BIKANER TECHNICAL UNIVERSITY, BIKANER
बीकानेर तकनीकी विश्वविद्यालय, बीकानेर

COURSE SCHEME AND SYLLABUS

M. TECH.
COMPUTER ENGINEERING

M. Tech.
Computer Engineering
Teaching and Examination Scheme
1st Year –I Semester

THEORY												
SN	**Category**	**Course**		**Contact hrs/week**			**Marks**				**Cr**
		Code	**Title**	**L**	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**	
1	PCC	1CSMCE1-01	Mathematical Foundations of Computer Science	3	-	-	3	20	80	**100**	**3**
2		1CSMCE1-02	Advance Data Structures	3	-	-	3	20	80	**100**	**3**
3		1CSMCE1-03	Advanced Database Management System	3	-	-	3	20	80	**100**	**3**
4	PEC-I	1CSMCE2-04	Data Science	3	-	-	3	20	80	**100**	**3**
		1CSMCE2-05	Distributed System								
		1CSMCE2-06	Wireless and Mobile Network								
		1CSMCE2-07	…….								
5	PEC-II	1CSMCE2-08	Machine Learning	3	-	-	3	20	80	**100**	**3**
		1CSMCE2-09	Intelligent system								
		1CSMCE2-10	Sensor Network and IoT								
		1CSMCE2-11	……								
6	OES	1CSMCE3-12	Human Values and Professional Ethics	2	-	-	3	20	80	**100**	**2**
			Sub Total	17						**600**	**17**
PRACTICAL & SESSIONAL											
7	PCC	1CSMCE1-13	Programming Lab	-	-	2	-	60	40	**100**	**2**
8	FW	1CSMCE4-14	Field Work	-	-	2	-	60	40	**100**	**2**
9	AC	1CSMCE5-15	Human Values Practice School	-	-	2	-	30	20	**-**	**-**
			Sub- Total			6				**200**	**4**
			TOTAL OF I SEMESTER	17		6				**800**	**21**

M. Tech.
Computer Engineering
Teaching and Examination Scheme
1st Year –II Semester

THEORY												
SN	**Category**	**Course**		**Contact hrs/week**			**Marks**				**Cr**
		Code	**Title**	**L**	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**	
1	PCC	2CSMCE1-01	Data Mining and Business Intelligence	3	-	-	3	20	80	**100**	**3**
2		2CSMCE1-02	Soft Computing	3	-	-	3	20	80	**100**	**3**
3		2CSMCE1-03	Advanced Computer Networks and Internet Architectures	3	-	-	3	20	80	**100**	**3**
4	PEC-I	2CSMCE2-04	Deep Learning	3	-	-	3	20	80	**100**	**3**
		2CSMCE2-05	Secure Software Design & Enterprise Computing								
		2CSMCE2-06	Computer Vision								
		2CSMCE2-07	……								
5	PEC-II	2CSMCE2-08	Human and Computer Interaction	3	-	-	3	20	80	**100**	**3**
		2CSMCE2-09	Cloud Computing								
		2CSMCE2-10	Digital Forensics								
		2CSMCE2-11	……								
6	OES	2CSMCE3-12	Research Methodology	2	-	-	3	20	80	**100**	**2**
			Sub Total	17						**600**	**17**
PRACTICAL & SESSIONAL											
7	PCC	2CSMCE1-13	Network Simulation Laboratory	-	-	2	-	60	40	**100**	**2**
8	FW	2CSMCE4-14	Field Work	-	-	2	-	60	40	**100**	**2**
			Sub- Total			4				**200**	**4**
			TOTAL OF II SEMESTER	17		4				**800**	**21**

L: *Lecture,* ***T:*** *Tutorial,* ***P:*** *Practical,* ***Cr:*** *Credits,*
ETE: *End Term Exam,* ***IA:*** *Internal Assessment*

PCC: Program Core Courses
PEC: Program Elective Courses
Electives Courses (3-4Nos.) should be relevant to the chosen specialization/branch
OES: Other Emerging Subjects: (i) Human Values and Professional Ethics
(ii) Research Methodology
It is decided common for all branches.
FW: Field Work
Student is required to work in the organization/industry concerned with his/her course.
AC: Audit Course
It is mandatory to pass the audit course. However, credit shall not be awarded.

