ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Computer Sciences
Course: M. Tech. (SSP), Programme: Computer Science and Engineering (CSE),
Duration: 2 years (Four Semesters)

Abbreviation used:

AC	Audit course	LC	Lab Course	PA	Practical Assessment
PC	Professional Core	PR	Project/ Practical/ Internship	L	Lecture
PE	Professional Elective	SE	Seminar/ Expert Lecture/ Etc.	T	Tutorial
OE	Open Elective	IA*	Internal Assessment	P	Practical
MC	Mandatory/ Common Course	EA	End-Semester Assessment		

Subject Code Format:

A1	A2	B3	C4	C5	C6
School/ Dept. (Offering) **BH:** Basic Sciences and Humanities **CS:** Computer Sciences **EE:** Electrical Sciences **EI:** Electronic Sciences **IP:** Infrastructure and Planning **MS:** Mechanical Sciences **BT:** Biotechnology **TE:** Textile Engineering		**Level** **1:** UG/ Int. Msc. (1st Year) **2:** UG/ Int. Msc. (2nd Year) **3:** UG/ Int. Msc. (3rd Year) **4:** UG/ Int. Msc. (4th Year) **5:** UG/ Int. Msc. (5th Year) **6:** PG (1st Year) **7:** PG (2nd Year) **8:** Ph.D.	**0:** AC **1:** PC **2:** PE **3:** OE **4:** MC **5:** LC **6:** PR **7:** SE **8:** **9:**	**Serial Number (01 to 99)** 01/ 03/…/ 19: Odd Sem. (CSE) 21/ 23/…/ 39: Odd Sem. (IT) 41/ 43/…/ 59: Odd Sem. (MCA) 61/ 63/…/ 79: Odd Sem. (Prog-4) 81/ 83/…/ 99: Odd Sem. (Prog-5) 02/ 04/…/ 20: Even Sem. (CSE) 22/ 24/…/ 40: Even Sem. (IT) 42/ 44/…/ 60: Even Sem. (MCA) 62/ 64/…/ 80: Even Sem. (Prog-4) 82/ 84/…/ 98: Even Sem. (Prog-5)	

1st Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PC 1	CS6101	Advanced Data Structures and Algorithms	3	0	0	3	40	60	-	100
2	PC 2	CS6103	Wireless Sensor Networks	3	0	0	3	40	60	-	100
3	PE 1 (Any One)	CS6201	Internet of Things	3	0	0	3	40	60	-	100
		CS6203	Cryptography								
4		CS6205	Data Mining								
	MC 1	BH6401	Mathematical Methods in Engineering	3	0	0	3	40	60	-	100
5	MC 2	MS6403	Research Methodology and IPR	2	0	0	2	40	60	-	100
6	LC 1	CS6501	Advanced Data Structures and Algorithms Lab	0	0	4	2	-	-	100	100
7	LC 2	CS6503	Computing Lab - I	0	0	4	2	-	-	100	100
8	AC 1	Any One from the List of AC 1 (Appendix-I)		2	0	0	0	40	60	-	100
			Total	**16**	**0**	**8**	**18**	**240**	**360**	**200**	**800**

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Computer Sciences
Course: M. Tech. (SSP), Programme: Computer Science and Engineering (CSE),
Duration: 2 years (Four Semesters)

1st Semester

PC 1	CS6101	Advanced Data Structures and Algorithms	3	0	0	3

Course Outcomes:

1. Understand basic data structures and its complexity analysis, ability to use asymptotic notations, solve recurrences, and perform algorithm analysis and its correctness.
2. Ability to design, analyze based on search structure, heap structures, multimedia structure and graph algorithm.
3. Have an idea of applications of algorithms in a variety of areas, including string matching and approximation algorithm.

Module-I:

Elementary Data Structures and Complexity Analysis: Overview of Basic Data Structures: Arrays, Linked List, Stack, Queues. Implementation of Sparse Matrices, Algorithm Complexity: asymptotic analysis, Simple Recurrence Relations and use in algorithm analysis, amortized analysis.

