EVALUATION SCHEME
M. TECH. COMPUTER SCIENCE & ENGINEERING
I-YEAR (I-SEMESTER)
(Effective from session: 2021-22)

S.No.	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME					
						SESSIONAL EXAM			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1.	TCS-511	ADAVANCED DATA STRUCTURES	3	1	0	30	20	50	100	150	3
2.	TCS-512	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE	3	1	0	30	20	50	100	150	3
3.	ECS-51X	ELECTIVE-I	3	1	0	30	20	50	100	150	3
4.	ECS-51X	ELECTIVE-II	3	1	0	30	20	50	100	150	3
5.	TRM-511	RESEARCH METHODOLOGY AND IPR	2	0	0	30	20	50	100	150	2
6.	TAC-51X	AUDIT COURSE-I*	2	0	0	30	20	50	100	150	0
PRACTICAL											
7.	PCS-511	LAB-I ADAVANCED DATA STRUCTURES	0	0	2	10	15	25	25	50	1
8.	PCS-51X	LAB-II (BASED ON ELECTIVES)	0	0	2	10	15	25	25	50	1
9.	GPP-511	GENERAL PROFICIENCY *	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**16**	**4**	**4**	**200**	**200**	**400**	**650**	**1050**	**16**

ELECTIVE-I
ECS-510 MACHINE LEARNING
ECS-511 WIRELESS SENSOR NETWORK
ECS-512 INTRODUCTION TO INTELLIGENT SYSTEMS
ECS-513 ADVANCE JAVA PROGRAMMING

ELECTIVE-II
ECS-515 DATA SCIENCE
ECS-516 DISTRIBUTED SYSTEMS
ECS-517 ADVANCED WIRELESS AND MOBILE NETWORKS
ECS-518 DIGITAL IMAGE PROCESSING
ECS-519 ADVANCED OPERATING SYSTEM

AUDIT COURSE-I
TAC -513 ENGLISH FOR RESEARCH PAPER WRITING

EVALUATION SCHEME
M. TECH. COMPUTER SCIENCE & ENGINEERING
I-YEAR (II-SEMESTER)
(Effective from session: 2021-22)

S.No.	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME					
						SESSIONAL EXAM			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1.	TCS-521	ADVANCED ALGORITHMS	3	1	0	30	20	50	100	150	3
2.	TCS-522	SOFT COMPUTING	3	1	0	30	20	50	100	150	3
3.	ECS-52X	ELECTIVE-III	3	1	0	30	20	50	100	150	3
4.	ECS-52X	ELECTIVE-IV	3	1	0	30	20	50	100	150	3
5.	TAC-52X	AUDIT COURSE-II*	2	0	0	30	20	50	100	150	0
PRACTICAL											
6.	PCS-521	ADVANCED ALGORITHMS LAB	0	0	2	10	15	25	25	50	1
7.	PCS-522	LAB-IV (BASED ON ELECTIVES)	0	0	2	10	15	25	25	50	1
8.	PCS-523	MINI PROJECT WITH SEMINAR	0	0	4	0	0	50	50	100	2
9.	GPP-521	GENERAL PROFICIENCY *	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**14**	**4**	**8**	**170**	**180**	**400**	**600**	**1000**	**16**

ELECTIVE-III
ECS-520 CYBER SECURITY
ECS-521 HIGH PERFORMANCE SCIENTIFIC COMPUTING
ECS-522 DATA ENCRYPTION & COMPRESSION
ECS-523 MOBILE COMPUTING NETWORKS

ELECTIVE-IV
ECS-525 HUMAN COMPUTER INTERACTION
ECS-526 ARCHITECTURE FOR LARGE SYSTEMS
ECS-527 MEDICAL IMAGING
ECS-528 CLOUD COMPUTING

AUDIT COURSE-II
TAC -521 DISASTER MANAGEMENT
TAC-523 PEDAGOGY STUDIES
TAC-524 STRESS MANAGEMENT BY YOGA
TAC-525 PERSONLITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

EVALUATION SCHEME
M. TECH. COMPUTER SCIENCE & ENGINEERING
II-YEAR (III-SEMESTER)
(Effective from session: 2022-23)

S.No.	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME					
						SESSIONAL EXAM			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1.	ECS-63X	ELECTIVE-V	3	1	0	30	20	50	100	150	3
2.	TOE-63X	OPEN ELECTIVE	3	0	0	30	20	50	100	150	2
PRACTICAL											
3.	PCS-631	DISSERTAION-I	0	0	20	0	0	200	300	500	10
4.	GPP-631	GENERAL PROFICIENCY*	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**6**	**1**	**20**	**60**	**40**	**300**	**500**	**800**	**15**

ELECTIVE-V
ECS-630 MOBILE APPLICATIONS AND SERVICES
ECS-631 BIG DATA ANALYTICS
ECS-632 OPTIMIZATION TECHNIQUES
ECS-633 NETWORK PROGRAMMING

OPEN ELECTIVE
TOE-630 BUSINESS ANALYTICS
TOE-631 INDUSTRIAL SAFETY
TOE-632 OPERATIONS RESEARCH
TOE-633 COST MANAGEMENT OF ENGINEERING PROJECTS
TOE-634 COMPOSITE MATERIALS
TOE-635 WASTE TO ENERGY

EVALUATION SCHEME
M. TECH. COMPUTER SCIENCE & ENGINEERING
II-YEAR (IV-SEMESTER)
(Effective from session: 2022-23)

S. No.	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME					
						SESSIONAL EXAM			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
PRACTICAL											
1.	PCS-641	DISSERTAION-II	0	0	28	0	0	300	400	700	14
2.	PCS-642	SEMINAR	0	0	4	0	0	100	0	100	2
3.	GPP-641	GENERAL PROFICIENCY*	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**0**	**0**	**32**	**0**	**0**	**400**	**400**	**800**	**16**

TCS 511: Advanced Data Structures
M.Tech. Semester –I (Computer Science &Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I:
Dictionaries: Definition, Dictionary Data Structures, Abstract Data Type, Amortized Complexity and Master theorem.
Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing, Bloom Filters, Cuckoo hashing and Distributed Hash Table.

