MAHATMA GANDHI UNIVERSITY

SCHOOL OF COMPUTER SCIENCES

M.Sc. Computer Science

Revised Syllabus 2020

MAHATMA GANDHI UNIVERSITY

SCHOOL OF COMPUTER SCIENCES

PROGRAMME: **M.Sc. Computer Science** FACULTY OF **SCIENCE**

DURATION: **4 Semesters** Minimum Total Credits Required: **80**

Revised Syllabus 2020: Semester wise List of Courses

Semester I

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
SKSMPC11	Operating Systems and Virtualization	3	1	2	3
SKSMPC12	Multicore Microprocessors and Parallel Programming	3	2	3	4
SKSMPC13	Algorithms and Complexity	3	2	3	4
SKSMPC14	Artificial Intelligence	3	2	-	4
SKSMPE1*	Elective – I	3	1	2	3
SKSMPC16	Case Study using Python-Lab	-	1	6	2
Total Credits (Semester I)					20

Semester II

SKSMPC21	Machine Learning	3	1	2	3
SKSMPC22	Digital Image Processing	3	2	3	4
SKSMPC23	Data Mining	3	2	3	4
SKSMPC24	Software Engineering	3	-	2	4
SKSMPE2*	Elective – II	3	1	2	3
SKSMPC26	Minor Project using Advanced Java and OOD Concepts-Lab	-	1	6	2
Total Credits(Semester II)					20

Semester III

SKSMPC31	Theoretical Computer Science	3	2	-	3
SKSMPC32	Deep Learning	3	2	3	4
SKSMPE3*	Elective – III	3	1	2	3
SKSMPE3*	Elective – IV	3	1	2	3
SKSMPC35	Deep Learning-Lab	-	1	6	2
SKSMPC36	Advanced Software Development Tools-Lab	-	1	3	1
SKSMPO31	Open Course	3	1	2	4
Total Credits(Semester III)					20

Semester IV

SKSMPC41	Main Project	One Semester			16
SKSMPC42	Comprehensive Viva-voce	-	-	-	4
Total Credits(Semester IV)					20

Total Credits for the M Sc Programme : 80

ELECTIVES

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
SKSMPE11	Cyber Security and Cyber Laws	3	1	2	3
SKSMPE12	Advanced Data Structures	3	1	2	3
SKSMPE13	3D Graphics	3	1	2	3
SKSMPE21	Wireless Communication and Sensor Networks	3	1	2	3
SKSMPE22	Cyber Physical Systems	3	1	2	3
SKSMPE23	Distributed Systems and Parallel Computing	3	1	2	3
SKSMPE31	Data Science	3	1	2	3
SKSMPE32	Internet Of Things and Block Chain Technologies	3	1	2	3
SKSMPE33	Cloud Computing	3	1	2	3
SKSMPE34	Fuzzy Logic and Nature Inspired Computing	3	1	2	3
SKSMPE35	Natural Language Processing	3	1	2	3
SKSMPE36	Digital Signal Processing and Speech Technologies	3	1	2	3

SEMESTER I

SKSMPC11 OPERATING SYSTEMS AND VIRTUALIZATION

Unit I

Introduction - Characteristics of Modern Operating Systems, Symmetric Multiprocessing and Micro-kernels, Virtual Machines, OS Design Considerations for Multiprocessor and Multicore, Windows Overview, Modern UNIX Systems, Linux, Android.

Unit II

Processes and Threads - Process Description and Control, Security issues, UNIX SVR4 Process Management, Threads, Windows Process and Thread Management, Solaris Thread and SMP Management, Linux Process and Thread Management, Android Process and Thread Management, Unix Concurrency Mechanisms, Linux Kernel Concurrency Mechanisms, Solaris Thread Synchronization Primitives, Windows Concurrency Mechanisms, Android Interprocess Communication.

Unit III

Memory - UNIX and Solaris Memory Management, Linux Memory Management, Windows Memory Management, Android Memory Management.

Scheduling - Traditional UNIX Scheduling, Multiprocessor and Multicore Scheduling, Real-time Scheduling, Linux Scheduling, UNIX SVR4 Scheduling, Windows Scheduling.

Unit IV

Input / Output and Files - UNIX SVR4 I/O, Linux I/O, Windows I/O, Unix File Management, Linux Virtual File Systems, Windows File System, Android File Management.

Unit V

Virtualization Concepts: Introduction to Virtual machines; Process Virtual Machines, System Virtual Machines, Multiprocessor Virtualization, Applications for VM Technology

Approaches to Virtualization: Hypervisors, Containers, Processor Issue, Memory Management, I/O Management, VMware ESXi, Microsoft Hyper-V and Xen Variants, Java VM, Linux VServer Virtual Machine Architecture, Android Virtual Machine.

References

1. William Stallings, Operating Systems: Internals and Design Principles, 9th Ed, Prentice-Hall.
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, 8th Ed, John Wiley.
3. James E. Smith, Ravi Nair, Virtual Machines-Versatile Platforms for Systems and Processes, Morgan Kaufmann Publishers.
4. Matthew Portnoy, Virtualization- Essentials, John Wiley & Sons, Inc.

SKSMPC12 MULTICORE MICROPROCESSORS AND PARALLEL PROGRAMMING

Unit I

Single Core To Multi-core Microprocessors: Introduction to Pentium IV Microprocessors, Architecture, Special Features, Registers, Addressing Modes, Memory Management, New Pentium Instructions. [1] An Introduction to Multicore Processors, Single Core Vs Multicore Processors, Architecture and PIN Descriptions of Intel Core 2 Processors.

Unit II

Parallel Computer Architecture, Flynn's Taxonomy of Parallel Architectures, Classes of MIMD Parallel Computers, Parallel Programming Models, Levels of Parallelism[5], Simultaneous Multithreading (SIMT) Architecture, Energy Consumption of Processors, Architecture of Multicore Processors, Case Study: Architecture of the Intel Core i7, Interconnection Networks, Parallel Computational Complexity, Laws and Theorems of Parallel Computation [3][4]

Unit III

Shared Memory Parallel Programming using OpenMP, Shared Memory Programming Model, Multithreaded Programs, Parallelization of Loops, Parallel Tasks, MPI Processes and Messaging, Distributed Memory Computers, Message Passing Interface, Basic MPI Operations, Process-to-Process Communication, Collective MPI Communication, Sources of Deadlocks. [3]

Unit IV

Introduction to Memory Hierarchy Organization, Basic Architectures of a Cache, Cache Performance, Prefetching, Cache Designing, Multicore Architecture, Physical Cache Organization, Logical Cache Organization, CaseStudies[4].

Introduction to Shared Memory Multiprocessors, Basic Cache Coherence Issues, Hardware Support for Synchronization, Memory Consistency Models, Advanced Cache Coherence Issues.[4].

