Subject Code: PECS-113

Subject Name: Blockchain Technology

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems: NIL**
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Computer Networks

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Elaborate the emerging concept of Blockchain Technology as a foundation for future.
CO2	Outline the secure interaction mechanism within a blockchain system.
CO3	Discuss various consensus algorithms used in blockchain system.
CO4	Demonstrate Ethereum network and understand smart contracts.
CO5	Explain the hyperledger fabric and deal with digital ledgers.
CO6	Analyze various research areas in blockchain technology.

Detailed Contents:

Part-A

Introduction to Cryptography: Need of Cryptography, Traditional and Modern techniques, Hash function, Distributed Hash Table, Digital Signatures, Symmetric and Asymmetric Key Cryptography, Zero Knowledge Proof, Double Spending problem. **[6 Hours]**

Introduction to Blockchain: Distributed Database, shortcomings of current transaction systems, distributed network, difference between blockchain and traditional database, evolution of blockchain. Bitcoin's Architecture, Blockchain Architecture: merkle root tree, gas limit, transactions and fee, nonce value, anonymity, reward, chain policy, miners, validators, types (private and public blockchains), Challenges to Blockchain Implementation, Features of Blockchain Network, Soft & Hard Fork. **[8 Hours]**

Distributed Consensus I: The mining mechanism, Two Generals Problem, Byzantine General problem and Fault Tolerance, Nakamoto consensus, Evaluation aspects Blockchain consensus protocols: Scalability, Throughput (TPS), Latency, Security, Fault Tolerance Rate, Energy

Consumption. **[5 Hours]**

Part-B

Distributed Consensus II: Consensus Algorithms: Proof of Work, Proof of Stake, Delegated Proof of Stake, Proof of Activity, Comparison among them. **[5 Hours]**

Ethereum: Public consortium blockchain: Introduction of Ethereum, Ethereum account, Ethereum network, Ethereum client, Ethereum gas, Ethereum virtual machine, Ethereum block, header, Ether, smart contracts. **[6 Hours]**

Blockchain use cases: Applications in finance: settlements, KYC, capital markets, insurance; supply chain: provenance of goods, visibility, trade supply chain finance, invoice management discounting; government: digital identity, land registration; medical information systems. **[6 Hours]**

Textbooks

1. Sam Gounder, 'Blockchain Technologies, Applications And Cryptocurrencies: Current Practice And Future Trends', World Scientific.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform.
3. Arvind N., Joseph B., Edward F., Andrew M., and Steven G., "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press.

Reference Books

1. Henning Dendrich, 'Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations', CreateSpace Independent Publishing Platform.
2. Melanie Swan, 'Blockchain: Blueprint for a New Economy', O'Reilly Media, Inc., 1st edition.
3. Neeraj Kumar, N. Gayathri, Md. Arafatur Rahram and B. Balaguram, 'Blockchain, Big Data and Machine Learning: Trends and Applications', CRC Press, Taylor and Francis.

E-books and online learning material

1. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System, White Paper.
2. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper.
3. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts.

Online lectures

1. "Introduction to Blockchain Technology and Applications", https://nptel.ac.in/courses/106/104/106104220/ Accessed on September 16, 2021
2. "Blockchain Architecture Design and use Cases", https://nptel.ac.in/courses/106/105/106105184/ Accessed on September 16, 2021

Subject Code: PECS-112

Subject Name: Internet of Things

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 15% Cloud
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Computer Networks

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Understand general concepts of Internet of Things (IoT).
CO2	Discriminate the functionality of IP and MAC addresses along-with the application layer protocols.
CO3	Illustration of the design principles for connected devices and web connectivity.
CO4	Analyze various M2M and IoT architectures.
CO5	Apply design concepts to IoT solutions.
CO6	Create IoT solutions using sensors, actuators, and Devices.