UNIT II:
Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

UNIT III
Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay trees
Tries: Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm

UNIT IV
Advanced Searching Techniques: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees.

UNIT V
Heaps: Heap Sort, Binomial Heaps and Fibonacci Heaps and their complexities

References:
1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.
3. Data Structures and Algorithms by A. V. Aho, J. E. Hopcroft and T. D. Ullman, Original edition, AddisonWesley, 1999, Low Price Edition.

TCS-512 Mathematical Foundations of Computer Science

M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I

Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation Applications of the univariate and multivariate Central Limit Theorem Probabilistic inequalities, Markov chains

UNIT II

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood, Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.

UNIT III

Graph Theory: Isomorphism, Planar graphs, graph colouring, hamilton circuits and euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems

UNIT IV

Computer science and engineering applications Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

UNIT V

Recent Trands in various distribution functions in mathmatical field of computerscience for varying fields like bioinformatic, soft computing, and computer vision.

References

1. John Vince, Foundation Mathematics for Computer Science, Springer.
2. K. Trivedi.Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
3. M. Mitzenmacher and E. Upfal.Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
4. Alan Tucker, Applied Combinatorics, Wiley

ECS-510 Machine Learning

M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I

Supervised Learning (Regression/Classification): Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods Beyond Binary Classification: Multi-class/Structured Outputs, Ranking.

UNIT II

Unsupervised Learning

Clustering: K-means/Kernel K-means , Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion , Generative Models (mixture models and latent factor models)

UNIT III

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

UNIT IV

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning. Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.

UNIT V

Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.

References

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

ECS-511 Wireless Sensor Network
M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I

Introduction to Wireless Sensor Networks: Motivation for a Network of Wireless Sensor Nodes, Definitions and Background, Sensing and Sensors, Wireless Sensor Networks, Challenges and Constraints, Energy, Self-Management, Wireless Networking, Decentralized Management, Design Constraints, Security.
Applications: Structural Health Monitoring, Traffic Control, Health Care, Pipeline Monitoring.

UNIT II

Node Architecture: The Sensing Subsystem, Processor Subsystem, Communication Interfaces, Prototypes.
Operating Systems: Functional Aspects, Nonfunctional Aspects, Prototypes.

UNIT III

Medium Access Control: Overview, Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, and Hybrid MAC Protocols.

UNIT IV

Power Management: Local Power Management Aspects, Dynamic Power Management, Conceptual Architecture.
Time Synchronization: Clocks and the Synchronization Problem, Time Synchronization in Wireless Sensor Networks, Basics of Time Synchronization and Time Synchronization Protocols.
Localization: Overview, Ranging Techniques, Range-Based Localization, Range-Free Localization and Event-Driven Localization.

UNIT V

Security: Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security.

References:

1. W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks –Theory and Practice", Wiley 2010
2. KazemSohraby, Daniel Minoli and TaiebZnati, "wireless sensor networks -Technology Protocols, and Applications", Wiley Interscience 2007
3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", springer 2010

ECS-512 Introduction to Intelligent Systems
M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I

UNIT I
Biological foundations to intelligent systems I: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

UNIT II
Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks. Recent trends in Fuzzy logic, Knowledge Representation.

UNIT III
Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search.
Heuristic search methods: best-first search, admissible evaluation functions, hill-climbing search. Optimisation and search such as stochastic annealing and genetic algorithm.

UNIT IV
Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

UNIT V
Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.

References

1. Luger G.F. and Stubblefield W.A. (2008). Artificial Intelligence: Structures and strategies for Complex Problem Solving. Addison Wesley, 6th edition.
2. Russell S. and Norvig P. (2009). Artificial Intelligence: A Modern Approach. Prentice-Hall, 3rd edition.

ECS-513 Advance Java Programming
M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT - |
Java Basics, Java streaming, Networking, Event handling, Multithreading, Byte code Interpretation, Customizing application, Data Structures, Collection classes.

UNIT II
Distributed Computing: Custom sockets, Remote Method Invocation Activation, Object serialization CORBA Distributed, JINI, GARBAGE, RMI.

UNIT -III
JAVA Beans and Swing, Bean concepts, Events in bean box, Bean customization, Persistence, Application, deployment using swing, Advanced swing techniques, JAR file handling. '

UNIT - IV
JAVA e-Applications,JNI, Servlets, Java Server Pages, JDBC, Session Beans, Entity Beans, Programming and deploying enterprise Java Beans, Java transactions.

UNIT -V
Related JAVA Techniques, Java Media Frame work, 3D graphics, Internationalization, Case study, Deploying n-tier application, E- commerce applications.

