INFORMATION TECHNOLOGY
Course Structure R-20

SEMESTER VII

S. No	Class	Course Code	Name of the Subject	L	T	P	C
1	PC	C67PC1	Data Warehousing and Data Mining	3	0	0	3
2	PC	C67PC2	Information Security	3	0	0	3
3	OE	C67OE3	Open Elective-III	3	0	0	3
4	PE	C67PE4	Professional Elective- III 1) Introduction to Data Analytics 2) Mobile Adhoc Networks 3) Multimedia & Rich Internet Applications	3	0	0	3
5	PE	C67PE5	Professional Elective- IV 1) Big Data Analytics 2) Social Networks 3) Internet of Things	3	0	0	3
6	PC	C67PC6	Data Warehousing and Data Mining Lab	0	0	4	2
7	PW	C67PW7	Major Project Phase-I	0	0	4	2
8	MC	MC007	Competitive Exams	0	0	0	**S**
			Total Credits				**19**

Major Project Phase I: Students can form a group of minimum of two or maximum of four under the allocated guide, students group should choose a project title, for the chosen project title carryout a detailed literature survey, problem formulation, planning higher level design. The project evaluation will be Continuous Internal Evaluation will be made by the PRC Committee. The PRC committee consists of Head, Project Coordinator, One Senior Professor, One Associate Professor, and guide.

Mandatory Course:

Competitive Exams: For completion of this course the student can submit the proof of appearing the competitive exams like, GATE, IELTES, GRE, TOEFL, CDAC, CDS, CAT, or any examination organized by NATIONAL TESTING AGENCY (NTA), or college in the level of NTA.

or

The student should request for the provision of conducting Technical Seminar by the department. The topic of seminar should be the current technology of respective Engineering Branch. The evaluation will be done by the Departmental Academic Committee (DAC) based on rubrics framed.

INFORMATION TECHNOLOGY

Course Structure R-20

SEMESTER VIII

S. No	Class	Course Code	Name of the Subject	L	T	P	C
1	OE	C68OE1	Open Elective-IV	3	0	0	3
2	PE	C68PE2	Professional Elective- V 1) Predictive Data Analytics 2) Storage Area Networks 3) Machine Learning	3	0	0	3
3	PE	C68PE3	Professional Elective- VI 1) Data Science 2) Semantic Web & Social Networks 3) Deep Learning	3	0	0	3
4	PW	C68PW4	Major Project Phase II	0	0	20	10
			Total Credits				**19**

Major Project Phase II: The approved project in Major Project Phase 1 should be implemented, student should submit the progress of his implementation work in 2 phases, to the PRC (Project Review Committee). The PRC consists of Head, Project Coordinator, One Senior Professor, One Associate Professor, and guide. Upon approval in both the phases, the student is eligible to submit the final project report by completing proper documentation to the external viva voce.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous, Accredited by NAAC with „A Grade)

DATA WAREHOUSING AND DATA MINING - C67PC1

B. Tech. VII Semester **L/T/P/C**

3/0/0/3

Course Objective:

Study data warehouse principles and its working learn data mining concepts understand association rules mining. Discuss classification algorithms learn how data is grouped using clustering techniques.

Course Outcomes

1. Able to construct a data ware house for a given small scale organization by applying star, snow and flake constellation construction schemas..
2. Ability to perform the preprocessing of data and apply mining techniques on it.
3. Able to Apply the different techniques to generate frequent, closed and maximal itemsets for given transactional database
4. Able to compare Appriori and FP Growth algorithms in terms of complexity analysis.
5. Able to classify the given example dataset based on the given example learning knowledge by using different classification techniques and be able to compare those in terms of complexity.
6. Able to construct the clusters and find out the outliers by using different clustering techniques from the given dataset and be able to identify the differences between various algorithms in terms of complexity.

UNIT – I

Data Warehouse: Introduction to Data warehouse, Difference between operational database systems and data warehouses. Data warehouse Characteristics, Data warehouse Architecture and its Components, Extraction – Transformation – Loading, Logical (Multi – Dimensional), Data Modeling, Schema Design, Star and Snow – Flake Schema, Fact Consultation, Fact Table, Fully Addictive, Semi – Addictive, Non Addictive Measures; OLAP Cube, OLAP Operations, OLAP Server Architecture – ROLAP, MOLAP and HOLAP.

UNIT – II

Introducing to Data Mining : Introduction, What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binaryzation, Data Transformation; Measures of Similarity and Dissimilarity – Basics.

UNIT – III

Association Rules : problems Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation; APRIOIRI Algorithm,The Partition Algorithms, FP- Growth Algorithms, Compact Representation of Frequent Ittem set-Maximal Frequent Item Set, Closed Frequent Item Sets.

UNIT – IV

Classification: Problem Definition, General Approaches to solving a classification problem, Evaluation of classifiers, Classification Techniques, Decision Tree – Decision tree Construction, Methods for Expressing attribute test conditions, Measures for Selecting the Best Split, Algorithm for Decision tree Induction; Naive Bayes Classifier, Bayesaian Belief Networks; K – nearest neighbor classification – Algorithm and Characteristics.