Module-II:

Search Structures: Height Balanced Trees: AVL trees, 2-3 trees, Red-black trees, B-trees, B^+-trees.
Heap Structures: Min-max heaps, Binomial heaps, Fibonacci heaps
Multimedia Structures: Segment trees, k-d trees, Point Quad trees
Graph Algorithms: Single-source shortest path Algorithms, All-pairs shortest path algorithms including Johnson Algorithm, Strongly Connected Components, Articulation Points, Topological sort
Minimum spanning tree algorithm using Boruvka steps

Module-III:

String Matching Algorithms: Introduction, The Brute-Force- Algorithm, Rabin-Karp Algorithm, String Matching with Finite automata, Knuth-Marries-Pratt Algorithm, Robin Karp algorithm
Approximation Algorithms: Travelling Salesperson Problem, Vertex-Cover Problem and Set-Cover Problem

Text Book:

1.Thomas Cormen, Charles Leiserson, Ronald Rivest and Clifford Stein, *Introduction to Algorithms*, MIT Press, 2009 (third edition).

Reference Books:

1.S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani, *Algorithms*, Mcgraw-Hill, 2006.
2.J. Kleinberg and E. Tardos, *Algorithm Design*, Addison-Wesley, 2006.
3.G. Brassard and P. Bratley, Algorithmics: Theory and Practice, Printice –Hall, 1988.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Computer Sciences
Course: M. Tech. (SSP), Programme: Computer Science and Engineering (CSE),
Duration: 2 years (Four Semesters)

PC 2	CS6103	Wireless Sensor Networks	3	0	0	3

Course Outcomes

1. Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology.
2. Analyze key routing protocols for sensor networks and main design issues.
3. Learn transport layer protocols for sensor networks, and design requirements
4. Understand the Sensor management, sensor network middleware, operating systems

Module I

Introduction: Introduction to Wireless Sensor Networks, Node architecture, Operating System, Advantages of Sensor Networks, Application of Sensor Networks, Challenges and Constraints.

Network deployment: Structured vs randomized deployment, Network topology, Connectivity in geometric random graphs, Connectivity using power control, Coverage metrics, Mobile deployment.

Localization: issues & approaches, Coarse-grained & Fine-grained node localization, Network-wide localization, Theoretical analysis of localization techniques.

Module II

Synchronization: Issues & Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization.

Wireless characteristics: Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference.

Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols. Sleep-based topology control: Constructing topologies for connectivity, constructing topologies for coverage

Module III

Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime- maximizing energy-aware routing techniques, Geographic routing, Routing to mobile sinks.

Data-centric networking: Data-centric routing, Data- gathering with compression, Querying, Data-centric storage and retrieval, The database perspective on sensor networks. Introduction to Tiny OS, NesC, Sensor Simulator.

Security: Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks.

REFERENCE BOOKS:

1. Wireless Sensor Networks: Technology, Protocols, and Applications: KazemSohraby, Daniel Minoli, TaiebZnati , Wiley Inter Science.
2. Wireless Sensor Networks: Architectures and Protocols: Edgar H. Callaway, Jr. Auerbach Publications, CRC Press.
3. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, TaiebZnati , Springer.
4. Networking Wireless Sensors: BhaskarKrismachari, Cambridge University Press
5. Distributed Sensor Networks: A Multiagent Perspective, Victor Lesser, Charles L. Ortiz, and MilindTambe , Kluwer Publications.
6. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Computer Sciences
Course: M. Tech. (SSP), Programme: Computer Science and Engineering (CSE),
Duration: 2 years (Four Semesters)

PE 1	CS6205	Data Mining	3	0	0	3

COURSE OBJECTIVE:

1. Be familiar with mathematical foundations of data mining tools.
2. Understand and implement classical models and algorithms in data warehouses and data mining
3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering**.**

Course Outcomes:

1. Understand the functionality of the various data mining and data warehousing component
2. Design Multidimensional data model for data warehouse and analyze the market needs by applying suitable OLAP operations.
3. Explain the concept of Data mining system and apply the various pre-processing techniques on large dataset.
4. Apply Association rules, classification and clustering techniques to discover various mining techniques.
5. Explore recent trends in data mining such as web mining, spatial-temporal mining.

Module-I:

Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture Of A Typical Data Mining Systems-Classification Of Data Mining Systems.

Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

Module-II:

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

Module-III:

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

Mining Object, Spatial, Multimedia, Text and Web Data:

Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

Text Book

1. Jiawei Han, MichelineKamber and Jian Pei"Data Mining Concepts and Techniques", ThirdEdition, Elsevier, 2011.

Reference Books

1 Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw –Hill Edition, Tenth Reprint 2007.

