LEARNING OUTCOMES

The design of the program was developed through discussions between the computer science and mathematics faculty. Each student's plan of study should address a set of learning outcomes developed from these discussions. The learning outcomes answer the question: "What should a graduate of our data science program be able to do?"

- Build mathematical / statistical models and understand their power and limitations
- Design an experiment
- Use machine learning and optimization to make decisions
- Acquire, clean, and manage data
- Visualize data for exploration, analysis, and communication
- Collaborate within teams
- Deliver reproducible data analysis
- Manage and analyze massive data sets
- Assemble computational pipelines to support data science from widely available tools
- Conduct data science activities aware of and according to policy, privacy, security and ethical considerations
- Apply problem-solving strategies to open-ended questions
Syllabus

21CSC101A FOUNDATIONS OF DATA SCIENCE 2-0-2-3

Unit-1

Unit-2
Descriptive statistics – Central tendency, dispersion, variance, covariance, kurtosis, five point summary, Distributions, Bayes Theorem, Error Probabilities; Permutation Testing, Statistical Inference; Hypothesis Testing, Assessing Models, Decisions and Uncertainty, Comparing Samples, A/B Testing, P-Values, Causality.

Unit-3
Estimation, Prediction, Confidence Intervals, Inference for Regression, Classification, Graphical Models, Updating Predictions.

TEXT BOOKS

REFERENCES:

21CSC102A Problem Solving and Computer Programming with Python 3 0 0 3

Unit 1
Conceptual introduction: topics in computer science, algorithms; modern computer systems: hardware architecture, data representation in computers, software and operating system; Installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages;

Unit 2
Conditions, boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation. Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated). String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice
versa. Binary, octal, hexadecimal numbers

Unit 3
Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Recursive functions. Testing, Debugging, Exceptions, Assertions. Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects

TextBook


21CSC181A Problem Solving Computer Programming Lab 0 0 2 1

1. Installing Python environments
2. Using Python Interpreter to do basic operations like arithmetic computations.
3. Working with variables of different datatypes and using them in expressions.
4. Building stand alone Python scripts
5. Implementing logic requiring conditional expressions and looping
6. Working with strings using inbuilt functionalities of the datatype
7. Working with Python inbuilt datatypes like Lists, Tuples and Dictionaries
8. Working with modularity : Implementing functions and designing logic in a modular fashion
9. Implement unit testing measures assertions and exception handling
10. Use Python to model object oriented programming principles using various use cases.

TextBook


21CSC111A Advanced Computer Programming with Python 3 0 0 3

Unit 1

Unit2
Applied Plotting, Charting & Data Representation in Python: Fundamentals of data reading, streams etc and using Pandas, Basic Charting using Matplotlib, Advanced plots, interactive plots and animated plots, Plotting with Pandas, Seaborn.

**Unit 3**

Python packages for accessing the Web Data: Regex, urllib, BeautifulSoup, Json, Retrieving and parsing webpages (Json, XML), REST API, Facebook and Twitter API. Connecting DB with Python: Reading and Writing, possible simple SQL queries.

**TextBook**


**21CSC112A Data Structures 3 1 0 4**

**Unit 1**

Abstraction - Abstract data types; Data Representation; Elementary data types; Basic concepts of data Structures; Mathematical preliminaries - big-Oh notation; efficiency of algorithms; notion of time and space complexity; performance measures for data structures. ADT array - Computations on arrays - sorting and searching algorithms.

**Unit 2**

ADT Stack, Queue, list - array, linked list, cursor based implementations of linear structures. ADT Tree - tree representation, properties traversal of trees; ADT- Binary Trees – properties and algorithms, ADT Priority Queue - Heaps; heap-based implementations; applications of heaps - sorting; Search Tree - Binary search tree; balanced binary search trees - AVL tree; Applications of Search Trees - TRIE; 2-3-4 tree; concept of B-Tree. ADT Dictionary - array based and tree based implementations; hashing - definition and application.

