KURUKSHETRA UNIVERSITY KURUKSHETRA

SCHEME OF EXAMINATION FOR M.TECH. (COMPUTER SCIENCE & ENGINEERING)
w.e.f. Academic Session 2018-2019

Paper Code	Nomenclature of Paper	Scheme of Studies Per Week		Credits	External Marks		Internal Marks	Total Marks	
		L	P		Max.	Pass		Max.	Pass
Semester – I									
MT-CSE-18-11	Mathematical foundations of Computer Science	4	0	4	100	40	50	150	60
MT-CSE-18-12	Advanced Data Structures	4	0	4	100	40	50	150	60
MT-CSE-18-13	Elective- I	4	0	4	100	40	50	150	60
MT-CSE-18-14	Elective- II	4	0	4	100	40	50	150	60
MT-CSE-18-15	Research Methodology and IPR	3	0	3	100	40	50	150	60
MT-CSE-18-16	Laboratory- I (Advanced Data Structures)	0	5	2.5	100	40	50	150	60
MT-CSE-18-17	Laboratory- II (Based on Electives)	0	5	2.5	100	40	50	150	60
Total		**19**	**10**	**24**	**700**	**280**	**350**	**1050**	**420**

Elective – I	**Elective – II**
MT-CSE-18-13(i): Machine Learning MT-CSE-18-13(ii): Wireless Sensor Networks MT-CSE-18-13(iii): Introduction to Intelligent Systems	MT-CSE-18-14(i): Data Science MT-CSE-18-14(ii): Distributed Systems MT-CSE-18-14(iii): Advanced Wireless and Mobile Networks

MT-CSE-18-11: Mathematical foundations of Computer Science

Maximum marks: 150 (External: 100, Internal: 50)

Time: 3 hours **Credits: 4**

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of objective type/short-answer type questions covering the entire syllabus. In addition to question no. 1, the examiner is required to set eight more questions selecting two from each unit. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit. All questions will carry equal marks.

Objectives:

- To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
- To study various sampling and classification problems.

Learning Outcomes:

At the end of this course students should be able to:

- To understand the basic notions of discrete and continuous probability.
- To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
- To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

Unit 1

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 2

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood, Recent Trends in various distribution functions in mathematical field of computer science for varying fields

Unit 3

Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, the problem of over fitting model assessment.

Unit 4

Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles.

Permutations and Combinations with and without repetition.

Specialized techniques to solve combinatorial enumeration problems Permutations and Combinations with and without repetition.

References

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

MT-CSE-18-12: Advanced Data Structures

Maximum marks: 150 (External: 100, Internal: 50)

Time: 3 hours **Credits: 4**

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of objective type/short-answer type questions covering the entire syllabus. In addition to question no. 1, the examiner is required to set eight more questions selecting two from each unit. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit. All questions will carry equal marks.

Objectives:

- The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- Student should be able to come up with analysis of efficiency and proofs of correctness.

Learning Outcomes:

At the end of this course students should be able to:

- Understand the implementation of symbol table using hashing techniques. Develop and analyze algorithms for red-black trees, B-trees and Splay trees. Develop algorithms for text processing applications.
- Identify suitable data structures and develop algorithms for computational geometry problems.

Unit 1

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Unit 2

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees. 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 3

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

Unit 4

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, k-D Trees.

Recent Trends in Hashing, Trees.

References

- Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004
- M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002

MT-CSE-18-13(i): Machine Learning

Maximum marks: 150 (External: 100, Internal: 50)

Time: 3 hours **Credits: 4**

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of objective type/short-answer type questions covering the entire syllabus. In addition to question no. 1, the examiner is required to set eight more questions selecting two from each unit. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit. All questions will carry equal marks.

Objectives:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
- To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- To explore supervised and unsupervised learning paradigms of machine learning.
- To exploring Deep learning technique and various feature extraction strategies.

Learning Outcomes:

At the end of this course students should be able to:

- Extract features that can be used for machine learning approach in various IOT applications and
- To get an insight of when to apply a particular machine learning approach.
- To mathematically analyze various machine learning approaches and paradigms.

Unit 1

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.

Unit 2

(Unsupervised Learning)Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Introduction to ICA, Evaluating Machine Learning algorithms and Model Selection.

Unit 3

Ensemble Methods (Boosting, Bagging and Random Forest), Modeling Sequence Problems, Time-Series Data, Deep Learning and Feature Representation Learning Forests.

Unit 4

An Introduction to some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Bayesian Learning and Inference.

References

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

MT-CSE-18-13(ii): Wireless Sensor Networks

Maximum marks: 150 (External: 100, Internal: 50)

Time: 3 hours **Credits: 4**

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of objective type/short-answer type questions covering the entire syllabus. In addition to question no. 1, the examiner is required to set eight more questions selecting two from each unit. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit. All questions will carry equal marks.

Objectives:

- To understand Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks.

Learning Outcomes:

At the end of this course students should be able to:

- Describe and explain radio standards and communication protocols for wireless sensor networks.
- Explain the function of the node architecture and use of sensors for various applications.
- Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.