Detailed Contents:

Part-A

Introduction to Internet of Things (IoT): IoT Definition, IoT Vision, Smart and Hyper-connected Devices, Conceptual Framework, Architectural View, Technology behind IoT, Major Components of IoT System, Sources of IoT, Examples of IoT. **[6 Hours]**

IoT & M2M: Difference between IoT and Machine to Machine, M2M Architecture, SNMP protocol, IoT reference model, Lightweight M2M Communication Protocol, Domain model - information model, functional model, communication model. **[6 Hours]**

Design Principles for Web Connectivity: Constrained Application Protocol, JSON (Java Script Object Notation) Format, Tag Length Value Format, MIME (Multipurpose Internet Mail Extension)

Type, Message Communication Protocols for Connected Devices, Web Connectivity for Connected Devices Network. **[6 Hours]**

Part-B

IoT Reference Architecture: Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment, Constraints affecting design of IoT, Technical design Constraints. **[6 Hours]**

Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Environmental and Agriculture applications, Other IoT applications. **[6 Hours]**

Developing IoT solutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT. **[6 Hours]**

Text Books

1. Davis Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, and Jerome Henry, "IoT Fundamentals – Networking Technologies, Protocols, and Use Cases for the Internet of Things", 5th Impression, CISCO Press.
2. Mayur Ramgir, "Internet of Things – Architecture, Implementation and Security", 1st Impression, Pearson India.
3. Raj Kamal, "Internet of Things – Architecture and Design Principles", 5th Reprint Edition, McGraw - Hill Education.
4. Arsheep Bahga, Vijay Madisetti, "Internet of Things – A Hands-On Approach", 3rd Impression, Universities Press.
5. Gaston C. Hillar, "Internet of Things with Python", 2nd Impression, PACKT Open Source Press.

Reference Books

1. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, "Internet of Things with Raspberry Pi and Arduino", 1st Impression, CRC Press.
2. Ashwin Pajankar, "Internet of Things with Arduino and Bolt", 2nd Impression, BPB Publications.

E-Books and online learning material

1. Donald Noris, "The Internet of Things", Mc Graw Hill Education, New York https://www.pdfdrive.com/download.pdf?id=176037121&h=c064c3b7014c0ed46f60e480e4a5b625&u=cache&ext=pdf.

2. Aleksandr Kapitonov, Raivo Sell “Introduction to Internet of Things”, Erasmus Education, Ritankar Sahu Publisher
http://iot-open.eu/download/io1-introduction-to-the-iot/?wpdmdl=2702&_wpdmkey=6022469db61f3&refresh=6022469dbfe3a1612859037.

Online Courses and Video Lectures

1. “Introduction to Internet of Things”,https://www.digimat.in/nptel/courses/video/106105166/L01.html.
Accessed on September 4, 2021.
2. “Computer Networks and Internet Protocol”, https://onlinecourses.nptel.ac.in/noc21_cs18/preview.
Accessed on September 4, 2021.

Subject Code: LPECS-106

Subject Name: Internet of Things laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 8	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Computer Networks

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Understand Internet of Things along-with its hardware and software components.
CO2	Interface I/O devices, sensors & communication modules.
CO3	Use wireless peripherals for exchange of data.
CO4	Understand the key features of Ad hoc and sensor networks
CO5	Analyze and evaluate protocols used in IoT and data received through sensors in IoT.
CO6	Develop real-time IoT based automation systems.

List of Practicals

1. Familiarization with Arduino/ Raspberry Pi and perform necessary software installation.
2. Demonstrate the communication modules like BLE, WIFI, XBEE.
3. Interfacing Arduino to Zigbee module.
4. Communicate between Arduino and Raspberry PI using any wireless medium.
5. Interface LED/ Buzzer with Arduino/ Raspberry Pi and write a program to turn ON/OFF LED for specific duration.
6. Interface DHT11/ DHT22 sensor with Arduino/ Raspberry Pi and write a program to print temperature and humidity readings.
7. Interface PI Camera with Arduino/ Raspberry Pi and write a program to start the camera and to place the clicked pictures on the desktop
8. Interface PIR Sensor with Arduino/ Raspberry Pi and write a program to check the motion of PIR sensor.
9. Setup a cloud platform to log the data.
10. Log Data using Raspberry PI and upload to the any cloud platform.

Mini Project: Students are required to prepare a mini project based on IoT system as per course contents.

Reference Material

Manuals available in Lab.

