**B.Tech IV Year - I Semester Course structure**

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**Web Development Using MEAN Stack**

**(CSE)**

**Course Code: P18CST14 Internal Marks: 40**

**External Marks: 60**

**Course Prerequisite: HTML, JAVA Script**

**Course Objectives:**

This course is designed to introduce students to learn how to design both the front and back end of web applications. The course will introduce web-based media-rich programming tools for creating interactive web pages.

**Course Outcomes:**

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

1. Apply Angular8 to develop web applications.
2. Make use of Forms and Services.
3. Utilize Node.js to create Server Side Applications.
4. Make use of Express to deploy web applications.
5. Experiment with NoSQL using MongoDB.

**UNIT-I:** (9 Lectures)

**Angular8:** Introduction, Installation, Creating First Angular8 Application, Architecture, Angular Components and Templates, Data Binding, Directives, Pipes, Services and Dependency Injection.

**Unit-II:** (9 Lectures)

**Angular8:** Reactive Programming, HTTP Client Programming, Angular Material, Routing and Navigation, Forms, Form Validation, CLI Commands.

**UNIT-III** (10 Lectures)

**Node.js:** Introduction, Node.js Process Model, Node.js Console, Node.js Basics, Node.js Modules, Local Modules, Export Module, Node Package Manager, Node.js Web Server..

**UNIT-IV** (8 Lectures)

**Node.js Contd. & Express.js:** Node.js File System, Node.js EventEmitter,

**Express.js:** Express.js Web App, Serving Static Resources.

**UNIT-V** (9 Lectures)

**MongoDB:** Access MongoDB in Node.js, Connecting and Creating Database in MongoDB, Insert Documents, Update Documents, Delete Documents, Query Database.

**Text Books:**

1. Node.js, MongoDB and Angular Web Development by Brad Dayley, Brendan Dayley-2nd Edition – Addison –Wesley.
2. Getting MEAN with Mango, Express, Angular and Node by Simon Holmes, Clive Harber-2nd Edition - Manning Publications.
3. MEAN Cookbook by Nicholas McClay- Packt.

**Reference Books:**

1. Node.js: Web Development for Beginners by Joseph Conner.
2. Mean Stack Developer by Camila Cooper.

**Web References:**

1. https://www.tutorialspoint.com/angular8/index.htm.
2. https://www.edx.org/course/introduction-to-mongodb-using-the-mean-stack.
3. https://www.simplilearn.com/full-stack-web-developer-mean-stack-certification-training.
4. https://www.tutorialsteacher.com/nodejs/expressjs-web-application.

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**Object Oriented Analysis and Design using UML**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CST15 External Marks: 60**

**Course Prerequisites:** **OOP concepts**.

**Course Objectives:**

1. The main objective of this course is that the students become familiar with all phases of OOAD and master the main features of the UML.
2. The students know about the main concepts of Object Technologies, how to apply them at work, ability to analyze and solve challenging problem in various domains.
3. Student will use systematic approach that focus and describe abstract systems of interaction between classes and objects..

**Course Outcomes:**

1. Ability to find solutions to the complex problems using object oriented approach.
2. Identify classes and responsibilities of the problem domain
3. Select the basic elements of modeling such as Things, Relationships and Diagrams depending on the views of UML Architecture and SDLC.
4. Apply Basic and Advanced Structural Modeling Concepts for designing real time applications.
5. Analyze Dynamic Aspects of a system using Behavioral Diagrams and Runtime environment of Software Systems.

**UNIT I:** (7 Lectures)

**Introduction**: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Evolution of Object Model, Foundation of Object Model, Elements of Object Model, Applying the Object Model.

**UNIT II:** (7 Lectures)

**Classes and Objects**: Nature of object, Relationships among objects, Nature of a Class, Relationship among Classes, Interplay of Classes and Objects, Identifying Classes and Objects.

**UNIT III:** (9 Lectures)

**Introduction to UML**: Why We Model: History of UML, The Importance of Modeling, Principles of Modeling,An Overview of the UML, Conceptual Model of the UML, Architecture, and Software Development Life Cycle.

**UNIT IV:** (10 Lectures)

**Structural Modeling:** Basic Structural Modeling: Classes, Relationships, Common Mechanisms, Diagrams and Class Diagrams.

Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Interfaces, Types and Roles, Packages, and Object Diagrams.

**UNIT V:** (12 Lectures)

**Behavioral Modeling:** Basic Behavioral Modeling: Interactions, Interaction Diagrams, Use Cases, Use Case Diagrams, Activity Diagrams.

Advanced Behavioral Modeling: Events and Signals, State Machines, Time and Space, State Diagrams.

**Architectural Modeling**: Component and Deployment Diagrams.

**Text Books:**

1. “Object- Oriented Analysis And Design with Applications”, Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, 3rd edition, 2013, PEARSON.
2. 2. “The Unified Modeling Language User Guide”, Grady Booch, James Rumbaugh, Ivar Jacobson, 12th Impression, 2012, PEARSON.

**References:**

1. “Object-oriented analysis and design using UML”, Mahesh P. Matha, PHI
2. “Head first object-oriented analysis and design”, Brett D. McLaughlin, Gary Pollice, Dave West, O‟Reilly
3. “Object-oriented analysis and design with the Unified process”, John W. Satzinger, Robert B. Jackson, Stephen D. Burd, Cengage Learning

**Web References:**

1. https://www.uml-diagrams.org/class-reference.html
2. https://www.webagesolutions.com/courses/TP1136-ooad-with-uml
3. https://onlinecourses.nptel.ac.in/noc20\_cs59/preview
4. https://www.youtube.com/watch?v=d0iIWDsXJCQ

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**SOFTWARE TESTING METHODOLOGIES**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE09 External Marks: 60**

**Course Prerequisites:** Software Engineering

**Course Objectives:**

* The primary objective of this course is to know the importance of automation testing compared with manual testing and importance of testing in real life while developing any product/project which reduces the risk of a developer.
* To know how to prepare testing techniques by using flow graph, transition flows and reduction of path expressions.
* To study fundamental concepts in software testing including software testing objectives, process, criteria, strategies, and methods.

**Course Outcomes:**

1. Interpret a model for testing and understand the process of testing.
2. Visualize control flow graph and demonstrate complete path testing to achieve C1+C2 and identify the complications in a transaction flow testing and anomalies in data flow testing.
3. Apply reduction procedures to control flow graph and simplify it into a single path expression.
4. Able to understand the use of decision tables and KV charts in test case design.
5. Identify effective approach for node reduction. And able to apply different testing tools to resolve the problems in Real time environment.

**UNIT I:** (8 Lectures)

**Introduction:** Purpose of Testing, Dichotomies, model for testing, consequences of bugs, Taxonomy of bugs.

**Software Testing Terminology and Methodology:** Software Testing Terminology, Software

Testing Life Cycle, relating test life cycle to development life cycle Software Testing.

**UNIT II:** (10 Lectures)

**Flow Graphs and Path testing**: Basic concepts, Predicates, Path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

**Transaction flow testing:** Transaction flows, transaction flow testing techniques.

**Data flow testing:** Basics of Data flow testing, strategies in dataflow testing, application of dataflow testing

**UNIT III:** (9 Lectures)

**Paths, path products and Regular expressions:** Path products & Path expression, reduction procedure, applications, regular expressions and flow anomaly detection.

