**Maulana Abul Kalam Azad University of Technology, West Bengal**

*(Formerly West Bengal University of Technology)*

**Syllabus for B. Tech in Artificial Intelligence and Data Science**

(Applicable from the academic session 2020-2021)

## SEMESTER – VI

| | |
|---|---|
| Name of the subject: | **Data Preparation and Analysis** |
| Course Code: **PCCAIDS601** | Semester**: VI** |
| Duration:6 months | Maximum Marks: 100 |
| **Teaching Scheme** | **Examination Scheme** |
| Theory: | Mid Semester exam: 15 marks |
| Tutorial: Nil | Assignment and Quiz: 10 marks |
| | Attendance: 5 marks |
| Practical : hrs /week | End Semester Exam: 70 marks |
| Credit Point: **2** | |

| | CONTENTS | Hrs./Week | Contents |
|---|---|---|---|
| Chapter | Name of the Topic | Hours | Marks |
| 01 | Defining data analysis problems<br>➢ Knowing the client<br>➢ Understanding the question(s) | 6 | 10 |
| 02 | Data gathering and preparation<br>➢ Data formats, parsing, and transformation<br>➢ Scalability and real-time issues | 8 | 15 |
| 03 | Data cleaning<br>➢ Consistency checking<br>➢ Heterogeneous and missing data<br>➢ Data transformation and segmentation | 8 | 25 |
| 04 | Exploratory analysis<br>➢ Descriptive and comparative statistics<br>➢ Clustering and association<br>➢ Hypothesis generation | 9 | 15 |
| 05 | Visualization<br>➢ Designing visualizationsTime series<br>➢ Geolocated data<br>➢ Correlations and connections<br>➢ Hierarchies and networks<br>➢ Interactivity | 8 | 25 |
| 06 | Ethics in the profession<br>➢ Cases in computing, statistics, and communication<br>➢ Professional ethics codes: ACM, IEEE, Am Stat. Assoc. | 10 | 10 |

Required Textbooks

Making Sense of Data: A Practical Guide to Exploratory Data Analysis and Data Mining, *byGlenn J. Myatt*

Recommended Texts

- *The Visual Display of Quantitative Information,* by Edward R. Tufte
- *Visualizing Data: Exploring and Explaining Data with the Processing Environment,* by Ben Fry
- *Exploratory Data Mining and Data Cleaning,* by Tamraparni Dasu

| Name of the Course: | **Computer Networks** | | |
|---|---|---|---|
| Course Code: PCC-CS602 | Semester: VI | | |
| Duration:6 months | Maximum Marks:100 | | |
| **Teaching Scheme** | | **Examination Scheme** | |
| Theory:3 hrs./week | | Mid Semester exam: 15 | |
| Tutorial: NIL | | Assignment and Quiz: 10 marks | |
| | | Attendance: 5 marks | |
| Practical: hrs./week | | End Semester Exam:70 Marks | |
| Credit Points: | 3 | | |
| **Objective:** | | | |
| 1 | To develop an understanding of modern network architectures from a design and performance perspective. | | |
| 2 | To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs). | | |
| 3 | To provide an opportunity to do network programming | | |
| 4 | To provide a WLAN measurement ideas. | | |
| Unit | Content | Hrs/Unit | Marks/Unit |
| 1 | Data communication Components: Representation of data and its flow Networks,Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum. | 9 | |

| | | | |
|---|---|---|---|
| 2 | Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA | 8 | |
| **3** | Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. | 14 | |
| **4.** | Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm. | 8 | |
| **5** | Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography. | 8 | |

**Text book and Reference books:**

1. Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House, New Delhi

**Course Outcomes**:

On completion of the course students will be able to

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

**Computer Networks Lab**
**Code: PCC-CS692**
**Contacts: 4P**

| | |
|---|---|
| Name of the Course: | Computer Networks Lab |
| Course Code: PCC-CS692 | Semester: VI |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement:60 |
| Practical: 4 hrs./week | Distribution of marks:40 |
| Credit Points: | 2 |

1) NIC Installation & Configuration (Windows/Linux)
2) Understanding IP address, subnet etc
Familiarization with
- Networking cables (CAT5, UTP)
- Connectors (RJ45, T-connector)
- Hubs, Switches

3) TCP/UDP Socket Programming
- Simple, TCP based, UDP based
- Multicast & Broadcast Sockets
- Implementation of a Prototype Multithreaded Server

4) Implementation of
□ □ Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
□ □ Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
□ □ Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)
5) Server Setup/Configuration
FTP, TelNet, NFS, DNS, Firewall

