LIST OF COURSES OFFERED FOR MINOR DEGREE IN AI&DS

Course Code	Course Title	Contact hours/week				Credits
		L	T	P	Total	
20ADM1	Artificial Intelligence	3	1	0	4	4
20ADM2	Fundamentals of Data Science	3	1	0	4	4
20ADM3	Machine Learning Predictive Algorithms	3	1	0	4	4
20ADM4	Fundamentals of Neural Networks	3	1	0	4	4
20ADM5	Introduction to Deep Leaning	3	1	0	4	4
20ADM6	Computer Vision	3	1	0	4	4
20ADM7	Data Analytics	3	1	0	4	4
20ADM8	Statistics with R Programming	3	1	0	4	4

B.Tech-AI&DS 20ADM1-ARTIFICIAL INTELLIGENCE

L	T	P	Cr.
3	1	0	4

Pre-requisite **:** Basic Engineering Mathematics Knowledge

Course Educational Objective: The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, reasoning, and learning. Students will implement a small AI system in a team environment. The knowledge of artificial intelligence plays a considerable role in some applications students develop for courses in the program.

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

CO1: Enumerate the history and foundations of Artificial Intelligence. **(Understand-L2)**

CO2: Apply the basic principles of AI in problem solving. **(Apply-L3).**

CO3: Explain the different searching algorithms to find and optimize the solution for the given problem. **(Understand - L2)**

CO4: Illustrate the different gaming algorithms and identify the importance of knowledge representation in Artificial Intelligence. **(Apply- L3)**

CO5: Describe the use of predicate logic and rule-based system to represent the knowledge in AI domain. **(Understand - L2)**

UNIT - I

Introduction:What Is AI?,The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT II

Problem Solving: Problem-Solving Agents, Example Problems, searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.

UNIT III

Search Algorithms: Problem solving agents, search algorithms terminologies, properties of search algorithms, types of search algorithms.

Uniformed/Blind Search Algorithms: Breadth-first Search, Depth-first Search,Depth-limited Search, Iterative deepening depth-first search, Uniform cost search, Bidirectional Search.

UNIT IV

Adversarial Search/ Game Playing: Introduction, Minimax algorithm, Alpha-Beta pruning. Knowledge Representation: Representations and mappings, approaches of knowledge representation, issues in knowledge representation.

UNIT V

Knowledge Representation: Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.

TEXT BOOKS:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd edition, Prentice Hall, 2009. Can also use 2nd Ed., Pearson Education International, 2003.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
3. Rich & Knight, Artificial Intelligence, second edition, Tata McGraw Hill.

REFERENCE BOOKS:

1. Nils Nilsson, "Artificial Intelligence: A New Synthesis", Morgan Kaufmann, 1998.
2. David Poole, Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge Univ. Press, 2010.
3. Ronald Brachman, "Knowledge Representation and Reasoning", Morgan Kaufmann, 2004.
4. Frank van Harmelen, Vladimir Lifschitz, Bruce Porter (Eds), "Handbook of Knowledge representation", Elsevier, 2008.
5. Ivan Bratko, "Prolog Programming for Artificial Intelligence", 4th Ed., Addison-Wesley, 2011.

B.Tech-AI&DS **20ADM2-FUNDAMENTALS OF DATA SCIENCE**

L	T	P	Cr.
3	1	0	4

Pre-requisite : Programming knowledge

Course outcomes:

CO 1: Distinguish basic building blocks of python to solve mathematical problems. (Understand)

CO 2: Describe the key concepts in data science (Remember)

CO 3: Enumerate the fundamentals of NumPy(Understand)

CO 4: Demonstrate the fundamentals of Pandas(Understand)

CO 5: Demonstrate data analysis, manipulation and visualization of data using Python libraries(Apply)

UNIT I

Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements. Strings: Creating strings and basic operations on strings, string testing methods.Lists, Dictionaries, Tuples.

UNIT II

What is Data science? Data Science life cycle, Datafication, Exploratory Data Analysis, The Data science process, A datascientist role in this process.