UNIT – V

Clustering : Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering -K-Means Algorithm, K-Means Additional issues, PAM Algorithm; Hierarchical Clustering – Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering, Strengths and Weakness; Outlier Detection.

TEXT BOOK

1. Data Mining – Concepts and Techniques – Jiawei Han, Michelinen Kamber, Morgan Kaufmann Publishers, Elsevier, 2nd Edition, 2006.
2. Introduction to Data Mining, Pang – Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.

REFERENCE BOOKS

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Data Warehouse Fundamentals, Pualraj Ponnaiah, Wiley Student Edition.
3. Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University Press

INFORMATION SECURITY - C67PC2

B. Tech. VII Semester **L/T/P/C**

3/0/0/3

Course Objectives:

1. Explain the objectives of information security.
2. Explain the importance and application of each of confidentiality, integrity, authentication and availability.
3. Understand various cryptographic algorithms.
4. Understand the basic categories of threats to computers and networks.
5. Describe public-key cryptosystem.
6. Describe the enhancements made to IPv4 by IPSec.
7. Understand Intrusions and intrusion detection.
8. Discuss the fundamental ideas of public-key cryptography.
9. Generate and distribute a PGP key pair and use the PGP package to send an encrypted e-mail message.
10. Discuss Web security and Firewalls.

Course Outcomes:

1. Understand the difference between threats and attacks.
2. Know the KEY Elements and Logical Elements of Networks
3. Able to handle authentication algorithms.
4. Understand the Policies, Guideline and Framework of E-mail and IP Security.
5. Understand the Policies, Guideline and Framework of Web Security

UNIT I

Attacks on Computers and Computer Security: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security.

Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, stegnography, key range and key size, possible types of attacks.

UNIT II

Symmetric key Ciphers: Block Cipher principles & Algorithms(DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4,Location and placement of encryption function, Key distribution **Asymmetric key Ciphers:** Principles of public key cryptosystems, Algorithms(RSA, Diffie-Hellman,ECC), Key Distribution.

UNIT III

Message Authentication Algorithms and Hash Functions: Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack algorithm **Authentication Applications:** Kerberos, X.509 Authentication Service, Public – Key Infrastructure, Biometric Authentication.

UNIT IV

E-Mail Security: Pretty Good Privacy, S/MIME **IP Security:** IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, key management.

UNIT V

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction **Intruders, Virus and Firewalls:** Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls **Case Studies on Cryptography and security:** Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual Elections.

TEXT BOOKS:

1. Cryptography and Network Security : William Stallings, Pearson Education,4th Edition.
2. Cryptography and Network Security : Atul Kahate, Mc Graw Hill, 2nd Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 2nd Edition.
3. Information Security, Principles and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM.Arthur Conklin, Greg White, TMH.

INTRODUCTION TO DATA ANALYTICS - C67PE4A

B. Tech. VII Semester **L/T/P/C**

3/0/0/3

Course Objectives:

1. To introduce the terminology, technology and its applications
2. To introduce the concept of Analytics for Business
3. To introduce the tools, technologies & programming languages this is used in day to day analytics cycle.

Course Outcomes:

1. Understand the data analysis using R programming.
2. Summarize the data and probability using R programming.
3. Storing and retrieving the No SQL data using R programming.
4. Understand Business analysis using R Studio.

UNIT I

Introduction to Analytics and R programming (NOS 2101):

Introduction to R, RStudio (GUI): R Windows Environment, introduction to various data types, Numeric, Character, date, data frame, array, matrix etc., Reading Datasets, Working with different file types .txt,.csv etc. Outliers, Combining Datasets, R Functions and loops.

Manage your work to meet requirements (NOS 9001)

Understanding Learning objectives, Introduction to work & meeting requirements, Time Management, Work management & prioritization, Quality & Standards Adherence,

UNIT II

Summarizing Data & Revisiting Probability (NOS 2101):

Summary Statistics - Summarizing data with R, Probability, Expected, Random, Bivariate Random variables, Probability distribution. Central Limit Theorem etc.

Work effectively with Colleagues (NOS 9002)

Introduction to work effectively, Team Work, Professionalism, Effective Communication skills, etc.

UNIT III

SQL using R Introduction to NoSQL, Connecting R to NoSQL databases.Excel and R integration with R connector.

UNIT IV

Correlation and Regression Analysis (NOS 9001)

Regression Analysis, Assumptions of OLS Regression, Regression Modelling.Correlation, ANOVA, Forecasting, Heteroscedasticity, Autocorrelation, Introduction to Multiple Regression etc.

UNIT V

Understand the Verticals - Engineering, Financial and others (NOS 9002)

Understanding systems viz. Engineering Design, Manufacturing, Smart Utilities, Production lines, Automotive, Technology etc. Understanding Business problems related to various businesses.