References

1. Deitel & Dietel, "Java: How to Program", Prentice Hall, 8" Edition, 2009.
2. Gary Cornell and Cay S. Horstmann, "Core Java®, Vol. 1 and Vol. 2, Sun Microsystems Press, 1999.
3. Stephen Asbury and Scott R. Weiner, "Developing Java Enterprise Applications", Wiley, 1998. -

ECS-515 Data Science

M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

UNIT II

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources

UNIT III

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT IV

Data visualisation: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

UNIT V

Applications of Data Science, Technologies for visualization, Bokeh (Python) , Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

References

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

ECS-516 Distributed Systems
M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I
INTRODUCTION: Distributed data processing; what is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts.
DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

UNIT II
DISTRIBUTED DATABASE DESIGN: Alternative design strategies; Distributed design issues; Fragmentation; Data Allocation.
SEMANTICS DATA CONTROL: View management; Data security; Semantic Integrity Control
QUERY PROCESSING ISSUES: Objectives of query processing; Characterization of query processors; Layers of Query processing; Query decomposition; Localization of distributed data

UNIT III
DISTRIBUTED QUERY OPTIMIZATION: Factors governing query optimization; Centralized query optimization; ordering of fragment queries; Distributed query optimization algorithms.
TRANSACTION MANAGEMENT
The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models
CONCURRENCY CONTROL
Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management

UNIT IV
RELIABILITY: Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols

UNIT V
PARALLEL DATABASE SYSTEMS: Parallel architectures; parallel query processing and optimization; load balancing, Mobile Databases, Distributed Object Management, Multi-databases.

ECS-517 Advanced Wireless and Mobile Networks
M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I
INTRODUCTION: Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc.

UNIT II
WIRELESS LOCAL AREA NETWORKS: IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Ad-hoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues.

UNIT III
WIRELESS CELLULAR NETWORKS:
1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving Coverage and capacity in cellular systems, Spread spectrum Technologies.

UNIT IV
WIRELESS SENSOR NETWORKS: Introduction, Application, Physical, MAC layer and Network Layer, Overview WiMAX (Physical layer, Media access control, Mobility and Networking),
IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover

UNIT V
SECURITY
Introduction to Wireless Sensors, IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Ad-hoc Networks, Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.

References

1. Schiller J., Mobile Communications, Addison Wesley 2000
2. Stallings W., Wireless Communications and Networks, Pearson Education 2005
3. Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc 2002
4. Yi Bing Lin and Imrich Chlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc 2000
5. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200

References

6. Schiller J., Mobile Communications, Addison Wesley 2000
7. Stallings W., Wireless Communications and Networks, Pearson Education 2005
8. Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc 2002
9. Yi Bing Lin and Imrich Chlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc 2000
10. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200

ECS-518 Digital Image Processing
M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

Unit 1-Introduction: Digital Image Processing, The origins of Digital Image Processing, Examples of Digital Image Processing application, Fundamental steps in Digital Image processing, Components of Image Processing system Fundamentals: Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels, Linear and Nonlinear Operations, An introduction to mathematical tool used in digital image processing.

Unit 2-Image Enhancement in the spatial domain: Background, Some basic gray level transformation, Introduction of Histogram processing, Enhancement using Arithmetic/Logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Concept of Sampling.

Unit 3-Image Restoration: Model of the Image Degradation/Restoration process, Noise Models, Restoration in the presence of noise only spatial filtering, Inverse filtering, Minimum Mean Square Error (Wiener) filtering, Geometric mean filter.

Unit 4-Image Compression: Fundamentals, Lossy Compression, Lossless Compression, Image Compression models, Error-free Compression : Variable length coding, LZW coding, Bit plane coding, Run length coding, Introduction to JPEG, introduction to color image processing, color fundamentals, color models, Pseudo color image processing.

Unit 5-Morphology and Segmentation: Erosion, Dilation, Duality, Opening and Closing, Hit-and Miss transform, Morphological **Algorithms :**Boundary Extraction, Hole filling, Extraction of connected components, Convex Hull, Concept of Thinning and thickening.

Image Segmentation: Definition, characteristics of segmentation Detection of Discontinuities, Thresholding, Region based segmentation. Introduction Object Recognition, pattern and Pattern classes.

References

1. Rafael C. Gonzalez and Richard E.Woods. ,Digital Image Processing: Addision Wesley.
2. Anil K. Jain , Fundamentals of Digital Image Processing, PHI.
3. B. Chanda& D. DuttaMajumber , Digital Image Processing and Analysis , PHI.
4. Dwayne Phillips , Image Processing in C , BPB

ECS-519 Advanced Operating System
M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I

Review of Operating Systems principles: Synchronization mechanisms, Process deadlocks, memory allocation, file management.

UNIT II

Architecture of Distributed Operating system: Motivation, System Architecture types, issues in distributed operating system, Communication primitives.

UNIT III

Inherent limitations of distributed operating systems: Event ordering. Timestamps. Distributed mutual exclusion. Token and non-token based algorithms. Comparative performance analysis.

UNIT IV

Distributed deadlock detection: Deadlock handling strategies, issues in deadlock detection & reevaluation, Control Organization: Centralized distributed & Hierarchical detection algorithms.

UNIT V

Concurrency control: Shared Memory. File Systems. Agreement protocols for handling processor failures. Coordination of processes and related algorithms, Interprocess Communications, Failure handling and recovery mechanisms.