2nd Year – III Semester

PRACTICAL & SESSIONAL											
SN	**Category**	**Course**		**Contact hrs/week**			**Marks**				**Cr**
		Code	**Title**	**L**	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**	
1	PSD	3CSMCE6-16	Industrial/Field Project	-	-	28	-	360	240	**600**	**14**
2	PSD	3CSMCE6-17	Seminar	-	-	4	-	60	40	**100**	**2**
		TOTAL OF III SEMESTER				32				**700**	**16**

PSD: Industrial/Field Project, Seminar, Dissertation

2nd Year – IV Semester

PRACTICAL & SESSIONAL											
SN	**Category**	**Course**		**Contact hrs/week**			**Marks**				**Cr**
		Code	**Title**	**L**	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**	
1	PSD	4CSMCE6-18	Dissertation	-	-	32	-	420	280	**700**	**16**
		TOTAL OF IV SEMESTER				32				**700**	**16**

M. Tech.
Computer Engineering
1st Year –I Semester

1CSMCE1-01: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

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

Random samples, sampling distributions of estimators**,** Methods of Moments and Maximum Likelihood**.**

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

Graph Theory: Isomorphism, Planar graphs, graph colouring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition.

Specialized techniques to solve combinatorial enumeration problems

Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.

Suggested Readings:

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

1CSMCE1-02: ADVANCED DATA STRUCTURES

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

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

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.

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

Suggested Readings:

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

1CSMCE1-03: ADVANCED DATABASE MANAGEMENT SYSTEMS

Advanced SQL: SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features.

Object-Based Databases and XML: Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Oriented versus Object-Relational, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications.

Query Processing and Query Optimization: Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems

Database-System Architectures: Centralized and Client –Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types, Parallel Databases, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Design of Parallel Systems.

Distributed Databases: Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases

Suggested Readings:

1. Silberchatz, Korth, Sudershan,"Database System Concepts", Tata MC Graw Hills Publishing, 5th Edition, 2005
2. Ramez Elmasri & Shamkant Navathe, "Database Management Systems", Pearson Education Asia, 6th Edition, 2010
3. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, 3rdEdition 2004
4. N.Tamer Ozsu, Patrick Valduriez, "Principles of Distributed Database Systems", Prentice Hal International Inc., 1999 4. Carlo Zaniolo, Stefano Ceri, Christos Faloustsos, R.T.Snodgrass, V.S.Subrahmanian, "Advanced Database Systems", Morgan Kaufman Series, 1997

1CSMCE2-04: DATA SCIENCE

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

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

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

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

Applications of Data Science, Technologies for visualization, Bokeh (Python)

Suggested Readings:

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

1CSMCE2-05: DISTRIBUTED SYSTEMS

Introduction to Distributed Systems, Design Goals, Types of Distributed systems, system architectures and fundamental models, middleware, Threads, virtualization, client-Server Model, Code migration .

Communication fundamentals, Remote Procedure Call, message oriented communication, and stream oriented communication, multicast communication.

Synchronization: clock synchronization, logical clocks, mutual exclusion algorithms: centralized, decentralized, distributed and token ring algorithms, election algorithms.

Replication management: need for replication, consistency models: data centric and client centric consistency models, replica management, consistency protocols: continuous, primary-based, replicated-write and cache-coherence protocols.

Fault tolerance: basic concepts and failure models, process resilience, reliable client-server and group communication, distributed commit recovery mechanisms. Security in distributed systems, secure channels, authentication, integrity and confidentiality, access control, security management.

Suggested Readings:

1. Distributed Systems, Principles and Paradigms, 2nd edition by Andrew S. Tanenbaum and Maarteen Van Steen, Pearson Education, (ISBN-13: 978- 0132392273), 2013 IT-89
2. Distributed System: Concepts and Design, 5th edition by Coulouris, Dollimore, Kindberg,Pearson Ed, (ISBN-13: 978-0132143011), 2013
3. Distributed Algorithms: Principles, Algorithms, and Systems by A. D. Kshemkalyani and M. Singhal, (ISBN-13: 978-0521189842) , 2013

1CSMCE2-06: WIRELESS AND MOBILE NETWORKS

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. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues.

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.

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

WIRELESS SENSOR NETWORKS : Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.