Unit V

OpenCL for Massively Parallel Graphic Processors, Anatomy of a GPU, Programmer's View of OpenCL, Programming in OpenCL.[3]

References

1. A. K. Ray & K. M. Bhurchandi, Advanced Microprocessors and Peripherals- Architectures, 3e, McGrawHill Education (India)Pvt. Ltd..
2. Berry.B.Brey, The Intel Microprocessors 8086/8088 /80186/80188, 80286, 80386,80486 PENTIUM, PENTIUM Pro, PII, PIII & IV Architecture, Programming & Interfacing, Pearson Education.
3. Roman Trobec, Boštjan Slivnik Patricio Bulić, Borut Robič, Introduction to Parallel Computing From Algorithms to Programming on State-of-the-Art Platforms, Springer Nature Switzerland AG 2018, ISSN 1863-7310 ISSN 2197-1781 (electronic).
4. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press.
5. Thomas Rauber, Gudula Runger, Parallel Programming for Multicore and Cluster Systems, Second Edition, Springer-Verlag Berlin Heidelberg 2007, 2012, ISBN 978-3-642-37800-3.
6. Aaftab Munshi, Benedict R. Gaster, Timothy G. Mattson, James Fung, Dan Ginsburg, OpenCL Programming Guide, Addison-Wesley, Pearson Education Inc.
7. David W. Walker, Parallel Computing, Encyclopedia of Physical Science and Technology (Third Edition).

SKSMPC13 ALGORITHMS AND COMPLEXITY

Unit I

Introduction: The Role of Algorithms in Computing, Design and Analysis Fundamentals, Performance Analysis, Mathematical Background for Algorithm Analysis, Recurrences: Substitution Method, Recursion-Tree Method, Master Method.

Unit II

Lower Bound Theory: Importance of Lower Bound Theory, Comparison Trees, Adversary Arguments, Lower Bounds through Reductions.

Unit III

Randomized Algorithms: Motivation, Applications and Advantages, Monte Carlo and Las Vegas Algorithms, De-randomization.

String Matching Algorithms: The Naive String Matching Algorithm, The Rabin-Karp Algorithm, String Matching with Finite Automata, The Knuth-Morris-Pratt Algorithm. Longest Common Subsequence.

Unit IV

Introduction to NP-Completeness: The class P and NP, NP-Complete, NP-Hard, NP-Completeness, and Reducibility; Cook's Theorem.

Approximation Algorithms: Absolute Approximations, Є-Approximations, Polynomial Time, and Fully Polynomial Time Approximation Schemes.

Unit V

Parallel Algorithms: Sequential vs. Parallel Algorithms; Architecture of an Ideal Parallel Computer; Principles of Parallel Algorithm Design; Models: Data Parallel Model, Task Graph Model, Work Pool Model, Master-Slave Model, Producer-Consumer or Pipeline Model; Hybrid Model; Speedup and Efficiency; Examples of Parallel Algorithms.

References

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Prentice Hall India, Third Edition.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajeshekharan, Computer Algorithms/C++, Second Edition, Universities Press.
3. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, Addison Wesley, Second Edition
4. A. Levitin, Introduction to Design and Analysis of Algorithms, Pearson.
5. Basu S.K., Design Methods and Analysis of Algorithms, Prentice Hall, Second Edition.
6. A. Basheer, M. Zaghlool, FPGA-Based High Performance Parallel Computing, Scholars' Press.
7. Richard Neapolitan, Kumars Naimipour, Foundations of Algorithms, Jones and Barlett Publishers, Canada, Fourth Edition.
8. Sara Base Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis, Pearson Education Asia.
9. Prabhakar Gupta, Vineet Agarwal, Manish Varshney, Design and Analysis of Algorithms, Prentice Hall India, Second Edition.
10. G. Brassard, P. Bratley, Fundamentals of Algorithms, PHI.

SKSMPC14 ARTIFICIAL INTELLIGENCE

Unit I
Introduction to Artificial Intelligence: Definition of AI; Future of AI; Brief Discussion of Major Topics (Expert System, Natural Language Processing, Speech and Pattern Recognition etc.) of AI. Problem Definition as a State Space Search, Production System, Control Strategies, Problem Characteristics.

Unit II
Types of search algorithms: Formal vs. Informal search: Breadth First Search, Depth First Search, iterative deepening, uniform cost search, Hill climbing and its Variations, simulated annealing, genetic algorithm search; Heuristics Search Techniques: Best First Search, A* algorithm, AO* algorithm, Min-max & game trees, refining minmax, Alpha – Beta pruning, Constraint Satisfaction Problem, Means-End Analysis.

Unit III
Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

Unit IV Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

Unit V
AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving**.**

References

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education.
2. Elaine Rich and Kelvin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill.
3. M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Editio.
4. Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press.

SKSMPC16 CASE STUDY USING PYTHON-LAB

Unit I

Python interpreter, invoking the interpreter, arguments passing, executable python scripts, python data types, collections, input output data, built in functions

Unit II

Operators (unary, arithmetic, etc.) -- Data types, variables, expressions, and statements -- Assignment statements -Control Structures: loops and decision

Unit III

Modularization and Classes - Standard modules -- Packages -- Defining Classes -- Defining functions -- Functions and arguments - Exceptions and data structures -- Data Structures (array, List, Dictionary) -- Error processing -- Exception Raising and Handling

Unit IV

Regular expression in python, searching, matching, splitting, grouping string programs- Object Oriented Programming -- Object Oriented Design -- Inheritance and Polymorphism

Unit V

Database programs in python-Installing MYSQL, connectivity using MYSQL, create database instance and using with python, MSQLdb module with python.

References

1. Starting out with python by Tony Gadis ,2nd edition Pearson Publications
2. Python: From Novice to Professional by Magnus Lie Hetland-Apress
3. Python 2.6 Bible –Dave Breuck and Stephen Tanner-Hungry minds Ins.
4. Beginning Python –Peter Norton,Alex Samuel, David Aitel-wrox publications
5. Python Essential Reference-David M Beazley second Edition

ELECTIVES

SKSMPE11 CYBER SECURITY AND CYBER LAWS

Unit I

Introduction to Cyber Security; Information security, Fundamentals, Network and security concept; Information assurance fundamentals, Basic cryptography, Symmetric encryption, Public key encryption, firewalls and virtualization.

Unit II

Attacker technique and motivations; Using Proxies, Tunneling technique, Fraud technique, Rogue antivirus, Click fraud, Threat infrastructure, Exploitation; Shell code, Integer overflow, Stack based buffer overflows, String vulnerabilities, SQL injection, Malicious PDF file, Race condition, Web exploit tools, DoS condition.

Unit III

Brute force and dictionary attacks, Cross site scripting, Social engineering, WarXing, Malicious code; self replicating malicious code, Evading detection and elevating privileges, Stealing information and exploitation, Memory forensics, Honeypots, Malicious code naming, Intrusion detection system

Unit IV

Introduction to Cybersecurity law, Infamous cybercrimes, Cybercrime taxonomy, Civil vs criminal cybersecurity offenses, Basic element of criminal law, Branches of law, Tort law, Cyber law enforcement, Cybersecurity law jurisdiction, Cybercrime and cyber tort punishment.