**UNIT IV:** (9 Lectures)

**Logic Based Testing:** Overview, decision tables, path expressions, kv charts, specifications

**State, state graphs and Transition Testing:** State Graphs, good and bad state graphs, state testing, testability tips.

**UNIT V:** (9 Lectures)

**Graph matrices and Application:** Motivational overview, matrix of graph relations, power of a matrix, node reduction algorithm,

**Software Testing Tools**: Introduction to Testing, Automated Testing, Concepts of Test Automation, Win runner, Load Runner, Jmeter, Mapping the GUI, Recording Test, Working with Test, Enhancing Test, Checkpoints,Running and Debugging Tests, Analyzing Results, Batch Tests, Rapid Test Script Wizard.

**Text Books:**

1. Software testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing- Yogesh Singh, Camebridge

**References:**

1. Brain Marick; ―The Craft of Software Testing‖; Prentice Hall Series in innovative technology.
2. RenuRajaniPradeep Oak; ―Software Testing,Effectivemethods,Tools and Techniques‖;TMHI
3. Dr.K.V.K.K.Prasad, ―Software Testing Tools‖ –Dreamtech.
4. Edward Kit, ―Software Testing in the Real World‖ –Pearson.
5. Perry, ―Effective methods of Software Testing‖, John Wiley.

**Web References:**

1. https://freevideolectures.com › Computer Science › IIT Bombay
2. https://www.youtube.com/watch?v=gPE9emPFrwo
3. https://nptel.ac.in/courses/106105150
4. www.softwaretestinghelp.com
5. https://www.atlassian.com/landing/software-testing/

**B.Tech IV Year I Semester**

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**BLOCKCHAIN TECHNOLOGY**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE10 External Marks: 60**

**Course Prerequisites:** **Cryptography**.

**Course Objectives:**

1. The students to explore the driving force behind the crypto currency Bit coin.
2. Along with the Decentralization, Cryptography,
3. Bit coins with its alternative coins,
4. Smart contracts and outside of currencies.

**Course Outcomes:**

1. Understand the types, benefits and limitation of blockchain.
2. Explore the blockchain decentralization and cryptography concepts.
3. Enumerate the Bitcoin features and its alternative options.
4. Describe and deploy the smart contracts
5. Summarize the blockchain features outside of currencies.

**UNIT I:** (9 Lectures)

**Introduction**: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

**UNIT II:** (9 Lectures)

**Decentralization and Cryptography:** Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.

Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys.

**UNIT III:** (10 Lectures)

**Bitcoin and Alternative Coins A:** Bitcoin, Transactions, Blockchain, Bitcoin payments B:Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash..

**UNIT IV:** (9 Lectures)

**Smart Contracts and Ethereum:** Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.

**UNIT V:** (8 Lectures)

**Alternative Blockchains:** Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media.

**Text Books:**

1. Mastering Blockchain - Distributed ledgers, decentralization and Smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017.

**References:**

1. Bitcoin and Crypto currency Technologies, Author- Arvind Narayanan, Joseph Bonneau,Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016
2. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017
3. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

**Web References:**

1. https://www.javatpoint.com/blockchain-tutorial
2. https://www.tutorialspoint.com/blockchain/index.htm
3. https://www.guru99.com/blockchain-tutorial.html
4. https://www.simplilearn.com/tutorials/blockchain-tutorial

**B.Tech IV Year I Semester**

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**DEEP LEARNING**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE11 External Marks: 60**

**Course Prerequisites:** Artificial Intelligence, Machine Learning

**Course Objectives:**

1. Understand complexity of Deep Learning algorithms and their limitations.
2. Understand modern notions in data analysis oriented computing.
3. Be capable of confidently applying common Deep Learning algorithms in practice and implementing their own.
4. Be capable of performing distributed computations.
5. Be capable of performing experiments in Deep Learning using real-world data.

**Course Outcomes:**

1. Implement deep learning algorithms, understand neural networks and traverse the layers of data abstraction which will empower the student to understand data more precisely.
2. Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces
3. Understand the language and fundamental concepts of artificial neural networks
4. Troubleshoot and improve deep learning models
5. Build own deep learning project
6. Differentiate between machine learning, deep learning and artificial intelligence

**UNIT I:** (9 Lectures)

**Introduction to Machine Learning :** Supervised and Unsupervised learning,Linear Models, Perceptrons: What is a Perceptron, XOR Gate

**Introduction to TensorFlow :** Computational Graph, Key highlights, Creating a Graph, Regression example.

**UNIT II:** (9 Lectures)

**Activation Functions :** Sigmoid,ReLU, Hyperbolic Fns,Softmax Artificial Neural Networks : Introduction, Perceptron Training Rule, Gradient Descent Rule.

**Gradient Descent and Backpropagation:** Gradient Descent, Stochastic Gradient Descent, Backpropagation, Some problems in ANN.

**UNIT III:** (10 Lectures)

**Optimization and Regularization** :Overfitting and Capacity, Cross Validation,Feature Selection, Regularization, Hyperparameters

**Autoencoders** (standard, sparse, denoising, contractive, etc), Adversarial Generative Networks, Autoencoder and DBM.

**UNIT IV:** (9 Lectures)

**Introduction to Convolutional Neural Networks**: Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, CNN applications **Introduction to Recurrent Neural Networks**: Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, RNN applications.

**UNIT V:** (8 Lectures)

**Deep Learning applications**: Image Processing, Natural Language Processing, Speech Recognition, Video Analytics.

**Text Books:**

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.

**References:**

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.

2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.

3. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw- Hill Education, 2004

**Web References:**

1. https://www.ibm.com/cloud/learn/deep-learning
2. https://en.wikipedia.org/wiki/Deep\_learning
3. https://www.geeksforgeeks.org/introduction-deep-learning/

**B.Tech IV Year - I Semester Course structure**

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**WIRELESS NETWORKS AND MOBILE COMPUTING**

**(CSE)**

**Course Code: P18CSE12 Internal Marks: 40**

**External Marks: 60**

**Course Prerequisite: Nil**

**Course Objectives:**

1. To make the student understand the concept of mobile computing paradigm, its applications and limitations.
2. To understand the typical mobile networking infrastructure through GSM.
3. To understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer.
4. To understand the ad hoc networks and related concepts.

**Course Outcomes:**

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

1. Compare the various types of Wireless Networks from teaching perspective.
2. Interpret the applications and architecture of Mobile Computing and multiplexing techniques.
3. Analyze the Mobile IP issues.
4. Analyze the various Mobile TCP Variants.
5. Analyze the various routing protocols in MANET.

**UNIT-I:** (8 Lectures)

**Wireless Networks**: Computing Networks, types of networks, wired networks, wireless networks, Generation of Wireless Networks: 2G, 3G, 4G, Cellular Networks, Mobile Ad Hoc Networks, Mesh Networks, Sensor Networks, Vehicular Adhoc Networks, Next Generation Networks.

**Unit-II:** (9 Lectures)

**Mobile Computing**: Architecture of Mobile Computing, Mobile Computing Applications, Limitations of Mobile Devices

**GSM**: Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS.

**UNIT-III** (12 Lectures)

**(Wireless) Medium Access Control (MAC)**: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

**Mobile Network Layer**: Mobile IP- Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunnelling and encapsulation, optimizations, Dynamic Host Configuration Protocol (DHCP).