**Unit 3**

Graphs: ADT- Data structure for graphs - Graph traversal- Transitive Closure- Directed Acyclic graphs - Weighted graphs – Shortest Paths - Minimum spanning tree – Greedy Methods for MST.

**TEXTBOOKS:**


**REFERENCES:**


21CSC183A Advanced Computer Programming Lab 0 0 2 1

1. Installing external packages and using them in Python scripts
2. Work with NumPy, SciPy on solving simple mathematical problems
3. Implementing functionalities in Pandas to work with tabular data and do simple database operations on them
4. Implement various plotting and charting methods using packages like Matplotlib and its abstractions like Seaborn
5. Develop Python scripts that can retrieve data from the Web and do operations like parsing, searching, and formatting using packages like BeautifulSoup, urllib, Regex
6. Implement direct database access/manipulations by using Python scripts.

TextBook


21CSC184A Data Structures Lab 0 0 2 1

Implementing Sample ADT, Templates - Stacks and Queues: Array implementation, Applications - Vector, Lists, using these STLs for other implementations -Linked list: Singly and Doubly Linked Lists Implementation, Linked Stacks, D-Queue, Circular Queue - Implementing STL: Sequences, Iterators - Trees: Binary search tree, Priority Queue, Heaps - Graphs: Graph Representations, Traversals (BFS, DFS) - Hashing: Hash Table creation, creating hash functions, dynamically resizing hash tables.

21CSC201A Database Management Systems 3 1 0 4

Unit I


Unit II

Unit III
Relational database design – features of good relational designs – atomic domains and normal forms - 1NF, 2NF, 3NF, 4NF and BCNF – decomposition using functional dependencies - functional dependency theory – algorithm for decomposition -decomposition using multivalues dependencies – PJNF and DKNF. Over view of Transaction Management and Concurrency control

Text Book:

Reference Books

21CSC202A Design and Analysis of Algorithms 3 1 0 4

Unit 1
Introduction: Problem solving -- adding 2 n-bit numbers, multiplication as repeated addition. Running time analysis -- recall of asymptotic notation, big-oh, theta, big-omega, and introduce little-oh and little-omega. Worst case and average case

Basic design paradigms with illustrative examples -- incremental design (e.g., incremental sorting, interpolating polynomials), decremental design (e.g., GCD with discussion on input size, factorial), and pruning (e.g., order statistics). Divide and Conquer: Integer multiplication revisited with an efficient algorithm that motivates and leads into recurrences. Solving recurrences using recurrence trees, repeated substitution, statement of master theorem. Brief recall of merge sort and its recurrence. Median in worst case linear time.

Unit 2
Greedy Algorithms: Greedy choice, optimal substructure property, minimum spanning trees -- Prims and Kruskals, Dijkstra's shortest path using arrays and heaps, fractional knapsack, and Huffman coding (use of priority queue). Dynamic Programming: Integral knapsack (contrasted with the fractional variant), longest increasing subsequence, edit distance, matrix chain multiplication, and independent sets in trees.

Unit 3
Graph Algorithms – Graph Traversal: Applications of BFS: distance, connectivity and connected components and cycles in undirected graphs. Applications of DFS: Topological sort, cycles in
directed graphs, Biconnected Components and Strong Connectivity. Path algorithms: Shortest path algorithms (along with analysis) SSSP: Bellman Ford. APSP: Floyd Warshall’s. Minimum Spanning Tree (with analysis and applications).

Textbooks


References

TEXT BOOKS


REFERENCES


21CSC212A    Machine Learning    3 0 2 4


Text books/ Reference books.

2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)

21CSC213A    Number Theory and Information Security    3 1 0 4
Algorithms for integer arithmetic: Divisibility, GCD, modular arithmetic, modular exponentiation, Montgomery arithmetic, congruence, Chinese remainder theorem, orders and primitive roots, quadratic residues, integer and modular square roots, prime number theorem, continued fractions and rational approximations.

