UTKAL UNIVERSITY
M. Tech. Degree in Information Technology
(Semester System)

The course in M. Tech. (IT) shall comprise of sixteen theory papers, each carrying 100 marks and of three hours duration spreading over first three semesters. There shall be one practical paper in each of the first three semesters carrying 100 marks and of three hours duration, one paper on comprehensive viva-voce & Thesis (Preparatory Part Evaluation) in the third semester carrying 100 marks, and final Thesis in the fourth semester carrying 300 marks.

PAPER CODE	SUBJECT	MARKS	
		Mid Sem.	End Sem.
	FIRST SEMESTER		
MTIT 101	Mathematical Foundations of Computer Science	30	70
MTIT 102	Advanced DBMS	30	70
MTIT 103	Advanced Computer Architecture	30	70
MTIT 104	Design and Analysis of Algorithms	30	70
MTIT 105	**Statistical Methods with LAB**	30	70
MTIT 106	Software Engineering	30	70
MTIT 107	**Practical: ORACLE**		100
	SECOND SEMESTER		
MTIT 201	Advanced Operating System	30	70
MTIT 202	Cryptography and Security	30	70
MTIT 203	Theory of Computation	30	70
MTIT 204	**Data Analytics using R**	30	70
MTIT 205	**Elective – 1**	30	70
MTIT 206	**Machine Learning**	30	70
MTIT 207	**Practical: JAVA**		100
	THIRD SEMESTER		
MTIT 301	**IoT**	30	70
MTIT 302	**Cloud Computing**	30	70
MTIT 303	Data Mining and Business Intelligence	30	70
MTIT 304	**Elective – 2**	30	70
MTIT 305	**Practical: PYTHON**		100
MTIT 306	Comprehensive Viva-Voce and Thesis (Preparatory Part Evaluation)		50+50
	FOURTH SEMESTER		
MTIT 401	Thesis		300

ELECTIVE PAPERS

SECOND SEMESTER (Elective -1)

Mobile Computing / Computer Graphics & Animation / Principle of Programming Language & Compiler Techniques.

THIRD SEMESTER (Elective -2)

Soft Computing / Pattern Recognition / Robotics.

- More number of elective papers may be added later as per requirement and availability of resource persons.

DETAILED SYLLABUS

SEMESTER- I

MTIT 101 : MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Unit-I Propositional Logic: Declarative sentences, Natural reductions, Propositional logic as on formal language, Normal forms.

Unit-II Predicate Logic: The needs for a richer language, Predicate logic as formal language, Proof theory of predicate logic, Semantics of predicate logic. Relations, Equivalence Relation, Functions, Boolean Algebras.

Unit-III Algebra Structure : Monaids and Groups, Binary Group Codes, Lattices, Rings, Integral Domains, Fields, Ideals, Polynomial, Rings, Polynomial Codes.

Unit-IV Graph Theory (I) : Definition of a graph, The Degree of Vertex, Sub graphs, Degree Sequences, Connected Graphs, Cut-Vertices and Bridges, Special Graphs, Digraphs, Properties of Trees, Tree Traversals.

Unit-V Graph Algorithms (MST ,shortest path) ,Graph Coloring , B F S , D F S, Graph Enumerations.

Books Recommended:

1. M.R.A. Hulth, M.D. Ryan, Logic in Computer Science : Modeling and Reasoning about systems, Cambridge University Press, 2000.
2. G. Birkhoff and T.C. Modern Applied Algebra, CBS Publisher, 1987. Ch. 1(1.1-1.5), 2(2.1-2.5,2.6), 5(5.1-5.5, 5.7-5.9), 7,8,9, (9.1-9.4), 10 (10.1,10.2,10.5,10.7), 11 (11.1-11.4).

MTIT 102 : ADVANCED D.B.M.S.

Unit-I Relational data model, Integrity constraints, Relational Queries, Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus, SQL.

Unit-II Design Guidelines for relational schemas and its algorithms, functional Dependencies, reasoning about functional dependencies. Normal forms (1 NF, 2NF, BCNF, 4NF and 5 NF) other kinds of Dependencies, Design of Relational Database.

Unit-III Query Processing and Query Evaluation, External storing, Evaluating relational operators, Selection Operation, Projection Operation, Join Operation, Typical Relational Query Optimizer, Translating SQL, query into relational algebra, Estimating the cost of a plan. Relation algebra equivalence.

Unit-IV Transaction processing Transaction and system concepts, Schedules and recoverability, Locking techniques and concurrency control, Concurrency control based on Timestamp ordering, Multisession concurrency control techniques, Multiple granularity locking. Recovery technique based on Deferred and Immediate update, Database security, discretionary Access control.