Books

1. Peterson, J.L. & Silbersehatz, A: Operating System Concepts, Addison, Wesley-Reading. . .
2. Brineh, Hansen: Operating System Principles, Prentice Hall of India.
3. Haberman, A.N: Introduction to Operating System Design Galgotia Publication, New Delhi.
4. Hansen, P.B: Architecture of Concurrent Programs, PHI.
5. Shaw, A.C: Logic Design of Operating Systems, PHI.
6. Silberschatz, P. Galving, G. Gahne : Applied operating system concepts, Wiley.
7. Mukesh Singhal & N.G. Shivaratri: Advanced concepts in operating systems, TMH 2001.
8. A S Tanenbaum : Modern Operating Systems, PHI.

TRM-511 Research Methodology and IPR
M.Tech. Semester –I (Computer Science &Engg.)

L	T	P		
2	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

UNIT 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation andassessment by a review committee.

UNIT 4: 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.

UNIT 5: 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**.**

Books

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

THS -513 English for Research Paper Writing
M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
2	-	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

PCS 511: Advanced Data Structures Lab
M.Tech. Semester –I (Computer Science &Engg.)

L	T	P		
-	-	2	**Class Work**	**:25 Marks**
			Exam.	**:25 Marks**
			Total	**:50 Marks**
			Duration of Exam	**: 3 Hrs**

LIST OF EXPERIMENTS

1. Write a program to implement all the functions of a dictionary (ADT) using hashing.
2. Write a program to implement Randomized version of Quicksort algorithm.
3. Write a program to perform searching using Skip list.
4. Write a program to implement R-B Tree insertion and Deletion.
5. Write a program to perform Splay tree operations.
6. Write a program to implement Tries data structures.
7. Write a program to implement Huffman Encoding.
8. Write a program to perform search operations using Range Trees.
9. Write a program for implementing Binomial Heaps.
10. Write a program for implementing Fibonacci Heaps.

PCS 51X: Based on Electives Lab
M.Tech. Semester –I (Computer Science & Engg.)

L	T	P		
-	-	2	**Class Work**	**:25 Marks**
			Exam.	**:25 Marks**
			Total	**:50 Marks**
			Duration of Exam	**: 3 Hrs**

Prerequisites: Knowledge of C/C++/ java and other Programming is essential.

The experiments will be based on the following paper: TCS 51X **Based on Electives**

TCS-521 Advanced Algorithms
M.Tech. Semester –II (Computer Science &Engg.)

L	T	P
3-	1	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150Marks**
Duration of Exam	**: 3 Hrs**

UNIT I
Introduction to Sorting and Graphs: Review of various sorting algorithms, topological sorting, shortest path by BFS and DFS, shortest path in edge-weighted case (Dijkstra's and Bellman Ford), Minimum Spanning Tree.

UNIT II
Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.
Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

UNIT III
Matrix Computations: Introduction to divide and conquer paradigm,Naïve Matrix Multiplication, Strassen's algorithm, inverse of a triangular matrix and LUP decomposition.

UNIT IV
Text Processing: String Operations, Brute-Force Pattern Matching, Boyer-Moore Algorithm, Knuth-Morris-Pratt Algorithm and Longest Common Subsequence problem.

UNIT V
Approximation Algorithms:NP Completeness and NP Hard, Vertex-cover problem ,Traveling-salesman problem, Random numbers and Introduction to Heuristic's.

References:

1. "Introduction to Algorithms" byCormenLeiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.

TCS-522 Soft Computing
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I

INTRODUCTION TO SOFT COMPUTING AND NEURAL

NETWORKS: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

UNIT II

FUZZY LOGIC: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making

UNIT III

NEURAL NETWORKS: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT IV

GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisit ion. Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.

UNIT V

Recent Trands in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.

References

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing, Prentice:Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications, Prentice Hall, 1995.
3. MATLAB Toolkit Manual

ECS-520 Cyber Security
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P
3	1	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

Unit 1

Introduction of Cryptography: Attacks, Services and Mechanisms, Classical Substitution and Transposition Techniques, Block v/s Stream Cipher, Conventional Encryption Model, Claude Shannon Theory, Fiestal Structure Block Cipher Principles, DES Standard, DES Differential and Linear Cryptanalysis, Block Cipher Modes of Operations and Steganography.

Unit 2

Confidentiality using Symmetric Encryption: Double DES, Triples DES, International Data Encryption Algorithm(IDEA), AES, Placement of Encryption Function, Key Distribution, Random Number Generation, Stream Ciphers and RC4.

Unit 3

Public Key Encryption: Public-Key Cryptography: Principles of Public-Key Cryptosystems, Primes numbers, GCD, Fermat's and Euler's Theorem, Primality Testing, RSA Algorithm, Chinese Remainder Theorem, Key Management,

Unit 4

Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Function and MACs, Birthday Attacks, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signatures, Digital Signature Standard(DSS).

Unit 5

Network and System Security: **Authentication Applications:** Kerberos, X.509 and Public Key Infrastructure, **Electronic Mail Security**: Pretty Good Privacy (PGP) and S/MIME, **IP Security:** Architecture, Authentication Header, Encapsulating Security Payloads, Combining Security Associations and Key Management, **Web Security:** Secure Socket Layer and Transport Layer Security and Secure Electronic Transaction (SET), **System Security:** Intruders, Viruses, DDoS attacks, Firewall Design Principles and Trusted Systems.