**UNIT-IV** (8 Lectures)

**Mobile Transport Layer** : Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

**UNIT-V** (8 Lectures)

**Mobile Ad hoc Networks (MANETs)**: Introduction, Characteristics, Applications & Challenges of a MANET, Routing, Proactive, Reactive and Hybrid Routing Algorithms.

**Text Books:**

1. Jochen Schiller, “Mobile Communications”, Addison-Wesley, 2nd edition, 2004.
2. Rajkamal, “Mobile computing” Second Edition ,Oxford University Press.

**Reference Books:**

1. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002, ISBN 0471419028.
2. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden ,Schwiebert, Loren, “Fundamentals of Mobile and Pervasive Computing”, ISBN: 0071412379, McGraw- Hill Professional, 2005.
3. Hansmann, Merk, Nicklous, Stober, “Principles of Mobile Computing”, Springer, second edition, 2003.
4. MartynMallick, “Mobile and Wireless Design Essentials”, Wiley DreamTech, 2003.

**Web References:**

1. https://www.youtube.com/watch?v=Eu\_mTZxPofI
2. https://slideplayer.com/slide/4810167/
3. https://www.tutorialspoint.com/mobile\_computing/mobile\_computing\_useful\_resources.htm.
4. http://www.freepdfbook.com/mobile-communications-jochen-schiller/

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**MULTIMEDIA APPLICATION DEVELOPMENT**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE13 External Marks: 60**

**Course Prerequisites:** Nil.

**Course Objectives:**

1. To give each student a firm grounding in the fundamentals of the underpinning technologies in graphics, distributed systems and multimedia
2. To teach students about the principled design of effective media for entertainment, communication, training and education
3. To provide each student with experience in the generation of animations, virtual environments and multimedia applications, allowing the expression of creativity
4. To provide each student with a portfolio of their own completed work at the end of the programme.

**Course Outcomes:**

1. Demonstrate knowledge and understanding of the concepts, principles and theories of Multimedia Applications and Virtual environments
2. Demonstrate knowledge and understanding of the current issues involved with development and deployment of multimedia system
3. Analyze and solve problems related to their expertise in Multimedia Applications
4. Demonstrate their ability to extend their basic knowledge to encompass new principles and practice
5. Demonstrate their computing, technical and theoretical skills by developing a substantial Multimedia application.

**UNIT I:** (7 Lectures)

**Fundamental concepts** 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.

**UNIT II:** (7 Lectures)

**Color in image and video** Color in image and video: color science, color models in images, color models in video.

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

**UNIT III:** (12 Lectures)

**Lossless compression algorithm:** Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding

**Lossy compression algorithm**: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zero tree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT).

**UNIT IV:** (10 Lectures)

**Video Compression Techniques:** Introduction to video compression. Video compression based on motion compensation. Search for motion vectors. MPEG.

**Basic Audio Compression Techniques:** ADPCM, Vocoders, Phase Insensitivity, Channel Vocoder, Formant Vocoder, Linear Predictive Coding, CELP. MPEG Audio Compression: Psychoacoustics, Equal-Loudness Relations, Frequency Masking, Temporal Masking, MPEG Audio, MPEG Layers, MPEG Audio Strategy, MPEG Audio Compression Algorithm, MPEG-2 AAC (Advanced Audio Coding).

**UNIT V:** (9 Lectures)

**Multimedia Networks:** Basics of Multimedia Networks, Multimedia Network Communications and Applications: Quality of Multimedia Data Transmission,

Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand (MOD).

**Text Books:**

1. Fudamentals of Multimedia by Ze-Nian Li and Mark S. Drew PHIl l Pearson Education
2. Multimedia System Design, Andleigh and Thakarar , PHI
3. Multimedia Technology & Application, David Hillman, Galgotia Publications.

**References:**

1. Rajan Parekh “Principles of Multimedia” (Tata McGraw-Hill)
2. S.J.Gibbs & D.C.Tsichritzis “Multimedia Programming”, Addison Wesley 1995
3. P.W.Agnew & A.S.Kellerman “Distributed Multimedia”, AddisonWesley 1996
4. C.A.Poynton, “A Technical Introduction to Digital Video” Wiley1996
5. F.Fluckiger, “Understanding Networked Multimedia”, Prentice- Hall 1995

**Web References:**

1. https://www.tutorialspoint.com/multimedia/index.htm
2. https://www.wisdomjobs.com/e-university/multimedia-tutorial-270.html
3. https://dokumen.tips/documents/the-manualscom-fundamentals-of-multimedia-by-ze-nian-li-and-mark-s-drew-solution-manual.html
4. https://www.academia.edu/34336904/Fundamentals\_of\_Multimedia

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**DATA SCIENCE**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE14 External Marks: 60**

**Course Prerequisites:** Programming and Data structures, Discrete Maths, and a basic knowledge of Computer organization.

**Course Objectives:**

* 1. To understand the mathematical foundations required for data science.
  2. To describe a flow process for data science problems.
  3. To introduce basic data sampling.
  4. To learn Hypothesis Testing.
  5. To learn the ideas and tools for data visualization.

**Course Outcomes:**

1. Explain the basic terms of Linear Algebra and Statistical Inference.
2. Describe the Data Science process and how its components interact.
3. Understand the various distribution and sampling.
4. Perform Hypothesis Testing on datasets.
5. Apply statistical inference for Regression.

**UNIT I:** (9 Lectures)

**LINEAR ALGEBRA:** Algebraic view – vectors 2D, 3D and nD, matrices, product of matrix & vector, rank, null space, solution of over determined set of equations and pseudo-inverse. Geometric view - vectors, distance, projections, eigenvalue decomposition, Equations of line, plane, hyperplane, circle, sphere, Hypersphere.

**UNIT II:** (9 Lectures)

**PROBABILITY AND STATISTICS:**  Introduction to probability and statistics, Population and sample, Normal and Gaussian distributions, Probability Density Function, Descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix.

**UNIT III:** (9 Lectures)

**DATA SAMPLING AND DISTRIBUTION:**

Normalization, Sampling Data-Simple Random sampling, Stratified, Cluster Sampling, Sampling Error/Bias. Bootstraping, Central Limit Theorem, Confidence intervals, Normal distribution, Binomial distribution, Poisson distribution

**UNIT IV:** (9 Lectures)

**HYPOTHESIS:** A/B Testing, Hypothesis Tests- null, one-way, two-way, P-value, Type 1 & 2 errors, t-tests, multiple testing, degrees of freedom, ANOVA, Chi-Square Tests, Power and Sample Size.

**UNIT V:** (9 Lectures)

**REGRESSION AND PREDICTION:** Simple Linear Regression, Multiple Linear Regression, Confidence and Prediction Intervals, Categorical Variables, Multi collinearity, Polynomial Regression.