Representation of finite fields: Prime and extension fields, representation of extension fields, polynomial basis, primitive elements, normal basis, optimal normal basis, irreducible polynomials, Root-finding and factorization algorithm, Lenstra-Lenstra-Lovasz algorithm.

Elliptic curves: The elliptic curve group, elliptic curves over finite fields, Schoof's point counting algorithm.

Primality testing algorithms: Fermat Basic Tests, Miller–Rabin Test, AKS Test.

Integer factoring algorithms: Trial division, Pollard rho method, p-1 method, CFRAC method, quadratic sieve method, elliptic curve method.


Quantum Computational Number Theory: Grover's algorithm, Shor's algorithm

Applications in Algebraic coding theory and cryptography.

TEXT BOOKS/REFERENCES:


21CSC214A OPERATING SYSTEMS

Unit 1

Unit 2
Process Synchronization: Critical section problem - synchronization hardware – Semaphores - Classical problems of synchronization - Critical regions – Monitors- Deadlocks - Deadlock
characterization - Methods of handling deadlocks - Deadlock prevention – Avoidance - Detection and recovery.

Unit 3

TEXTBOOK:


REFERENCES:


21CSC282A Database Management Systems Lab 0 0 2 1

1) Working with objects using SQL for the following
   i. Data definition language: create, alter, grant, revoke, drop, truncate.
   ii. Data manipulation language: select, insert, update, delete.
   iii. Transaction control statements: commit, rollback, savepoint.

2) Constraints – Queries: Simple selection, projection and selection with conditions.
3) Functions: aggregate functions, group by, order by, date and conversion functions.

4) Set operators, joins, sub query: simple, nested, correlated, existence test, membership test, DDL and sub queries and DML and sub queries.

5) Working with other schema objects: view, sequence, index, synonym, cluster, lock, BLOB, CLOB, nested table, type.
6) PL/SQL programs, cursors, functions, procedures, packages, triggers, exception handling.

7) Front end tool: form creation, validation, trigger and report generation.

8) Mini Project.

**21CSC301A**     **DATA VISUALIZATION**     **3 0 0 3**

**Unit 1**
Introduction to Data Visualization – Classification of Visualization techniques – Structure and representation – Selection of a Visualization – Visualizations for high dimensional data – Graphics and computing.

**Unit 2**

**Unit 3**

**TEXTBOOK**


**21CSC302A**     **Deep Learning**     **3 0 0 3**

- Feedforward Networks: Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders.
- Deep Neural Networks: Difficulty of training deep neural networks, Greedy layerwise training.
- Recurrent Neural Networks: Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs
- Convolutional Neural Networks: LeNet, AlexNet.
- Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.
• Recent trends: Variational Autoencoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning
• Applications: Vision, NLP, Speech (just an overview of different applications in 2-3 lectures)

Textbook:

References:
1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT press 2016
3. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

21CSC304A Software Engineering 3 1 0 4
Software process and lifecycle: Software Product, Software Processes, Study of different process models, Project Management Concepts, Planning and Scheduling, Team organization and people management.
Software requirement engineering: Software requirements, extraction and specification, Feasibility Studies, Requirements Modeling, object oriented analysis.
Risk Management: Metrics and Measurement, Estimation for software projects, software configuration management, Maintenance and Reengineering.
Software Testing: Unit testing, integration testing, black box and white box testing, regression testing, performance testing, object oriented testing. Verification and validation of Software:Software Inspections and Audit, Automated Analysis, Critical systems validation.