UNIT-III

NumPy Basics: The NumPy ndarray: A Multidimensional Array Object, Creating ndarrays ,Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.

UNIT IV

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, Data Frame, Index Objects, Essential Functionality Reindexing, Dropping entries from an axis, Indexing, selection, and filtering, Sorting.

UNIT V

Data Preprocessing: Data Loading, Storage, and FileFormats - Reading and Writing data in text format, binary data formats, interacting with html and web apis, interacting with databases; Data Wrangling: Clean, Transform, Merge, Reshape - Combining and Merging Data Sets, Reshaping and Pivoting, Data Transformation, String Manipulation; Data Aggregation and Group Operations – Group by Mechanics, Data Aggregation, Groupby Operations and and Transformations, Pivot Tables and Cross-Tabulation

TEXT BOOKS:

1. Wes McKinney, "Python for Data Analysis",O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.
3. Python For Data Analysis (O Reilly, Wes Mckinney)

REFERENCE BOOKS:

1. Python: The Complete Reference, Martin C. Brown, McGraw Hill Education
   Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015
2. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016.

B.Tech-AI&DS 20ADM3-MACHINE LEARNING PREDICTIVE ALGORITHMS

L	T	P	Cr.
3	1	0	4

Pre-requisite: Probability and Statistics, Linear Algebra

Course Educational Objective: The objective of the course provides the basic concepts and techniques of Machine Learning and helps to use recent machine learning software for solving practical problems. It enables students to gain experience by doing independent study and research.

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

CO1: Identify the characteristics of machine learning. **(Understand- L2)**

CO2: Summarize the Model building and evaluation approaches **(Understand- L2)**

CO3: Demonstrate Bayesian learning and regression algorithms for real-world Problems. **(Apply- L3)**

CO4: Demonstrate supervised learning algorithms to solve the real-world Problems. **(Apply- L3)**

CO5: Demonstrate unsupervised learning algorithms for the real world data. **(Apply- L3)**

UNIT-I

Introduction to Machine Learning and Preparing to Model

Introduction to Machine Learning- Introduction, What is Human Learning? Types of Human Learning, What is Machine Learning? Types of Machine Learning, Problems Not To Be Solved Using Machine Learning, Applications of Machine Learning.

Preparing to Model- Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

UNIT-II

Modelling & Evaluation, Basics of Feature Engineering

Modelling & Evaluation- Introduction, Selecting a Model, Training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model. Basics of Feature Engineering- Introduction, Feature Transformation, Feature Subset Selection

UNIT-III

Bayesian Concept Learning and Regression

Bayesian Concept Learning - Introduction, Why Bayesian Methods are Important?, Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network.

Regression: Introduction, Regression Algorithms - Simple linear regression, Multiple linear regression, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

UNIT-IV

Supervised Learning: Classification, Ensemble Learning Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms - k-Nearest eighbour (kNN), Decision tree, Random forest model, Support vector machines. Ensemble Learning- Boosting, Bagging.

UNIT-V:

Unsupervised Learning- Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering –Clustering as a Machine Learning task, Different types of clustering techniques, Partitioning methods, Hierarchical clustering, Density-based methods: DBSCAN. Finding Pattern using Association Rule - Definition of common terms, Association rule, Apriori algorithm.

TEXT BOOKS:

1. Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, "Machine Learning", Pearson Education India ,1st edition.
2. Tom M. Mitchell, "Machine Learning', MGH, 1997.

REFERENCE BOOKS:

1. Shai Shalev-Shwartz, ShaiBen David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge.
2. Peter Harington, "Machine Learning in Action" , Cengage, 1st edition, 2012.
3. Peter Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge university press,2012.
4. Jason Brownlee, "Machine Learning Mastery with Python Understand Your Data, Create Accurate Models and Work Projects End-To-End", Edition: v1.4, 2011.