Unit V

Cyber privacy and data protection law; Common law of privacy, Privacy laws, Data breach laws, Data breach litigation, Privacy notice law, Personal liability, Data disposal law, Cryptography and digital forensics law, Social media privacy, Future development in cybersecurity law.

References

1. James Graham, Rick Howard, Ryan Olson, Cyber Security Essentials, CRC Press.
2. Mayank Bhushan, Rajkumar Singh Rathore, Aatif Jamshed, Fundamentals of Cyber Security, BPB Publications.
3. Tari Schreider, Cybersecurity Law, Standards and Regulations, 2nd Edition, Rothstein Publishing.
4. Information Resources Management Association, Cyber Law, Privacy, and Security Concepts, Methodologies, Tools, and Applications, IGI Global.
5. Jeff Kosseff, Cybersecurity Law, Wiley.

SKSMPE12 ADVANCED DATA STRUCTURES

Unit I

Introduction to Data Structure; Overview, Types and Charecteristics of Data Structure, Arrays, Stacks, Queues, Linked lists, Trees, Graphs.

Unit II

Generalized linked lists**,** Representation, Recursive Algorithms, Reference Counts– Shared and Recursive Lists; Heterogeneous Lists – Deterministic Skip Lists. Hashing:- Separate Chaining; Open Addressing – Linear Probing – Quadratic Probing; Double Hashing – Rehashing – Extendible Hashing.

Unit III

Search Structures, 2-3 Trees – 2-3-4 Trees Rd-Black Trees – B-Trees - Splay Trees – Digital Search Trees Tries – Differential Files – AA-Trees – Treaps – K Trees K-d Trees – Tries.

Unit IV

Heap Structures, Min-Max Heaps – D-heaps – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Binary Heaps – Skew Heaps – Pairing Heaps – Applications.

Unit V

Abstract Data Type (ADT) – algorithms - concepts - definition - objectives of algorithms - quality of an algorithm - space complexity and time complexity of an algorithm, Sorting, Searching and Application.

References

1. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, Fundamentals of Data Structures in C++, 2nd Edition, Universities Press.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Second Edition, Pearson Education Asia.
3. Debashish Samanta, Classic Data Structures, PHI Second Edition.
4. Kutti, Padhye, Data Structures in C++, PHI, First Edition.
5. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Addison-Wesley.
6. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Silicon Press.
7. Richard F. Gilberg and Behrouz A. Forouzan, Data Structures: A Pseudocode Approach With C, Cengage Learning.
8. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, Data Structure using C, Prentice- Hall.
9. Robert Kruse, Tondo C L and Bruce Leung, Data Structures & Program Design in C, Pearson India, 2nd Edition.
10. Thomas H Cormen, Charles E Leiserson, and Ronald L Rivest, Introduction to Algorithms, 3rd Edition, Prentice Hall of India Private Limited.
11. Jean-Paul TrSemblay, Paul G. Sorenson, P. G. Sorenson, Introduction to Data Structures with Applications, Mcgraw-Hill College.

SKSMPE13 3D GRAPHICS

Unit I
Introduction - Three dimensional Concepts, Display Methods.

Unit II
3D Geometric transformations- Translation, Scaling, Rotation, Reflection, Shear, Composite Transformations, Modeling and Co-ordinate transformations.

Unit III
Represetations of 3D Objects - Polygon surfaces, Representation of curves and surfaces, Representing solids- Sweep representations, Boundary representations, Spatial-partitioning representations, Constructive solid geometry.
Visible surface detection methods.
Shading and Illumination.

Unit IV
Viewing - Projections, Projection Matrices.

Unit V
Discrete Techniques in OpenGL - Texture mapping, Bit and Pixel operations, Compositing, Sampling and Aliasing Techniques.

References

1. Hearn D.,Baker M, P., *Computer Graphics*, Prentice-Hall of India.
2. Foley J,D. , Andries Van Dam, *Computer Graphics - Principles and Practice,* Addison-Wesley.
3. Angel, Edward., *Interactive Computer Graphics- A Top-down Approach with OpenGL*, Addison-Wesley.
4. F. S. Hill, Computer Graphics Using OpenGL, Pearson Education.
5. Alan Watt, *3D Computer graphics*, Pearson Education.

SEMESTER II

SKSMPC21 MACHINE LEARNING

Unit I

Introduction: Concept of Machine Learning, Mathematical Foundations for Machine Learning: Linear Algebra, Analytic geometry, Matrix Decompositions, Vector Calculus, Probability and Distributions, Continuous Optimization, Applications of Machine Learning, Key elements of Machine Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier

Unit II

Linear Regression: Prediction using Linear Regression, Gradient Descent, Linear Regression with one Variable, Linear Regression with Multiple Variables, Polynomial Regression, Feature Scaling/Selection.

Unit III

Logistic Regression: Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one Variable and with Multiple Variables.

Unit IV

Regularization: Regularization and its Utility: The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance.

Unit V

Neural Networks: Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Back Propagation Algorithm.

References

1. Ethem Alpaydin, "Introduction to Machine Learning", 4th Edition, The MIT Press.
2. Deisenroth, Marc Peter, et al. Mathematics for Machine Learning. Cambridge University Press, 2020.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning".
4. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", The MIT Press.
5. Kevin P. Murphy, "Machine Learning, 2nd Edition, The MIT Press.
6. Yegnanarayana B, Artificial Neural Networks , Prentice-Hall India Pvt. Ltd.
7. “Mastering Machine Learning: A Step-by-Step Guide with MATLAB”, MathWorks.
8. Giuseppe Ciaburro, “MATLAB for Machine Learning”, Packt Publishing Limited.
9. U Dinesh Kumar, Manaranjan Pradhan, “Machine Learning using Python”, Wiley.
10. S Sivanandam, S Sumathi, S. N Deepa, “ Introduction to Neural Networks using Matlab 6.0, Tata McGraw-Hill Education.
11. Tom M. Mitchell, "Machine Learning", 1st Edition, Tata McGraw-Hill Education.

SKSMPC22 DIGITAL IMAGE PROCESSING

Unit I

Elements of digital image processing systems, Elements of visual perception, psycho visual model, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB,HSI models, Image acquisition and sampling, Quantization, Image file formats, Two-dimensional convolution, correlation, and frequency responses.

Unit II

Image Transforms- 1D DFT, 2D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Radon and Wavelet Transform.

Unit III

Image Enhancement and Restoration- Histogram modification and specification techniques, Noise distributions, Spatialaveraging, Directional Smoothing, Median, Geometric mean, Harmonic mean,Contra harmonic filters, Homomorphic filtering, Color image enhancement. Image Restoration – degradation model, Unconstrained and Constrained restoration, Inverse filtering, Wiener filtering, Geometric transformations – spatial transformations, Gray-Level interpolation.

