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

Paper Code	Nomenclature of Paper	Scheme of Studies Per Week		Credits	External Marks		Internal Marks	Total Marks	
		L	P		Max.	Pass		Max.	Pass
Semester – II									
MT-CSE-18-21	Advance Algorithms	4	0	4	100	40	50	150	60
MT-CSE-18-22	Soft Computing	4	0	4	100	40	50	150	60
MT-CSE-18-23	Elective- III	4	0	4	100	40	50	150	60
MT-CSE-18-24	Elective- IV	4	0	4	100	40	50	150	60
MT-CSE-18-25	Laboratory- I (Advance Algorithms)	0	5	2.5	100	40	50	150	60
MT-CSE-18-26	Laboratory- II (Based on Electives)	0	5	2.5	100	40	50	150	60
MT-CSE-18-27	Mini Project with Seminar	2	0	2	100	40	50	150	60
MT-CSE-18-28	Audit Course	2	0	2	35	14	15	50	20
Total		**20**	**10**	**25**	**735**	**294**	**365**	**1100**	**440**

Elective III	Elective IV
MT-CSE-18-23(i): Data Preparation and Analysis MT-CSE-18-23(ii): Computer Vision MT-CSE-18-23(iii):Secure Software Design & Enterprise Computing	MT-CSE-18-24(i): Advanced Computer Architecture MT-CSE-18-24(ii): Human and Computer Interaction MT-CSE-18-24(iii): Digital Forensic

Audit Course: Students of affiliated Institutes/ Colleges are required to select any one paper out of option given below.
  I.   English for Research Paper Writing
  II.   Disaster Management
  III.   Sanskrit for Technical Knowledge
  IV.   Value Education
  V.   Constitution of India
  VI.   Pedagogy Studies
  VII.   Stress Management by Yoga
  VIII.   Personality Development through Life Enlightenment Skills.

Paper Code	Nomenclature of Paper	Scheme of Studies Per Week		Credits	External Marks		Internal Marks	Total Marks	
		L	P		Max.	Pass		Max.	Pass
Semester – III									
MT-CSE-18-31	Elective- V	4	0	4	100	40	50	150	60
MT-CSE-18-32	Dissertation-I / Industrial Project	0	20	10	250	100	100	350	140
MT-CSE-18-33	Audit Course	2	0	2	35	14	15	50	20
Total		**6**	**20**	**16**	**385**	**154**	**165**	**550**	**220**

Elective V

MT-CSE-18-31(i): Mobile Applications and Services
MT-CSE-18-31(ii): Compiler for HPC
MT-CSE-18-31(iii): Optimization Techniques

Audit Course: Students of affiliated Institutes/ Colleges are required to select any one paper out of option given below (Excluding the paper already studied in 2nd semester):
  I.   English for Research Paper Writing
  II.   Disaster Management
  III.   Sanskrit for Technical Knowledge
  IV.   Value Education
  V.   Constitution of India
  VI.   Pedagogy Studies
  VII.   Stress Management by Yoga
  VIII.   Personality Development through Life Enlightenment Skills.

Paper Code	Nomenclature of Paper	L	P	Credits	Max.	Pass	Internal	Max.	Pass
Semester – IV									
MT-CSE-18-41	Dissertation – II	0	32	16	350	140	100	450	180
Grand Total of All Semesters		**45**	**72**	**81**	**2170**	**868**	**980**	**3150**	**1260**

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

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**

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:
- 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, Anand Rajaraman 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**

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 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**

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 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 PANs Bluetooth 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 Imrich Chlamtac, 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**

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:
- 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.

MT-CSE-18-21: Advance Algorithms

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 algorithms and use it for a specific problem.
- To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
- Students should be able to understand different classes of problems concerning their computation difficulties.
- To introduce the students to recent developments in the area of algorithmic design.

Learning Outcomes:
At the end of this course students should be able to:
- Analyze the complexity/performance of different algorithms.
- Determine the appropriate data structure for solving a particular set of problems. Categorize   the different problems in various classes according to their complexity.
- Students should have an insight of recent activities in the field of the advanced data structure.

Unit 1
Sorting: Review of various sorting algorithms, topological sorting
Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Unit 2
Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.
Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

Unit 3
Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.
Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, UP-decomposition.

Unit 4
Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness.
Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation.
Extension to polynomials. Application: Interpolation problem.

References
- Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms"
- Aho, Hopcroft, Ullman, "The Design and Analysis of Computer Algorithms"
- Kleinberg and Tardos, "Algorithm Design"

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 soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing based solutions for real-world problems.
- To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
- To provide student an hand-on experience on MATLAB to implement various strategies.