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

**Big Data Analytics**
**Code: PCC-AIDS 602**
**Contacts: 3L**

| | | |
|---|---|---|
| Name of the Course: | **Big Data Analytics** | |
| Course Code: **PCC-AIDS 602** | Semester: VI | |
| Duration:6 months | Maximum Marks: 100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory: 3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz : 10 marks | |
| | Attendance: 5 marks | |
| Practical: NIL | End Semester Exam: 70 Marks | |
| Credit Points: | 3 | |

| **LECTURE WITH BREAKUP** | **NO. OF LECTUR** |
|---|---|
| **Unit 1:**<br>What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics. | 8 |
| **Unit 2:**<br>Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations. | 8 |
| **Unit 3:**<br>Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based datastructures | 9 |
| **Unit 4:**<br>MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution,<br>MapReduce types, input formats, output formats | 10 |
| **Unit 5:** | 7 |
| Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. | |

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| **Unit 6:**<br>Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries. | 6 |

**References:**

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017).
3. V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
4. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
8. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
9. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
10. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
11. Alan Gates, "Programming Pig", O'Reilley, 2011.

**Distributed Systems**
**Code: PECAIDS-601C**
**Contact: 3L**

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **INTRODUCTION** Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts **DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE** Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues | 8 | |
| 2 | **DISTRIBUTED DATABASE DESIGN** Alternative design strategies; Distributed design issues; Fragmentation; Data allocation **SEMANTICS DATA CONTROL** View management; Data security; Semantic Integrity Control QUERY **PROCESSING ISSUES** Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data | 11 | |
| 3 | **DISTRIBUTED QUERY OPTIMIZATION** Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms **TRANSACTION MANAGEMENT** The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models **CONCURRENCY CONTROL** Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management | 11 | |
| 4. | Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols Algorithm | 8 | |
| 5 | **PARALLEL DATABASE** SYSTEMS Parallel architectures; parallel query processing and | 6 | |

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|---|---|---|---|
| 6 | **ADVANCED TOPICS Mobile** Databases, Distributed Object Management, Multi-databases | 4 | |

**Text book and Reference books:**

1. Principles of Distributed Database Systems, M.T. Ozsu and PValduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

**Data Mining**
**Code:** PECAIDS-601B
**Contacts: 3L**

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|---|---|---|---|
| Name of the Course: | Data Mining and prediction by machines | | |
| Course Code PECAIDS-601B | Semester: VI | | |
| Duration: 6 months | Maximum Marks: 100 | | |
| **Teaching Scheme** | | **Examination Scheme** | |
| Theory:3 hrs./week | | Mid Semester exam: 15 | |
| Tutorial: NIL | | Assignment and Quiz: 10 marks | |
| | | Attendance: 5 marks | |
| Practical: NIL | | End Semester Exam:70 Marks | |
| Credit Points: | 3 | | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| | **Unit 1:** | | |
| 1 | Overiew of data ming and predictive analytics. Where does it apply and where does it not apply. The emerging interdisplinary field of Data Science – what on Earth is it? The potential pitfalls of analytics including big bad data and the problem of local sparsity in large data sets -- big never guarantees sufficient. Brief discussion of Career Opportunities including an overview of the UNH MS Analytics program. | 4 | |
| 2 | **Unit 2:** Data preprocessing and cleanup including informative missing values and imputation. | 3 | |
| 3 | **Unit 3:** Unsupervised learning: Exploring data with visualization (primarily JMP Pro and Enterprise Guide), Principal Components, Cluster Analysis, Variables Clustering, and Market Basket analysis (association analysis). The problem of explanatory (traditional) vs predictive modeling and why it matters. | 8 | |

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| 4. | **Unit 4:**<br>The under and overfitting dilemma of predictive modeling. Includes a discussion of measures of overfitting and underfitting such as AICc, BIC, and the very new ERIC. | 6 | |
| 5 | **Unit 5:**<br>Validation strategies to assess model predictive behavior and predictive inference | 2 | |
| 6 | **Unit 6:**<br>Supervised learning for classification: k-nearest neighbors, Decision Trees and Random Forests, Naïve Bayes, Neural Nets, Logistic Regression, Generalized Regression, Support Vector Machines, Discriminant Analysis. Topics include boosted neural and tree models. | 5 | |
| 7 | **Unit 7:**<br>Supervised learning for prediction: review of multiple linear regression and related topics like influence and multi-collinearity, PCR, Neural Nets, Generalized Regression including the LASSO (adaptive), LARS, Ridge, and Elastic Net (adaptive). Traditional variable Selection strategies such as Forward Selection and All Possible Models will also be covered. | 6 | |
| 8 | **Unit 8:**<br>Model assessment measures for predictive and classification models: model scoring, prediction error analysis, ROC and Lift curves, profit matrices for | 6 | |