Requirements Gathering

Gathering all the data related to Business objective

TEXT BOOKS:

1. Student's Handbook for Associate Analytics.

REFERENCE BOOKS:

1. Introduction to Probability and Statistics Using R, ISBN: 978-0-557-24979-4, is a textbook written for an undergraduate course in probability and statistics.
2. An Introduction to R, by Venables and Smith and the R Development Core Team. This may be downloaded for free from the R Project website (http://www.r-project.org/, see Manuals). There are plenty of other free references available from the R Project website.
3. Montgomery, Douglas C., and George C. Runger, Applied statistics and probability for engineers. John Wiley & Sons, 2010

4. Time series Analysis and Mining with R. Yanchang Zhao.

MOBILE ADHOC NETWORKS - C67PE4B

B. Tech. VII Semester

L/T/P/C **3/0/0/3**

Course Objective:

This course covers major aspects of ad hoc networks, from design through performance issues to application requirements. It starts with characteristics features, applications of ad hoc networks, modulation techniques and voice coding. It also covers the IEEE 802.11 wireless LAN and Bluetooth standards.

Course Outcomes:

1. Able to gain an understanding of the current topics in MANETs and WSNs, both from an industry and research point of views.
2. Able to understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks. ·
3. Able to Understand how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

UNIT - I

INTRODUCTION: Introduction to ad-hoc networks – definition, characteristics features, applications. Characteristics of wireless channel, ad-hoc mobility models: indoor and outdoormodels.

UNIT - II

MEDIUM ACCESS PROTOCOLS: MAC Protocols: Design issues, goals and classification. Contention based protocols – with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNIT - III

NETWORK PROTOCOLS:

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, unicast routing algorithms, Multicast routing algorithms, hybrid routing

algorithm, energy aware routing algorithm, hierarchical routing, QoS aware routing.

UNIT - IV

END – END DELIVERY AND SECURITY:

Transport Layer: Issues in designing – Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

UNIT – V

CROSS LAYER DESIGN:

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks.

TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks Architecture and Protocols, 2nd edition, Pearson Edition, 2007.

2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000.

REFERENCE BOOKS:

1. Stefano Basani, Macro Conti, Silvia Giordano and Ivan stojmenovic, Mobile ad-hpc networking, wiley – IEEE press, 204.
2. Mohammad Ilyas, The handbook of ad-hoc wireless networks, CRC press, 20.
3. T. Camp J. Boleng and V. Davies " A Survey of Mobility Models for Ad-hoc Network"
4. Research, "wireless communication and mobile comp. special Isssue on Mobile Ad-hpc Networking Research, Trends and Applications, vol.2, no.5

MULTIMEDIA & RICH INTERNET APPLICATIONS- C67PE4C

B. Tech. VII Semester **L/T/P/C**

3/0/0/3

Course Objective:

This course aims to further develop students‟ competency in producing dynamic and creative graphic solutions for multimedia productions. It provides students with the basic concepts and techniques of interactive authoring. It also introduces students with the advanced scripting skills necessary for implementing highly interactive, rich internet applications using multimedia technologies and authoring tools. Students will develop aesthetic value and competencies in multimedia authoring. Artistic visual style and layout design are stressed, as well as the editing and integration of graphic images, animation, video and audio files. The course allows students to master industry-wide software and technologies to create highly interactive, rich internet applications.

Course Outcomes:

1. Ability to create and design rich internet applications.
2. Ability to develop different multimedia tools to produce web based and independent user interfaces

UNIT - I

Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video.

UNIT- II

Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.

Multimedia Data Compression: Lossless compression algorithms, Lossy compression algorithms, Image compression standards.

UNIT III

Basic Video compression techniques, Case study: MPEG Video Coding I, Basic Audio compression techniques, Case study: MPEG Audio compression.Web 2.0 : What is web 2.0, Search, Content Networks, User Generated Content, Blogging, Social Networking, Social Media, Tagging, Social Marking, Rich Internet Applications, Web Services, Mashups, Location Based Services, XML, RSS, Atom, JSON, and VoIP, Web 2.0 Monetization and Business Models, Future of the Web.

UNIT - IV

Rich Internet Applications(RIAs) with Adobe Flash : Adobe FlashIntroduction, Flash Movie Development, Learning Flash with Hands-o Examples, Publish your flash movie, Creating special effects with Flash,Creating a website splash screen, action script, web sources.Rich Internet Applications(RIAs) with Flex 3 - Introduction, Developingwith Flex 3, Working with Components, Advanced Component Development,Visual Effects and Multimedia,

UNIT - V

Ajax- Enabled Rich Internet Application: Introduction, Traditional Web Applications vs Ajax Applications, Rich Internet Application with Ajax, History of Ajax, Raw Ajax example using xml http request object, Using XML, Creating a full scale Ajax Enabled application, Dojo ToolKit.