Subject Code: PECS-118

Subject Name: Big Data

Programme: B.Tech. (CSE)	L: 3 T: 0 P: 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 30%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Data Mining

Additional Material Allowed in ESE: NIL

On Completion of the course student should be able to:

CO#	COURSE OUTCOMES (CO)
CO1	Explain the structural concepts and analytics tools of big data related with business problems.
CO2	Apply Hadoop and MapReduce commands in big data distributed environment of Clusters.
CO3	Evaluate Hadoop distributed file system with Mapper and Reducer for big data management.
CO4	Discuss and compare different types of databases for big data application management.
CO5	Classify business analytics and analytical methods in practice for decision making in businesses.
CO6	Examine and utilize different analytical methods and case studies for the analysis of big data problems in contemporary businesses.

Detailed Contents

Part-A

Introduction to Big Data: Big data overview, V's of big data, Data structures, State of the practice in analytics, Current analytical architecture, Drivers of big data, Big data ecosystem and a New Approach to Analytics, Key roles for the new big data ecosystem, Data at rest v/s data at motion, Examples of big data analytics tools. **[5 Hours]**

Apache Hadoop: Understanding distributed system and Hadoop, Comparing SQL databases and Hadoop, MapReduce building blocks of Hadoop –Name node, Data node, Secondary name node, Job-Tracker, Task-Tracker, Introducing and configuring Hadoop cluster – Local, Pseudo distributed mode, Fully distributed mode, Handling web-based Cluster, and Configuring XML files. **[7 Hours]**

Working with Hadoop: Interacting with HDFS, Steps to read and write into HDFS. Anatomy of MapReduce Program – Hadoop data type, Mapper and Reducer, Partitioner, Combiner, Reading and

writing format, Word count with predefined Mapper and reducer. Introduction to with Hive and Spark. **[7 Hours]**

Part-B

Big Data Management: In-database Analytics – Introduction to NoSQL– Aggregate data models, Graph databases, Graph-less databases, Distribution models, Introduction to HBase, MongoDB, and Cassandra. **[7 Hours]**

Business Analytics: Decision making in business analytics, Business analytics in practice – Financial analytics, Healthcare analytics, Sport and web analytics. Categorization of analytics methods and models – Descriptive analytics, Predictive analytics, Perspective analytics. **[4 Hours]**

Analytical Methods and Case studies: Linear regression, Logistic regression, K-Means clustering, Decision tree classification. Case studies: Social data analytics, Recommendation engines, Customer analytics. **[5 Hours]**

Text Books

1. Tom White, "Hadoop: The Definitive Guide", Fourth Edition, O'Reilly Media.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics", First Edition, Wiley.
3. Parag Kulkarni, Sarang Joshi,S.Brown, "Big Data Analytics", PHI Learning Pvt. Ltd.
4. Paul C. Zikopoulos, Chris Eaten, Dirk Deroos, "Understanding Big Data", McGraw Hill.

Reference Books

1. Chuck Lam, "Hadoop in Action", Reprint edition, Dreamtech Press
2. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC2, First Edition, Wiley Publications.
3. Jeffrey D. Camm, "Essentials of Business Analytics", First Edition, CENGAGE Learning.
4. Jared Dean, "Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners", First Edition, Wiley Publications.
5. Eric Siegel, Thomas H. Devanport, "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", First Edition, Wiley Publications.