B.Tech-AI&DS 20ADM4-FUNDAMENTALS OF NEURAL NETWORKS

L	T	P	Cr.
3	1	0	4

Pre-requisite: Probability and Statistics, Linear Algebra

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

CO 1: Demonstrate ANN structure and activation Functions

CO 2: Define foundations and learning mechanisms and state-space concepts

CO 3: Identify structure and learning of perceptions

CO 4: Explain Feed forward, multi-layer feed forward networks and Back propagation Algorithms

CO 5: Analyze Radial Basis Function Networks, The Regularization and RBF networks.

UNIT I

Characteristics of neural networks, Structure and working of biological neural networks, artificial neural networks: Terminology, Models of neurons: McCulloch Pitts model, perception model, Adeline model, topology, basic learning laws, Functional unit for ANN for pattern recognition task.

UNIT-II

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.

UNIT-III

Single layer perceptions, Structure and learning of perceptions, Pattern classifier, Introduction and Bayes' classifiers, Preceptor as a pattern classifier, Perception convergence. Limitations of a perceptions.

UNIT-IV

Feed forward ANN, Structures of Multi-layer feed forward networks. Back propagation algorithm, Back propagation- training and convergence, Functional approximation with back propagation. Practical and design issues of back propagation learning.

UNIT-V

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

TEXT BOOKS:

1. B.Yagnanarayana, “Artificial Neural Network” , PHI Publication 2012
2. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia.
3. Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, 1997.

B.Tech-AI&DS 20ADM5-INTRODUCTION TO DEEP LEANING

L	T	P	Cr.
3	1	0	4

Pre-requisite: Probability and Statistics

Course Outcomes:

- Demonstrate the mathematical foundation of neural network
- Describe the machine learning basics
- Compare the different architectures of deep neural network
- Build a convolutional neural network
- Build and train RNN and LSTMs

UNIT I

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.

Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' Rule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

UNIT II

Machine Learning: Basics and Underfitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feedforward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

UNIT III

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier.

UNIT IV

Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

UNIT V

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

TEXT BOOKS:

1) Ian Good fellow, Yoshin Bengio, Aaron Courville, "Deep Learning", MIT Press,2016.
2) Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition, 2017.

REFERENCE BOOKS:

1) Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers, 2019.
2) Deep learning Cook Book, Practical recipes to get started Quickly, Douwe Osinga, O'Reilly, Shroff Publishers, 2019.

e-Resources:

1) https://keras.io/datasets/
2) http://deeplearning.net/tutorial/deeplearning.pdf
3) https://arxiv.org/pdf/1404.7828v4.pdf
4) https://github.com/lisa-lab/DeepLearningTutorials

B.Tech-AI&DS **20ADM6-COMPUTER VISION**

L	T	P	Cr.
3	1	0	4

Pre-requisite: Linear Algebra, Probability and Statistics and Computer Graphics.

Course Educational Objective: To introduce students the fundamentals of image formation; To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition; To develop an appreciation for various issues in the design of computer vision and object recognition systems; and to provide the student with programming experience from implementing computer vision and object recognition applications.

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

CO1: Demonstrate image processing techniques required for computer vision**.** **(Understand– L2)**

CO2: Describe image formation models. (**Understand – L2)**

CO3: Describe the feature extraction and motion estimation techniques. **(Understand - L2)**

CO4: Illustrate segmentation algorithms for shape analysis. **(Apply – L3)**

CO5: Implement image classification Applications using object recognition methods. **(Apply – L3)**

UNIT-I

Introduction: Image Processing, Computer Vision and Computer Graphics , What is Computer Vision -Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.

UNIT-II

Image Formation Models: Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, Orthographic & Perspective Projection,• Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading, Photometric Stereo, Depth from Defocus , Construction of 3D model from images.

UNIT-III

Image Processing and Feature Extraction: Image preprocessing, Image representations (continuous and discrete) , Edge detection**.**

Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

UNIT-IV

Shape Representation and Segmentation: Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, and Multire solution analysis.

UNIT-V

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition.

TEXT BOOKS:

1. Computer Vision -A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

REFERENCE BOOKS:

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA), Springer,
4. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
5. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012.