2 K.P. Soman, ShyamDiwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

3 G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.

4 Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

AC 1	BH6001	English for Research Paper Writing	2	0	0	0

Coruse Objectives:

To enable students:

i) acquire the skill to write research papers with clarity, in a persuasive style and in an ethical manner.
ii) identify a research problem and research questions, adopting appropriate methodology
iii) learn nitty-gritty of paragraph development, sentence structure, abstract, referencing etc.

Modules I:

Introduction to research, importance of English for research writing, Planning and preparation, identifying research problem, research questions, structuring paragraph, developing a persuasive style in writing, objectivity, avoiding ambiguity etc.

Modules II:

Literature review/survey, writing introduction, result discussion, analyzing findings, conclusion and various sections.

Modules III:

Abstract, title, key-words, referencing/bibliography, indexing/impact factor, research ethics, plagiarism (self-plagiarism), Anti-Plagiarism software and tools (e.g. Turn-it-in) etc.

Course Outcome:

i) Develop skills of cohesion and coherence in Research writing.
ii) Develop clarity of thought while choosing a topic.
iii) Identify research problem and questions.
iv) Develop skills in referencing and structure of a research document.

Text Books:

1. Goldbort R *Writing for Science*, Yale University Press (available on Google books): 2006
2. Day R: *How to write and Publish a Scientific Paper*, Cambridge University Press :2006
3. Adrian Wallwork, *English for Writing Research Papers*, Springer New York, 2011

Reference books:

1. S.C. Parja & Vikram Kate. *Writing and Publishing a Scientific Research Paper*. Springer: 2017.
2. Highman N, *Handbook of Writing for the Mathematical Sciences*, Highman's Book: 1998.
3. Chicago Manual of Style- 17th edition https://umanitoba.ca/student/academiclearning/media/CMS17-2018.pdf

MC 1	BH6401	Mathematical Methods in Engineering	3	0	0	3

Module I:
Linear Algebra: Preliminary idea on Vector space, solvability of Ax = b by Gauss Elimination Method, orthogonality and QR transformation; Eigenvalues and eigenvectors, similarity transformation, Fourier series, Fourier Transformation.
Optimization Techniques: Introduction to LPP, Simplex method, Big-M Method, Revised Simplex method, Concept of Duality.

Module II:
Matrix Theory: Norms and spaces, Special Matrices and their properties, least squared and minimum normed solutions.
Matrix Decomposition Algorithms: LU decomposition method, Singular value decomposition (SVD), low-rank approximations, Gram-Schmidt process, polar decomposition.
Dimensions Reduction Algorithms: Principal component analysis, linear discriminant analysis, minimal polynomial, and Jordan canonical form.
Calculus: Basic concepts of calculus**,** Jacobian, Hessian, convex sets, convex functions, and their properties.

Module III:
Numerical Methods: Solution of ODEs by Multistep methods: Adam-Bashforth method, Adam-Moulton Method, Solution of PDEs: Elliptic, parabolic and hyperbolic.
Recurrence Relations and Generating Functions: Method of Characteristic Roots, Solving homogeneous and Inhomogeneous Recurrence Relations.
Probability: Basic concepts of probability: Conditional probability distribution, Marginal probability distribution, joint distributions, covariance, correlation and regression.

Text Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig,10th Edition., Wiley-India
2. Linear Algebra and its Application, 4th Edition., G. Strang, S. Chand (G/L) & Company Ltd, 2005.
3. Fundamentals of Matrix Computations, David S. Watkins, Wiley Publication, 2004.
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K.H. Rosen, 7th Edition., Tata McGraw Hill.

Reference Books:

1. A First Look at Rigorous Probability Theory, Jeffery S. Rosenthal, 2ndEdn., Singapore: World Scientific Publishing, 2006.
2. Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
3. Linear Algebra, 4thEdn., S. Lipschutz, M.L. Lipson, Schaums Outline Series, Mc Graw Hill.
1. Applied Mathematical Methods 1st Edition, Kindle Edition, Bhaskar Dasgupta.
2. Numerical Analysis, Richard L. Burden, J. Douglas Faires, Annette M. Burden, Cengage Learning Publication, 2015.
3. Probability and Statistics for Engineers and Scientists, 9th Edition., R.E. Walpole, R.H. Myers, S.L. Myers, K. Le, Prentice Hall.