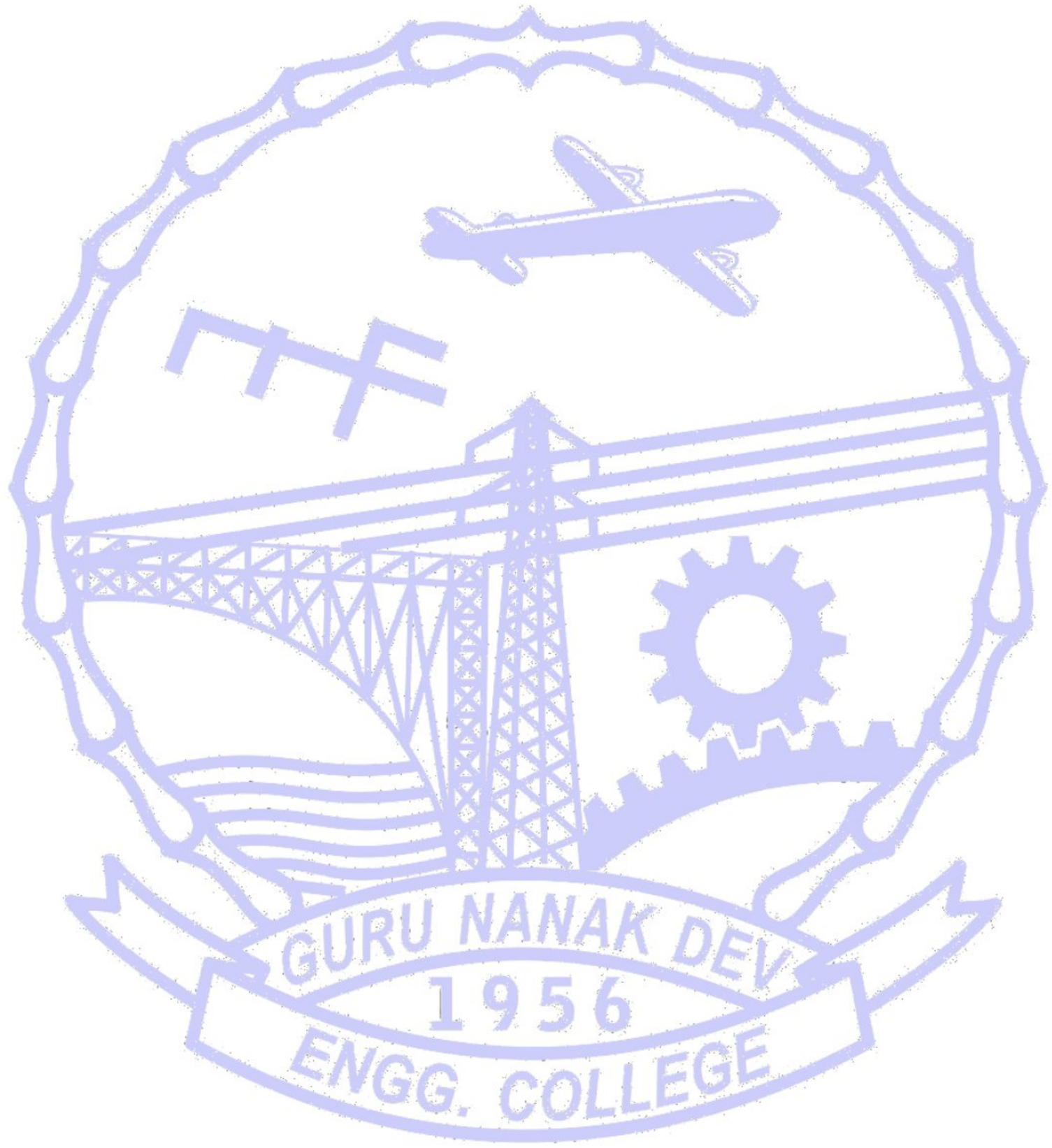
E-Books and Online Learning Material

1. Lecture Notes on Big Data and Business Analytics by Ms. G. Sulakshana and Ms. G. Srilekha https://www.iare.ac.in/sites/default/files/NEW%20LECHURE%20NOTES.pdf
2. Online Book "Big Data- Principles and Paradigms" by Rajkumar Buyya http://dhoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/Big%20Data%20Principles%20and%20Paradigms.pdf

Online Courses and Video Lectures

1. "Big Data Computing", https://nptel.ac.in/courses/106/104/106104189 Accessed on July 20, 2021

2. "Introduction to Data Analytics", https://nptel.ac.in/courses/110/106/110106072/
Accessed on July 20, 2021



Department of Computer Science and Engineering

Subject Code: PECS-119

Subject Name: Data Science

Programme: B.Tech. (CSE)	**L: 3 T: 0 P: 0**
Semester: 8	**Teaching Hours**: 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE)**: 3 hrs
Total Marks: 100	**Course Status**: Elective

Prerequisites: Knowledge of basic programming and mathematical functions.

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Analyze the need and usage of various facets of data.
CO2	Examine the steps for Data collection and Data Science process.
CO3	Identify and apply various forms of representing data.
CO4	Perform exploratory data analysis.
CO5	Understand and apply various visualization techniques.
CO6	Demonstrate and enrich knowledge for various model validation techniques.