TEXT BOOKS:

1. Fundamentals of Multimedia by Ze-Nian Li and Mark S. Drew PHILearning, 2004
2. Professional Adobe Flex 3, Joseph Balderson, Peter Ent, et al, WroxPublications, Wiley India, 2009.
3. AJAX, Rich Internet Applications, and Web Development forProgrammers, Paul J Deitel and Harvey M Deitel, Deitel DeveloperSeries, Pearson Education.

REFERENCE BOOKS:

1. Multimedia Communications: Applications, Networks, Protocols andStandards, Fred Halsall, Pearson Education, 2001, rp 2005.

2. Multimedia Making it work, Tay Vaughan, 7th edition, TMH, 2008.

3. Introduction to multimedia communications and Applications,Middleware, Networks, K.R.Rao, Zoran, Dragored, Wiley India, 2006,

4. Multimedia Computing, Communications & Applications, RalfSteinmetz and Klara Nahrstedt, Pearson Education, 2004

5. Principles of Multimedia, Ranjan Parekh, TMH, 2006.

BIG DATA ANALYTICS- C67PE5A

B. Tech. VII Semester **L/T/P/C**

3/0/0/3

Course Objectives:

1. To introduce the terminology, technology and its applications
2. To introduce the concept of Analytics for Business
3. To introduce the tools, technologies & programming languages which is used in day to day analytics cycle

Course Outcomes:

1. Understand the big data analytics concepts.
2. Understand the big data analytics patterns.
3. Implement the big data analytics.
4. Analyze the big data using Apache, MapReduce.
5. Analyze the No SQL data and framework of Django.

UNIT I

Introduction to Big Data: What is Analytics, What is Big Data, Characteristics of Big Data, Domain Specific Examples of Big Data, Analytics for Big Data, Big Data Stack.

Setting up big data Stack: **Hortonworks Data Platform (HDP) , Cloudera CDH Stack , Amazon Elastic MapReduce (EMR) , Azure HDInsight.**

UNIT II

Big data Patterns: Analytics architecture components and Design styles, Map Reduce Patterns.

No SQL: Key-Value Databases, Document Databases, Column Family Databases, Graph Databases.

Unit III

Big Data Implementations

Data Acquisition: **Data Acquisition Considerations , Publish - Subscribe Messaging Frameworks , Big Data Collection Systems , Messaging Queues , Custom Connectors**

Big Data Storage: **HDFSUNIT**

IV

Batch Analysis: **Hadoop and MapReduce, Hadoop - MapReduce Examples, Pig, Case Study: Batch Analysis of News Articles, Apache Oozie, Apache Spark, Search.**

UNIT V

Serving Databases and Web frameworks: **Relational (SQL) Databases, Non-Relational (NoSQL) Databases, Python Web Application Framework – Django, Case Study: Django application for viewing weather data**

TEXT BOOKS:

1. Big Data Science and Analytics A Hands-on Approach. By Arshdeep Bahga, Vijay Madisetti

SOCIAL NETWORKS - C67PE5B

B. Tech. VII Semester **L/T/P/C**

3/0/0/3

Course Objectives:

1. explain basic concepts and theories of network analysis in the social sciences, and understand how these concepts and theories can help explain different actors‟ micro behaviors as well as macro outcomes;
2. critically examine the ways in which networks can contribute to the explanation of social, political, economic and cultural phenomena;
3. use statistical software to visualize networks and analyze their properties, connecting these to network concepts and theories;
4. explain principles underlying statistical models for social networks;
5. use software to implement statistical models of social networks to analyze network formation and evolution;
6. Use software to simulate the dynamics of networks based on social network models.

Course Outcomes:

1. Understand a broad range of network concepts and theories.
2. Appreciate how network analysis can contribute to increasing knowledge about diverse aspects of society.
3. Use a relational approach to answer questions of interest to them (i.e. be able to apply 'network thinking').
4. Analyze social network data using various software packages.
5. Present results from social network analysis, both orally and in writing.

UNIT I

Social Network analysis: History, concepts and research Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

UNIT II

Extraction and Mining Communities in Web Social Networks

Extracting evolution of Web Community from a Series of Web Archive – Detecting Communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining Algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social Network communities

UNIT III

Social network Infrastructures and communities

Decentralized online social networks, Multi Relational characterization of dynamic social network communities, Accessibility testing of social websites

UNIT IV

Predicting Human Behavior and Privacy Issues

Understanding and predicting human behavior for social communities – User data Management – Inference and Distribution – Enabling new human experiences – Reality Mining – Context – Awareness – Privacy in online social networks – Trust in online Environment – Trust models based on subjective logic – Trust network analysis – Trust Transitivity analysis – Combining trust and reputation – Trust derivation based on trust Comparisons – Attack spectrum and countermeasures.

Unit - V

Visualization and Applications of Social Networks

Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation –

Visualizing online social networks, Visualizing social networks with matrix-based

Representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare – Collaboration networks – Co-Citation networks.