Learning Outcomes:

At the end of this course students should be able to:
- Identify and describe soft computing techniques and their roles in building intelligent machines
- Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.

Unit 1

Introduction to Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

Unit 2

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, Implementation using Python/Matlab

Unit 3

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, Implementation using Python/ Matlab

Unit 4

Genetic Algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition, Implementation using Python/ Matlab

References
- Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, "Neuro:Fuzzy and Soft Computing", Prentice:Hall of India, 2003.
- George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic:Theory and Applications", Prentice Hall, 1995.

MT-CSE-18-23(i): Data Preparation and Analysis

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 prepare the data for analysis and develop meaningful Data Visualizations

Learning Outcomes:
At the end of this course students should be able to
- Extract the data for performing the Analysis.

Unit 1
Data Gathering and Preparation: High Cardinality Variable in Descriptive Stats, High Cardinality Variable in Predictive Modeling, Outliers, Type of outliers, Treatment of outliers Data formats, parsing and transformation, Scalability and real-time issues.

Unit 2
Data Cleaning: Consistency checking, Heterogeneous and missing data, Noisy Data, Data Cleaning as Process, Data Integration, Data Transformation and segmentation, Data Reduction, Data Cube Aggregation, Attribute Subset Selection, Concept hierarchy Generation.

Unit 3
Exploratory Analysis: Descriptive and comparative statistics, Clustering, Clustering Hierarchical and Partitioning methods, Constraint-Based Cluster Analysis, Association Mining Apriori Algorithm and Association to Correlations, Hypothesis Generation.

Unit 4
Visualization: Data Visualization techniques (for measurement and categorical data)-Interactive visualization techniques-Common misuses of data visualization- Techniques for Statistical Inference Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity.

References:
- Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt
- J Hanes, M. Kamber, "Data Mining Concepts and Techniques", Elsevier India.
- G.S. Linoff, M.J.A. Berry, "Data Mining Techniques", Wiley India Pvt. Ltd.
- A. Berson, S.J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw- Hill.

MT-CSE-18-23(ii): Computer Vision

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:
- Be familiar with both the theoretical and practical aspects of computing with images.
- Have described the foundation of image formation, measurement, and analysis
- Understand the geometric relationships between 2D images and the 3D world.
- Grasp the principles of state-of-the-art deep neural networks.

Learning Outcomes:

At the end of this course students should be able to:
- Developed the practical skills necessary to build computer vision applications
- To have gained exposure to object and scene recognition and categorization from images.

Unit 1

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis.

Unit 2

Edge detection, Edge detection performance, Hough transform, corner detection, Segmentation, Morphological filtering, Fourier transform.

Unit 3

Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data pre-processing.

Unit 4

Pattern Analysis; Clustering: K-Means, K-Medoids, Mixture of Gaussians.

Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised.

Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.

References
- Richard Szeliski, "Computer Vision: Algorithms and Applications"
- Goodfellow, Bengio, and Courville, "Deep Learning"
- Fisher et al., "Dictionary of Computer Vision and Image Processing"

MT-CSE-18-23(iii): Secure Software Design & Enterprise Computing

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 fix software flaws and bugs in various software and to make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic.
- To understand Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

Learning Outcomes:

At the end of this course students should be able to:
- Differentiate between various software vulnerabilities.
- Understand software process vulnerabilities for an organization.
- Monitor resources consumption in a software.
- Interrelate security and software development process.

Unit 1

Secure Software Design: Identify software vulnerabilities, Software Design Threats and Mitigations, perform software security analysis, Perform security testing and quality assurance.

Unit 2

Enterprise Application Development: Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system.

Unit 3

Enterprise Systems Administration: Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

Unit 4

Obtain the ability to manage and troubleshoot a network running multiple services. Handle insecure exceptions and command/SQL injection, SQL injection attack, Defend web and mobile applications against attackers.

References
- Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.
- Engineering Safe and Secure Software Systems by C.Warren Axelrod
- Enterprise Software Security: A Confluence of Disciplines by Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters and Diana L. Burley

MT-CSE-18-24(i): Advanced Computer Architecture

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 objective of this course is to provide in-depth coverage of current and emerging trends in Advanced Computer Architectures with emphasis on system design and performance.
- It focuses on instruction, data & thread level parallelisms and improvements in performance of memory hierarchy.