Unit IV

Image Segmentation and Recognition- Edge detection. Image segmentation by region growing, region splitting and merging, edge linking, Morphological operators: dilation, erosion, opening, and closing. Image Recognition – Patterns and pattern classes, matching by minimum distance classifier, Statistical Classifier. Matching by correlation, Neural network application for image recognition.

Unit V

Image Compression- Need for image compression, Huffman, Run Length Encoding, Arithmetic coding, Vector Quantization, Block Truncation Coding. Transform Coding – DCT and Wavelet. Image compression standards.

References

1. Rafael C. Gonzalez, Richard E. Woods, ‘Digital Image Processing’, Pearson Education, Inc., Third Edition.
2. Scott E Umbaugh, ‘Digital Image Processing and Analysis’, CRC Press, Second Edition.
3. Anil K.Jain, ‘Fundamentals of Digital Image Processing’, Prentice Hall of India.
4. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition
5. Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, ‘Digital Image Processing using MATLAB’, Pearson Education, Inc.
6. William K. Pratt, ‘ Digital Image Processing’, John Wiley, NewYork.
7. Milan Sonka, Vaclav Hlavac, Roger Boyle, ‘Image Processing, Analysis, and Machine Vision’, Brooks/Cole, Vikas Publishing House, Second Ed.

SKSMPC23 DATA MINING

Unit I

Introduction to Data Mining, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining, Basic Concepts of Data Warehouse, Multitired Data Warehouse Architecture, Data Warehouse Models, Data Warehouse Modeling, Data Cube, a Multidimensional Data Model, Schemas for Multidimensional Data Models, Stars, Snowflakes, Fact Constellation Technology. Typical OLAP Operations.

Unit II

Data Objects and Attribute Types, Basic Statistical Description of Data, Visualisation Techniques, Pixel Oriented, Geometric Projection, Icon-based, Measuring Data Similarity and Dissimilarity, Data Matrix, Dissimilarity Matrix, Measures for Nominal Attributes, Binary Attributes, Numeric Data, Ordinal Attributes, Cosine Similarity.

Needs of Preprocessing the Data, Major Tasks, Data Cleaning, Data Integration, Data Reduction, Overview of Data Reduction Strategies, Principal Component Analysis, Attribute Subset Selection, Histograms, Clustering, Transformation, Overview of Transformation Strategies, Normalisation, Discretization by Histogram analysis, Cluster, Correlation Analysis.

Unit III

Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Frequent Itemset Mining Methods, Apriori Algorithm, Mining Frequent Itemsets Using Vertical Data Formats, Generating Association Rules, Strong Rules and Weak Rules.

Unit IV

Introduction to Classification, Classification by Decision Tree Induction, Attribute Selection Measures, Tree Pruning, Naïve Bayesian Classification, Concepts of : Classification by Back propagation, Lazy Learners, k-Nearest Neighbor Classifiers, An Overview of Other Classification Methods, Genetic, Fuzzy Sets, Model Evaluation and Selection, Haldout Method, Cross Validation, Boot Strap.

Unit V

Introduction to Cluster Analysis,An Overview of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Probabilistic Model-Based Methods, Expectation-Maximisation Algorithm, Outlier Detection, Outlier Detection Methods, Introduction to Spatio-temporal Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

References

1. Data Mining – Concepts and Techniques - JIAWEI HAN & MICHELINE KAMBER,ELSEVIER,3rd Edition.
2. Mehmed Kantardzic, Data Mining: Concepts, Models, Methods, and Algorithms, John Wiley & Sons, Inc., Third Edition.
3. Mehmed Kantardzic, DATA MINING,
4. Data Mining Techniques – ARUN K PUJARI, University Press, 2001.
5. Building the DataWarehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd.
6. Data Warehousing in the Real World – SAM ANAHORY & DENNIS MURRAY. Pearson Edn Asia.
7. Data Warehousing Fundamentals – PAULRAJ PONNAIAH WILEY STUDENT EDITION

8. The Data Warehouse Life cycle Tool kit– RALPH KIMBALL WILEY STUDENT EDITION

SKSMPC24 SOFTWARE ENGINEERING

Unit I

Software and Software Engineering, Software Development Process Models – The Waterfall Model, V-Model, Incremental Process Models, Prototyping, Spiral Model, Concurrent Models. Software Implementation and Management process- inspection, Agile Development, Principles that Guide Practice.

Unit II

Understanding Requirements, Requirements Modeling: Scenarios, Information, and Analysis Classes, Requirements Modeling for WebApps, Design Concepts, Software Architecture: Definition, Importance and Styles, User Interface Design.

Unit III

Object Oriented Software Design using UML, Class Diagram, Deployment Diagram, Use case Diagram, Sequence Diagram, Communication Diagram, Activity Diagram, State Diagram.

Unit IV

Quality Concepts, Review Techniques, Software Quality Assurance, Software Configuration Management, Product Metrics, Software Testing Strategies, Testing Conventional Applications, Testing Object-Oriented Applications, Testing Web Applications.

Unit V

Project Management Concepts, Process and Project Metrics, Estimation for Software Projects, Project Scheduling, Risk Management.

References

1. Pressman, R.S., Software Engineering: A Practitioner's Approach, MGHISE, 7th Edition.
2. Bernd Bruegg and Allen H, Object Oriented Software Engineering Using UML, Patterns and Java, 2nd Edition.
3. Rajib Mall, Fundamentals of Software Engineering,4th Edition, PHI.
4. Anirban Basu, Software Quality Assurance, Testing and Metrics, First Edition, PHI
5. Sommerville, I., Software Engineering, Pearson Education, 7th Ed..
6. Schach, S., Software Engineering, TMH, 7th Ed..
7. Kelkar, S.A., Software Engineering: A Concise Study, PHI.
8. Hughes, B and Cotterel, M., Software Project Management, 3rd Edition, TMH.

SKSMPC26 MINOR PROJECT USING ADVANCED JAVA AND OOD CONCEPTS

Unit I

Software Engineering Concepts, Software and Software Engineering, Software Development Process Models – The Waterfall Model, V-Model, Incremental Process Models, Prototyping, Spiral Model, Concurrent Models. Software Implementation and Management process-inspection, Agile Development, Principles that Guide Practice.

Object Oriented Programming Concepts, Object Oriented Software Design using UML, Class Diagram, Deployment Diagram, Use case Diagram, Sequence Diagram, Communication Diagram, Activity Diagram, State Diagram.

Unit II

Distributed Application using Remote Method Invocation**:** Introduction to RMI, Defining the Remote Interface, Implementing the Remote Interface, Defining the Client, Compile and Execute the Server and the Client. Java Servlets: Servlet Overview, Basic Servlet Architecture, Servlet Form Processing, Session Management, Database Management Using Servlets.

UNIT III

Java Server Pages: Basic JSP Scripting, JSP Architecture, Using JSP Scripting Elements, Implicit Objects, JSP Directives, Using Database with JSP, Java beans and their Application in JSP.