Unit-V Introduction to Distributed Database, Distributed DBMS Architecture, Storing data in a Distributed DBMS, Distributed Database Design, Semantic Data Control, Distributed Query Processing and Optimization.

Books Recommended:

1. Ramez Elmasri and Shakant B. Navathe, Fundamentals of database systems Addison wisely.
2. Raghu Ramakrishna and Johannes Gehrke, Database Management Systems me Graw Hill.
3. M.T.OZSU, P. Valdruriez – Principles of Distributed Database systems Person Education.

References:

1. J.D. Ullman, Principles of Database and Knowledge Base systems, Computer Science Press, 1998, Volume I and II.
2. A sillberschatz, H.E. Korth and S. Sudarsha, Database System Concepts, Me Graw Hill, 1997.

MTIT 103 : ADVANCED COMPUTER ARCHITECTURE

Prerequisite: Introduction to Computer Organization (Digital Logic Circuits, Processor Organization, I/O Organization).

Unit-I Fundamentals of Computer Design : Introduction the task of a computer designer, Technology and usage trends, Cost Performance measures, Quantitative Principles of Computer Design, The concept of memory hierarchy.

Instruction set principles and Examples : Introduction, Classification of Instruction

Unit-II Pipelining Basic concepts, Pipeline for DLX, Pipeline Hazards, Data and Control Hazards, Difficulties in implementation, Last ruction set design and pipelining. The MIPS R 4000 Pipeline.

Unit-III Instruction level Parallelism (H.P.) : Concepts and challenges, Overcoming Data Hazards with Dynamic Scheduling, Reducing Branch Penalties with Dynamic Hardware Prediction, ILP with multiple issue, Hardware Support for Extracting More Parallesim, studies of H.P. The Power PC 620.

Unit-IV Memory Hierarchy Design : Basic concepts of memory, Internal organization of Memory Chips, Caches Reducing Cache Misses and Miss Penalty, Reducing Hit Time, Main memory, Virtual Memory, Issues in the Design of Memory Hierarchies, Alpha AXP 21064 Memory Hierarchies, Fallacies and Pitfalls in Memory Hierarchy Design.

Storage Systems : Types of storage device, Busses I/O Performance measures, Reliability, Availability and RAID, Interfacing to OS, Designing an I/O System, Unix File System Performance.

Unit-V Multiprocessor : Taxonomy of Parallel Architecture, Performance Matrices and Advantages for communication Mechanisms, Challenges of parallel processing, Characteristics of Application Domains, centralized. Shared memory architectures, Distributed shared memory architectures, synchronization memory system issues, Design and performance of SGI challenges multiprocessor.

Books Recommended

1. J.L. Hennessy and D.A. Patterson – Computer Architecture – A Quantitative Approach 2nd edition – Morgan Kaufmann Publishers, 1996 (Chapters 1,2,3,4,5,6,8).

References:

1- V.C. Hammncher, Z.G. Vranesic, Znky – Computer Organization Mc Graw Hill, 1996
(Chapter –1,2,3,4,5 Appendix A).
2. M.M. Mano – Computer.

MTIT 104 : DESIGN AND ANALYSIS OF ALGORITHMS

Unit-I Design and Analysis Techniques (I) : Introduction, Growth of Function, Recurrences, Divide and Conquer (Heap Sort, Quick Sort, Fast Fourier Transforms), Lower bounds of sorting counting sort.

Unit-II Design and Analysis Techniques (II) : Randomization (Randomized Quick sort, Primarily testing), Dynamic Programming (Floyd – Warshall Algorithm, Longest Common Subsequence), Greedy Method (Single Source Shortest path, Matroids, Task Scheduling).

Unit-III Analysis of Data Structure : Binomial Heaps, Fibonaeei Heaps, Disjoint Sets, Suffix Trees, String matching Algorithm (Ukonnen's algorithm) and applications, Amortized Analysis.

Unit-IV NP-Completeness Polynomial Time, Polynomial time verification, NP Completeness and Reducibility, NP- Complete Problems. Approximation Algorithms The Vertex Cover Problem, The Travelling Sale man Problem.

Unit-V NP Completeness proof ,Hamiltonian path and Hamiltonian cycle reduction , Proof of NP- Complete Problems ,clique ,Vertex Cover ,Independent Vertexsit ,Graph Coloning.

Books Recommended:

1. T.H. Coreman, C.E.I. eiserson and R.L. Rivest, C. Steain – Introduction to Algorithms, Protein hall of India, 2003.
2. M.R. Garey and D.S. Jhonson, Computers and Intractability – a theory of NP completeness, W.H. Freeman, 1979.
3. M. De Berg, M. Vankreveld, M. Overmars, O. Sehwrzkopf Computational Geometry Algorithm Springer Verlog, 2000.