TEXT BOOKS:

1. Peter Mika, ―Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, ―Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

REFERENCE BOOKS:

1. Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking –Techniques and applications, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo - Social information Retrieval Systems: EmergingTechnologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGIGlobal Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, -The Social Semantic Web,Springer, 2009.

INTERNET OF THINGS - C67PE5C

B. Tech. VII Semester **L/T/P/C**

3/0/0/3

Course Objectives:

1. To introduce the terminology, technology and its applications
2. To introduce the concept of M2M (machine to machine) with necessary protocols
3. To introduce the Python Scripting Language which is used in many IoT devices
4. To introduce the Raspberry PI platform, that is widely used in IoT applications
5. To introduce the implementation of web based services on IoT devices.

Course Outcomes:

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

1. Understand the characteristics, protocols and communication models required for logical design of IoT.
2. Gain knowledge on protocol stacks for IoT and M2M networks and configurations.
3. Write Python Programming using modules, file handling and various Packages.
4. Design the IoT system using Raspberry Pi.
5. Develop web based services on IoT devices.

UNIT I

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

UNIT-II

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT- III

Overview of Python - packaging, file handling, data/time operations, classes, Exception handling. Python packages - JSON, XML, HTTP Lib, URL Lib, SMTP Lib.

UNIT IV

IoT Physical Devices and Endpoints - Introduction to Raspberry PI - Interfaces (serial, SPI, I2C). Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT V

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs. Webserver – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.

REFERNCE BOOKS:

2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,

DATA WAREHOUSING AND DATA MINING LAB - C67PC6

B. Tech. VII Semester **L/T/P/C**

0/0/4/2

Course Objectives

Learn how to build a data warehouse and query it (using open source tools like Pentaho Data Integration and Pentaho Business Analytics), Learn to perform data mining tasks using a data mining toolkit (such as open source WEKA), Understand the data sets and data preprocessing, Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression, Exercise the data mining techniques with varied input values for different parameters.

Course Outcomes

1. Ability to understand the various kinds of tools.
2. Demonstrate the classification clusters and etc. in large data sets.
3. Ability to add mining algorithms as a component to the exiting tools
4. Ability to apply mining techniques for realistic data.

1. Build Data Warehouse and Explore WEKA

A. Build a Data Warehouse/Data Mart (using open source tools like Pentaho Data Integration tool, Pentoaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects, etc.).

- Identify source tables and populate sample data
- Design multi-dimensional data models namely Star, snowflake and Fact constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, Manufacturing, Automobile, etc.).
- Write ETL scripts and implement using data warehouse tools
- Perform various CLAP operations such slice, dice, roll up, drill up and pivot
- Explore visualization features of the tool for analysis like identifying trends etc.

B. Explore WEKA Data Mining/Machine Learning Toolkit

- Downloading and/or installation of WEKA data mining toolkit,

- Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface, Experimenter, command-line interface.
- Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, Classify panel, Cluster panel, Associate panel and Visualize panel)
- Study the arff file format
- Explore the available data sets in WEKA.
- Load a data set (ex. Weather dataset, Iris dataset, etc.)
- Load each dataset and observe the following

1. List the attribute names and they types
2. Number of records in each dataset
3. Identify the class attribute (if any)
4. Plot Histogram
5. Determine the number of records for each class.
6. Visualize the data in various dimensions

2. Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets

A. Explore various options available in Weka for preprocessing data and apply (like DiscretizatiOfl Filters, Resample filter, etc.) on each dataset

B. Load each dataset into Weka and run Apron algorithm with different support and confidence values. Study the rules generated.

C. Apply different discretizatiOn filters on numerical attributes and run the Apriori association rule algorithm. Study the rules generated. Derive interesting insights and observe the effect of discretization in the rule generation process.

3 Demonstrate performing classification on data sets

A. Load each dataset into Weka and run 1d3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic.

B. Extract if-then rules from the decision tree generated by the classifier observe the confusion matrix and derive Accuracy, F-measure, TPrate, FPrate, Precision and Recall values. Apply cross-validation strategy with various fold levels and compare the accuracy results.

C. Load each dataset into Weka and perform Naïve-bayes classification and k-Nearest Neighbour classification. Interpret the results obtained.

D. Plot RoC Curves

E. Compare classification results of 1D3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce whlch classifier is performing best and poor for each dataset and justify.

4 Demonstrate performing clustering on data sets

A. Load each dataset into Weka and run simple k-means clustering algorithm with different values of k (number of desired clusters). Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.

B. Explore other clustering techniques available in Weka.

c. Explore visualization features of Weka to visualize the clusters. Derive interesting insights and explain.

5 Demonstrate performing Regression on data sets

A. Load each dataset into Weka and build Linear Regression model. Study the clusters formed. Use Training set option. Interpret the regression model and derive patterns and COflC1USjOflS from the regression results.

B. Use options cross-validation and Percentage split and repeat running the Linear Regression Model. Observe the results and derive meaningful results.