Detailed Contents:

PART-A

Introduction: Introduction to Data Science, Introduction to Big Data, Relationship between Big Data and Data Science, Benefits and uses of Data science and Big data. Data Structure: Structured vs Unstructured Data. Drivers of big data, Data Growth-issues and challenges, Data Science vs Business Intelligence**.** **[6 Hours]**

Data Collection and Data Science Process: Sources of Data, Data collection and APIs, Data Science Process: Goal setting, retrieving data, data preparation, data cleansing and transformation, exploratory data analysis, data visualization, Model building and performance evaluation, presentation. **[6 Hours]**

Data Representation: Various Forms of data, Text data, Graph-based data. Modern databases- text files, spreadsheets, SQL databases, NoSQL databases, Distributed databases, Live data streams, Image, Sensor and Network data. Dataset Terminology: Observations and variables, Discrete and Continuous variables, Quantitative and Qualitative variables, Dependent and Independent variables. **[8 Hours]**

PART-B

Data Exploration: Introduction and purpose of EDA (Exploratory Data Analysis), Descriptive statistics: mean, median and mode, variance and measures of variance: standard deviation, range, skewness, correlation, correlation. Handling anomalous values, missing values and outliers. **[9 Hours]**

Data Visualization: Purpose and techniques of Data visualization: Histograms, Box Plots, Scatterplots. Normal Distribution: meaning and its characteristics, concept of transformations, transformation functions: Power function, Exponential function, Polynomial function, Model building and variable selection, Dimensionality, Feature selection methods: forward selection and backward selection procedure, stepwise selection procedure. Concepts of overfitting and under-fitting. Model validation and comparison: Confusion matrix: accuracy, precision and recall**,** ROC Curve. **[9 Hours]**

Text Books

1. Sinan Ozdemir and Sunil Kakade, "Principles of Data Science", Second Edition, Packt Publishing.
2. Roger D. Peng and Elizabeth Matsui: "The Art of Data Science", Lean Publishing
3. Joel Grus, Data Science from Scratch, Second Edition, O'Reilly

Reference Books

1. Foster Provost & Tom Fawcett: "Data Science for Business" O'Reilly
2. Roger D. Peng, R Programming for Data Science

E-Books and Online learning material

Davy Cielen, Arno D.B. Meysman, Mohamed Ali, Introducing Data Science - Big Data, Machine Learning and More Using Python Tools, Manning Publications Co.

http://bedford-computing.co.uk/learning/wp-content/uploads/2016/09/introducing-data-science-machine-learning-python.pdf

Online Courses and Video lectures

1. "Data Science for Engineers", https://nptel.ac.in/courses/106/106/106106179/ Accessed on September 10, 2021
2. "Python for Data Science", https://nptel.ac.in/courses/106/106/106106212/ Accessed on September 10, 2021
3. "Foundations of Data Science", https://www.youtube.com/watch?v=WEBUWYxaqLQ Accessed on September 10, 2021

Subject Code: LPECS-109

Subject Name: Data Science Laboratory

Semester: 8	**Teaching Hours**: 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE)**: 2 hrs
Total Marks: 50	**Course Status**: Elective

Prerequisites: Fundamentals of database systems

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Understand concepts of R programming.
CO2	Understand and demonstrate use of variables, data types and operations using R.
CO3	Perform and use various mathematical constructs for better analysis of data.
CO4	Implement various visualization techniques for gaining more data insights.
CO5	Utilize the knowledge and techniques of Data Science for having more information gain form
CO6	Design and develop projects using Data Science tools and techniques

List of Practicals

1. Introduction to R.
2. Programs to implement use of Variables and Data types in R.
3. Program to implement Arithmetic, Logical and Matrix operations in R.
4. Program to implement concept of Functions.
5. Program to implement control structures.
6. Program to Read and Write data from dataset.
7. To study and write program for using Linear Algebra for Data Science.
8. To study various libraries and packages for Data Visualization in R.
9. Write a program to find data distribution using box and scatter plot.
10. Write a program to find outliers using plot.
11. Write a program to plot Histogram and Bar chart on sample data.

