotting Region Limits-Adding Points, Lines, and Text to an Existing Plot-ggplot2 Package-Quick Plot with qplot-Setting Appearance Constants with Geoms-- READING AND WRITING FILES- R-Ready Data Sets- Contributed Data Sets- Reading in External Data Files- Writing Out Data Files and Plots- Ad Hoc Object Read/Write Operations.

TEXT BOOKS:

1. TilmanM. Davies, “THE BOOK OF R - A FIRST PROGRAMMING AND STATISTICS” Library of Congress Cataloging-in-Publication Data, 2016.

REFERENCE BOOKS:

1. Roger D. Peng,"R Programming for Data Science "Lean Publishing, 2016.

2. Hadley Wickham, Garrett Grolemund," R for Data Science", OREILLY Publication, 2017.

3. Steven Keller, "R Programming for Beginners", CreateSpace Independent Publishing Platform 2016.

4. Kun Ren ,"Learning R Programming", Packt Publishing, 2016.

E BOOKS:

1. https://web.itu.edu.tr/~tokerem/The_Book_of_R.pdf

MOOC:

1. https://online-learning.harvard.edu/subject/r

2. https://www.udemy.com/course/r-basics/

3. https://www.datacamp.com/courses/free-introduction-to-r

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: IV**
Subject: Data Visualization **Subject Code: B127476(022)**
Total Theory Periods: 40 **Total Tutorial Periods: 10**
No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**
ESE Duration: Three Hours, Maximum Marks in ESE: 100 **Minimum Marks in ESE: 35**

UNIT– I: INTRODUCTION TO VISUALIZATION:

Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values ,Color as a Tool to Highlight, Directory of Visualizations- Amounts, Distributions, Proportions, x–y relationships, Geospatial Data.

UNIT– II: VISUALIZING DISTRIBUTIONS:

Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots-Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile-Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis.

UNIT– III: VISUALIZING ASSOCIATIONS & TIME SERIES:

Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total ,Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Treemaps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series, Multiple Time Series and Dose–Response Curves, Time Series of Two or More Response Variables.

UNIT– IV: VISUALIZING UNCERTIANITY:

Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots.

UNIT– V: PRINCIPLE OF PROPORTIONAL INK:

The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2D Histograms, Contour Lines, Common Pitfalls of Color Use-Encoding Too Much or Irrelevant Information ,Using Nonmonotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency

TEXT BOOKS:

1. Claus Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures”, 1st edition, O’Reilly Media Inc, 2019.

REFERENCE BOOKS:

1. Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization, O’Reilly, 2016

2. Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018.

E BOOKS:

1. https://www.netquest.com/hubfs/docs/ebook-data-visualization-EN.pdf

MOOC:

1. https://www.coursera.org/learn/data-visualization

2. https://www.coursera.org/learn/python-for-data-visualization#syllabus

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: IV**

Subject: Computer Network Lab **Subject Code: B127491(022)**

Maximum Marks in ESE: 40

List of Experiments:-

1. Basic Commands of Networking
2. Subnetting and Supernetting
3. Remote Desktop Connection
4. Virtual LAN
5. Routing Information Protocol(RIP)
6. Open Shortest Path First (OSPF) Protocol
7. Border Gateway Protocol(BGP)
8. Basics of Wireshark
9. Socket Programming

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: IV**

Subject: Data Visualization Lab **Subject Code: B127492(022)**

Maximum Marks in ESE: 40

Prerequisite: Python or R

List of Experiments:-

1. Download the House Pricing dataset from Kaggle and map the values to Aesthetics
2. Use different Color scales on the Rainfall Prediction dataset
3. Create different Bar plots for variables in any dataset
4. Show an example of Skewed data and removal of skewedness
5. For a sales dataset do a Time Series Visualization?
6. Build a Scatterplot and suggest dimension reduction
7. Use Geospatial Data-Projections on datasets in http://www.gisinindia.com/directory/gis-data-for-india
8. Create the a trend line with a confidence band in any suitable dataset
9. Illustrate Partial Transparency and Jittering
10. Illustrate usage of different color codes