C. Explore Simple linear regression technique that only looks at one variable.

Resource Sites

1. http:llwww.pentaho corn,
2. http://www.cswajkatoacflz,mI,,wk

TKR COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous, Accredited by NAAC with „A Grade)

PREDECTIVE DATA ANALYTICS - C68PE2A

B. Tech. VIII Semester

L/T/P/C **3/0/0/3**

Course Objectives:

1. To introduce the terminology, technology and its applications
2. To introduce the concept of Analytics for Business
3. To introduce the tools, technologies & programming languages this is used in day to day analytics cycle.

Course Outcomes:

1. To learn and understand the terminology of predictive analytics frame work and its applications
2. Apply logistic regression techniques; implement objective segmentation for performing prediction tasks for business needs.
3. Apply time series methods for analyzing and predicting the business needs.
4. Implement standard process for working with documents

UNIT I

Visualizing and Manipulating Data using R: Learning Predictive Analytics with R by Eric Mayor-Packet Publishing

Data Visualization with Lattice, Learning Predictive Analytics with R by Eric Mayor-Packet Publishing

Cluster Analysis, Learning Predictive Analytics with R by Eric Mayor-Packet Publishing

UNIT II

Aglomerative Clustering using hclust();Learning Predictive Analytics with R by Eric Mayor-Packet Publishing Dimensionality Reduction using PCA , Learning Predictive Analytics with R by Eric Mayor-Packet Publishing-3Hrs

Exploring Association Rules with Apriori,Learning Predictive Analytics with R by Eric Mayor-Packet Publishing ,Probability Distributions, Covariance and Correlation ,Learning Predictive Analytics with R by Eric Mayor-Packet Publishing

UNIT III

Linear Regression:Learning Predictive Analytics with R by Eric Mayor-Packet Publishing, Forecasting a Time Series: Smoothing, Predictive Analytics, Microsoft Excel,2e, Conrad Carlberg, Que, Pearson, Informit.com, More Advanced Smoothing Models, Predictive Analytics, Microsoft Excel,2e,Conrad Carlberg, Que,Pearson,Informit.com

UNIT IV

Classification with K-Nearest Neighbors and Naïve Bayes Learning Predictive Analytics with R by Eric Mayor-Packet Publishing, Classification Trees, Learning Predictive Analytics with R by Eric Mayor-Packt Publishing. Multilevel Analysis ,Learning Predictive Analytics with R by Eric Mayor-Packt Publishing

UNIT V

Text Analysis with R ,Learning Predictive Analytics with R by Eric Mayor-Packt Publishing, Cross Validation and Boot Strapping using Caret and Exploring Predictive Models using PMML, Learning Predictive Analytics with R by Eric Mayor-Packt Publishing.

TEXT BOOK:

1. Student‟s Handbook for Associate Analytics-III.

REFERENCE BOOK:

1. Gareth James, Daniela Witten, Trevor Hastie Robert Tib shirani. An Introduction to Statistical Learning with Applications in R.

STORAGE AREA NETWORKS - C68PE2B

B. Tech. VIII Semester **L/T/P/C**

3/0/0/3

Course Objectives:

1. Understand Storage Area Networks characteristics and components.
2. Describe the challenges associated with data center networking and the need for switch network convergence.
3. Storage Area Networks including storage architectures, logical and physical components of a storage infrastructure, managing and monitoring the data center.
4. Describe the concept of RAID and different RAID levels and their suitability for different application environments.
5. Learn Fibre Channel protocols and how SAN components use them to communicate with each other.

Course Outcomes:

1. Identify and describe the functions to build data center networking for switch network.
2. Discuss different types of logical and physical components of a storage infrastructure.
3. Describe the different types of RAID implementations and their benefits.
4. Understand the importance of Fibre Channel protocols and how to communicate with each other.
5. Describe the benefits of the different network storage options for different application environments.
6. Identify single points of failure in a storage infrastructure and list solutions.

UNIT I

Introduction to Information Storage

Information Storage , Data, Types of Data, Big Data, Information, Storage, Evolution of Storage Architecture, Data Center Infrastructure, Core Elements of a Data Center, Key Characteristics of a Data Center, Managing a Data Center

Data Center Environment

Connectivity ,Physical Components of Connectivity, Interface Protocols , Storage, Disk Drive Components , Disk Drive performance, Direct-Attached Storage, DAS Benefits and Limitations Storage Design Based on Application Requirements and Disk Performance ,Disk Native Command Queuing ,Introduction to Flash Drives ,Components and Architecture of Flash Drives, Features of Enterprise Flash Drives, Types of Intelligent Storage Systems

UNIT II

Introduction to Storage Area Network (SAN), Properties of SANs, Storage networking architecture

Fibre Channel Storage Area Networks Fibre Channel: Overview, The SAN and Its Evolution, FC Connectivity, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN, iSCSI, FCIP, FCoE

UNIT III

Network-Attached Storage

General-Purpose Servers versus NAS Devices , Benefits of NAS , File Systems and Network File Sharing, Components of NAS, NAS I/O Operation , NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance, File-Level Virtualization,

Object-Based and Unified Storage: Object-Based Storage Devices**,** Content-Addressed Storage, CAS Use Cases, Unified Storage.