Self-Study:
Text Books: 1.Ian Sommerville, Software Engineering, Addison – Wesley
References:
2. Rajib Mall, Fundamentals of Software Engineering, Prentice Hall of India
3. Ivar Jacobson, Object Oriented Software Engineering A use case Approach, Pearson

21CSC331A ADVANCED BIG DATA ANALYTICS 3-0-0-3
Unit - I
How MapReduce Works - Anatomy of a MapReduce Job Run, Failures, Shuffle and Sort, Task Execution
Unit -II
MapReduce Types and Formats - MapReduce Types, Input Formats, output formats,

Unit- III
MapReduce Features- Counters, Sorting, Joins, Side Data Distribution

Unit -IV
Simple analytics using MapReduce, Calculating frequency distributions and sorting using MapReduce, Calculating histograms using MapReduce, Calculating scatter plots using MapReduce

Unit – V
Hierarchical clustering, Clustering algorithm to large dataset, classification using Navie bayes classifier, other applications

Text Books/References:

2. Srinath Perera  and Thilina Gunarathne , Hadoop MapReduce Cookbook : Recipes for analyzing large and complex datasets with Hadoop MapReduce, Packt PublishingLtd,2013.

21CSC334A      Data Analytics in Computational Biology        3  0  0  3

Introduction to Bioinformatics - applications of Bioinformatics - challenges and opportunities - introduction to NCBI data model- Various file formats for biological sequences.

Bioinformatics resources – Importance of databases - Biological databases- Primary & Secondary databases (Genbank, EMBL, DDBJ, Swiss Prot , PDB, NDB, BLOCKS, Pfam, ProSITE, etc.).


Multiple sequence alignment methods – Tools and application of multiple sequence alignment. Sequence alignment tools (BLAST, FASTA, CLUSTAL-W/X, MUSCLE, TCOFFEE), Variants of BLAST (BLASTn, BLASTp, PSIBLAST, PHI-BLA

Phylogenetic analysis algorithms: Maximum Parsimony, UPGMA, Transformed Distance, Neighbors-Relation, Neighbor-Joining, jackknife, Probabilistic models and associated algorithms
such as Probabilistic models of evolution and maximum likelihood algorithm, Bootstrapping methods, use of tools such as PHYLIP, MEGA, PAUP.

References/ Textbooks


21CSC335A  Data Compression  3 0 0 3

Unit 1

Unit 2
Scalar and Vector Quantization: Scalar Quantization – Introduction, Uniform and Adaptive quantization. Vector Quantization- Introduction, Advantages, LBG, Tree vector quantization, Trellis coded quantization Audio Compression: Distortion criteria- Auditory perception, PCM, DPCM, ADPCM, Predictive coding- basic algorithm, Basic sub-band coding, MPEG Audio Coding

Unit 3

TEXTBOOKS:

REFERENCES:

21CSC336A DEEP LEARNING FOR IMAGE PROCESSING

Unit 1

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

21CSC338A Mining of Massive Datasets

Basics of Data Mining - Computational Approaches - Statistical Limits on Data Mining - Bonferroni’s Principle - MapReduce - Distributed File Systems - MapReduce Algorithms Using MapReduce - Extensions to MapReduce. Finding Similar Items - Applications of Near-Neighbor Search - Shingling of Documents - Similarity-Preserving Summaries of Sets - Locality-Sensitive Hashing for Documents - Distance Measures

Text Book

References
Tom White, Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale, O'Reilly Media; 4 edition, 2015.

21CSC340A Social Network Analytics 3 0 0 3

Unit 1: Online Social Networks (OSNs)
Introduction - Types of social networks (e.g., Twitter, Facebook), Measurement and Collection of Social Network Data. Techniques to study different aspects of OSNs -- Follower-followee dynamics, link farming, spam detection, hashtag popularity and prediction, linguistic styles of tweets. Case Study: An Analysis of Demographic and Behaviour Trends using Social Media: Facebook, Twitter and Instagram

Unit 2: Fundamentals of Social Data Analytics
Introduction - Working with Social Media Data, Topic Models, Modelling social interactions on the Web – Agent Based Simulations, Random Walks and variants, Case Study: Social Network Influence on Mode Choice and Carpooling during Special Events: The Case of Purdue Game Day

Unit 3: Applied Social Data Analytics

Text and Reference Literature
21CSC341A               Soft Computing                          3 0 0 3

Unit I

Unit II
Fuzzy Logic:Introduction – the case of imprecision, the utility and limitation of fuzzy systems. Classical sets and Fuzzy sets: operations, properties and mapping.