**Text Books:**

1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O’Reilly. 2014.
2. Bruce, Peter, and Andrew Bruce. Practical statistics for data scientists: 50 essential concepts. " O'Reilly Media, Inc.", 2017.
3. Introduction to Linear Algebra - By Gilbert Strang, [Wellesley-Cambridge Press,](http://www.wellesleycambridge.com/) 5th Edition.2016.
4. Applied Statistics and Probability For Engineers – By Douglas Montgomery.2016.
5. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
6. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

**References:**

**Web References:**

1. https://leanpub.com/LittleInferenceBook
2. https://www.coursera.org/learn/statistical-inference
3. https://www.datacamp.com/community/open-courses/statistical-inference-and-data-analysis

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**SOFT COMPUTING**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE15 External Marks: 60**

**Course Prerequisites:** Nil

**Course Objectives:**

To introduce the concepts in Soft Computing such as Artificial Neural Networks, Fuzzy logic- based systems, genetic algorithm-based systems and their hybrids.

**Course Outcomes:**

1. To Learn about soft computing techniques and their applications.
2. To Analyze various neural network architectures.
3. To Define the fuzzy systems.
4. To Understand the genetic algorithm concepts and their applications.
5. To Identify and select a suitable Soft Computing technology to solve the problem; construct a solution.

**UNIT I:** (8 Lectures)

**Introduction to Soft Computing:** Artificial neural networks - biological neurons, Basic models of artificial neural networks – Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.

**UNIT II:** (9 Lectures)

**Artificial Neural Networks :** Perception networks – Learning rule – Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network – Architecture, Training algorithm.

**UNIT III:** (10 Lectures)

**Fuzzy Logic and Fuzzy systems:**

**Fuzzy logic -** fuzzy sets - properties - operations on fuzzy sets, fuzzy relations - operations on fuzzy relations.

**Fuzzy systems:** [Fuzzy membership functions, fuzzification, Methods of Membership value assignment - intuition-inference-rank ordering, Lambda –cuts for fuzzy sets, Defuzzification](http://www.ktustudents.in/) methods.

**UNIT IV:** (9 Lectures)

**Genetic Algorithms:** Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules -Decomposition of rules –Aggregation of rules, Fuzzy Inference Systems – Mamdani and Sugeno types, Neuro-fuzzy hybrid systems –characteristics – classification.

**UNIT V:** (9 Lectures)

**Hybrid systems:** Introduction to genetic algorithm, operators in genetic algorithm - coding - selection - cross over – mutation, Stopping condition for genetic algorithm flow, Genetic -neurohybrid systems, Genetic-Fuzzy rule based system.

**Text Books:**

1. S. N. Sivanandam and S. N.Deepa, Principles of soft computing - Wiley India.
2. Timothy J. Ross, Fuzzy Logic with engineering applications – Wiley India.

**References:**

1. N. K. Sinha and M. M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications-Academic Press /Elsevier. 2009.
2. Simon Haykin, Neural Network- A Comprehensive Foundation- Prentice Hall International, Inc.
3. R. Eberhart and Y. Shi, Computational Intelligence: Concepts to Implementation, Morgan Kaufman/Elsevier, 2007.
4. Ross T.J. , Fuzzy Logic with Engineering Applications- McGraw Hill.
5. Driankov D., Hellendoorn H. and Reinfrank M., An Introduction to Fuzzy Control- Narosa Pub.
6. Bart Kosko, Neural Network and Fuzzy Systems- Prentice Hall, Inc., Englewood Cliffs Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning- Addison Wesley.

**Web References:**

1. https://onlinecourses.nptel.ac.in/noc21\_cs11/preview
2. https://www.javatpoint.com/what-is-soft-computing
3. https://www.tutorialspoint.com/fuzzy\_logic/index.htm
4. https://www.tutorialspoint.com/artificial\_neural\_network/index.htm

**B.Tech IV Year I Semester**

**Course Structure**

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**CLOUD COMPUTING**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE16 External Marks: 60**

**Course Prerequisites:** Nil

**Course Objectives:**

1. The cloud environment, building software systems and components that scale to millions of users in modern internet.
2. Cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas, and Virtualizations.
3. Developing cloud based software applications on top of cloud platforms.
4. Programming and Software Environments on different cloud platforms.
5. Understanding of cloud resource management scheduling algorithms and file systems.

**Course Outcomes:**

1. Apply the key dimensions of the challenge on Cloud Computing
2. Assessment of the economics, financial, and technological implications for selecting cloud computing for own organization
3. Assessing the financial, technological, and organizational capacity of employer’s for actively initiating and installing cloud-based applications.
4. Assessment of own organizations’ needs for capacity building and training in cloud computing-related IT areas.
5. Accessing the data from different file systems on different cloud flat forms.

**UNIT I:** (9 Lectures)

**Systems modeling, Clustering:** Scalable Computing over the Internet, Technologies for Network based systems, System models for Distributed and Cloud Computing, Software environments for distributed systems and clouds, Performance, Security And Energy Efficiency.

**UNIT II:** (8 Lectures)

**Virtual Machines and Virtualization:** Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices.

**UNIT III:** (10 Lectures)

**Cloud Platform Architecture:** Cloud Computing and service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware.

**UNIT IV:** (8 Lectures)

**Cloud Programming and Software Environments**: Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS- Simple Storage Service(S3) Architecture and Microsoft Azure, Emerging Cloud Software Environments.

**UNIT V:**

**Cloud Resource Management and Scheduling and Storage Systems:** (10 Lectures)

Policies and Mechanisms for Resource Management, Two level Resource Allocation Architecture.

**Scheduling Algorithms for Computing Clouds**: Fair Queuing, Borrowed Virtual Time, Deadlines in cloud and map reduce scheduling.

**Storage models:** Distributed Vs parallel file systems: Google file system. Apache Hadoop, BigTable.

**Text Books:**

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.\
3. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti,University

**References:**

1. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
2. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH.

**Web References:**

1. https://pdfs.semanticscholar.org/0c79/1585b91e80320e9cbff9edefcdd834bd2791.pdf
2. http://www.ijircce.com/upload/2017/january/49\_2\_NEW.pdf
3. https://www.ripublication.com/irph/ijict\_spl/ijictv4n1spl\_07.pdf
4. http://aircconline.com/ijist/V6N2/6216ijist01.pdf
5. www.javatpoint.com

**B.Tech IV Year I Semester**

**Course Structure**

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**OOAD with UML LAB**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSL11 External Marks: 60**

**Course Prerequisites:** Java Programming

**Course Objectives:**

1. Construct UML diagrams for static view and dynamic view of the system.
2. Generate creational patterns by applicable patterns for given context.
3. Create refined model for given Scenario using structural patterns.
4. Construct behavioural patterns for given applications

**Course Outcomes:**

1. Understand the Case studies and design the Model.
2. Understand how design patterns solve design problems.
3. Develop design solutions using creational patterns.