Books

- William Stallings, "Cryptography and Network Security: Principles and Practice"' Prentice Hall, New Jersey
- Johannes A. Buchmann, "Introduction to Cryptography" Springer Publishers
- AtulKahate, "Cryptography and Network Security" TMH
- Network Security Bible : Eric Cole, Wiley Dreamtech India Pvt. Ltd.
- Practical Cryptography —Bruce Schneier Wiley Dreamtech India Pvt. Ltd

ECS-521 High Performance Scientific Computing
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

Course Outcome

After learning the course the students should be able to:

- Demonstrate the knowledge of numerical computing using an appropriate programming language.
- Be competent in experimental computing in a numerical context and of the optimization of algorithms on high performance architectures.
- Be able to reason about the accuracy of mathematical and numerical models of real physical phenomena.
- Have an awareness of the modern field of computational science and engineering and of the impact of high performance computing on science and industry.
- Have an understanding of the various paradigms of high performance computing and their potential for performance and programmability.

Unit-1: Introduction

Single Processor Computing, Parallel Computing, Parallel System Organization

Unit-2: Numerical Linear Algebra and application

High Performance Linear Algebra, Numerical Treatment of Differential Equations

Applications: Molecular Dynamics, Sorting, Graph Analytics, N-body Problems, Monte Carlo Methods, Computation Biology

Unit-3: Interactive Python using IPython, and the IPython Notebook

Python scripting and its uses in scientific computing, Subtleties of computer arithmetic that can affect program correctness

Unit-4: Fortran 90, a Compiled language

That is widely used in scientific computing, Makefiles for building software and checking dependencies, Analyse the cost of data communication. Registers, cache, main memory, and how this memory hierarchy affects code performance.

Unit-5: OpenMP on Top of Fortran

OpenMP on top of Fortran for parallel programming of shared memory computers, such as a multicore laptop., MPI on top of Fortran for distributed memory parallel programming, such as on a cluster, Parallel computing in IPython, Debuggers, unit tests, regression tests, verification and validation of computer codes, Graphics and visualization of computational results using Python

ECS-522 Data Encryption & Compression
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I

Introduction to Security: Need for security, Security approaches, Principles of security, Types of attacks.
Encryption Techniques: Plaintext, Cipher text, Substitution & Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size.

UNIT II

Symmetric & Asymmetric Key Cryptography: Algorithm types & Modes, DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric & Asymmetric key together, Digital signature, Knapsack algorithm.
User Authentication Mechanism: Authentication basics, Passwords, Authentication tokens, Certificate based & Biometric authentication, Firewall.

UNIT III

Case Studies Of Cryptography: Denial of service attacks, IP spoofing attacks, Secure inter branch payment transactions, Conventional Encryption and Message Confidentiality, Conventional Encryption Principles, Conventional Encryption Algorithms, Location of Encryption Devices, Key Distribution. Public Key Cryptography and Message Authentication: Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, Key Management.

UNIT IV

Introduction: Need for data compression, Fundamental concept of data compression & coding, Communicat ion model, Compression ratio, Requirements of data compression, Classification.Methods of Data Compression: Data compression--Loss less &Lossy

UNIT V

Entropy encoding-- Repetitive character encoding, Run length encoding, Zero/Blank encoding; Statistical encoding--Huffman, Arithmetic & Lempel-Ziv coding; Source encoding-- Vector quantization (Simple vector quantization & with error term); Differential encoding—Predictive coding, Differential pulse code modulat ion, Delta modulat ion, Adaptive different ial pulse code modulation; Transform based coding : Discrete cosine transform & JPEG standards; Fractal compression , Recent trends in encryption and data compression techniques.

References:

1. Cryptography and Network Security by B. Forouzan, McGraw-Hill.
2. The Data Compression Book by Nelson, BPB.
3. Cryptography & Network Security by AtulKahate, TMH.

ECS-523 Mobile Computing Networks
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P
3	1	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

Unit 1: Overview of Ad Hoc Networks: Why Ad Hoc Networks?, Challenges, and benefits of Mobile Computing, Breakthrough Technology, Wireless Computing, Nomadic Computing, Mobile Computing, Ubiquitous Computing, Pervasive Computing, Invisible Computing, Applications of mobile computing, Wireless and Mobile Computing Models, LAN Protocols: IEEE 802.11/a/g/n & Bluetooth, Data Management Issues. Sensor Networks- Challenges, Architecture, and Applications.

Unit 2: Routing: Taxonomy, Applications, Challenges in Mobile Environments, Hidden and exposed terminal problems, Routing Protocols- Proactive, Reactive, and Hybrid protocols, Dynamic State Routing (DSR), Ad hoc On-Demand Distance Vector (AODV), Destination Sequenced Distance – Vector Routing (DSDV), and Cluster Based Routing Protocol (CBRP), and Temporally Ordered Routing algorithm (TORA).

Unit 3: Distributed location Management: Pointer forwarding strategies, Process communication techniques, socket programming, Remote Procedure Call (RPC), Remote Method Invocation (RMI), client/server programming.

Unit 4: Mobile IP- Problem with Mobility, Terminology, Operation, Tunneling, Data transfer to the mobile system, Transport Control Protocol (TCP) Over wireless- Indirect TCP (I-TCP), Snoop TCP, Mobile TCP (M-TCP), Case Study of Client/Server architecture.

Unit 5: Fault tolerance and Security: Mobile Agents Computing, Security- Issues and Mechanisms, Certificate, Secure Agent Transfer, Timestamp Tamper-proofing, Secure Agent Reception, Host Protection, Providing Security and Integrity to Agent Data and State, Securing Agent Itineraries, Security Architecture, fault tolerance- Issues and Mechanisms, Agent Failure Scenarios, Node (host) Failure Detection and Recovery, Agent Failure Detection and Recovery, Communication Failure Detection and Recovery, Fault Tolerant System-3-Layered Monitor System, transaction processing in Mobile computing environment. Mobile Agent Systems: Aglets, PMADE and Case Study.