B.Tech-AI&DS **20ADM7-DATA ANALYTICS**

L	T	P	Cr.
3	1	0	4

Pre-requisite: Linear Algebra, Probability and Statistics and Computer Graphics.

Course Outcomes:

At the end of the course, student will be able to

CO 1: Identify probability distributions commonly used as foundations for statistical modeling.

CO 2: Use R to carry out basic statistical modeling and analysis

CO 3: Apply basic tools (plots, graphs, summary statistics) to carry out EDA

CO 4: Describe the Data Science Process and how its components interact

CO 5: Explain EDA and the Data Science process in a case study

UNIT I

Introduction, The Ascendance of Data, Motivating Hypothetical: Data Sciencester, Finding Key Connectors, The Zen of Python, Getting Python, Virtual Environments, Whitespace Formatting, Modules, Functions, Strings, Exceptions, Lists, Tuples, Dictionaries default dict, Counters, Sets, Control Flow, Truthiness, Sorting, List Comprehensions, Automated Testing and assert, Object- Oriented Programming, Iterables and Generators, Randomness, Regular Expressions, Functional Programming, zip and Argument Unpacking, args and kwargs, Type Annotations, How to Write Type Annotations.

UNIT II

Visualizing Data: matplotlib, Bar Charts, Line Charts, Scatterplots. Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation.

Gradient Descent: The Idea Behind Gradient Descent, Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent.

UNIT III

Getting Data: stdin and stdout, Reading Files, Scraping the Web, Using APIs,Working with Data: Exploring Your DataUsing NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.

Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.

UNIT IV

Machine Learning: Modeling, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, k-Nearest Neighbors, Naive Bayes, Simple Linear Regression, Multiple Regression, Digression, Logistic Regression

UNIT V

Clustering: The Idea, The Model, Choosing k, Bottom-Up Hierarchical Clustering. Recommender Systems: Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization Data Ethics, Building Bad Data Products, Trading Off Accuracy and Fairness, Collaboration, Interpretability, Recommendations, Biased Data, Data Protection IPython, Mathematics, NumPy, pandas, scikit-learn, Visualization, R

TEXTBOOKS:

1) Joel Grus, "Data Science From Scratch", OReilly.
2) Allen B.Downey, "Think Stats", OReilly.

REFERENCE BOOKS:

1. Doing Data Science: Straight Talk From The Frontline, 1st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013
2. Mining of Massive Datasets, 2nd Edition, Jure Leskovek, Anand Rajaraman and JeffreyUllman, v2.1, Cambridge University Press, 2014
3. "The Art of Data Science", 1st Edition, Roger D. Peng and Elizabeth matsui, Lean Publications, 2015
4. "Algorithms for Data Science", 1st Edition, Steele, Brian, Chandler, John, Reddy, Swarna, springers Publications, 2016

e-Resources:

1) https://github.com/joelgrus/data-science-from-scratch
2) https://github.com/donnemartin/data-science-ipython-notebooks
3) https://github.com/academic/awesome-datascience

B.Tech-AI&DS 20ADM8-STATISTICS WITH R PROGRAMMING

L	T	P	Cr.
3	1	0	4

Pre-requisite: Linear Algebra, Probability and Statistics and Programming Knowledge

OUTCOMES:

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

CO 1: List motivation for learning a programming language

CO 2: Access online resources for R and import new function packages into the R workspace

CO 3: Import, review, manipulate and summarize data-sets in R

CO 4: Explore data-sets to create testable hypotheses and identify appropriate statistical tests

CO 5: Perform appropriate statistical tests using R Create and edit visualizations with

UNIT-I

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT-II

R Programming Structures, Control Statements, Loops, - Looping Over Nonvector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.

UNIT-III

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files.

UNIT-IV

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.

UNIT-V:

Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests,

TEXT BOOKS:

1) The Art of R Programming, A K Verma, Cengage Learning.
2) R for Everyone, Lander, Pearson
3) The Art of R Programming, Norman Matloff, No starch Press.

REFERENCE BOOKS:

1) R Cookbook, Paul Teetor, Oreilly.
2) R in Action, Rob Kabacoff, Manning