**List of Experiments:**

**Week 1:** Familiarization with Rational Rose or Umbrella For each case study:

**Week 2, 3 & 4:**

For each case study:

a) Identify and analyze events

b) Identify Use cases

c) Develop event table

d) Identify & analyze domain classes

e) Represent use cases and a domain class diagram using Rational Rose

f) Develop CRUD matrix to represent relationships between use cases and problem domain classes

**Week 5 & 6:**

For each case study:

a) Develop Use case diagrams

b) Develop elaborate Use case descriptions & scenarios

c) Develop prototypes (without functionality)

d) Develop system sequence diagrams

**Week 7, 8, 9 & 10:**

For each case study:

a) Develop high-level sequence diagrams for each use case

b) Identify MVC classes / objects for each use case

c) Develop Detailed Sequence Diagrams / Communication diagrams for each use case showing interactions among all the three-layer objects

d) Develop detailed design class model (use GRASP patterns for responsibility

assignment)

e) Develop three-layer package diagrams for each case study

**Week 11 & 12:**

For each case study:

a) Develop Use case Packages

b) Develop component diagrams

c) Identify relationships between use cases and represent them

d) Refine domain class model by showing all the associations among classes

**Week 13 onwards:**

For each case study:

* Develop sample diagrams for other UML diagrams

State chart diagrams,

Activity diagrams and

Deployment diagrams.

**B.Tech IV Year I Semester**

**Course Structure**

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**MOBILE APPLICATION DEVELOPMENT LAB**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSL12 External Marks: 60**

**Course Prerequisites:** Java Programming

**Course Objectives:**

1. To learn about the concepts and principles of mobile computing;
2. To explore both theoretical and practical issues of mobile computing;
3. To develop skills of finding solutions and building software for mobile computing applications.

**Course Outcomes:**

1. Grasp the concepts and features of mobile computing technologies and applications;
2. Identify the important issues of developing mobile computing systems and applications
3. Organize the functionalities and components of mobile computing systems into different layers and apply various techniques for realizing the functionalities;
4. Develop mobile computing applications by using Wireless tool Kit and tools;
5. Organize and manage software built for Mobile Apps deployment.

**List of Experiments:**

|  |  |
| --- | --- |
| 1) | Write a J2ME program to show how to change the font size and colour. |
| 2) | Write a J2ME program which creates the following kind of menu.  \*cut,\*copy,\*paste,\*delete,\*select all,\*unselect all |
| 3) | Create a J2ME menu which has the following options(Event Handling)  Cut - can be on/off, Copy - can be on/off, Paste - can be on/off  Delete - can be on/off, Select all – put all 4 options on Unselect all – put all |
| 4) | Create a MIDP application, which draws a bar graph to the display. Data values can be given at int [] array. You can enter four data (integer) values to the input text field. |
| 5) | Create an MIDP application which examines, that a phone number, which a user has entered is in the given format (input checking):\*Area code should be one of the following: 040, 041, 050, 0400 ,044\* |
| 6) | Write a sample program to show how to make a SOCKET connection from J2ME phone. This J2ME sample program shows how to make a SOCKET connection from a J2ME phone. Many a time there is a need to connect backend HTTP server from the J2ME application. show how to make a SOCKET connection from the phone to port 80. |
| 7) | This J2ME sample program shows how to display a simple LOGIN SCREEN on the J2ME phone and how to authenticate to a HTTP server  This free J2ME sample program, shows how a J2ME application can do authentication to the backend server. |
| 8) | Web Application using J2ME The following should be carried out with respect to the given set of application domains:(Assume that the Server is connected to the well-maintained database of the given domain. Mobile Client is to be connected to the Server and fetch the required data value/information) |
| 9) | Write an Android application program that displays Hello World using Eclipse. |
| 10) | Write an Android application program that accepts a name from the user and displays the hello name to the user in response as output using Eclipse |
| 11) | Write an Android application program that demonstrates the  following:  (i) Linear Layout(ii) Relative Layout(iii) Table Layout(iv) Grid View layout |
| 12) | Write an Android application program that converts the temperature in Celsius to Fahrenheit. |
| 13) | Write an Android application program that demonstrates intent in  mobile application development |

**B.Tech IV Year I Semester**

**Course Structure**

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**MEAN Stack LAB**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSL13 External Marks: 60**

**Course Prerequisites:** Javascript

**Course Objectives:**

1. To learn about the concepts and principles of Angular and Node.js
2. To explore both theoretical and practical issues of Web Applications;
3. To develop skills of finding solutions and building Web Applications

**Course Outcomes:**

1. Knowledge on concepts and features of Angular ;
2. Identify the important issues of developing Web applications
3. Organize the functionalities and components of Angular and Node.js to develop projects
4. Develop Blockchain applications by using Javascript;

**List of Experiments:**

1. Write a AngularJS Program to print your Details

2. Write a AngularJS program to binding data and perform Expressions using ng-bind

3. Write a AngularJS program using AngularJS Directives?

4. Write a AngularJS Program for creating Tables

5. Write a AngularJS Program for creating forms and perform the validation

6. Write a Node.js Program to create a HTTP server using HTTP Module

7. Write a Node.js Program to Perform operations on files a) Read files b) Create files c)Update files d)Delete files e)Rename files

8. Write a blockchain application in javascript for the simple transaction

9. Write a blockchain application in javascript to calculate hash code for the transaction

**B.Tech IV Year II Semester**

**Course Structure**

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| **L** | **T** | **P** | **C** |
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**DESIGN PATTERNS**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE17 External Marks: 60**

**Course Prerequisites: OOAD**

**Course Objectives:**

1. To understand design patterns and their underlying object oriented concepts.
2. To understand implementation of design patterns and providing solutions to real world software design problems.
3. To understand patterns with each other and understanding the consequences of combining patterns on the overall quality of a system.

**Course Outcomes:**

1. Know the underlying object oriented principles of design patterns.
2. Understand the context in which the pattern can be applied.
3. Understand how the application of a pattern affects the system quality and its trade-offs
4. Understand the Behavioural and Structural patterns.
5. Know the Design pattern strategies.

**UNIT I:** (9 Lectures)

Introduction to Design Patterns Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalogue of Design Patterns, Organizing the Catalogue, Solving of Design Problems using Design Patterns, Selection of a Design Pattern, Use of Design Patterns.

**UNIT II:** (9 Lectures)

Designing A Document Editor: A Case Study Design problems, Document structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation. Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

**UNIT III:** (10 Lectures)

Structural Patterns-1: Adapter, Bridge, Composite.

Structural Patterns-2: Decorator, Façade, Flyweight, Proxy, Discuss of Structural Patterns.

**UNIT IV:** (8 Lectures)

Behavioural Patterns-1: Chain of Responsibility, Command, Interpreter, Iterator.

Behavioural Patterns-2: Mediator, Memento, Observer.

**UNIT V:** (9 Lectures)

Behavioural Patterns-2(cont’d): State, Strategy, Template Method, Visitor, Discussion of Behavioural Patterns. What to Expect from Design Patterns, A Brief History, The Pattern Community An Invitation, A Parting Thought.

**Text Books:**

1. Design Patterns By Erich Gamma, Pearson Education.

**References:**

1. Pattern’s in JAVA Vol-I By Mark Grand, Wiley DreamTech.
2. Pattern’s in JAVA Vol-II By Mark Grand, Wiley DreamTech.
3. JAVA Enterprise Design Patterns Vol-III By Mark Grand, Wiley DreamTech.
4. Head First Design Patterns By Eric Freeman-Oreilly-spd
5. Design Patterns Explained By Alan Shalloway,Pearson Education. 6. Pattern Oriented Software Architecture, F.Buschmann &others, John Wiley & Sons

**Web References:**

1. https://www.javatpoint.com/design-patterns-in-java
2. https://www.geeksforgeeks.org/software-design-patterns/
3. https://www.tutorialspoint.com/design\_pattern/design\_pattern\_overview.html
4. https://www.oodesign.com/
5. http://ui-patterns.com/patterns

**B.Tech IV Year II Semester**

**Course Structure**

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**SOCIAL NETWORK ANALYSIS**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE18 External Marks: 60**

**Course Prerequisites: Nil**

**Course Objectives:**

1. To understand the concept of semantic web and related applications.
2. To learn knowledge representation using ontology.
3. To understand human behaviour in social web and related communities.
4. To learn visualization of social networks.