Reference Books:

1. Claus Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures”, 1st edition, O’Reilly Media Inc, 2019.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester: IV**

Subject: R for Data Science Lab **Subject Code: B127493(022)**

Maximum Marks in ESE: 40

UNIT– I:
Practical Component:

1. Develop the R program for Basic Mathematical computation –Square, Square root, exponential etc.
2. Create an object X that stores the value then overwrite the object in by itself divided by Y. Print the result to the console.
3. Create and store a sequence of values from x to y that progresses in steps of 0.3.
4. Overwrite the existing object using the same sequence with the order reversed.
5. Confirm that the length of the vector created is 20.
6. Extract the first and last elements of already created vector from, storing them as a new object.

UNIT– II:
Practical Component:

1. Create and store a three-dimensional array with six layers of a 4 X 2 matrix, filled with a decreasing sequence of values between 4.8 and 0.1 of the appropriate length.
2. Extract and store as a new object the fourth- and first-row elements, in that order, of the second column only of all layers of (1).
3. Use a fourfold repetition of the second row of the matrix formed in (2) to fill a new array of dimensions 2 X 2 X 2 X.
4. Create a new array comprised of the results of deleting the sixth layer of (1).
6. Overwrite the second and fourth row elements of the second column of layers 1, 3 and 5 of (4) with -99.

UNIT– III:
Practical Component:

1. Confirm the specific locations of elements equal to 0 in the 10 X 10 identity matrix I10
2. Store this vector of 10 values: foo <- c(7,5,6,1,2,10,8,3,8,2).Then, do the following:
   i**.** Extract the elements greater than or equal to 5, storing the result as bar.
   ii. Display the vector containing those elements from foo that remain after omitting all elements that are greater than or equal to 5.
3. Store the string "Two 6-packs for $12.99". Then do the following:
   i. Use a check for equality to confirm that the substring beginning with character 5 and ending with character 10 is "6-pack".
   ii**.** Make it a better deal by changing the price to $10.99.
4. Create a factor with levels of confidence as follows: Low for percentages [0,30]; Moderate for Percentages (30, 70]; and High for percentages (70,100].

UNIT– IV:

Practical Component:

1. Create a list that contains, in this order, a sequence of 20 evenly spaced numbers between -4 and 4; a 3 X 3 matrix of the logical vector c(F,T,T,T,F,T,T,F,F) filled column-wise; a character vector with the two strings "don" and "quixote"; and a factor vector containing the observations c("LOW","MED","LOW","MED","MED","HIGH"). Then, Extract row elements 2 and 1 of columns 2 and 3, in that order, of the logical matrix.
2. Create and store this data frame as d frame with the fiiels of person, sex, funny in your R work space. Append the two new records.
3. Write a single line of code that will extract from my data frame just the names and ages of any records where the individual is female and has a level of funniness equal to Med OR High.
4. Use your knowledge of handling character strings in R to extract all records from my data frame that correspond to people whose names start with *S*.

UNIT– V:

Practical Component:

1. Create a database with the fields of weight,height and sex then create a plot of weight on the x-axis and height on the y-axis. Use different point characters or colors to distinguish between males and females and provide a matching legend. Label the axes and give the plot a title.
2. create a plot using ggplot2 for the same database consists of weight on the x-axis and height on the y- axis. Use different point characters or colors to distinguish between males and females and provide a matching legend. Label the axes and give the plot a title.
3. Write R code that will plot education on the x-axis and income on the y-axis, with both x- and y-axis limits fixed to be [0;100]. Provide appropriate axis labels. For jobs with a prestige value of less than or equal to 80, use a black * as the point character. For jobs with prestige greater than 80, use a blue @.