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|---|---|---|---|
| | classification, various model comparison criteria. Ensemble Modeling: combining predictive models to create even more powerful models; includes boosting and bagging strategies. | | |

**Text book and Reference books:**

1. Data Mining for Business Intelligence: Concepts, Techniques and Applications with JMP Pro; Shmueli, Bruce, Stephens, Patel 2017,Wiley & Sons
2. Preparing Data for Analysis with JMP by Robert Carver
3. Introduction to Statistical Learing, sixth printing, by Gareth, Tibshirani, Hastie, and Whitten

**Database Management Systems**
**Code: PCCCS 601**
**Contact: 3L**

| Name of the Course: | **Database Management Systems** | |
|---|---|---|
| Course Code: **PCCCS 601** | Semester: VI | |
| Duration:6 months | Maximum Marks:100 | |
| **Teaching Scheme** | | **Examination Scheme** |
| Theory:3 hrs./week | | Mid Semester exam: 15 |
| Tutorial: NIL | | Assignment and Quiz: 10 marks |
| | | Attendance: 5 marks |
| Practical: hrs./week | | End Semester Exam:70 Marks |
| Credit Points: | 3 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Database system architecture:**Data Abstraction, Data Independence,Data Definition Language(DDL),Data ManipulationLanguage(DML). **Data models:** Entity-relationshipmodel, network model, relational and object oriented data models, integrity constraints, data manipulation operations. | 9 | |

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|---|---|---|---|
| 2 | **Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver.<br>**Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Losslessdesign.<br>**Query processing and optimization:** Evaluation of relational algebra expressions,Query equivalence, Join strategies, Query optimization algorithms. | 13 | |
| 3 | **Storage strategies**: Indices, B-trees, hashing. | 3 | |
| 4. | **Transaction processing:** Concurrencycontrol, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery. | 5 | |
| 5 | **Database Security:** Authentication, Authorization and access control, DAC,MAC and RBAC models, Intrusion detection, SQL injection. | 3 | |
| 6 | **Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining. | 3 | |

**Text book and Reference books:**

1. "Database System Concepts" , 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan,McGraw-Hill.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
3. Database Management Systems, R.P. Mahapatra, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)
4. "Fundamentals of Database Systems" , 5th Edition by R. Elmasri and S.Navathe,
5. PearsonEducation "Foundations of Databases", Reprint by SergeAbiteboul, Richard Hull, Victor Vianu,Addison-Wesley

**Maulana Abul Kalam Azad University of Technology, West Bengal**

**Human Computer Interaction** *(Erstwhile West Bengal University of Technology)*

**Code:**OECAIDS-601B *Draft* **Syllabus for B. Tech in AI and Data Science**

**Contact: 3L** (Applicable from the academic session 2020-2021)

| Name of the Course: | **Human Computer Interaction** | |
|---|---|---|
| Course Code: OECAIDS-601B | Semester: VI | |
| Duration: 6 months | Maximum Marks:100 | |
| **Teaching Scheme** | | **Examination Scheme** |
| Theory:3 hrs./week | | Mid Semester exam: 15 |
| Tutorial: NIL | | Assignment and Quiz: 10 marks |
| | | Attendance : 5 marks |
| Practical: NIL | | End Semester Exam :70 Marks |
| Credit Points: | 3 | |

| Unit | Content | Hrs/Unit | Marks/ Unit |
|---|---|---|---|
| 1 | Human: I/O channels – Memory – Reasoning and problem solving;<br>The computer: Devices – Memory – processing and networks;<br>Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. | 9 | |
| 2 | Interactive Design basics – process – scenarios – navigation – screen design –<br>Iteration and prototyping. HCI in software process – software life cycle –<br>usability engineering – Prototyping in practice – design rationale. Design rules<br>– principles, standards, guidelines, rules. Evaluation Techniques – Universal<br>Design. | 11 | |
| 3. | Cognitive models –Socio-Organizational issues and stake holder requirements<br>–Communication and collaboration models-Hypertext, Multimedia and WWW. | 8 | |
| 4. | Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile<br>Applications: Widgets, Applications, Games- Mobile Information Architecture,<br>Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. | 8 | |
| 5. | Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools,<br>Overlays, Inlays and Virtual Pages, Process Flow. Case Studies. | 8 | |