Books

1. Charles E. Perkins, Ad hoc Networks, Addison Wesley, 2008.
2. Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley, 2007.
3. Mazliza Othman, Principles of mobile computing and communications, Auerbach Publications, 2007.
4. Uwe Hansmann, Lothar Merk, Martin Nicklous, Thomas Stober, Principles of Mobile computing, 2nd Ed., Wiley, 2006.
5. Daniel Minoli, A Networking Approach to Grid Computing, Wiley, 2004.
6. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff UNIX Network Programming: The Sockets Networking API, Volume 1, Third Edition: Addison Wesley, 2003.
7. Lange, D.B. and Oshima, M., Programming and Deploying Java Mobile Agents with Aglets, 1st Ed., Addison Wesley, 2001.
8. William T. Cockayne, Michal Zyda, Mobile agents, Manning Publication, 2000.
9. Milojicic, D., Douglis, F. and Wheeler R., (ed.), Mobility Processes, Computers and Agents, Addison Wesley, 1999.

ECS-525 Human Computer Interaction
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I
Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT II
Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III
COGNITIVE MODELS –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV
Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V
Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies. Recent Trends: Speech Recognition and Translation, Multimodal System

References

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, "Mobile Design and Development", First Edition , O

ECS-526 Architecture for Large Systems
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P
3	1	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

Course Outcome This course describes the principles of computer design and classifies instructions set architecture, at the end students will be able to:

- Describe the operations of performance such as pipelines, dynamic scheduling branch predictions, caches.
- Describe the operations of virtual memory.
- Describe the modern architecture such as RISC, Scalar, VLIW Multi core and multi CPU systems.
- Compare the performance of different CPU architecture.
- Develop the applications for high performance computing systems.

Unit-1: Pipeline processor principles and design, Instruction set architecture;

Unit-2: Memory addressing; Instruction composition; Instruction-level parallelism.

Unit-3: Hazards: dynamic scheduling, branch prediction; Memory hierarchy;

Unit-4: Processor case studies; Multiprocessor introduction: Shared-memory architectures and their synchronisation and consistency issues,

Unit-5: Advanced multi-core topics; Transactional Memory; Interconnection networks.

References

1. J. L. Hennessy and D. A, “Computer Architecture: A Quantitative Approach”.
2. David Culler, J.P. Singh and Anoop Gupta, “Parallel Computer Architecture: A Hardware/Software Approach”.
3. Kai Hwang, “Advanced Computer Architecture: Parallelism, Scalability, Programmability”.

ECS-527 Medical Imaging
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P
3	1	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

UNIT I
BASIC CONCEPTS
Introduction to Medical Imaging: The Modalities and image Properties, Image Quality, Spatial Resolution, Convolution, Frequency Domain, Contrast, Physical mechanisms of Blurring, Medical Imaging Informatics.

UNIT II
DIAGNOSTIC RADIOLOGY
Ray Computed Tomography: Introduction, Rays detectors in CT, imaging, Cardiac CT, Dual energy CT, Biological affects and safety. Ultrasound Imaging: Introduction, Physics of Acoustic waves, Generation and Detection of Ultrasound, Doppler Imaging, Biological effects and safety.

UNIT III
MAGNETIC RESONANCE IMAGING (MRI) &NUCLEARIMAGING
MRI: Advanced image Acquisition Methods, Artifacts, Spectroscopy, Quality. Control, Siting, Bioeffects and Safety. Nuclear Imaging: Positron Emission Tomography and Dual Modality Imaging- SPECT/CT, PET/CT.

UNIT IV
MEDICAL IMAGE ANALYSIS AND VISUALIZATION
Introduction, Manual Analysis, Automated Analysis, Computational strategies for Automated Medical Image Analysis, Pixel Classification, Geometric model matching using a Transformation Matrix, Flexible Geometric Model Matching. Visualization for Diagnosis and Therapy: Introduction- 2D Visualization-User Interaction-intraoperative Navigation.

UNIT V
RADIATION BIOLOGY AND PROTECTION
Radiation Biology: Overview, Interaction of radiation with tissue, Whole body response to radiation: The acute radiation syndrome, Hereditary Effects of Radiation Exposure, Radiation Protection: Sources of exposure to ionizing radiation, Radiation detection equipment in radiation safety, Medical emergencies involving ionizing radiation.

References

1. Paul Suetens, "Fundamentals of Medical Imaging", 2nd Edition, Cambridge University Press, UK, 2009.
2. Jerrold. T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt, Jr. John M. Boone, "Essential Physics of Medical imaging", 3rd Edition, Lippincott Williams & Wilkins,.USA, 2012.
3. Steve Webb, "The Physics of Medical Imaging", Adam Hilger, Philadelphia, 2012.
4. Jerry L. Prince, Jonathan M. Links, "Medical Imaging Signals and Systems", Pearson El, 2006.

ECS-528 Cloud Computing
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I

Foundations: Introduction to Cloud Computing, Migrating into a Cloud Enriching the 'Integration as a Service' Paradigm for the Cloud Era, Cloud Computing for Enterprise Applications. - :

UNIT II

Infrastructure as a Service (laaS): Virtual Machines Provisioning and Migration Services, On the Management of Virtual Machines for Cloud Infrastructures, Enhancing Cloud Computing Environments using a Cluster as a Service, Secure Distributed Data Storage in Cloud Computing.