UNIT IV

Introduction to Business Continuity

Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions

Backup and Archive

Backup Considerations, Backup Granularity ,Recovery Considerations , Backup Methods , Backup Architecture, Backup and Restore Operations , Backup Topologies , Backup in NAS Environments, Backup Targets ,Data Deduplication for Backup, Data Archive, Archiving Solution , Architecture

Local and Remote Replication

Uses of Local Replicas , Replica Consistency , Local Replication Technologies , Tracking Changes to Source and Replica , Restore and Restart Considerations , Creating Multiple Replicas , Modes of Remote Replication , Remote Replication Technologies , Three-Site Replication

UNIT V

Securing the Storage Infrastructure

Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking

Managing the Storage Infrastructure

Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution, Information Lifecycle Management, Storage Tiering

TEXT BOOK:

1. Information Storage and Management, Second Edition, Soma Sundaram, GnanaSundaram, Alok Shrivastava, EMC education services, Wiley Inc.

REFERENCE BOOK:

1. Storage Area Network Essentials, Richard Barker and Paul Massiglia, Wiley Computer Publishing

MACHINE LEARNING - C68PE2C

B. Tech. VIII Semester **L/T/P/C**

3/0/0/3

Course Objective

To be able to formulate machine learning problems corresponding to different applications and range of machine learning algorithms along with their strengths and weaknesses.

Course Outcomes:

On completion of this course the student should be able to

1. Understand the basic concepts such as decision trees and neural networks.
2. Develop the ability to formulate machine learning techniques to respective problems.
3. Apply machine learning algorithms to solve problems of moderate complexity

UNIT I

INTRODUCTION - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning

CONCEPT LEARNING AND THE GENERAL TO SPECIFIC ORDERING –
Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.

UNIT II

DECISION TREE LEARNING – Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, Hypothesis space search indecision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

ARTIFICIAL NEURAL NETWORKS – Introduction, Neural network representation, appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks.

EVALUATION HYPOTHESES – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, a general approach for deriving confidence intervals, Difference in error of two hypotheses

UNIT III

BAYESIAN LEARNING – Overview of -Bayes theorem principle, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities , Minimum Description Principle, Bayes optimal Classifier, Gibs algorithm, NavieBaysean Classifier.

COMPUTATIONAL LEARNING THEORY – Introduction, Probability learning an
Approximately correct hypothesis, Sample complexity for Finite Hypothesis Space,
INSTANCE-BASED LEARNING- Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case Based Reasoning, Remark son Lazy and Eager Learning

UNIT IV

Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule.
Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL.
Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG, Remarks on Explanation- Based Learning-Discovering new features,

UNIT V

Combining Inductive and Analytical Learning – Motivation, Inductive- Analytical approaches to Learning, Reinforce learning task and Q Learning.

TEXT BOOKS:

1. Machine Learning – Tom M. Mitchell, -MGH
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)

REFERENCE BOOKS:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge University Press.
2. Richard o.Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc., 2001.
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press,1995

TKR COLLEGE OF ENGINEERING & TECHNOLOGY

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DATA SCIENCE - C68PE3A

B. Tech. VIII Semester **L/T/P/C**

3/0/0/3

Course Objectives:

1. Provide a strong foundation for data science and application areas related to it.
2. Understand the underlying core concepts and emerging technologies in data science.
3. Learn the process of working with data on large scale.
4. Explore the concepts of Data Processing.
5. Learn basic concepts of Machine Learning.
6. Prepare students for advanced courses in Data Science

Course Outcomes:

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

1. Understand the fundamental concepts of data science.
2. Evaluate the data analysis techniques for applications handling large data and demonstrate the data science process.
3. Understand concept of machine learning used in the data science process.
4. Visualize and present the inference using various tools.
5. Learn to think through the ethics surrounding privacy, data sharing.

UNIT I

Introduction

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

UNIT II

Data Collection and Data Pre-Processing

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

UNIT III

Exploratory Data Analytics

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

UNIT IV

Model Development

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

UNIT V

Model Evaluation

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

TEXT BOOKS:

1. Jojo Moolayil, “Smarter Decisions: The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O‟Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.

REFERENCE BOOKS:

1. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
2. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

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SEMANTIC WEB & SOCIAL NETWORKS - C68PE3B

B. Tech. VIII Semester **L/T/P/C**

3/0/0/3

Course Objectives:

1. To understand the concept of semantic web and learn knowledge representation using ontology.
2. Implementation of semantic web applications and the architectures of social networking
3. Social network performance analysis.