UNIT IV

Distributed Applications and Components: J2EE architecture, Enterprise Java Beans (EJB) - Application Servers-Types of Bean - Session Bean, Entity Bean and Message Driven Bean.

Unit V

Struts and Hibernate: Overview of MVC Design, Struts, Components, Configuration files-Introduction to Hibernate, Hibernate Application, Hibernate Object Life Cycle. Spring framework: Spring Modules, Inversion of Control and Dependency injection, Web Services: SOAP, RESTful. Introduction to Springboot.

References

1. Pressman, R.S., Software Engineering: A Practitioner's Approach, MGHISE, 7th Edition.
2. Bernd Bruegg and Allen H, Object Oriented Software Engineering Using UML, Patterns and Java, 2nd Edition.
3. Budi Kurniawan, Sams, Java for the Web with Servlets, JSP, and EJB: A Developer's Guide to Scalable J2EE Solutions.
4. Karl Avedal, Professional JSP, Wrox Press, 2nd Edition.
5. James Holmes, The Complete Reference to Struts, Tata McGraw-Hill, Second Edition.
6. Jeff Linwood, Dave Minter, Beginning to Hibernate, Second Edition.
7. Rod Johnson, Juergen Hoeller, Alef Arendsen, Thomas R, Professional Java Development with the Spring Framework, Wiley India Pvt. Ltd.
8. Greg L. Turnquist, Learning Spring Boot, Packt Publishing.
9. https://tomcat.apache.org/

ELECTIVES

SKSMPE21 WIRELESS COMMUNICATION AND SENSOR NETWORKS

Unit I

Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless communication System, Comparison of Common wireless system, Trends in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G), 4G and 5G networks. Wireless Local Loop (WLL), Wireless Local Area networks (WLAN), Bluetooth and Personal Area Networks.

Unit II

The Cellular Concept: Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Handoff Strategies, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular System-cell splitting, Cell sectorization, Repeaters, Micro cell zone concept.

Unit III

Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering. MAC Protocols: Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues

Unit IV

Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

Unit V

QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

References

1. Theodore S. Rappaport , “Wireless Communication” , Prentice hall.
2. Vijay Garg, “Wireless Communications and Networking”, Elsevier.
3. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication.
4. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition.
5. William Stallings, "Wireless Communications and Networks ", Pearson Education.

SKSMPE22 CYBER PHYSICAL SYSTEMS

Unit I

Introduction to CPS; Characteristics of CPS, CPS Domains, Cross-Domain Analysis, Adaptive control in CPS.

Unit II

Distributed Consensus control for wireless CPS, Communication channels of multi agent system, Consensus control, Interaction control theory, Distributed control, Adaptive Quantization, Transmission length.

Unit III

Online control and optimization of CPS, Framework, IPA, Data harvesting problems, Direct RF energy harvesting, Relayed RF energy harvesting.

Unit IV

Industrial CPS, Communication in 5G MTS, Challenges and research trends, Network architecture for MTC, RA for MTC.

Unit V

Data reliability challenge, Network wide programming challenges, CPS and human action, Security and privacy of CPS, Validation Verification and formal methods of CPS.

References

1. Danda B. Rawat, Sabina Jeschke, Christian Brecher, Cyber-Physical Systems Foundations, Principles and Applications, Elsevier Science
2. Glenn A. Fink, Sabina Jeschke, Security and Privacy in Cyber-Physical Systems Foundations, Principles, and Applications, WileY.
3. Walid M. Taha, Abd-Elhamid M. Taha, Johan Thunberg, Cyber-Physical Systems: A Model-Based Approach, Springer International Publishing.

SKSMPE23 DISTRIBUTED SYSTEMS AND PARALLEL COMPUTING

Unit I

Characterization of distributed systems: Introduction, Examples of Distributed Systems, Resource sharing and the Web, Challenges, Architectural models, Fundamental models, Networking issues.

Unit II

Distributed Objects and Remote Invocation: Communication between Distributed Objects, Remote Procedure Call, Remote Method Invocation, Request Reply Protocol. Overview of Clocks, Events and Process States, Synchronizing Physical Clocks, Logical time and Logical clocks-Coordination and Agreement: Overview of Distributed Mutual Exclusion-Central Server Algorithm and Ring-Based Algorithm, Elections-Ring based Election Algorithm.

Unit III

Distributed Computing and Cloud Computing, introduction, Characteristics, Difference, History of Cloud Computing and Distributed Computing, Pros and cons, Security, Distributed Transactions: Flat and Nested Distributed Transactions, Atomic Commit Protocols, Concurrency Control in Distributed Transactions, Distributed Deadlocks, Transaction Recovery, Reliable Distributed Computing, Dynamic Membership, Group Communication System.

Unit IV

Overview of Parallel Systems, Modeling Parallel Computation, Micro-Processor Models, Parallel Computation Complexity, Laws and Theorems of Parallel Computation, OpenCL for Massively Parallel Processors.

Unit V

Introduction to Hadoop, Data, Data Storage and Analysis, MapReduce: Weather Dataset, Analyzing with Unix Tool, Scaling Out, Hadoop Streaming, Hadoop Pipes. Design of HDFS, Blocks, Namenodes and datanodes, Command line Interface, Basic File system Operation, Hadoop file system, Interfaces, Reading data from Hadoop URL, Reading data from FileSystem API, writing data.

References

1. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems: Concepts and Design, Pearson Education Asia, 5th EditioN.
2. Tanenbaum Andrew S. and Steen Maarten Van**,** Distributed Systems: Principles and Paradigms, 2nd Edition.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH.
4. Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing", Wiley – India.
5. M.N Rao, Cloud Computing, First Edition, PHI.
6. Das Gupta, Cloud Computing Based Projects using distributed Architecture,PHI.
7. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers.
8. Tom White, Hadoop: The Definitive Guide, OReilly Media.
9. Deepak Vohra, Practical Hadoop Ecosystem, A definitive Guide to Hadoop Related Framework, Apress.

10. Anurag Srivastava and Tanmay Deshpande, Hadoop Blueprints, Packt.
11. Romen, Bostjan,Bulic,Borut , Introduction to Parellel Computing, Springer.

SEMESTER III

SKSMPC31 THEORETICAL COMPUTER SCIENCE

Unit I

Finite Automata: The central concept of Automata Theory, Introduction to Finite Automata, Deterministic Finite Automata, Nondeterministic Finite Automata, Finite Automata with ϵ-Transitions.

Unit II

Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions.

Properties of Regular Languages: The Pumping Lemma for Regular Languages, Closure properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

Unit III

Context-Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.

Pushdown Automata: Introduction to PDA, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.

Unit IV

Properties of Context Free Languages: Normal Forms for Context Free Grammars, The Pumping Lemma for Context-Free Languages, Closure Properties of Context-Free Languages, Decision Properties of Context-Free Languages.

Unit V

Turing Machines: The Turing Machine, Programming Techniques for Turing Machines, Turing Machines and Computers.