UNIT III

Platform and Software as a Service (PaaS/laaS): Aneka - Integration of Private and Public Clouds, CometCloud: An Autonomic Cloud Engine, T-Systems'' Cloud-Based Solutions for Business Applications, Workflow Engine for Clouds, Understanding Scientific Applications for Cloud Environments, The MapReduce Programming Model and Implementations. : :

UNIT IV

Monitoring and Management: An Architecture for Federated Cloud Computing, SLA Management in Cloud Computing: A Service Provider's Perspective, Performance Prediction for HPC on Clouds.

UNIT V

Applications: Architecting Applications for the Amazon Cloud, Massively Multiplayer Online Game Hosting on Cloud Resources, Building Content Delivery Networks Using Clouds, Resource Cloud Mashups

References

1. "Cloud Computing: Principles and Paradigms", Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley, New York, USA

THS -521 Disaster Management
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P
2	-	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

THS-523 Pedagogy Studies
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P
2	-	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

THS-524 Stress Management by Yoga
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P
2	-	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

THS-525 Personality Development through Life Enlightenment Skills
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P
2	-	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

PCS 521: Advanced Algorithms Lab
M.Tech. Semester –II (Computer Science &Engg.)

L	T	P		
-	-	2	**Class Work**	**:25 Marks**
			Exam.	**:25 Marks**
			Total	**:50 Marks**
			Duration of Exam	**: 3 Hrs**

LIST OF EXPERIMENTS

1. Write a program to implement graph search using BFS and DFS.
2. Write a program to implement Topological Sort.
3. Write a program to implement network flow problem using Ford Fulkerson method.
4. Write a program to implement network flow problem using Edmond Karp method.
5. Write a program to perform Naive Matrix Multiplication.
6. Write a program to perform Strassen Matrix Multiplication.
7. Write a program to implement Brute Force pattern matching technique.
8. Write a program to implement Boyer-Moore pattern matching technique.
9. Write a program to implement KMP pattern matching technique.
10. Write a program for implementing Travelling Salesman Problem.

PCS-52X LAB-IV (Based on Electives)

M.Tech. Semester –II (Computer Science & Engg.)

L	T	P
-	-	2

Class Work	**:25 Marks**
Exam.	**:25 Marks**
Total	**:50 Marks**
Duration of Exam	**: 3 Hrs**

PCS-523 Mini Project with Seminar
M.Tech. Semester –II (Computer Science & Engg.)

L	T	P		
-	-	4	**Class Work**	**:50 Marks**
			Exam.	**:50 Marks**
			Total	**:100 Marks**
			Duration of Exam	**: 3 Hrs**

Concerned Teachers/Experts in the selected area must be identified by a student for approval of the problem. A student is required to submit Three copies of bound report One week before the presentation to office of Head/Concerned faculty (examiner) appointed by the Head.

ECS-630 Mobile Applications and Services
M.Tech. Semester –III (Computer Science & Engg.)

L	T	P
3	1	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

UNIT I
Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User.

UNIT II
More on Uis: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis, . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.

UNIT III
Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics.

UNIT IV
Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia.

UNIT V
Platforms and Additional Issues : Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking , Active Transactions, More on Security, Hacking Android, Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT

References

1. Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley & Sons

ECS-631 Big Data Analytics
M.Tech. Semester –III (Computer Science &Engg.)

L	T	P
3	1	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

UNIT I
Introduction To Big Data Platform and Data Analytics, Challenges Of Conventional Systems, Web Data, Evolution Of Analytic Scalability, Analytic Processes And Tools, Analysis Vs Reporting, Modern Data Analytic Tools, Statistical Concepts: Sampling Distributions, Resampling, Statistical Inference, Prediction Error. Regression Modeling, Multivariate Analysis, Bayesian Modeling, Inference and Bayesian Networks, Support Vector and Kernel Methods

UNIT II
Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, CAP theorem, version stamps, map-reduce, partitioning and combining, composing map-reducecalculations.

UNIT III
Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

UNIT IV
MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

UNIT V
Hbase, data model and implementations, Hbase clients, Hbase examples, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Spark and Scala Basics, Spark RDD, Data frames and Spark SQL, Machine learning with Spark , Apache Spark Streaming.

References

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
6. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
7. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
8. Alan Gates, "Programming Pig", O'Reilley, 2011

ECS-632 Optimization Techniques
M.Tech. Semester –III (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

UNIT I
Engineering application of Optimization, Formulation of design problems as mathematical programming problems. Introduction to linear Programming: Introduction to Linear Programming Problems, Formulation of Linear Programming Problems, Graphical method for solution of LPP, Additional Examples,
Solving LPPs: The simplex method for solution of LPP, the essentials of simplex method, setting up the simple method, The Algebra of the simplex method, simplex method in Tabular form. Tie Breaking in simplex method,
Solution of maximization and minimization problems, Big- M method, Two phase method, Unbounded and degenerate solution of LPP, Duality in Linear programming

UNIT II
General Structure of Optimization Algorithms, Constraints, The Feasible Region.

UNIT III
Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.

UNIT IV
Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

UNIT V
Real life Problems and their mathematical formulation as standard programming problems. Recent trends: Applications of ant colony optimization, genetics and linear and quadratic programming in real world application

Inventory Theory: Components of inventory models, Deterministic continuous review models, A deterministic periodic review model, A stochastic continuous review model.