Learning Outcomes

At the end of this course students should be able to:
- Know the classes of computers, and new trends and developments in computer architecture
- Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.
- Understand exploiting ILP using dynamic scheduling, multiple issue, and speculation.
- Understand data-level parallelism in vector, SIMD and GPU architectures.
- Understand multithreading by using ILP and supporting thread-level parallelism (TLP).
- Understand warehouse scale computers to exploit request-level & data level parallelism.
- Understand multiprocessor cache coherence using the directory based and snooping class of protocols.
- Understand the several advanced optimizations to achieve cache performance.
- Understand virtual memory and virtual machines.

Unit 1

Instruction Level Parallelism (ILP): Concepts & Challenges, Data Dependences and Hazards, Control Dependences; Basic Compiler Techniques for Exposing ILP – Basic Pipeline Scheduling and Loop Unrolling, Reducing Branch Costs with Advanced Branch Prediction, Overcoming Data Hazardous with Dynamic Scheduling, Tomasulo's Approach, Hardware Based Speculation; Exploiting ILP Using Multiple Issue and Static Scheduling – VLIW & Superscalar Processors, Advanced Techniques For Instruction Delivery and Speculation.

Unit 2

Data Level Parallelism in Vector, SIMD & GPU Architectures: Vector Architecture – Working of Vector Processors, Vector Execution Time, Multiple Lanes, Vector Registers, Memory Banks, Stride, Gather Scatter; SIMD Instruction Set Extensions for Multimedia; Graphics Processing Units, Vector Architecture V/S GPUs, Multimedia SIMD V/S GPUs; Detecting and Enhancing Loop-Level Parallelism – Finding Dependences, Eliminating Dependent Computations.

Thread-Level Parallel Parallelism: Multiprocessor Architecture – Centralized Shared-Memory Architectures, Cache Coherence Problem, Schemes Enforcing Coherence, Snooping Coherence Protocol; Extensions to basic coherence protocol; Distributed Shared-Memory and Directory-Based Coherence

Unit 3

Warehouse-Scale Computers (WSC) to Exploit Request-Level and Data-Level Parallelism: WSC V/S Servers, Programming Models and Workloads for WSC, Architecture of Warehouse-Scale Computers, Physical Infrastructure and Costs of WSC.

Memory Hierarchy: Basics of Memory Hierarchy, Optimization of Cache Performance, Memory Technology & Optimizations, Virtual Memory – Fast Address Translation, Selecting Page Size, Protection of Virtual Memory

Unit 4

MIMD Architectures: Architectural Concepts of Distributed & Shared Memory MIMD Architectures (UMA, NUMA, COMA, CC-NUMA); Interconnection Networks – Direct Interconnection Networks (Linear Array,

Ring, Star, 2D Mesh, Hyper Cubes), Switching Techniques; Dynamic Interconnection Networks (Shared Bus, Crossbar, Multistage Networks); Specifications of Top Three Super Computers of Top500 List.

References

- Hennessy J.D., Patterson D.A., "Computer Architecture: A Quantitative Approach", 5th Ed., MK, 2012.
- Sima D., Fountain T., Kasuk P., "Advanced Computer Architectures - A Design Space Approach," Pearson Education, 1997.
- Hesham El-Rewini, Mostafa Abd-El-Barr, "Advanced Computer Architecture and Parallel Processing", Wiley India Pvt. Ltd.
- Kai Hwang, "Advanced computer architecture – Parallelism, Scalability, Programmability", Tata McGraw Hill, 2001.
- Rajaraman V. & Murthy C.S.R., "Parallel Computer: Architecture & Programming", PHI Learning.
- David Culler, "Parallel Computer Architecture", 1st Ed., Elsevier India.
- Stallings W., "Computer Organization and Architecture", 10th Ed., Pearson Education.

MT-CSE-18-24(ii): Human and Computer Interaction

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:
- Learn the foundations of Human Computer Interaction
- Be familiar with the design technologies for individuals and persons with disabilities
- Be aware of mobile Human Computer interaction.
- Learn the guidelines for user interface

Learning Outcomes:

At the end of this course students should be able to:
- Understand the structure of models and theories of human computer interaction and vision.
- Design an interactive web interface on the basis of models studied.

Unit 1

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 2

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 3

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

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 4

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

References
- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
- Brian Fling, "Mobile Design and Development", First Edition , O Reilly Media Inc., 2009
- Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O Reilly, 2009.

MT-CSE-18-24(iii): Digital Forensic

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:
- Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
- Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools

Learning Outcomes:

At the end of this course students should be able to
- Understand relevant legislation and codes of ethics.
- Understand Computer forensics and digital detective and various processes, policies and procedures E-discovery, guidelines and standards, E-evidence, tools and environment.