Introduction to: Undecidability, Intractable Problems, DNA Computing, Membrane Computing.

References

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, Pearson, 3rd Edition.
2. Peter Linz, An Introduction to Formal Language and Automata, Jones and Bartlett Publishers, 6th Edition.
3. Kamala Krithivasan, Rama R., Introduction to Formal Languages, Automata Theory and Computation, Pearson.
4. John C. Martin, Introduction to the Languages and the Theory of Computation, Tata McGrawHill, 3rd Edition.

5. M.Sipser, Introduction to the Theory of Computation, Singapore: Brooks/Cole, Thomson Learning, 3rd Edition.

SKSMPC32 DEEP LEARNING

Unit I

Machine Learning Review: Concept, Applications and Key Elements of Machine Learning, Machine Learning Fundamentals - Binary Classification, Regression, Generalization, Regularization.

Learning Algorithms, Capacity, Overfitting and Underfitting, Hyper Parameters and Validation Sets, Estimator, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Building a Machine Learning Algorithm.

Unit II

Training Deep Neural Networks: Introduction, Back Propagation, Setup and Initialization Issues, The Vanishing and Exploding Gradient Problems, Gradient -Descent Strategies, Batch Normalization.

Teaching Deep Learners to Generalize: Introduction, The Bias-Variance Trade-off, Generalization Issues in Model Tuning and Evaluation, Penalty-based Regularization, Ensemble Methods, Early Stopping, Unsupervised Pretraining, Continuation and Curriculum Learning, Parameter Sharing.

Unit III

Optimization for Training Deep Models: Challenges in Neural Network Optimization, Basic Algorithms: SGD and Momentum, Parameter Initialization Strategies, Adaptive Learning Rates: RMSProp, Adam. Approximate SecondOrder Methods: Newton, BFGS, Optimization Strategies and Meta-Algorithms, Batch Normalization, Coordinate Descent, Pretraining.

Unit IV

Convolutional Neural Networks: Convolution Operation, Pooling Operation, Convolution-Detector-Pooling Building Block, Convolution Variants, Intuition Behind Convolutional Neural Networks.

Recurrent Neural Networks: RNN Basics, Training RNNs, Bidirectional RNNs, Encoder-Decoder Architecture, Gradient Explosion and Vanishing, Gradient Clipping, Autoencoders, Long Short Term Memory

Unit V

Advanced Deep Learning Models and Applications: Image Processing, Natural Language Processing, Speech Recognition, Video Analytics.

References

1. Ian Goodfellow Yoshua Bengio Aaron Courville, Deep Learning, The MIT Press.
2. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer.
3. Nikhil Ketkar, Deep Learning with Python: A Hands-on Introduction, Apress.
4. Li Deng, Dong Yu, Deep Learning: Methods and Applications, Foundations and Trends in Signal Processing ,Vol. 7, Nos. 3–4.
5. Sandro Skansi, “Introduction to Deep Learning from Logical calculus to Artificial Intelligence”, Springer.
6. Ethem Alpaydin, "Introduction to Machine Learning", 4th Edition, The MIT Press.
7. Tom M. Mitchell, "Machine Learning", 1st Edition, Tata McGraw-Hill Education.
8. Christopher M. Bishop, "Pattern Recognition and Machine Learning".

9. Kevin P. Murphy, "Machine Learning, 2nd Edition, The MIT Press.
10. “Mastering Machine Learning: A Step-by-Step Guide with MATLAB”, MathWorks.
11. U Dinesh Kumar, Manaranjan Pradhan, “Machine Learning using Python”, Wiley.

SKSMPC35 DEEP LEARNING-LAB

Students are required to apply deep learning, reinforcement learning and deep reinforcement learning techniques to solve problems by implementing and testing relevant learning algorithms using any of the deep libraries such as Tensorflow, Keras, Caffe.

SKSMPC36 ADVANCED SOFTWARE DEVELOPMENT TOOLS-LAB

Unit I

Advanced Python: Advanced Python: Object Oriented, OOPs concept, Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Operations Exception, Exception Handling, Except clause, Try -finally clause, User Defined Exceptions, Python Libraries. Introduction to Machine learning packages like NUMPY, SCIPY, PANDAS etc.

Unit II

Python for Data Science: Pre-Processing of Data, Visualizing the Data, Exploratory Data Analysis, Clustering and identification of Outliers using Python, Performing Cross-Validation, Selection, and Optimization using Python, Learning from Data using Python.

Unit III

Introduction to Big Data and Hadoop Ecosystem: Install, configure and run Hadoop and HDFS, HDFS JAVA API, Map reduce, Hadoop ETL, Hadoop Reporting Tools.

Unit IV

Hadoop Environment: Setting up Hadoop Cluster and HDFS Monitoring, Pig and HIVE, Apache Spark,

Unit V

Security in Hadoop, Administering Hadoop, HDFS- Monitoring & Maintenance, Hadoop benchmarks, Hadoop in the cloud.

References

1. Ashok Namdev Kamthane and Amit Ashok Kamthane, Programming and ProblemSolving with Python, McGraw-Hill Education.
2. Irv Kalb, Learn to Program with Python, Apress.
3. Deepak Vohra, Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools, - Apress.
4. Mayank Bhushan, “Big Data and Hadoop: Learn by Example, “BPB Publications.

ELECTIVES

SKSMPE31 DATA SCIENCE

Unit I

Introduction to data science - Data science process, Roles in a data science project, Stages of a data science project, Applications of data science, setting expectations - Determining lower and upper bounds on model performance, Loading data - Working with data from files, Working with relational databases, Applications of data science

Unit II

Exploring data - Using summary statistics to spot problems, Spotting problems using graphics and visualization, Managing data - cleaning data, Sampling for modeling and validation

Choosing and evaluating models - Mapping problems to machine learning tasks, Evaluating classification models, scoring models, probability models, ranking models and clustering models. Validating models - Identifying common model problems, quantifying model soundness, Ensuring model quality, Case Studies.

Unit III

Single variable and multivariable models, Linear and logistic regression, Unsupervised methods, Bagging, and random forests, Generalized additive models, kernel methods to increase data separation, Support vector machines.

Unit IV

Delivering results - Documentation - Using comments and version control for running documentation, deploying models, producing effective presentations - Presenting results to the project sponsor, presenting model to end users and other data scientists.

Unit V

Introduction to Big data and Distributed file system - Algorithm using Map Reduce, Understanding Map Reduce architecture, Hadoop, Writing Hadoop Map-Reduce programs, Loading data into HDFS, Executing the Map phase, Shuffling and sorting, Reducing phase execution.

References

1. Nina Zumel, John Mount "Practical Data Science with R", Manning Publications.
2. Boris Lublinsky, Kevin T. Smith. Alexcy Yakubovich, "Professional Hadoop Solutions", Wiley.
3. Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerd, "Big Data Principles and Paradigms", Morgan Kaufmann, 2016.
4. Ervin Varga , "Practical Data Science with Python 3, Synthesizing Actionable Insights from Data".
5. Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk from The Frontline", O'Reilly.
6. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, "Mining of Massive Datasets". Cambridge University Press.