Unit III
Classical relations and fuzzy relations: cardinality, operations, properties and composition – tolerance and equivalence relations. Properties of membership function, fuzzification and defuzzification. Logic and fuzzysystems. Fuzzy control systems – Aircraft landing control problems.

Unit IV

Text Books:

1) Kumar S. ‘Neural Networks – A classroom approach’, TMH, 20014.
Reference Books:


21CSC342A Statistical Pattern Recognition 3-0-2-4

UNIT I
Introduction and Bayesian Decision Theory– Pattern recognition systems – the design cycle – learning and adaptation – Bayesian decision theory – continuous features – Minimum error rate classification – discriminant functions and decision surfaces – the normal density based discriminant functions.

UNIT II

UNIT III

UNIT IV

UNIT V

References:

Multivariate Data: Random Vector: Probability mass and density functions, Distribution function, Mean vector & Dispersion matrix. Multivariate and Bivariate normal distributions.

Time series as a discrete parameter stochastic process, Auto - covariance, Auto-correlation functions and their properties, moving average models, autoregressive models, Autoregressive Moving Average models.

Text Books:

References:


Linear Transformations: Positive definite matrices - Matrix norm and condition number - QR-Decomposition - Linear transformation - Relation between matrices and linear transformations - Kernel and range of a linear transformation - Change of basis - Nilpotent transformations - Trace and Transpose, Determinants, Symmetric and Skew Symmetric Matrices, Adjoint and Hermitian Adjoint of a Matrix, Hermitian, Unitary and Normal Transformations, Self Adjoint and Normal Transformations, Real Quadratic Forms.

Eigen values and Eigen vectors: Problems in Eigen Values and Eigen Vectors, Diagonalization, Orthogonal Diagonalization, Quadratic Forms, Diagonalizing Quadratic Forms, Conic Sections. Similarity of linear transformations - Diagonalisation and its applications - Jordan form and rational canonical form.

TEXT BOOKS
REFERENCES:

21MAT109A CALCULUS 3 1 0  4

Unit 1
Chapter 2- Sec: 2.1 to 2.7 and Chapter 3- Sec: 3.1 to 3.6, 3.7, Self Study - Sec: 3.7.

Unit 2
Chapter 4- Sec: 4.1 to 4.4, 4.6 to 4.8, Self Study - Sec: 4.5

Unit 3
Chapter 5- Sec: 5.1 to 5.6

Unit 4
Chapter 8: 8.1 to 8.5, 8.7,8.8, Self Study - Sec: 8.6

Unit 5
Chapter 6 – Sec: 6.1 to 6.7

TEXTBOOK:

REFERENCE BOOKS:
Phase I

Logic, Mathematical Reasoning and Counting: Logic, Prepositional Equivalence, Predicate and Quantifiers, Theorem Proving, Functions, Mathematical Induction. Recursive Definitions, Recursive Algorithms, Basics of Counting, Pigeonhole Principle, Permutation and Combinations. (Sections: 1.1 -1.3, 1.5 -1.7, 2.3, 4.1 - 4.4, 5.1 - 5.3 and 5.5)

Phase II

Relations and Their Properties: Representing Relations, Closure of Relations, Partial Ordering, Equivalence Relations and partitions. (Sections: 7.1, 7.3 - 7.6)

Advanced Counting Techniques and Relations: Recurrence Relations, Solving Recurrence Relations, Generating Functions, Solutions of Homogeneous Recurrence Relations, Divide and Conquer Relations, Inclusion-Exclusion. (Sections: 6.1 - 6.6)