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|---|---|---|---|
| 6. | Recent Trends in Speech Recognition and Translation Multimodal System | 3 | |

**Text book and Reference books:**

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security,Addison Wesley.

| | | | |
|---|---|---|---|
| **Subject:** Neural Networks | | | |
| **Course Code:** OECAIDS-601C | | **Semester: VI** | |
| **Duration: 36** | | **Maximum Marks: 100** | |
| **Teaching Scheme** | | **Examination Scheme** | |
| **Theory: 3 Hrs./week** | | End Semester Exam: 70 | |
| **Tutorial: 0** | | Attendance : 5 | |
| **Practical:** | | Continuous Assessment:25 | |
| **Credit: 3** | | | |
| | | | |
| **Aim:** | | | |
| **Sl. No.** | | | |
| **1.** | Develop algorithms simulating human brain. | | |
| **2.** | Implement Neural Networks in Tensor Flow for solving problems. | | |
| **3.** | Explore the essentials of Deep Learning and Deep Network architectures. | | |
| **4.** | Define, train and use a Deep Neural Network for solving real world problems thatrequire artificial Intelligence based solutions. | | |
| **Objective:** | | | |
| **Sl. No.** | | | |
| **1.** | To acquire knowledge on the basics of neural networks. | | |
| **2.** | To implement neural networks using computational tools for variety of problems. | | |
| **3.** | To explore various deep learning algorithms. | | |
| **Pre-Requisite:** | | | |
| **Sl. No.** | | | |
| 1. | Calculus, Linear Algebra | | |
| 2. | Probability & Statistics | | |
| 3. | Ability to code in R/Python | | |
| **Contents** | | **Hrs./week** | |
| **Chapter** | **Name of the Topic** | **Hours** | **Marks** |
| 01 | **Introduction**<br>Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamentallearning techniques. | **3** | **5** |
| 02 | **Feed forward neural network**<br>Artificial Neural Network, activation function, multi-layer neural network,cardinality, operations, and properties of fuzzyrelations. | **6** | **10** |

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|---|---|---|---|
| 03 | **Training Neural Network**<br>Risk minimization, loss function, backpropagation, regularization, model selection, and optimization | **6** | **15** |
| 04 | **Conditional Random Fields**<br>Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy. | **9** | **15** |
| 05 | **Deep Learning**<br>Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, RecurrentNeural Network, Deep Belief Network. | **6** | **15** |
| 06 | **Deep Learning research**<br>Object recognition, sparse coding, computer vision, naturallanguage | **6** | **10** |
| | **Sub Total:** | **36** | **70** |
| | **Internal Assessment Examination & Preparation of Semester Examination** | **4** | **30** |
| | **Total:** | **40** | **100** |

**List of Books**
**Text Books:**

| Name of Author | Title of the Book | Edition/ISSN/ISBN | Name of the Publisher |
|---|---|---|---|
| Goodfellow, I.,Bengio,Y.,and Courville A., | Deep Learning | | MIT Press |
| Satish Kumar | Neural Networks: A Classroom Approach | | Tata McGraw-Hill |
| **Reference Books:** | | | |
| Bishop, C. ,M. | Pattern Recognition and Machine Learning | | Springer |
| Yegnanarayana, B. | Artificial Neural Networks | | PHI Learning Pvt. Ltd |
| Golub, G.,H., and VanLoan,C.,F. | Matrix Computations | | JHU Press |

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*Draft* **Syllabus for B. Tech in AI and Data Science**

(Applicable from the academic session 2020-2021)

| | | |
|---|---|---|
| Name of the Course: | Cryptography & Network Security | |
| Course Code:<br>OEC-AIDS 601D | Semester: VI | |
| Duration: 6 months | Maximum Marks: 100 | |
| **Teaching Scheme** | | **Examination Scheme** |
| Theory: 3 hrs./week | | Mid Semester exam: 15 |
| Tutorial: NIL | | Assignment and Quiz: 10 marks |
| | | Attendance: 5 marks |
| Practical: NIL | | End Semester Exam : 70 Marks |
| Credit Points: | 3 | |

Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms , A Model for Network Security, Classical Encryption Techniques, Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography, Cryptographic Tools, Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers, Practical Application: Encryption of Stored Data, User Authentication, Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication, Malicious Software, Types of Malicious Software (Malware), Propagation—Infected Content—Viruses, Propagation—Vulnerability Exploit—Worms, Propagation—Social Engineering—SPAM Email, Trojans, Payload—System Corruption, Payload—Attack Agent—Zombie, Bots, Payload—Information Theft—Key loggers, Phishing, Spyware, Payload—Stealthing— Backdoors, Rootkits, Countermeasures, Firewalls and Intrusion Prevention Systems, the Need for Firewalls, Firewall Characteristic, Types of Firewalls, Firewall Basing, Firewall Location and Configurations, Intrusion Prevention Systems.