Unit 1

Introduction to Wireless Sensor Networks: Introduction, Motivations, Applications, Issues and Challenges in designing sensor networks;

Sensor Network Architecture: Layered architecture, Unified Network Protocol Framework(UNPF), Clustered architecture, Low-Energy Adaptive Clustering Hierarchy (LEACH); Wireless Sensor Node architecture; Cross-layer designs

Unit 2

Medium Access Control Protocol design:Fixed Access, Random Access, WSN MAC protocols: synchronized, duty-cycled; SMACS, EAR; CSMA-Based MAC Protocols

Location Discovery:Indoor Localization, Sensor Network Localization

Unit 3

Security: Possible attacks, countermeasures, SPINS, Static and dynamic key Distribution, LEAP, INSENS

Evolving Standards: Energy-Efficient Design, Synchronization, Transport Layer Issues

Unit 4

Routing protocols for WSN: Resource-aware routing, Location- based protocols, Data-centric protocols, Hierarchical protocols, Mobility-based and Heterogeneity based protocols, Geographic Routing, Broadcast, Multicast; Data Dissemination, Data Gathering;

Quality of Sensor Network: Coverage, Exposure

References

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

MT-CSE-18-13(iii): Introduction to Intelligent Systems

Maximum marks: 150 (External: 100, Internal: 50)

Time: 3 hours **Credits: 4**

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of objective type/short-answer type questions covering the entire syllabus. In addition to question no. 1, the examiner is required to set eight more questions selecting two from each unit. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit. All questions will carry equal marks.

Objectives:

- To introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.
- To explore the essential theory behind methodologies for developing systems that demonstrate intelligent behavior including dealing with uncertainty, learning from experience and following problem solving strategies found in nature.

Learning Outcomes:

At the end of this course students should be able to:

- Demonstrate knowledge of the fundamental principles of intelligent systems and would be able to analyze and compare the relative merits of a variety of AI problem solving techniques.

Unit 1

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

Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

Unit 2

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. Optimization and search such as stochastic annealing and genetic algorithm.

Unit 3

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 4

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. Recent trends in Fuzzy logic, Knowledge Representation

References

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

MT-CSE-18-14(i): Data Science

Maximum marks: 150 (External: 100, Internal: 50)

Time: 3 hours **Credits: 4**

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Objectives:

- Provide you with the knowledge and expertise to become a proficient data scientist.
- It will demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
- One can critically evaluate data visualizations based on their design and use for communicating stories from data.

Learning Outcomes:

At the end of this course students should be able to:

- Explain how data is collected, managed and stored for data science.
- Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.

Unit 1

Introduction to Data Science: Big Data and Data Science Hype, Statistical Inference, Exploratory Data Analysis and Data Science Process, Data Science Toolkit, Types of data, Example applications of Data Science.

Unit 2

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data.

Mining Data Stream: The Stream Data Model, Sampling data is a stream, Filtering Streams, Counting distinct elements in a stream.

Unit 3

Page Rank: Definition, Structure of the Web, Avoiding Dead Ends, Spider traps and taxation, Using Page Rank in search engines. Page rank iteration using map reduce.

Introduction to machine learning models, Training sets, Approaches to machine learning. Machine learning architecture.

Unit 4

Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Techniques for Data Visualization. Introduction and implementation to SQL and Python.

References:

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

MT-CSE-18-14(ii): Distributed Systems

Maximum marks: 150 (External: 100, Internal: 50)

Time: 3 hours **Credits: 4**

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Objectives:

- To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems.

Learning Outcomes:

At the end of this course students should be able to:

- Design trends in distributed systems. It will help in applying network virtualization, remote method invocation and objects.

Unit 1

Introduction to distributed data processing and distributed database system; Advantages and disadvantages of DDBS; Types of DDBS, Promises and Complications in a distributed DBMS; Distributed DBMS architecture.

Unit 2

Distributed Database Design: Top-down design process, Designing Process and Issues, Fragmentation, Allocation, Database Integration: Schema Matching, schema integration, schema mapping. Data and access control: view management, data security, semantic integrity control.

Unit 3

Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data, Optimization of Distributed Queries: Centralized query optimization; Distributed Query optimization.

Unit 4

Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management, Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

Introduction and implementation to SQL and Python.

References

- Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
- Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

MT-CSE-18-14(iii): Advanced Wireless and Mobile Networks

Maximum marks: 150 (External: 100, Internal: 50)

Time: 3 hours **Credits: 4**

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Objectives:

- The students should get familiar with key concepts of wireless networks, standards, technologies, their basic operations and the future needs and challenges.
- To learn how to evaluate MAC and network protocols using network simulation software tools.
- The students should get familiar with the wireless/mobile market and the future needs and challenges.

Learning Outcomes:

At the end of this course students should be able to:

- Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
- Design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.

Unit 1

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

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 2

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 3

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22, Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview

Wireless PANsBluetooth AND Zigbee, Introduction to Wireless Sensor Networks

Unit 4

Security:Security requirements in wireless Networks, Issues and challenges, Vulnerabilities, Network security attacks, Secure routing in Ad Hoc Wireless Networks, Wi-Fi Security.

Advanced Topics:IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Ad-hoc Networks.

References

- Schiller J., Mobile Communications, Addison Wesley 2000
- Stallings W., Wireless Communications and Networks, Pearson Education 2005
- Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc 2002
- Yi Bing Lin and ImrichChlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc 2000
- Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200
- C.Siva Ram Murthy and B.S.Manoj, Ad Hoc Wireless Networks- Architecture and Protocols, Pearson Education 2004

MT-CSE-18-15: Research Methodology and IPR

Maximum marks: 150 (External: 100, Internal: 50)

Time: 3 hours **Credits: 3**

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Objectives:

- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Learning Outcomes:

At the end of this course students should be able to:

- Understand research problem formulation.
- Analyze research related information Follow research ethics

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, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 3

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 4

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 Computer Software.

References

- Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
- Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
- Ranjit Kumar, 2 nd Edition , “Research Methodology: A Step by Step Guide for beginners”
- Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
- Niebel , “Product Design”, McGraw Hill, 1974.
- Asimov , “Introduction to Design”, Prentice Hall, 1962.
- 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
- Mayall , “Industrial Design”, McGraw Hill, 1992.