WIRELESS PANs : Bluetooth AND Zigbee, Introduction to Wireless Sensors.

SECURITY : Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.

Suggested Readings:

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

1CSMCE2-08: MACHINE LEARNING

Introduction to Machine Learning: Overview of different tasks: classification, regression, clustering, control, Concept learning, information theory and decision trees.

Supervised Learning: Decision trees, nearest neighbors, linear classifiers and kernels, neural networks, linear regression; Support Vector Machines.

Unsupervised Learning: Clustering, Expectation Maximization, Dimensionality Reduction, Feature Selection, PCA, factor analysis, manifold learning.

Reinforcement Learning: Value iteration; policy iteration; TD learning; Q learning; actor-critic.

Other Topics: Bayesian learning, online learning. Learning theory, Bias Variance trade-offs

Suggested Readings:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Introduction to Machine Learning, Alpaydin, E., MIT Press, 2004
3. Machine Learning, Tom Mitchell, McGraw Hill, 1997.
4. Elements of Machine Learning, Pat Langley Morgan Kaufmann Publishers, Inc. 1995. ISBN 1-55860-301-8

1CSMCE2-09: INTELLIGENT SYSTEMS

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

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

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.

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.
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.

Suggested Readings:

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

1CSMCE2-10: SENSOR NETWORKS AND INTERNET OF THINGS

Introduction and Applications: smart transportation, smart cities, smart living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security.

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Real-World Design Constraints- Introduction, Technical Design constraints hardware, Data representation and visualization, Interaction and remote control.

Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, **Commercial Building Automation-** Introduction, Case study: phase one- commercial building automation today, Case study: phase two- commercial building automation in the future. Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control,

Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases

IOT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device Board, Linux on Raspberry , Interface and Programming & IOT Device

Suggested Readings:

1. Mandler, B., Barja, J., Mitre Campista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publishing

1CSMCE3-12: HUMAN VALUES AND PROFESSIONAL ETHICS

Need, Basic Guidelines, Content And Process For Value Education:
Understanding the need, basic guidelines, Self Exploration - its content and process; 'Natural Acceptance' and Experiential Validation, Continuous Happiness and Prosperity- Human Aspirations, Right understanding, Relationship and Physical Facilities, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Understanding Harmony in the Human Being - Harmony in Myself:
Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha Understanding the Body as an instrument of 'I', Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship:
Understanding harmony in the Family, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) , meaning of Vishwas; Difference between intention and competence, meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals ,Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family.

Understanding Harmony in the Nature and Existence - Whole Existence as Coexistence:
Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all pervasive Space. Holistic perception of harmony at all levels of existence

Implications of the Above Holistic Understanding of Harmony on Professional Ethics - Natural Acceptance of Human Values:
Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers. Case studies related to values in professional life and individual life.

Suggested Readings:

1. R. R. Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, 2009. ISBN: 978-9-350-62091-5
2. R. Subramanian, Professional Ethics includes Human Values, Oxford Univ. Press.
3. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
4. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
5. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
6. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

1CSMCE1-13: PROGRAMMING LAB

Experiment 1. Write a program to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions use the following collision resolution techniques,

A. Linear probing

B. Quadratic probing

C. Random probing

D. Double hashing/rehashing Implement the above program using hash function from (i)Division methods, (ii)Truncation methods (iii)Folding methods

Experiment 2. Write a program to perform string matching using Rabin-Karp algorithm.

Experiment 3. Write a program to perform string matching using Finite Automata.

Experiment 4. Write a program to perform string matching using Knuth-Morris-Pratt algorithm.

Experiment 5. Write a program to perform string matching using Boyer-Moore algorithm.

Experiment 6. Write a program for Binary Search Tree to implement following operations:

a. Insertion

b. Deletion

i. Delete node with only child

ii. Delete node with both children

c. Finding an element

d. Finding Min element

e. Finding Max element

f. Left child of the given node

g. Right child of the given node

h. Finding the number of nodes, leaves nodes, full nodes, ancestors, descendants.

Experiment 7. Write a program to implement Inorder Threaded Binary Tree with insertion and deletion operation.

Experiment 8. Write a program to implement Preorder Threaded Binary Tree with insertion and deletion operation.

Experiment 9. Write a program to implement Postorder Threaded Binary Tree with insertion and deletion operation.