**Course Outcomes:**

1. Develop semantic web related applications.
2. Represent knowledge using ontology.
3. Predict human behaviour in social web and related communities.
4. Visualize social networks..

**UNIT I:** (9 Lectures)

**Introduction to Semantic Web:** Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: 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.

**UNIT II:** (9 Lectures)

**Modelling, Aggregating and Knowledge Representation:**Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for 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.

**UNIT III:** (10 Lectures)

**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.

**UNIT IV:** (8 Lectures)

**Predicting Human Behaviour and Privacy Issues:** Understanding and predicting human behaviour 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.

**UNIT V:** (9 Lectures)

**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 Edit ion, Springer 2007.
2. Borko Furht, -Handbook of Social Network Technologies and Applicat ions, 1st Edition, Springer, 2010.

**References:**

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: Emerging Technologies 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, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, -The Social Semantic Web, Springer, 2009

**Web References:**

1. https://learnengineering.in/cs6010-social-network-analysis/
2. https://www.tutorialspoint.com/social\_media\_marketing/social\_media\_analysis.htm
3. https://csenotescorner.blogspot.com/2017/01/cs6010-social-network-analysis-syllabus.html
4. https://www.sagepub.com/sites/default/files/upm-binaries/35208\_Chapter1.pdf

**B.Tech IV Year II Semester**

**Course Structure**

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**Internet of Things**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE19 External Marks: 60**

**Course Prerequisites:** Computer Networks

**Course Objectives:**

1. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
2. Formulate a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
3. Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
4. Design and carry out an empirical evaluation of different algorithms on problem formulation, and state the conclusions that the evaluation supports.

**Course Outcomes:**

1. Demonstrate knowledge and understanding of the security and ethical issues of the Internet of Things
2. Conceptually identify vulnerabilities, including recent attacks, involving the Internet of Things
3. Develop different M2M communication models
4. Compare and contrast the threat environment based on industry and/or device type.
5. Understand and Implement various IoT cloud based services..

**UNIT I:** (8 Lectures)

**The Internet of Things**: An Overview of Internet of things, Internet of Things Technology, behind IoTs, Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles For Connected Devices.

**UNIT II:** (10 Lectures)

**IoT DESIGN METHODOLOGY**: Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specification, IoT Level Specification, Functional View Specification, Operational View specification, Device & Component Integration and Application Development.

**UNIT III:** (10 Lectures)

**PROTOTYPING EMBEDDED DEVICE WITH ARDUINO:** Sensors, Actuators, Embedded Computing Basics- Micro Controllers, System on Chips, Choosing your Platform, Arduino – Developing on the Arduino.

**UNIT IV:** (8 Lectures)

Web Communication protocols for Connected Devices, Data Acquiring, Organizing and Analytics in IoT/M2M, Applications/Services/Business Processes, Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM).

**UNIT V:** (9 Lectures)

Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology.

**DOMAIN SPECIFIC APPLICATIONS OF IoT:** Home Automation, Agriculture Applications, Smart City applications.

**Text Books:**

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015
3. Adrian McEwen & Hakim Cassimally, “Designing the Internet of Things”, Wiley Publications – 2014..

**References:**

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley

2. Getting Started with the Internet of Things CunoPfister , Oreilly

1. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.
2. Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014.
3. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice.

**Web References:**

1. https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT
2. https://www.tutorialspoint.com/internet\_of\_things/internet\_of\_things\_tutorial.pdf
3. https://www2.deloitte.com/content/dam/insights/us/articles/iot-primer-iot-technologies-applications/DUP\_1102\_InsideTheInternetOfThings.pdf

**B.Tech IV Year II Semester**

**Course Structure**

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**GPU PROGRAMMING**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE20 External Marks: 60**

**Course Prerequisites:**

**Course Objectives:**

1. To understand the basics of GPU architectures.
2. To write programs for massively parallel processors.
3. To understand the issues in mapping algorithms for GPUs.
4. To introduce different GPU programming models.

**Course Outcomes:**

1. Describe GPU Architecture.
2. Write programs using CUDA, identify issues and debug them.
3. Implement efficient algorithms in GPUs for common application kernels, such as

matrix multiplication.

1. Write simple programs using OpenCL.
2. Identify efficient parallel programming patterns to solve problems.

**UNIT I:** (9 Lectures)

**Introduction to CUDA:** CUDA Terminology - Kernels, Threads, Blocks, Memory Management, Basic Matrix Multiplication using Parallel Programming, Built-in Variables and Functions, Thread Scheduling, CUDA Memory Model, Thread Synchronization, Matrix Multiplication Revisited.

**UNIT II:** (9 Lectures)

# GPU Architecture Overview: Trends in CPU and GPU Performance, CPU Architecture Overview, CPU Parallelism, and Scheduling, History of GPUs, GPU Architecture Evolution.

**UNIT III:** (9 Lectures)

**Parallel Algorithms**:Reduction, Scan (Naive and Work-Efficient), Stream Compaction, Summed Area Tables, Radix Sort.

**UNIT IV:** (10 Lectures)

**CUDA Performance**: Parallel Reduction Revisited, Warp Partitioning, Memory Coalescing, Bank Conflicts, Dynamic Partitioning of SM Resources, Data Pre-fetching, Instruction Mix, Loop Unrolling, Thread Granularity.

**UNIT V:** (8 Lectures)

# CUDA Atomics: Atomic Functions, Atomic Add, Subtract, Exchange, CAS

**Text Books:**

1. Shane Cook, CUDA Programming: A Developers Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.

**References:**

1. Nicholas Wilt, CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison -Wesley, 2013.
2. Jason Sanders, Edward Kandrot, CUDA by Example: An Introduction to General Purpose GPU Programming^, Addison – Wesley, 2010.
3. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors – A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.

**Web References:**

1. http://www.nvidia.com/object/cuda\_home\_new.html
2. http://www.openCL.org

**B.Tech IV Year II Semester**

**Course Structure**

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**NATURAL LANGUAGE PROCESSING**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE21 External Marks: 60**

**Course Prerequisites:** Artificial Intelligence, Machine Learning

**Course Objectives:**

1. Understand and apply fundamental algorithms and techniques in the area of natural language processing (NLP).
2. Understand approaches to syntax and semantics in NLP.
3. Understand current methods for statistical approaches to machine translation.
4. Understand language modeling.
5. Understand machine learning techniques used in NLP.

**Course Outcomes:**

1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
2. Ability to design, implement and analyze NLP algorithms.
3. To develop language modelling using NLP algorithms.
4. To write NLP algorithms to check syntax and semantics
5. To deploy a conversational agent using NLP.

**UNIT I:** (9 Lectures)

Introduction to Natural Language Understanding, Syntactic Processing: Grammars and Parsing.