Phase III

Graph Theory: Introduction to Graphs, Graph Operations, Graph and Matrices, Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path Problem, Planar Graph, Graph Colorings and Chromatic Polynomials. (Sections: 8.1 - 8.8)

TEXTBOOKS:


REFERENCES:

Unit – I

Unit – II

Unit – III
Two dimensional random variables-Joint, marginal and conditional probability distributions for discrete and continuous cases, independence, expectation of two dimensional random variables - conditional mean, conditional variance, covariance and correlation.

Unit-IV
Point Estimation, Sampling Distributions and Central limit theorem, Point estimation, Maximum likelihood Estimation, - Confidence Interval on the mean of a Normal Distribution with Variance known and unknown, -Confidence interval on the variance and ratio of variances.

Unit – V
Hypothesis Testing, Tests on the mean of normal distributions with variance known and unknown. Tests on the variance single and two samples, Test of goodness of fit.

Textbooks:

Reference books:
Unit 1. Introduction: Mathematical optimization, Least-squares and linear programming, Convex optimization, Nonlinear optimization.

Chapter 1.

Unit 2

Chapter-2

Unit 3

Chapter-3.

Unit 4

Chapter-4.

Unit 5:

TEXT BOOKS:

REFERENCES:
Unit I

Unit II
Multiple Linear Regression: Multiple Linear Regression Models, Estimation of the Model Parameters, Hypothesis testing in Multiple Linear Regression, Confidence Interval on the Regression and Prediction of New observations.

Unit III

Unit IV
Polynomial regression models – polynomial models in one variable – Polynomial models in two or more variables – variable selection and model building – computational techniques for variable selection.

Unit V
Introduction to analysis of variance- one way and two way ANOVA – Analysis of variance in Regression: Response surface designs – Introduction to response surface methodology, Method of steepest accent, Analysis of second order response surface, experimental design for fitting response surfaces.

Text Books/References:


21ENG102A Communicative English 2-0-2-3

Objectives:
To help students obtain an ability to communicate fluently in English; to enable and enhance the students skills in reading, writing, listening and speaking; to impart an aesthetic sense and enhance creativity

Course Contents:

Unit I
Kinds of sentences, usage of preposition, use of adjectives, adverbs for description, Tenses, Determiners- Agreement (Subject – Verb, Pronoun- Antecedent) collocation, Phrasal Verbs, Modifiers, Linkers/ Discourse Markers, Question Tags

Unit II
Paragraph writing – Cohesion - Development: definition, comparison, classification, contrast, cause and effect - Essay writing: Descriptive and Narrative

Unit III
Letter Writing - Personal (congratulation, invitation, felicitation, gratitude, condolence etc.) Official (Principal / Head of the department/ College authorities, Bank Manager, Editors of newspapers and magazines)

Unit IV
Reading Comprehension – Skimming and scanning- inference and deduction – Reading different kinds of material –Speaking: Narration of incidents / stories/ anecdotes- Current News Awareness

Unit V
Prose: John Halt’s ‘Three Kinds of Discipline’ [Detailed]
Max Beerbohm’s ‘The Golden Drugget’ [Detailed]
Poems: Ogden Nash- ‘This is Going to Hurt Just a Little Bit’ [Detailed]
Wole Soyinka- ‘Telephone Conversation’ [Non-Detailed]
Kamala Das- ‘The Dance of the Eunuchs’ [Non-Detailed]
Short Stories: Edgar Allan Poe’s ‘The Black Cat’, Ruskin Bond’s ‘The Time Stops at Shamili’ [Non-Detailed]

CORE READING:
1. Ruskin Bond, Time Stops at Shamli and Other Stories, Penguin Books India Pvt Ltd, 1989
2. Syamala, V. Speak English in Four Easy Steps, Improve English Foundation Trivandrum: 2006
5. Online sources

References:
8. Murphy, Raymond, Murphy’s English Grammar, CUP, 2004
9. Online sources
Objectives:

To convey and document information in a formal environment; to acquire the skill of self projection in professional circles; to inculcate critical and analytical thinking.