Minor project:

Students are required to develop a project to use various Data Science constructs like box, scatter plot, Histogram, Dimensionality, Transformation to visualize sample dataset.

Reference Material

Manuals available in Lab.

Subject Code: PECS-123
Subject Name: Human Computer Interaction

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Knowledge of problem solving using different algorithms and basic programming.

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO #	Course Outcomes (CO)
CO1	Examine the capabilities of both humans and computers from the viewpoint of human information processing.
CO2	Create the structure of human computer interaction models.
CO3	Apply an interactive design process and universal design principles to design HCI systems.
CO4	Depict and use HCI design principles, standards and guidelines.
CO5	Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.
CO6	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.

Detailed Contents:

PART-A

Foundations of Human Computer Interaction: Introduction to HCI, The Human: I/O channels, Memory, Reasoning and Problem Solving; The Computer: Devices, Memory, Processing and Networks; Interaction: Models, Frameworks, Ergonomics, Styles, Elements, Interactivity and Paradigms. **[8 Hours]**

Design Process and Implementation: Interactive Design Basics: Process, Scenarios, Navigation, Screen Design, Iteration and Prototyping. HCI in Software Process: Software Life Cycle, Usability Engineering, Prototyping in Practice, Design Rationale. Design Rules: Principles, Standards, Guidelines, Rules. Evaluation Techniques: Universal Design. **[8 Hours]**

User and Task Model: Cognitive Models, Socio-Organizational Issues and Stakeholder Requirements, Analyzing Tasks, Dialog Notations and Design. **[6 Hours]**

PART-B

Web Interface Design: Hypertext, Multimedia, World Wide Web, Overlays, Inlays and Virtual Pages, Contextual Tools, Designing Process, Case Studies. **[5 Hours]**

User Interface Evaluation: Heuristic Evaluation, Evaluation with Users, Model-based Evaluation, Mobile Application Frameworks, Types of Mobile Applications, Mobile Design Architecture and its Elements. **[5 Hours]**

Computing Theories & Recent Trends: Groupware and Computer Supported Collaborative Work, Ubiquitous Computing, Virtual Reality and Augmented Reality, Speech Recognition and Translation. **[4 Hours]**

Text Books

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education.
2. Ben Shneiderman, Maxine Cohen, Catherine Plaisant, Steven M. Jacobs, "Designing the User Interface", 5th Edition, Pearson Education.
3. K. Meena, R. Sivakumar, "Human-Computer Interaction" PHI Learning, Delhi.
4. Shneiderman, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th Edition, Pearson Education India.

Reference Books

1. Brian Fling, "Mobile Design and Development", 1st Edition, O"Reilly Media Inc.
2. Bill Scott and Theresa Neil, "Designing Web Interfaces", 1st Edition, O"Reilly.
3. Dr. Samit Bhattacharya, "Human-Computer Interaction: User-Centric Computing for Design", 1st Edition, McGraw-Hill.

E-Books and online learning material

1.Human Computer Interaction
https://www.researchgate.net/publication/224927543_HumanComputer_Interaction/link/02e7e51a84759ab04d000000/download

2.HCI - Fundamentals and Practice http://www.ittoday.info/Excerpts/HCI.pdf

3.HCI – An Overview http://www.ee.cityu.edu.hk/~hcso/ee4213_ch1.pdf

Online Courses and Video Lectures

1."Human-Computer Interaction", https://nptel.ac.in/courses/106/103/106103115/
Accessed on July 9, 2021
2."Introduction to Human Computer Interaction", https://nptel.ac.in/courses/106/106/106106177/
Accessed on July 9, 2021
3."Human-Computer Interaction" https://swayam.gov.in/nd1_noc19_cs86/preview
Accessed on July 9, 2021

Subject Code: PECS-124

Subject Name: Deep Learning

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Course Status:** Elective

Prerequisite: complete knowledge of Clustering, Classification and Graphical Models

CO #	Course Outcomes (CO)
CO1	Understand the concept of Deep Learning, types of learning and computational units.
CO2	Compare and analyze new optimization methods for neural networks, feed forward networks, Recurrent neural networks, Convolutional Neural Networks, Autoencoders and Boltzmann Machines.
CO3	Learn deep learning methods for working with sequential data, deep recurrent and memory networks.
CO4	Identify, formulate and analyze uses and Constraints of various Convolutional Neural Networks.
CO5	Know the open issues in deep learning and have a grasp of the current research directions.
CO6	Apply deep learning mechanisms to various learning problems.