**UNIT II:** (9 Lectures)

Features and Augmented Grammars, Toward Efficient Parsing, Ambiguity Resolution.

**UNIT III:** (10 Lectures)

Statistical Methods: Probabilistic Context-Free Grammars, Best-First Parsing.

**UNIT IV:** (8 Lectures)

Semantic Interpretation: Linking Syntax and Semantics, Ambiguity Resolution, other Strategies for Semantic Interpretation.

**UNIT V:** (9 Lectures)

Context and World Knowledge: Using World Knowledge, Discourse Structure, Defining a Conversational Agent.

**Text Books:**

1. Natural Language Understanding – James Allen, Second Edition, Pearson Education.

**References:**

1. Speech and Language Processing – Daniel Jurafsky, James H.Martin.
2. Foundations of Statistical Natural Language Processing – Christopher Manning, Hinrich Schutze, MIT Press.
3. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
4. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2013-2014
5. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

**Web References:**

**B.Tech IV Year II Semester**

**Course Structure**

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**IMAGE PROCESSING**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE22 External Marks: 60**

**Course Prerequisites:** None

**Course Objectives:**

1. Fundamental concepts in digital image processing and enhancement in spatial domain.
2. Approaches used in enhancement in frequency domain and image segmentation.
3. Image restoration and image compression techniques.
4. Morphological transformations, and image representation and description

**Course Outcomes:**

1. Define image processing systems, and develop algorithms for image enhancement techniques in spatial domain.
2. Develop enhancement techniques in frequency domain and image segmentation
3. Develop image restoration, and image compression techniques.
4. Implement morphological transformation algorithms, and select various descriptors for image representation

**UNIT I:** (8 Lectures)

**Introduction**: Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

**Digital Image Fundamentals**: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels.

.

**UNIT-II:** (10 Lectures)

**Image Enhancement in the Spatial Domain:** Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, smoothing spatial Filters, Sharpening spatial Filters.

**Image Enhancement in the Frequency Domain:** Introduction to the Fourier Transform and the Frequency Domain, smoothing frequency domain Filters, Sharpening frequency-domain Filters.

**UNIT III:** (10 Lectures)

**Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

**Image Restoration:** A Model of the Image Degradation/Restoration Process, Linear, Position- Invariant Degradations, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.

**UNIT IV:** (10 Lectures)

**Image Compression:** Image Compression Models, Error-free Compression, Lossy Predictive Compression, Image Compression Standards.

**Morphological Image Processing:** Dilation and Erosion, The Hit-or-Miss Transformation, Some basic Morphological Algorithms.

**UNIT V:** (8 Lectures)

**Representation and Recognition:** Representation, Boundary Descriptors, Regional Descriptors.

**Image Recognition:** Patterns and pattern classes – Matching by minimum distance classifier – Matching by Correlation.

**Text Books:**

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing' Addison Wesley Pubs (Second Edition).

**References:**

1. Image Processing. Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac, Roger Boyle (Second Edition).
2. A.K.Jain, 'Fundamentals of Digital Image Processing' PHI.
3. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 4th Edition

**Web References:**

1. http://www.imageprocessingbasics.com/
2. www.imageprocessingplace.com/root\_files\_V3/tutorials.htm
3. www.library.cornell.edu/preservation/tutorial/intro/intro-01.html

www.olympusmicro.com/primer/digitalimaging/javaindex.html

**B.Tech IV Year II Semester**

**Course Structure**

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**Pattern Recognition**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE22 External Marks: 60**

**Course Prerequisites:** Artificial Intelligence, Machine Learning

**Course Objectives:**

1. To enable the students to understand the fundamentals of Pattern recognition.
2. To make the students should learn to choose an appropriate feature, Pattern classification algorithm for a pattern recognition problem
3. To make the students properly implement the algorithm using modern computing tools such as Matlab, OpenCV, C, C++ and correctly.
4. To analyze, and report the results using proper technical terminology

**Course Outcomes:**

1. understand the fundamentals of pattern recognition and machine learning algorithms
2. design and implement certain important pattern recognition techniques
3. develop applications by using pattern recognition algorithms.
4. construct machine learning models for pattern recognition.
5. present the various patterns using mathematical models..

**UNIT I:** (9 Lectures)

Introduction to Pattern Recognition: Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition,Pattern Representation: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature, Feature Selection.

**UNIT II:** (9 Lectures)

Nearest Neighbor Based Classifiers: Nearest Neighbor Algorithm, Variants of the NNAlgorithm, Use of the Nearest Neighbor Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection, Bayes Classifier: Bayes Theorem, Minimum error rate classifier, Estimation of Probabilities, Comparison with the NNC, Naive Bayes Classifier.

**UNIT III:** (10 Lectures)

Hidden Markov Models: Markov Models for Classification, Hidden Markov Models, Classification Using HMMs, Classification of Test Patterns. Decision Trees: Introduction, Decision Trees for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Overfitting and Pruning, Example of Decision Tree Induction.

**UNIT IV:** (8 Lectures)

Support Vector Machines: Introduction, Linear Discriminant Functions, Learning the Linear Discriminant Function, Neural Networks, SVM for Classification, Linearly Separable Case, Non- linearly Separable Case. Combination of Classifiers: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers, Evaluation of Classifiers, Evaluation of Clustering.

**UNIT V:** (9 Lectures)

Clustering: Clustering and its Importance, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets, An Application to Handwritten Digit Recognition: Description of the Digit Data, Pre-processing of Data, Classification Algorithms, Selection of Representative Patterns.

**Text Books:**

1. Pattern Recognition an Introduction, V. Susheela Devi M. Narasimha Murty, University Press.
2. Pattern Recognition, Segrios Theodoridis,Konstantinos Koutroumbas, Fourth Edition, Elsevier..

**References:**

1. Pattern Recognition and Image Analysis, Earl Gose, Richard John Baugh, Steve Jost, PHI 2004.
2. C. M. Bishop, „Neural Networks for Pattern Recognition‟, Oxford University Press, Indian Edition, 2003.
3. Pattern Classiﬁcation, R.O.Duda, P.E.Hart and D.G.Stork, Johy Wiley, 2002.

**Web References:**

1. https://en.wikipedia.org/wiki/Pattern\_recognition#:~:text=Pattern%20recognition%20is%20the%20automated,computer%20graphics%20and%20machine%20learning.
2. https://www.geeksforgeeks.org/pattern-recognition-introduction/
3. https://www.youtube.com/watch?v=ZGUlaomeJ-k
4. https://link.springer.com/journal/11493
5. https://www.sciencedirect.com/journal/pattern-recognition
6. https://www.journals.elsevier.com/pattern-recognition/
7. https://www.coursera.org/learn/machine-learning/.../classification
8. https://www.youtube.com/watch?v=UzxYlbK2c7E

**B.Tech IV Year -II Semester Course structure**

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**CYBER SECURITY**

(CSE)

**Course Code: P18CSE23 Internal Marks: 40**

**External Marks: 60**

**Course Prerequisite:** Nil

**Course Objectives:**

1. The Cyber security Course will provide the students with foundational Cyber Security principles, Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
2. Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.