7. Tony Ojeda, Sean Patrick Murphy, Benjarnin Bengfort. Abhijit Dasgupta. "Practical Data Science Cookbook", Packt Publishing Limited.

SKSMPE32 INTERNET OF THINGS AND BLOCK CHAIN TECHNOLOGIES

Unit I

Introduction to Blockchain in Internet of Things, Overview, Blockchain applicationin internet of things, Security and privacy in Internet of things, Technical dimensions of blockchain, Consensus mechanism, Key issues in internet of things, Architectures of Internet of things, Evaluation metrics of internet of things.

Unit II

Key Blockchain concepts, Nodes, Cryptocurrency, Tockens, Cryptography, Modern encription, Public and Private keys, Hash, Ledgers, Proof of work, Proof of stake, Hyperledger, Ripple, Unearthing Etherum, Second generation application of blockchain techniques, Smart contracts, Decentralised application,

Unit III

Internet of things concepts, Smart object and smart environment, Machines to machines communication, IoT framework, Network connectivity, Sensors, Actuator, Radio frequency identification, Middleware Technologies, Data Exchange.

Unit IV

Security and Privacy issues in internet of things; Confidentiality, Integrity, Authentication, Privacy concerns in IoT; Identity, Location, Trajectory, Blockchain in privacy preserving cloud data storage services; Technical dimenssion in cloud data preserving services, Basic techniques, Threat model, Data submission, Primitiveness identification, Blockchain enabled controllable data management, System initialization, Document modification, Documents Management, User registration, Voting and counting, Use case.

Unit V

Quantitative analysis; Problem of interest, Programs as graph, Factors determining execution time, Execution time analysis, Security and Privacy; Cryptographic primitives, Protocol and networks security, Information flow, Identity, Blockchain Protected Identity, Blockstack, Microsoft, IBM's Trusted Identity, Blockchain and IoT, Toyota, IBM.

References

1. Shiho Kim, Peng Zhang and Ganesh Chandra, Role of Rlockchain Technologies in IoT Applications, Academic Press, Elsevier.
2. Liehuang Zhu,Keke Gai and Meng Li, Blockchain Technology in Internet of Things, Springer International Publishing.
3. Qusay F. Hassan, Internet of Things A to Z; Technologies and Applications, Wiley, 2018.
4. Chellammal Surianarayanan, Kavita Saini, Pethuru Raj, Blockchain Technology and Applications, CRC Press.
5. Ahmed Banafa, Secure and Smart Internet of Things (IoT) Using Blockchain and Artificial Intelligence (AI), River Publishers.

SKSMPE33 CLOUD COMPUTING

Unit I

Cloud computing, History of Cloud Computing, Cloud service providers, Properties, Characteristics - Benefits of Cloud Computing- Cloud Storage- Cloud computing vs. Cluster computing vs. Grid computing-Role of Open Standards- Companies in the Cloud Today.

Unit II

Web-Based Application, Pros and Cons of Cloud Service Development, The NIST model, Cloud Delivery Models- SaaS, Paas, Iaas, Cloud deployment models- Private cloud, public cloud, community cloud, hybrid cloud, Alternative Deployment Models- The Linthicum Model, The Jericho Cloud Cube Model.

Unit III

Security objectives, Services, Security design principles, secure development practice, Approaches to Cloud Software Requirements Engineering.

Unit IV

Secure Cloud Software Testing, Testing for SQA, Conformance, functional, Performance & security testing.

Unit V

Threats to Infrastructure, Data and Access Control, Cloud Service Provider Risks- Back-Door, Spoofing, Man-in-the-Middle, Replay threats, TCP Hijacking, Social Engineering, Dumpster Diving, Password Guessing, Trojan Horses and Malware.

References

1. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH.
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing", Wiley – India.
3. M.N Rao, Cloud Computing, First Edition, PHI.
4. Das Gupta, Cloud Computing Based Projects using distributed Architecture,PHI.
5. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers.
6. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August.

SKSMPE34 FUZZY LOGIC AND NATURE INSPIRED COMPUTING

Unit I

Fuzzy Logic: Concepts of uncertainty and imprecision; Properties and operations on classical sets and fuzzy sets; Classical and fuzzy relations; Membership functions and its types; Fuzzification; Fuzzy rule-based systems; Defuzzification; Fuzzy propositions; Fuzzy extension principle; Fuzzy inference system, Fuzzy Logic Control Systems, Recent applications.

Unit II

Genetic Algorithms: Difference between traditional algorithms and Genetic Algorithm (GA); Basic concepts of GA; Working principle;Encoding methods; Fitness function; GA Operators:Reproduction, Crossover, Mutation; Convergence of GA;Detailed algorithmic steps; Adjustment of parameters; Multicriteria optimization; Solution of typical problems using genetic algorithm; Recent applications.

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Unit III

Ant Colony Algorithms - Ant colony basics, hybrid ant system, ACO in combinatorial optimisation, variations of ACO.

Unit IV

Particle Swam algorithms - particles moves, particle swarm optimisation, variable length PSO, applications of PSO.

Unit V

Artificial Bee Colony algorithms - ABC basics, ABC in optimisation, Multi-dimensional bee colony algorithms, applications of bee algorithms, Case studies and Hybrid Systems.

References

1. D. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison-Wesley.
2. S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic
3. Algorithm: Synthesis and Applications, PHI.
4. S. N. Sivanandam and S. N. Deepa, Principles of Soft Computing, 2nd ed., Wiley India.
5. J. Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House.
6. G. Klir, B. Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Pearson.
7. John Yen, Reza Langari, Fuzzy Logic –Intelligence, Control and Information, Pearson Education.
8. Albert Y.Zomaya - "Handbook of Nature-Inspired and Innovative Computing", Springer.
9. Floreano, D. and C. Mattiussi -"Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press.
10. Leandro Nunes de Castro - " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group.
11. Marco Dorrigo, Thomas Stutzle -" Ant Colony Optimization", Prentice Hall of India, New Delhi.

SKSMPE35 NATURAL LANGUAGE PROCESSING

Unit I

Introduction to Natural Language Processing, History of NPL, Text Analytics and NLP, Various Steps in NLP, Tokenization, POS tagging, Stop word removal, Text normalisation, Spelling Correction, Stemming, Lemmatization, NER, Word Sense Disambiguation, Sentence Boundary Detection, Data Collection, Preprocessing.

Unit II

Basic Feature Extraction Methods, Introduction, Types of Data, Cleaning Text Data, Tokenizing Texts with Different Packages – Keras and TextBlob, Types of Tokenizers, Stemming, Lemmatization, Singularizing and Pluralizing Words, Language Translation.