Detailed Contents:

PART-A

Introduction: Deep Learning definition, why Deep Learning, history of Deep Learning, Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Convergence theorem for Perceptron Learning Algorithm. **[5 Hours]**

Feedforward Networks: Multilayer Perceptron, Representation power of Feedforward Neural Networks, Backpropagation Gradient Descent, Empirical Risk Minimization, autoencoders. **[4 Hours]**

Deep Neural Networks: Difficulty of training deep neural networks, Greedy layerwise training, Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, **[5 Hours]**

Recurrent Neural Networks: Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs **[5 Hours]**

Part-B

Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet **[6 Hours]**

Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines. **[5 Hours]**

Recent trends: Variational Autoencoders, Auto-encoders and unsupervised learning, Stacked auto-encoders and semi-supervised learning, transfer learning, multi-model learning, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning **[6 Hours]**

Textbooks

1. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

2. Bengio, Yoshua. "Learning deep architectures for AI", Foundations and trends in Machine Learning 2.1 (2009):

Reference Books

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996

2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

E-books and online learning material

1. http://deeplearning.net/tutorial/deeplearning.pdf

2. http://neuralnetworksanddeeplearning.com/index.html

3. https://d2l.ai/d2l-en.pdf

Online Courses and Video Lectures

1. "Deep Learning", https://nptel.ac.in/courses/106/106/106106184/ Accessed on July 9, 2021

2. "Deep Learning for Visual Computing", https://nptel.ac.in/courses/108/105/108105103/

   Accessed on July 9, 2021

Subject Code: LPECS-112

Subject Name: Deep Learning Laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 8	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Knowledge of problem solving using different algorithms and basic programming.

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Implement deep learning algorithms, understand neural networks and traverse the layers of data abstraction which will empower to understand data more precisely.
CO2	Learn topics such as convolutional neural networks, recurrent neural networks, training deep ne and high-level interfaces
CO3	Troubleshoot and improve deep learning models
CO4	Performing experiments in Deep Learning using real-world data
CO5	Design the test procedures to Access the efficacy of the developed model.
CO6	Apply deep learning mechanisms to various learning problems.

List of Practicals

1. Learn to build your first simple neural network and analyse it using some real data.
2. Build recurrent networks and long short-term memory networks and perform sentiment analysis on it.
3. Build a ResNet architecture and use it for some real-world data.
4. Implement AlexNet architecture and use it for image database.
5. Implement a 2-D CNN and use it for speech data corpus.
6. Implement a hybrid network using CNN and LSTM and use it for classification.
7. Use deep neural networks to design agents that can learn to take actions in a simulated environment. Apply reinforcement learning to complex control tasks like video games and robotics.
8. Build a pair of multi-layer neural networks and make them compete against each other in order to generate new, realistic faces.

Reference Material

Manuals available in Lab.

Subject Code: PRCS-107
Subject Name: Software Management Tools

Programme: B.Tech.(CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 8	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 0	**Duration of End Semester Exam (ESE): NA**
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Knowledge of basic programming skills

On completion of the course, the student will have the ability to:

CO#	COURSE OUTCOMES (CO)
CO1	Apply knowledge for the management of various software.
CO2	Recognize the benefits of software planning and configuration management tools.
CO3	Explore various software management tools for throughout evaluation of the software projects.
CO4	Analyze various software management tools along with their components for project planning and designing purpose.
CO5	Implement various CICD tools and techniques for effective application of relevant standards for project management.
CO6	Identify the benefits of various tools for software debugging, UML Diagrams and various project charts.

Detailed Contents:

To provide the hands-on experience in managing various software projects. In this lab, students are required to work on various open-source software management tools like Github, OpenProj, Bugzilla, Jenkins, Harvest, WinRunner and tools of CICD (DEV or UAT) etc. for planning, managing, analyzing, designing, testing and implementing various software projects based on the platform used from the developer as well as client point of view. Languages they have learned so far. Therefore, based on the software requirement, project management reports should be prepared under the guidance of faculty coordinator.