**Course Outcomes:**

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

1. Cyber Security architecture principles
2. Identifying System and application security threats and vulnerabilities
3. Identifying different classes of attacks
4. Cyber Security incidents to apply appropriate response
5. Describing risk management processes and practices

**UNIT-I:** (9 Lectures)

**Introduction to Cyber Security**: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defence, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terror

**Unit-II:** (10 Lectures)

**Cyber offenses**: How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

Cybercrime Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Laptops.

**UNIT-III** (8 Lectures)

**Tools and Methods Used in Cybercrime**: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft.

**UNIT-IV** (8 Lectures)

**Cybercrimes and Cyber security**: Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies

**UNIT-V** (10 Lectures)

Understanding Computer Forensics: Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Network Forensics, Approaching a Computer Forensics Investigation, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics,

Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti-forensics.

**Text Books:**

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal

Perspectives, Nina Godbole, SunitBelapure, Wiley.

1. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage

Learning

1. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018..

**Reference Books:**

1. Information Security, Mark Rhodes, Ousley, MGH.

**Web References:**

1. https://www.udemy.com/cyber-security/online-course
2. https://www.tutorialspoint.com/.../cyber\_crime\_and\_cyber\_security.htm
3. https://byjus.com/free-ias-prep/cyber-security
4. https://www.coursehero.com/file/97034432/cyber-security

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**B.Tech IV Year - II Semester Course structure**

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**HUMAN COMPUTER INTERACTION**

(CSE)

**Course Code: P18CSE24 Internal Marks: 40**

**External Marks: 60**

**Course Prerequisite:** Knowledge of Computer and Its Architecture

**Course Objectives:**

1. To provide basic methodologies and processes for designing interfaces.
2. To improve the interaction between users and computers by making computers more usable and receptive to the user‘s needs.
3. To provide relevant principles of behaviour, mostly derived from cognitive science and psychology and other sources that describe human ethologic in particular environment, especially technological ones.
4. To make the students familiar with developing new interfaces and interaction techniques.

**Course Outcomes:**

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

1. Identify the elements of good user interface design through effective GUI.
2. Identify the importance of human characteristics and understanding business functions.
3. Analyze screen design principles for making good decisions based on technological considerations in interface design.
4. Select the window, device and screen based controls through navigation schemes.
5. Identify the basic components and interaction devices to interact with the computers.

**UNIT-I:** (9 Lectures)

**Introduction**: Importance of user Interface – definition, importance of good design, benefits of good design. A brief history of Screen design.

**The graphical user interface** – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

**Unit-II:** (9 Lectures)

**Design process** – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.

**UNIT-III** (10 Lectures)

**Screen Designing** : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

**UNIT-IV** (8 Lectures)

**Windows** – New and Navigation schemes selection of window, selection of devices based and screen based controls.

**UNIT-V** (9 Lectures)

**Components** – text and messages, Icons and images – Multimedia, colour – uses, problems with choosing colours.

**Interaction Devices** – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

**Text Books:**

1. Wilbert O Galitz, ‖The Essential Guide to User Interface Design‖, Wiley DreamaTech, Third Edition, 2007.

**Reference Books:**

1. Ben Shneiderman,CatherinePlaisant,―Designing the User Interface‖,Fourth Edition, Pearson Education ,2008.
2. ALAN DIX, JANET FINLAY, GREGORYD. ABOWD, RUSSELL BEALE,―HumanComputer Interaction‖,Third Edition,PEARSON,2009.

**Web References:**

1. http://ps.fragnel.edu.in/~dipalis/prgdwnl/eguid.pdf
2. https://www.alljntuworld.in/download/human-computer-interaction-materials-notes/
3. http://www.crectirupati.com/sites/default/files/lecture\_notes/HCI-notes.pdf

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**B.Tech IV Year II Semester**

**Course Structure**

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**GAME THEORY**

**(CSE)**

**Internal Marks : 40**

**Course Code: P18CSE25 External Marks: 60**

**Course Prerequisites: Probability Theory**

**Course Objectives:**

1. **T**o introduce the basics of game theory to undergraduate students in various disciplines.
2. It focuses on fundamentals of game theory including basic concepts and techniques
3. various ways of describing and solving games, and various applications in economics, political sciences, and business.
4. It will help students sharpen their understanding of strategic behavior in different situations involving many individuals.
5. The students will learn how to recognize and model strategic situations, to predict when and how their action will have an influence on others, and to exploit strategic situations for the benefit of their own.

**Course Outcomes:**

1. Analyze games based on complete and incomplete information about the players
2. Analyze games where players cooperate
3. Compute Nash equilibrium
4. Apply game theory to model network traffic
5. Analyze auctions using game theory.

**UNIT I:** (10 Lectures)

What is Game Theory? Definition of Games. Actions, Strategies, Preferences, Payoffs. Examples. Strategic form games and examples: Prisoner's Dilemma, Bach or Stravinsky, Matching Pennies. Notion of Nash Equilibrium. Examples of Nash Equilibrium. Dominated Actions. Symmetric Games and Symmetric Equilibria. Case Studies of Nash Equilibrium in popular games.

**UNIT II:** (8 Lectures)

**Mixed-Strategy Nash Equilibrium**

Mixed Strategy Nash Equilibrium- Randomization of Actions, Mixed strategy Nash equilibrium, Dominated actions, Pure strategy equilibria in the presence of randomization, Illustrations: (1)expert diagnosis (2) reporting a crime. Finding all mixed strategy Nash equilibria of some representative games.

**UNIT III:** (10 Lectures)

**Two Player Zero sum Games (Matrix Games)**- Max-minimization and Min maximization. Saddle points. Nash equilibrium in matrix games. Mini-max theorem, Solution via linear programming. Examples; Extensive games with Perfect Information- Extensive games, Strategies and outcomes, Nash equilibrium, Subgame perfect equilibrium, finding subgame perfect equilibria using backward induction. Allowing for simultaneous moves. Examples.

**UNIT IV:** (10 Lectures)

**Bayesian and Repeated Games-** Motivational Examples. Definition of a Bayesian Game and Bayesian Nash Equilibrium and examples. Auctions: Independent private values, Nash equilibrium of first price auction and second price auction, common valuations, revenue equivalence of auctions

**UNIT V:** (7 Lectures)

**Mechanism Design:** Strategic voting, unrestricted preferences, Implementation, quasi linear setting, Efficient mechanisms, Computational applications of mechanism design, Task scheduling, Bandwidth allocation in computer networks.

**Text Books:**

# Martin Osborne,” An Introduction to Game Theory”,(International Ed.), Oxford University, Press,2009.

# P.Morris,”Introduction to game theory”,Springer,2013.

# A. Dixit, S. Skeath and D. Reiley, Games of Strategy, 3rd edition, 2009 or 4th edition, 2015, W.W. Norton & Company: New York..

**References:**

# Ken Binmore, “Fun and Games : A Text On Game Theory”, D. C. Heath & Company, 2003.

# Y. Narahari,”Essentials of Game Theory and Mechanism Design”, IISc Press, 2014

# Web References:

1. http://www.nitandhra.ac.in/main/B.Tech/CSE.pdf
2. https://www.coursera.org/learn/game-theory-1?ac
3. https://www.geeksforgeeks.org/game-theory
4. https://www.economics.utoronto.ca/osborne/igt/TOC.HTM