Unit III

Developing a Text classifier, Machine Learning, Various Clustering Algorithms, K-Means Clustering, Supervised Learning, Various Classifiers, Regression, Tree Methods, Sampling, Dimensionality Reduction, Deciding on a Model Type, Performance of a model, Saving and Loading Models.

Unit IV

Collecting Text Data from the Web, Collecting Data by Scraping Web Pages, Requesting Content from Web Pages, Dealing with Semi-Structured Data, Dealing with Online JSON Files, XML Files, Using APIs to Retrieve Real-Time Data, Topic Modelling, Exploratory Data Analysis, Bag of Words, Modelling Algorithms, Latent Semantic Analysis, Latent Dirichlet Allocation, Topic Fingerprinting.

Unit V

Text Summarisation and Text Generation, Introduction, Extractive Text Summarisation, Abstractive Text Summarisation, Summarizing Text using Gensim, Word Frequency,
Generating Text with Markov Chains, Vector Representation, Encoding, Positional Character Level Encoding, One-Hot Encoding, Word-Level One Hot Encoding, Word Embeddings, Word2Vec, Using Pre-trained Word Vectors, Document Vectors
Sentiment Analysis, Types of Sentiments, Applications, Tools, Python NLP Libraries, Understanding Data for Sentiment Analysis, Training Sentiment Models,

References

1. Dwight Gunning: Sohom Ghosh, Natural Language Processing fundamentals, Packt Publishing.
2. Palash Goyal and Sumit Pandey, Deep Learning for Natural Language Processing: Creating Neural Networks with Python, Apress.
3. Steven Bird, Ewan Klein, Edward Loper, *Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit* (O'Reilly website 2018) http://www.nltk.org/book/
4. Dipanjan Sarkar, *Text Analytics with Python*, Apress/Springer https://link-springer-com.proxy.uchicago.edu/book/10.1007%2F978-1-4842-2388-8
5. Stanford University CS224n: Natural Language Processing with Deep Learning http://web.stanford.edu/class/cs224n/

6. Paul Vierthaler's Stylometric PCA and Network Data Explorer https://www.pvierth.com/pca

SKSMPE36 DIGITAL SIGNAL PROCESSING AND SPEECH TECHNOLOGIES

Unit I

Introduction: Fundamentals of Speech, The Human Speech Production Mechanism, LTI Model for Speech Production, Nature of the Speech Signal, Linear Time-Varying Model, Phonetics, Types of Speech, Voiced and Unvoiced Decision Making, Audio File Formats: Nature of the WAV File.

Unit II

Parameters of Speech: Pitch and Formants, Fundamental Frequency or Pitch Frequency, Parallel Processing Approach for Calculation of Pitch Frequency, Pitch Period Measurement, Formants and Their Relation With LPC, Evaluation of Formants, Estimation of Formants.

Spectral Parameters of Speech: Homomorphic Processing, Cepstral Analysis of Speech: Cepstral Coefficients, The Auditory System as a Filter Bank, Mel Frequency Cepstral Coefficients, Perceptual Linear Prediction, Log Frequency Power Coefficients, RelAtive SpecTrAl Perceptual Linear Prediction, Short-Time Spectral Analysis of Speech, Wavelet Transform Analysis of Speech.

Unit III

Linear Prediction of Speech: Lattice Structure Realization, Forward Linear Prediction, Autocorrelation Method, Covariance Method, Lattice Methods, Selection of Order of the Predictor, Line Spectral Frequencies/Line Spectral Pair Frequencies.

Speech Quantization and Coding: Uniform and Non-Uniform Quantizers and Coder, Companded Quantizer, Uniform Quantization of Non-uniform Sources: Adaptive Quantizers, Waveform Coding of Speech, Speech Coding Techniques.

Unit IV

Speech Processing Applications: Speech Recognition Systems, Architecture of a Large Vocabulary Continuous Speech Recognition System, Deterministic and Statistical sequence Recognition for ASR, Statistical Pattern Recognition and Parameter Estimation, VQ-HMM-Based Speech Recognition, Discriminant Acoustic Probability Estimation, Word Spotting/Keyword Spotting, Speech Recognition and Understanding, Speaker Recognition, Speech Enhancement, Adaptive Echo Cancellation.

Unit V

Speech Synthesis: A Text-to-Speech System, Synthesizer Technologies, Speech Synthesis Using Other Methods, Speech Transformations, Emotion Recognition from Speech, Watermarking for Authentication of a Speech/Music Signal.

References

1. S.D Apte, Speech and Audio Processing, Wiley India Edition.
2. Rabiner Lawrence R., and Biing-Hwang Juang, Fundamentals of Speech Recognition, Prentice Hall International.

3. Gold Ben, Nelson Morgan, and Dan Ellis, Speech and Audio Signal Processing: Processing and Perception of Speech and Music, John Wiley & Sons.
4. Benesty Jacob, M. Mohan Sondhi, and Yiteng Huang, Handbook of speech processing, Springer.
5. Katagiri S., Handbook of Neural Networks for Speech Processing, Artech House, Boston.
6. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications,Pearson Education / PHI, India.
7. A.V. Oppenheim, R. W. Schaffer, Discrete Time Signal Processing, Prentice Hall of India, New Delhi.
8. Andreas Antoniou, Digital Signal Processing, Tata McGraw Hill, NewDelhi.
9. M. H. Hayes, Schaums Outlines of Digital Signal Processing, Tata McGraw Hill, India.

OPEN COURSE

SKSMPO31 FUNDAMENTALS OF PROGRAMMING

Unit I

Introduction to Problem Solving: Steps for Problem Solving, Machine Language Programming, Assembly Language Programming, High Level Language Programming.

Unit II

Basics of Object Oriented Programming & C++: Introduction to Object Oriented Programming(OOP), Procedural vs. Object oriented programming, Concepts of OOP, Benefits and applications of OOP. Overview of C++, Program structure, Identifiers, Variables, Constants, enum, Data Types, Operators and Control Structures, Functions-declaration and definition, Arrays & Strings, Basics of Object & Classes, Member functions, Private and Public members, Scope resolution operator, Concept of inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members.

Unit III

Introduction to Open Source Software: Concept of open source software – GNU/Linux – Different distribution of Linux - Features of Linux, Advantages - Linux Architecture- Linux directory commands - Linux File commands - Shell Programming- Comparison of Windows and Linux operating systems.

Unit IV

Python Programming: History- Features in python- Working with python- Basic syntax-variables and data types-Operators-Conditional statements- Loops-Functions-Lists & Dictionaries- Modules.

Unit V

Documentation and Presentation Tools

References

1. Robert Lafore, "Object Oriented Programming in C++", McGraw Hill.
2. Bjarne Stroustrup, "The C++ Programming Language" , Addison Wesley.
3. Christopher Negus, "Linux Bible", Wiley India Edition.
4. Richard Blum & Christine Bresnahan, "Linux Command Line and Shell Scripting", Wiley.
5. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.
6. Peter Norton & Alex Samuel, "Beginning Python" , David Aitel-wrox publications.

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