Course Outcomes:
CO1: Understand and apply concepts of linear algebra, matrix theory and have adequate knowledge of Fourier series and transform.
CO2: Implement appropriate techniques to solve different problems on optimization.
CO3: Apply various techniques of Numerical Methods to solve ODEs, PDEs, and DEs. Understand few concepts on multivariable calculus.
CO4: Use Probability theory & Statistics in problem solving.

MC 2	MS6403	Research Methodology and IPR	3	0	0	3

Course Outcomes:

CO1: Understood the Meaning of research problem, Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

CO2: Got the knowledge of How to get new ideas (Criticizing a paper) through the Literature Survey (i.e. Gap Analysis).

CO3: Understood the Filing patent applications- processes, Patent Search, Various tools of IPR, Copyright, Trademarks.

CO4: Understood How to apply for Research grants and Significance of Report Writing, Steps in Report Writing, Mechanics and Precautions of Report Writing, Layout of Research Report.

CO5: Got the knowledge of How to write scientific paper & Research Proposal - Structure of a conference and journal paper, how (and How Not) to write a Good Systems Paper:

Module I:

Introduction to RM: Meaning and significance of research. Importance of scientific research in decision making. Types of research and research process. Identification of research problem and formulation of hypothesis. Research Designs. Types of Data: Primary data Secondary data, Design of questionnaire; Sampling fundamentals ad sample designs, Methods of data collection, Measurements and Scaling Techniques, Validity & Reliability Test.

Module II:

Data Processing and Data Analysis-I, Data editing, Coding, Classification and Tabulation, Descriptive and Inferential Analysis, Hypothesis Testing- Parametric Test (z test, t test, F test) and non-parametric test (Chi square Test, sign test, Run test, Krushall-wallis test).

Module III:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT. Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Reference Books:

1. Research Methodology, Chawla and Sondhi, Vikas
2. Research Methodology, Paneerselvam, PHI

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Computer Sciences
Course: M. Tech. (SSP), Programme: Computer Science and Engineering (CSE),
Duration: 2 years (Four Semesters)

LC 1	CS6501	Advanced Data Structures and Algorithms Lab	0	0	4	2

List of Experiments

1. Implementation of Sparse Matrices.
2. Implementation of Binary search trees.
3. Implementation of AVL-trees, insertion and deletion into AVL trees.
4. Implementation of Red – Black trees.
5. Implementation of B-trees
6. Implementation of Priority queues
7. Implementation of Heaps: Min-max Heap, Binomial and Fibonacci Heaps.
8. Implementation of Graph Traversals: BFS and DFS.
9. Implementation of Shortest Path Problems: Dijkastra's Algorithm
10. Implementation of All Pair Shortest Path: Floyd-Warshall~~'s~~ algorithm
11. Implementation of Minimum Spanning tree :Kruskal's Algorithm, Prim's Algorithm
12. Implementation of String Matching Algorithms: KMP only

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Computer Sciences
Course: M. Tech. (SSP), Programme: Computer Science and Engineering (CSE),
Duration: 2 years (Four Semesters)

LC 2	CS6503	Computing Lab - I	0	0	4	2

Experiment 1 Analyzing Number of Transmitting Nodes Vs Collision count, Mean Delay for an Ethernet LAN.

Experiment 2 Analyzing Bus Vs Star topology with respect to number of collisions (for a fixed number of transmitting nodes) for Ethernet LAN.

Experiment 3 Analyzing the difference between Hub vs Switch transmission with respect to throughput and delay.

Experiment 4 Analyzing the performance of Token Ring with Number of Nodes vs Response Time, Mean Delay using NETSIM.

Experiment 5 Comparing CSMA/CA vs CSMA/CD protocol with respect to throughput and collision count (for a fixed number of transmitting nodes).

Experiment 6 a) Verification of Stop and Wait Protocol.
b) Verification of Go Back N Protocol.
c)Verification of Selective Repeat Protocol.

Experiment 7 Matlab basics and elementary calculations.

Experiment 8 Implementation of various matrix operations using Matlab:
a) Matrix addition
b) Matrix subtraction
c) Matrix multiplication
d) Transpose of a matrix
e) Inverse of a matrix.

Experiment 9 Built in Function for matrix operation using Matlab.

Experiment 10 Plotting graphs in 2D and 3D IN line graph, bar graph and pie chart using Matlab.