**Text Books:**

1. Cryptography and Network Security: Principles and Practice by William Stalings 6th Edition published by PHI (2011)
2. Computer security principles and practice, William Stallings, Lawrie Brown, third edition, Prentice-Hall, 2011
3. Cryptography and Network Security, V.K. Jain, Khanna Publishing House

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*Draft* **Syllabus for B. Tech in AI and Data Science**

(Applicable from the academic session 2020-2021)

**Machine Learning**
**Code: PEC-AIDS 601A**
**Contacts: 3L**

| | | |
|---|---|---|
| Name of the Course: | Machine Learning | |
| Course Code: **PEC-AIDS 601A** | Semester: VI | |
| Duration: 6 months | Maximum Marks: 100 | |
| **Teaching Scheme** | | **Examination Scheme** |
| Theory: 3 hrs./week | | Mid Semester exam: 15 |
| Tutorial: NIL | | Assignment and Quiz: 10 marks |
| | | Attendance: 5 marks |
| Practical: Nil | | End Semester Exam: 70 Marks |
| Credit Points: | 3 | |

| **COURSE OBJECTIVE** | | |
|---|---|---|
| □ To learn the concept of how to learn patterns and concepts from data without being explicitly programmed | | |
| □ To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances. | | |
| □ Explore supervised and unsupervised learning paradigms of machine learning. | | |
| □ To explore Deep learning technique and various feature extraction strategies. | | |
| | **Hrs/unit** | **Marks/unit** |
| **Unit 1:**<br>**Supervised Learning (Regression/Classification)**<br>□ Basic methods: Distance-based methods, Nearest-Neighbours, DecisionTrees, Naive Bayes<br>□ Linear models: Linear Regression, Logistic Regression, GeneralizedLinear Models<br>□ Support Vector Machines, Nonlinearity and Kernel Methods<br>□ Beyond Binary Classification: Multi-class/Structured Outputs, Ranking | 10 | |
| **Unit 2:**<br>**Unsupervised Learning**<br>□ Clustering: K-means/Kernel K-means<br>□ Dimensionality Reduction: PCA and kernel PCA<br>□ Matrix Factorization and Matrix Completion<br>□ Generative Models (mixture models and latent factor models) | 7 | |
| **Unit 3**<br>Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests) | 6 | |
| **Unit 4**<br>Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning | 9 | |

| | | |
|---|---|---|
| **Unit 5**<br>Scalable Machine Learning (Online and Distributed Learning)<br>A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference | 9 | |
| **Unit 6:**<br>Recent trends in various learning techniques of machine learning and classification methods | 5 | |

**References:**

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007
4. Dr. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018

**Database Management System Lab**
**Code: PCC-CS691**
**Contacts: 4P**

| | |
|---|---|
| Name of the Course: | **Database Management System Lab** |
| Course Code: **PCC-CS691** | Semester:VI |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement:60 |
| Practical: 4 hrs./week | Distribution of marks:40 |
| Credit Points: | 2 |

**Laboratory Experiments:**
**Structured Query Language**
**1. Creating Database**

- Creating a Database
- Creating a Table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Indexes

**2. Table and Record Handling**

- INSERT statement
- Using SELECT and INSERT together
- DELETE, UPDATE, TRUNCATE statements
- DROP, ALTER statements

**3. Retrieving Data from a Database**

1. The SELECT statement
2. Using the WHERE clause

3. Using Logical Operators in the WHERE clause
4. Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING **Clause**
5. Using Aggregate Functions
6. Combining Tables Using JOINS
7. Subqueries

**4. Database Management**

- Creating Views
- Creating Column Aliases
- Creating Database Users
- Using GRANT and REVOKE

| **Cursors in Oracle PL / SQL**<br>**Writing Oracle PL / SQL Stored Procedures** |
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Any experiment specially designed by the college

(Detailed instructions for Laboratory Manual to be followed for further guidance)