Experiment 10. Write a program to transform BST into Threaded Binary Tree.

Experiment 11. Write a program for AVL Tree to implement following operations: (For nodes as integers)

a. Insertion: Test program for all cases (LL, RR, RL, LR rotation)

b. Deletion: Test Program for all cases (R0, R1, R-1, L0, L1, L-1)

c. Display: using set notation.

Experiment 12. Write a program to implement Red-Black trees with insertion and deletion operation for the given input data as Strings.

Experiment 13. Write a program to transform BST into AVL trees and also count the number rotations performed.

Experiment 14. Write a program to find the black height of any given node in Red-Black tree and find the black height of the Red-Black tree.

Experiment 15. Write a program to implement insertion, deletion, display and search operation in m-way B tree (i.e. a non-leaf node can have at most m children) for the given data as integers (Test the program for m=3, 5, 7).

1CSMCE4-14: FIELD WORK

Student is required to work in the organization/industry concerned with his/her course.

1CSMCE5-15: HUMAN VALUES PRACTICE SCHOOL

This practice school in first semester will have two parts -

I. Industry Interaction

In this, students will start his industry interaction in the very first semester of the M.Tech. Course. He/ She has to visit an organization for 3 hours /week in any industry finalized/selected by competent authority. This interaction will give him feel and insight to the real time working.

A. This 3 hours /work will be after the classroom studies
B. Selection criteria of organisation-
   1. Have turnover more than 20 lakhs
   2. Have more than 20 employees

C. During these hours, student will observe following points in the organisation:
   1. Organisational structure and hierarchy
   2. Different kind of jobs/works done by the employees at all levels in the company
   3. Working of different departments
   4. Types of skills require to work in an organisation
   5. Ways of internal and external communication
   6. Formal dressing and attitude
   7. Coordination and team work

II. Social Responsibility

To make students understand his role and responsibility in society & nature and co-existence as whole, student has to take an initiative towards contribution in any relevant social and environmental issue.

A. This work will be performed after the time of regular classes

B. Student will perform one or more of the following activities after the approval of mentor and HOD:
   1. Making contribution in increasing the income of any street vender or any needy person from under privileged section
   2. Cleanliness Campaign
   3. Donation of his/her belongings which is of no use to him/her to needy ones
   4. Plantation and care for nature (soil, natural resources, plants and animals)
   5. Girl child and women safety, education and empowerment.
   6. Blood donations and help of needy people at hospitals

7. Helping the under – privileged section of the society
8. Educating the street children or in schools when and where needed.
9. Nukkad Natak on any topic of social or environmental concern.
10. Any other relevant activities.

2CSMCE1-01: DATA MINING AND BUSINESS INTELLIGENCE

Introduction: Evolution and importance of Data Mining-Types of Data and Patterns mined Technologies-Applications-Major issues in Data Mining. Knowing about Data- Data Preprocessing: Cleaning– Integration–Reduction–Data transformation and Discretization.

Data Warehousing: Basic Concepts-Data Warehouse Modeling- OLAP and OLTP systems - Data Cube and OLAP operations–Data Warehouse Design and Usage-Business Analysis Framework for Data Warehouse Design- OLAP to Multidimensional Data Mining. Mining Frequent Patterns: Basic Concept – Frequent Item Set Mining Methods – Mining Association Rules – Association to Correlation Analysis.

Classification and Predication: Issues - Decision Tree Induction - Bayesian Classification – Rule Based Classification – kNearest mining Classification. Prediction –Accuracy and Error measures.

Clustering: Overview of Clustering – Types of Data in Cluster Analysis – Major Clustering Methods.

Introduction to BI -BI definitions and concepts- BI Frame work-Basics of Data integration Introduction to Business Metrics and KPI - Concept of dash board and balance score card. Tool for BI: Microsoft SQL server: Introduction to Data Analysis using SSAS tools Introduction to data Analysis using SSIS tools- Introduction to Reporting Services using SSRS tools- Data Mining Implementation Methods.