Unit 1

Digital Forensics Science: Forensics science, computer forensics and digital forensics.

Computer Crime: Analysis of cyber-criminalistics area, holistic approach to cyber-forensics

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications.

Unit 2

Evidence Management & Presentation: Discuss the importance of understanding what court documents would be required for a criminal investigation, Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

Unit 3

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, and complete a case, Critique a case,

Network Forensics: open-source security tools for network forensic analysis, Requirements for preservation of network data.

Unit 4

Mobile Forensics: mobile forensics techniques, mobile forensics tools.

Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

References
- John Sammons, The Basics of Digital Forensics, Elsevier
- John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

MT-CSE-18-31(i): Mobile Applications and Services

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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives:

- This course presents the two main mobile platforms and their ecosystems, namely Android and iOS.
- To explore emerging technologies and tools used to design and implement feature-rich mobile applications for smartphones and tablets
- It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile

Learning Outcomes:

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

- Identify the target platform and users and be able to define and sketch a mobile application
- Understand the fundamentals, frameworks, and development life cycle of mobile application platforms of Android
- Design and develop a mobile application prototype

Unit 1

Introduction to Mobile Applications, Factors in Developing Mobile Applications, Frameworks and Tools, Introduction to Android Development Environment, Generic UI Development Android User, Basics of Android, Importance and scope, Android Architecture, Android Stack, Android Applications Structure, Android Emulator, Android SDK, Overview of Android Studio, Android and File Structure, Android Virtual Device Manager

Unit 2

More on Uis: Building a User Interface, TextView, EditText, Check Boxes, Radio Buttons, The Spinner, ArrayAdapter, DatePicker, Text-to-Speech Techniques, Fragments and Multi-platform development, Creating Widgets: Layouts, Canvas Drawing, Shadows, Gradients; Handling database in Android, Android Storing and Retrieving Data, Working with a Content Provider

Unit 3

Android Applications: Various life cycles for applications; Location and Mapping: location based services, Mapping, Google Maps activity, Working with MapView and MapActivity; Playing and Recording of Audio and Video in application; Sensors and Near Field Communication; Building client server applications.

Unit 4

Preparing for publishing, Signing and preparing the Application, Publishing to the Android Market
Introduction to iPhone OS and iOS, Apple iPhone Platform, UI tool kit interfaces, Event handling and Graphics services, Layer Animation. Overview of Cross-platform application development.

References

- Wei-Meng Lee, "Beginning Android™ 4 Application Development " John Wiley & Sons
- Zigurd Mednieks, Laird Dornin, G,Blake Meike and Masumi Nakamura "Programming Android", O'Reilly Publications.
- Pradeep Kothari, "Android Application Development: Black Book", Wiley India Ltd.
- Wei-Meng Lee, "Beginning iPhone SDK Progrmming with Objective-C", Wiley India Ltd.
- James C.S. "Android Application development", CENGAGE Learning.

MT-CSE-18-31(ii): Compiler for HPC

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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives
- To introduce structure of compilers and high performance compiler design for students.
- To discuss concepts of cache coherence and parallel loops in compilers.

Learning Outcomes:
At the end of this course students will be able to:
- Understand the structure of compiler.
- Understand parallel loops, data dependency and exception handling and debugging in compiler.

Unit 1
High Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance, Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph.

Unit 2
Scalar Analysis with Factored Use-Def Chains: Constructing Factored UseDef Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays. Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis.

Unit 3
Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations. Optimizing for Locality: Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality.

Unit 4
Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from for all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.

References
- Michael Wolfe, High-Performance Compilers for Parallel Computing, Pearson
- John Levesque, Gene Wagenbreth, High Performance Computing: Programming and Applications (Chapman & Hall/CRC Computational Science) 1st Edition

MT-CSE-18-31(iii): Optimization Techniques

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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives:
- To provide insight to the mathematical formulation of real world problems.
- To optimize these mathematical problems using nature based algorithms. And the solution is useful especially for NP-Hard problems.

Learning Outcomes:
At the end of this course students will be able to:
- Formulate optimization problems.
- Understand and apply the concept of optimality criteria for various types of optimization problems.
- Solve various constrained and unconstrained problems in Single variable as well as multivariable.
- Apply the methods of optimization in real life situation.

Unit 1
Engineering application of Optimization, Formulation of design problems as mathematical programming problems.
General Structure of Optimization Algorithms, Constraints, The Feasible Region

Unit 2
Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.