Course Outcomes:

1. To understand the semantic web, it‟s modeling, and knowledge representation using Ontology language.
2. Demonstrate the semantic web technologies like RDF ontology and others
3. Learn the various semantic web applications
4. Identify the architectures and challenges in building social networks
5. Analyze the performance of social networks using electronic sources.

UNIT I

The Semantic Web

Introduction to Semantic Web, Limitations of current Web The Semantic solution, Development of Semantic Web, Semantic Web Technologies, A Layered Approach

Modeling, Aggregating and Knowledge Representation

Ontology and their role in the Semantic Web, Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations

UNIT II

Describing Web Resources: RDF 23

Introduction , RDF: Data Model, RDF Syntaxes, RDFS: Adding Semantics, RDF Schema:The Language , RDF and RDF Schema in RDF Schema, An Axiomatic Semantics for RDF and RDF Schema , A Direct Inference System for RDF and RDFS

UNIT III

Querying the Semantic Web

SPARQL Infrastructure , Basics: Matching Patterns, Filters , Constructs for Dealing with an Open World , Organizing Result Sets , Other Forms of SPARQL Queries , Querying Schemas , 8 Adding Information with SPARQL Update , The Follow Your Nose

UNIT IV

Web Ontology Language: OWL2

Introduction, Requirements for Ontology Languages,

Creating an OWL -S Ontology for web services, semantic search Technology.

UNIT V

Logic and Inference: Rules

Introduction, Example of Monotonic Rules: Family Relationships, Monotonic Rules: Syntax Monotonic Rules: Semantics, OWL2 RL: Description Logic Meets Rules, Rule Interchange Format: RIF, Semantic Web Rules Language (SWRL), Rules in SPARQL: SPIN

No monotonic Rules: Motivation and Syntax, Example of No monotonic Rules: Brokered Trade, Rule Markup Language (RuleML),

TEXT BOOKS:

1. A semantic web primer: Grigoris Antoniou, Frank Van Harmelen and Rinke Hoekstra, Third edition, MIT press.

2. Peter Mika, ―Social Networks and the Semantic Web, First Edition, Springer 2007.

REFERENCE BOOKS:

1. Borko Furht, ―Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

2. Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.

3. Dion Goh and Schubert Foo - Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
4. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.
5. John G. Breslin, Alexander Passant and Stefan Decker, -The Social Semantic Web, Springer, 2009.

DEEP LEARNING - C68PE3C

B. Tech. VIII Semester **L/T/P/C**

3/0/0/3

Course Objectives:

To present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data. We will delve into selected topics of Deep Learning, discussing recent models from both supervised and unsupervised learning. Special emphasis will be on convolutional architectures, invariance learning, unsupervised learning and non-convex optimization.

Course Outcomes:

1. Understand the concepts of TensorFlow, its main functions, operations and the execution pipeline
2. Implement deep learning algorithms, understand neural networks and traverse the layers of data abstraction which will empower the student to understand data more precisely.
3. Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces
4. Build deep learning models in TensorFlow and interpret the results
5. Understand the language and fundamental concepts of artificial neural networks

UNIT-I

Machine Learning Basics

Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, Building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

UNIT-II

Deep Feed forward Networks

Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

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-III

Optimization for Training Deep Models

How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

Convolutional Networks

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks.

UNIT-IV

Sequence Modeling: Recurrent and Recursive Nets

Unfolding Computational Graphs, Recurrent Neural Networks and Bidirectional RNN, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory,

Applications

Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.

UNIT-V

Autoencoders

Undercomplete Autoencoders, Regularized Autoencoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Autoencoders, Learning Manifolds with Autoencoders, Contractive Autoencoders, Predictive Sparse Decomposition, Applications of Autoencoders.

Representation Learning

Greedy Layer-Wise Unsupervised Pretraining, Transfer Learning and Domain Adaptation, Semi-Supervised Disentangling of Causal Factors, Distributed Representation, Exponential Gains from Depth, Providing Clues to Discover Underlying Causes.

Structured Probabilistic Models for Deep Learning

The Challenge of Unstructured Modeling, Using Graphs to Describe Model Structure, Sampling from Graphical Models, Advantages of Structured Modeling, Learning about Dependencies, Inference and Approximate Inference, The Deep Learning Approach to Structured Probabilistic Models.

Text Books:

1. Deep Learning, Ian Good Fellow, Yoshua Bengio and Aaron Courville.

Reference Books:

1. Neural Networks and Learning Machines, Simon Haykin, Third Edition,
2. Pearson.
3. Michael Nielsen, “Neural Networks and Deep Learning”, Determination Press, 2015.
4. http://neuralnetworksanddeeplearning.com/
5. CharuC.Aggarwal “Neural Networks and Deep learning” Springer International Publishing, 2018
6. Satish Kumar, “Neural Networks, A Classroom Approach”, Tata McGraw -Hill, 2007.
7. Simon Haykin, “Neural Networks, A Comprehensive Foundation”, 2nd Edition, Addison Wesley Longman, 2001.