Suggested Readings:

1. Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining Concepts and Techniques”, Third Edition, Elsevier Publisher, 2006.
2. K.P.Soman, Shyam Diwakar and V.Ajay, “Insight into Data Mining Theory and Practice”, PHI of India, 2006.
3. Loshin D, “Business Intelligence”, First Edition, Elsevier Science, 2003.
4. Darren Herbold, Sivakumar Harinath, Matt Carroll, Sethu Meenakshisundaram, Robert Zare and Denny Guang-Yeu Lee, “Professional Microsoft SQL Server Analysis Services 2008 with MDX”, Wrox, 2008.
5. Brian Knight and Erik Veerman, Grant Dickinson and Douglas Hinson, “Professional SQL Server 2008 Integration Services”, Wiley Publishing, Inc, 2008

2CSMCE1-02: SOFT COMPUTING

Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptrons, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Non specificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets

Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

Evolutionary Computing: Introduction, Evolutionary Techniques, Swarm Intelligence, Bacterial Foraging, Ant Colony Optimization, and Genetic Algorithm.

Suggested Readings:

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing, Prentice:Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications, Prentice Hall, 1995.
3. “An Introduction to Neural Networks”, Anderson J.A., PHI, 1995
4. “An Introduction to Genetic Algorithm”, Melanie Mitchell, PHI, 1997
5. MATLAB Toolkit Manual

CSMCE1-03: ADVANCED COMPUTER NETWORKS AND INTERNET ARCHITECTURES

Introduction: Overview of Computer Networks, Categories of Computer Networks, Physical Topologies, Seven Layer Architecture, TCP/IP Protocol Suite, Network Models: Internet, Ethernet, Wireless LANs; Network Standardization. Transmission media: Fiber Optics; Wireless Transmission: Radio, Microwave, Infrared, Millimeter Waves, Light wave; Satellite; Mobile Telephone System; Cable Television.

Data link layer: Multiple Access and LAN Technologies: Random Access, ALOHA, CSMA, CSMA/CD, CSMA/CA, Ethernet, IEEE Standards, IEEE 802.11: Architecture, MAC Sub layer. Wireless LANs, Broadband Wireless, Bluetooth, Bridges. Network Layer: Routing: Broadcast, Multicast, Routing for Mobile Hosts, Ad Hoc Networks; Congestion; Quality of Service. IP Addressing: Network layer level protocols: IPv4, IPv6.

Advanced Internetworking and Routing: Circuit Switching, Packet Switching, Routing Protocols, Address Mapping: ARP, RARP, ICMP, IGMP. Transport Layer: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Wireless TCP and UDP. Congestion Control, Quality of Service (QOS), Integrated Services.

Network Applications: Electronic Mail Representation and Transfer, World Wide Web; Multimedia: Digital Audio; Audio Compression; Streaming IP Telephony (VoIP), Video Compression; Video on Demand; Multicast Backbone; File Transfer and Remote File Access, Network Management (SNMP).

Internet Architectures- Flow of traffic and routing behavior within Internet, Application of Qos models, application of new resilient designs. Understanding of control and data planes in high end Internet core routers, CEF, hardware packet flows. MPLS, labels, label stacking, packet analysis, RSVP, label allocation, distribution models. MPLS-VPNs- Detailed understanding of MPLS L3 VPNS, routing model employed, forwarding of mplsvpn packets, VRF tables, application scenarios.

Suggested Readings:

1. Forouzan,B.A, 2009, Data Communications and Networking, 4th Edition, Tata McGraw Hill Education.
2. Tanenbaum, A.S , 2010, Computer Networks, 3rd Edition, Pearson Education.
3. Douglas E. Comer, Internet Working with TCP/IP Volume – I, Fifth Edition, Prentice Hall, 2008.
4. W. Richard Stevens, Bill Fenner and Andrew M. Rudoff, Unix Network Programming, Vol.1: The Sockets Networking API, Third Edition, Addison-Wesley Professional, 2003.

2CSMCE2-04: DEEP LEARNING

Neural Networks basics - Binary Classification, Logistic Regression, Gradient Descent, Derivatives, Computation graph, Vectorization, Vectorizing logistic regression – Shallow neural networks: Activation functions, non-linear activation functions, Back propagation, Data classification with a hidden layer .

Deep Neural Networks: Deep L-layer neural network, Forward and Backward propagation, Deep representations, Parameters vs Hyper parameters, Building a Deep Neural Network (Application).