Unit 3
Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

Unit 4
Real life Problems and their mathematical formulation as standard programming problems. Applications of Optimization Algorithms.

References:
- Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366-9.
- Practical Optimization Algorithms and Engineering Applications Andreas Antoniou.
- An Introduction to Optimization Edwin K., P. Chong & Stanislaw h. Zak.
- Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. Dynamic Ideas. ISBN 978-0-9759146-2-5.
- John K. Karlof (2006). Integer programming: theory and practice.CRC Press. ISBN 978-0-8493-1914-3.
- H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387-92279-9.
- 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.
- Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser; William R. 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.

AUDIT COURSE: (i) English For Research Paper Writing

Maximum marks: 50 (External: 35, Internal: 15)

Time: 3 hours   **Credits: 2**

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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives:
- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title
- Ensure the good quality of paper at very first-time submission

Learning Outcomes:

At the end of this course students will be able to:
- Write good quality papers.

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit 2

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions useful phrases, how to ensure paper is as good as it could possibly be the 4 first- time submission.

References:
- Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
- Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
- Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
- Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

AUDIT COURSE: (ii) Disaster Management

Maximum marks: 50 (External: 35, Internal: 15)

Time: 3 hours   **Credits: 2**

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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives:
- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches.

Learning Outcomes:

At the end of this course students will be able to:
- Handle disaster situation in a better way.

Unit 1

Introduction: Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Disaster Prone Areas In India: Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

Unit 2

Disaster Preparedness And Management: Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Risk Assessment: Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co- Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

References:
- R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
- Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
- Goel S. L., Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

AUDIT COURSE: (iii) Sanskrit For Technical Knowledge

Maximum marks: 50 (External: 35, Internal: 15)

Time: 3 hours   **Credits: 2**

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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives:
- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Learning Outcomes:

At the end of this course students will be able to:
- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

Unit 1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences Order, Introduction of roots

Unit 2

Technical information about Sanskrit Literature, Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

References:
- "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
- "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
- "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Maximum marks: 50 (External: 35, Internal: 15)
Time: 3 hours   **Credits: 2**
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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives:
- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Learning Outcomes:
At the end of this course students will be able to:
- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

Unit 1
Values and self-development –Social values and individual, attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements. Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature ,Discipline.

Unit 2
Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation Doing best for saving nature Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

References:
- Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

AUDIT COURSE: (v) Constitution Of India
Maximum marks: 50 (External: 35, Internal: 15)
Time: 3 hours **Credits: 2**
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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Learning Outcomes:
At the end of this course students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics. Discuss the passage of the Hindu Code Bill of 1956.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

Unit 1
History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)
Philosophy of the Indian Constitution: Preamble, Salient Features
Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality ,Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Unit 2
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected, Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy. Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References:
- The Constitution of India, 1950 (Bare Act), Government Publication.
- Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
- M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
- D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AUDIT COURSE: (vi) Pedagogy Studies

Maximum marks: 50 (External: 35, Internal: 15)

Time: 3 hours   **Credits: 2**

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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives:
- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Learning Outcomes:

At the end of this course students will be able to:
- Understand what pedagogical practices are being used by teachers in formal and informal classrooms in developing countries and what is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- Understand how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and Terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education. Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Unit 2

Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies. Professional development: alignment with classroom practices and follow- up support Peer support Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

References:

- Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
- Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
- Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
- Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
- Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
- Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
- www.pratham.org/images/resource%20working%20paper%202.pdf.

Maximum marks: 50 (External: 35, Internal: 15)

Time: 3 hours   **Credits: 2**

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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives:
- To achieve overall health of body and mind
- To overcome stress

Learning Outcomes:

At the end of this course students will be able to:
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

Unit 1

Definitions of Eight parts of yog. (Ashtanga), Yam and Niyam. Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit 2

Asan and Pranayam, i) Various yog poses and their benefits for mind & body, ii)Regularization of breathing techniques and its effects-Types of Pranayam

References:
- 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
- "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

AUDIT COURSE: (viii) Personality Development Through Life Enlightenment Skills

Maximum marks: 50 (External: 35, Internal: 15)

Time: 3 hours   **Credits: 2**

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 four 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 two questions from each Unit. All questions will carry equal marks.

Objectives:
- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Learning Outcomes:

At the end of this course students will be able to:
- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students.

Unit 1

Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses- 71,73,75,78 (do's) Approach to day to day work and duties. Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.

Unit 2

Statements of basic knowledge. Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63.

References:
- "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram Publication Department), Kolkata
- Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
- Rashtriya Sanskrit Sansthanam, New Delhi.