References:

1. Aho, Hoperaft , Ullman, The Design and Analysis of Computer Algorithms, Addison, Wesley Longmans, 1998.
2. M.T. Godrich and R. Tamassaia – Algorithm Design : Foundations, Analysis and Internet Examples – Joohn Willey and Sons, 2002.
3. E. Horowitz, S. Sahani, S. Rajasekarm- Fundamental of Computer Algorithms.

MTIT 105 : STATISTICAL METHODS WITH LAB

Unit-I- Probability and Distributions:

Probability spaces, Conditional probability, Independence, Discrete and continuous random variables, Distributions: Binomial, Poisson and Normal, Expectation, Law of large numbers, Central limit theorem.

Unit-II-Distributions Derived from the Normal Distribution :

Introduction, X^2, *t,* and *F* distribution, The sample Mean and the Sample Variance, Problems, Survey Sampling : Introduction, Population parameters, Sample random Sampling - The Expectation and variance of the Sample Mean, Estimation of the Population Variance, The Normal Approximation to the Sampling Distribution of $\bar{X}$, Estimation of a Ratio.

Unit-III-Estimation of Parameters and Fitting of Probability Distributions:

Introduction, Parameter Estimation, The Method of Moments, The Method of Maximum Likelihood, Maximum Likelihood Estimates of Multinomial Cell Probabilities, Large sample theory for maximum likelihood estimates, Confidence intervals from Maximum likelihood estimates, The Bayesian Approach to Parameter Estimation – Further Remarks on priors, Large Sample Normal Approximation to the Posterior, computational Aspects, Efficiency and Sufficiency.

Unit-IV-Testing Hypotheses and Assessing goodness of Fit :

Introduction, The Neyman-Person Paradigm- Specification of the Significance Level and the concept of a *p*-value, The Null Hypothesis, Uniformly Most Powerful Tests, The Duality of Confidence Intervals and Hypothesis Tests, Generalized Likelihood Ratio Test, Likelihood Ratio tests for the Multinomial Distribution, Probability Plots, Tests for Normality.

Unit-V-Comparing Two Samples:

Introduction, comparing Two Independent Sample – Methods Based on the Normal Distribution, A Nonparametric Method-the Mann Whitney Test, Comparing Paired Samples, Methods Based on the Normal Distribution, A Nonparametric Method-The Signed Rank Test, The Analysis of Variance : Introduction, The One-Way Layout-Normal Theory : the F Test, The Problem of Multiple Comparisons, a Nonparametric Method-The Kruskal Wallis Test

LAB WORK: Implementation of some of the techniques (selected by the instructor) using R Programming

Reference Books:

1. Mathematical Statistics and Data Analytics - John A Rice, CENGAGE Learning , 3RD Edition.

2. Robert I. Kabacoff, R in Action –Data analysis and graphics with R, Dreamtech press.

3. Christian Heumann, Michael Schomaker and Shalabh, Introduction to Statistics and Data Analysis- With Exercises, Solutions and Applications in R; Springer, 2016.

MTIT 106 : SOFTWARE ENGINEERING

Unit-I	Introduction, Software life cycle modules, Requirements Analysis and specification, Software design, Function oriented software design.
Unit-II	Introduction to object oriented Analysis and Design, Iterative Development and the unified process, case study – The next Gen POS, Inception, Understanding Requirements, Use case Model, Identifying other requirements, from inception to elaboration.
Unit-III	Elaboration use case model, Drawing system sequence diagrams, visualizing concepts, adding associations, adding attributes adding details with operation contracts, interaction diagrams notations, GRASP, use case realization, Determining visibility, creating design class diagram.
Unit-IV	Elaboration Interaction 2 : Interaction 2 and other requirements GOF Design pattern. Special topics on drawing and tools, planning and project queues comments on interactive development and the UP Rational Unfiled Process.
Unit-V	Coding and Testing, Software reliability and quality management, computer Aided Software Engineering Software maintenance.

Books Recommended

1. Rajib Mail : Fundamentals of Software Engineering 2nd E.d. PHI.
2. I. Summerville : Software Engineering Pearson Education.
3. Craig Larman : Applying UMI and Patterns An introduction OOA and D and the Unified Process 2nd Ed., Pearson Education Asia.

References

1. Martin Flower, UMI, Distiled Pearson Education.
2. G. Booch, I Jacobson, J. Ramburg, UML user Guide, Pearson.

MTIT 107(LAB) : ORACLE

Marks Distributions

Lab Work	- 70 marks
Viva-voce + Records	- 30 marks