Unit I

Vocabulary Building: Prefixes and Suffixes; One word substitutes, Modal auxiliaries, Error Analysis: Position of Adverbs, Redundancy, misplaced modifiers, Dangling modifiers – Reported Speech

Unit II

Instruction, Suggestion & Recommendation - Sounds of English: Stress, Intonation

- Essay writing: Analytical and Argumentative

Unit III

Circulars, Memos – Business Letters - e-mails

Unit IV

Reports: Trip report, incident report, event report - Situational Dialogue - Group Discussion

Unit V

Listening and Reading Practice - Book Review

References

1. FelixaEskey. Tech Talk, University of Michigan. 2005
1. Data Visualization using plot, pie chart, bar chart, histogram and Box plot
2. Find the central measures for given data, like, mean, mode, median and deviations
3. Root finding
4. Regression models
5. Correlation coefficient
6. Rank correlation.

21CSC283A Machine Learning Lab 0 0 2 1

18CSC401 Parallel and Distributed Systems 3 1 0 4

Unit 1
Introduction – parallelism and goals, parallel computing models – RAM, PRAM, CTA.
Reasoning about Performance – Introduction - Basic Concepts - Performance Loss - Parallel

Unit 2
Parallel Programming: Task and Data Parallelism with examples – Comparison Programming
with Threads - POSIX Threads- Thread Creation and Destruction. Mutual Exclusion-
Synchronization - Safety and Performance Issues – Reduction – threads Inter process
communication – internet protocols – multicast communication – MPI. Remote
invocation:Remote procedure call – remote method invocation -

Unit 3
System models : physical models, architecture models, operating system support. Distributed file
systems – introduction- time and global states – synchronization of physical clocks –
coordination and agreements: Mutual exclusion, election, consensus.

Text Books

1. George Coulouris , Jean Dollimore , Tim Kindberg , Gordon Blair DISTRIBUTED
2. Calvin Lin ,Larry Snyder, Principles of Parallel Programming, Pearson, 2009
References


18CSC449

IoT Workshop 3 0 0 3

Unit - 1
Introduction to IoT - IoT definition - Characteristics - Things in IoT - IoT Complete Architectural Stack - IoT enabling Technologies - IoT Challenges - IoT Levels - A Case Study to realise the stack.
Sensors and Hardware for IoT - Accelerometer, Proximity Sensor, IR sensor, Gas Sensor, Temperature Sensor, Chemical Sensor, Motion Detection Sensor. Hardware Kits - Arduino, Raspberry Pi, Node MCU. A Case study with any one of the boards and data acquisition from sensors (Lab Component)

Unit - 2
Protocols for IoT - infrastructure protocol IPV4/V6/RPL, Identification (URLs), Transport (Wi-Fi, Li-Fi, BLE), Discovery, Data Protocols, Device Management Protocols. - A Case Study with MQTT/CoAP usage. (Lab Component)

Cloud and Data analytics - Types of Cloud - IoT with cloud challenges - Selection of cloud for IoT applications - Fog computing for IoT - Edge computing for IoT - Cloud security aspects for IoT applications - RFM for Data Analytics - Case study with AWS / AZURE / Adafruit / IBM Bluemix (Lab Component).

Unit - 3
Case studies with architectural analysis:
IoT applications - Smart City - Smart Water - Smart Agriculture - Smart Energy - Smart Healthcare - Smart Transportation - Smart Retail - Smart waste management. (Lab Component - As a project)

Text and Reference Books
2. Infosys Training E Materials.
5. NPTEL Reference: https://onlinecourses.nptel.ac.in/noc17_cs22/preview