References

1. Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. Dynamic Ideas. ISBN 978-0-9759146-2-5.
2. John K. Karlof (2006). Integer programming: theory and practice.CRC Press. ISBN 978-0-8493-1914-3.
3. H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387-92279-9.
4. Pulleyblank; Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009). 50 Years of Integer Programming 1958-2008: From the Early Years to the State-of-the- Art. Springer. ISBN 978-3-540-68274-5.
5. Der-San Chen; Robert G. Batson; Yu Dang (2010). Applied Integer Programming: Modeling and Solution. John Wiley and Sons. ISBN 978-0-470-37306-4.

ECS-633 Network Programming
M.Tech. Semester –III (Computer Science & Engg.)

L	T	P		
3	1	-	**Class Work**	**:50 Marks**
			Exam.	**:100 Marks**
			Total	**:150 Marks**
			Duration of Exam	**: 3 Hrs.**

Unit 1: Socket Programming: Creating sockets, Posix data type, Socket addresses, Assigning address to a socket, Java socket programming, Thread programming, Berkeley Sockets: Overview, socket address structures, byte manipulation & address conversion functions, elementary socket system calls – socket, connect, bind, listen, accept, fork, exec, close, TCP ports (ephemeral, reserved), Berkeley Sockets: I/O asynchronous & multiplexing models, select & poll functions, signal & fcntl functions, socket implementation (client & server programs), UNIX domain protocols
.

Unit 2: APIs & Winsock Programming: Windows socket API, window socket & blocking I/O model, blocking sockets, blocking functions, timeouts for blocking I/O, API overview, Different APIs & their programming technique, DLL & new API's, DLL issues, Java Beans.

Unit 3: Web Programming: Java network programming, packages, RMI, Overview of Javascript, WAP architecture & WAP services, Web databases, Component technology, CORBA concept, CORBA architecture, CGI programming.

Unit 4: Firewall & security techniques Cryptography, Digital Signature.

Unit 5: Client/Server Programming: Client side programming: Creating sockets, Implementing generic network client, Parsing data using string Tokenizer, Retrieving file from an HTTP server, Retrieving web documents by using the URL class. Server side programming: Steps for creating server, Accepting connection from browsers, creating an HTTP server, Adding multithreading to an HTTP server.

Books:

1. Steven.W.R: UNIX Network Programming, PHI (VOL I& II)
2. Window Socket Programming by Bobb Quinn and Dave Schutes
3. Davis.R: Windows Network Programming, Addison Wesley
4. NETWORK PROGRAMMING With Windows Socket By Baner .P., PH New Jersey

TOE-630 Business Analytics

M.Tech. Semester –III (Computer Science & Engg.)

L	T	P
3	-	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

TOE-631 Industrial Safety
M.Tech. Semester –III (Computer Science & Engg.)

L	T	P
3	-	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

TOE-632 Operations Research

M.Tech. Semester –III (Computer Science & Engg.)

L	T	P
3	-	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

TOE-633 Cost Management of Engineering Projects
M.Tech. Semester –III (Computer Science & Engg.)

L	T	P
3	-	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

TOE-634 Composite Materials
M.Tech. Semester –III (Computer Science & Engg.)

L	T	P
3	-	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

TOE-635 Waste to Energy

M.Tech. Semester –III (Computer Science & Engg.)

L	T	P
3	-	-

Class Work	**:50 Marks**
Exam.	**:100 Marks**
Total	**:150 Marks**
Duration of Exam	**: 3 Hrs.**

PCS-631 Dissertation-I

M.Tech. Semester –III (Computer Science & Engg.)

L	T	P		
-	-	20	**Class Work**	**:200 Marks**
			Exam.	**:300 Marks**
			Total	**:500 Marks**
			Duration of Exam	**: 3 Hrs**

The student will submit a synopsis at the beginning of the semester for approval to Dissertation evaluation committee in a specified format. The student will have to present the progress of the work through seminars and progress report. A report must be submitted to the committee for evaluation purpose at the end of the semester in a specified format.

Distribution of Credits for Dissertation shall be as follows.

1) Selection of Topic and Work-Plan, Mid-Semester presentation and Pre- Submission Presentation - 200 Marks
2) Final Viva- Voce Examination -300 Marks

PCS-641 Dissertation-II
M.Tech. Semester –IV (Computer Science & Engg.)

L	T	P		
-	-	28	**Class Work**	**:300 Marks**
			Exam.	**:400 Marks**
			Total	**:700 Marks**
			Duration of Exam	**: 3 Hrs**

Distribution of Credits for Dissertation shall be as follows.

1) Mid-Semester presentation andPre- Submission Presentation - 300 Marks
2) Final Viva- Voce Examination - 400 Marks

A student is required to submit **Three** copies of bound report of the dissertation after pre-submission presentation to office of Head duly signed by his/her supervisor.

PCS-642 Seminar

M.Tech. Semester –IV (Computer Science & Engg.)

L	T	P
-	-	4

Class Work	**:100 Marks**
Exam.	**:Zero Marks**
Total	**:100 Marks**
Duration of Exam	**: 3 Hrs**

Concerned Teachers/Experts in the selected area must be identified by a student for approval of the topic. A student is required to submit **Three** copies of bound report of the seminar **One** week before the presentation to office of Head/Concerned faculty (examiner) appointed by the Head.