Supervised Learning with Neural Networks – Practical aspects of Deep Learning: Train/Dev / Test sets, Bias/variance, Overfitting and regularization, Linear models and optimization, Vanishing/exploding gradients, Gradient checking – Logistic Regression, Convolution Neural Networks, RNN and Back propagation – Convolutions and Pooling.

Optimization algorithms: Mini-batch gradient descent, exponentially weighted averages, RMS prop, Learning rate decay, problem of local optima, Batch norm – Parameter tuning process.

Neural Network Architectures – Recurrent Neural Networks, Adversarial NN, Spectral CNN, Self-Organizing Maps, Restricted Boltzmann Machines, Long Short-Term Memory Networks (LSTM) and Deep Reinforcement Learning – Tensor Flow, Keras or MatConvNet for implementation.

Suggested Readings:

1. Deep Learning, Ian Goodfellow, Yoshua Bengio and Aeron Courville, MIT Press,First Edition, 2016. 2. Deep Learning, A practitioner's approach, Adam Gibson and Josh Patterson, O'Reilly, First Edition, 2017.
2. Hands-On Learning with Scikit-Learn and Tensorflow, Aurelien Geron, O'Reilly, First Edition, 2017. 4. Deep Learning with Python, Francois Chollet, Manning Publications Co, First Edition, 2018.
3. Python Machine Learning by Example, Yuxi (Hayden) Liu, First Edition, 2017.
4. A Practical Guide to Training Restricted Boltzmann Machines, Geoffrey Hinton, 2010, https://www.cs.toronto.edu/~hinton/absps/guideTR.pdf.

2CSMCE2-05: SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING

Secure Software Design

Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

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, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

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).

Obtain the ability to manage and troubleshoot a network running multiple services, understand the requirements of an enterprise network and how to go about managing them.

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

Suggested Readings:

1. 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.

2CSMCE2-06: COMPUTER VISION

Introduction to computer vision: Role of Artificial intelligence and image processing in Computer Vision, Industrial Machine Vision applications, System architecture. Visual Sensors: Camera sensors: RGB, IR, Kinect sensor, Camera interfaces and video standards, Characteristics of camera sensors commercially available cameras. Camera Calibration: Interior, exterior calibration and rectification using Tsai's Calibration method.

Basics of image processing – Pixel representations histograms, transforms, colour filters, noise removal, Geometry: Math methods -linear algebra, vectors, rotations, Stereo – Epi-polar geometry, correspondence, triangulation, Disparity maps. Basics of video processing – Background subtraction techniques – frame differencing, Gaussian Mixture Modelling (GMM), Object localization and processing: - Contours, edges, lines, skeletons.

Image representation: Local Wavelet basis (multiscale), Global Fourier basis (Frequency), Adaptive basis (PCA and ICA), Adaptive basis (discriminants) Basics of Object detection – Template matching, Cascade classifiers.

Object Recognition: Object Modeling, Bayesian Classification, Feature Selection and Boosting, Scene and Object Discrimination.

Motion and Tracking: Motion detection and tracking of point features, optical flow, SURF, SIFT. Tracking- Kalman filter, Particle Filter, Comparison of deterministic and probabilistic methods condensation, tracking humans, multi-frame reconstruction under affine and perspective projection geometry.

Suggested Readings:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Deep Learning, by Goodfellow, Bengio, and Courville.
3. Dictionary of Computer Vision and Image Processing, by Fisher et al.

2CSMCE2-08: HUMAN AND COMPUTER INTERACTION

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

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.

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.

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

Suggested Readings:

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

2CSMCE2-09: CLOUD COMPUTING

Overview of Computing Paradigm and introduction to cloud computing: Recent trends in Computing (Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing), Evolution of cloud computing(Business driver for adopting cloud computing), Cloud Computing (NIST Model) , Cloud service providers, Properties, Characteristics & Disadvantages, Cloud computing vs. Cluster computing vs. Grid computing, Role of Open Standards

Cloud Computing Architecture: Cloud computing stack: Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS): Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service(SaaS), Deployment Models(Public cloud, Private cloud, Hybrid cloud, Community cloud).

Infrastructure as a Service(IaaS):Introduction to IaaS ,IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM),Resource Virtualization(Server, Storage, Network), Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service).

Platform as a Service(PaaS):Introduction to PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management (Computation, Storage) Examples: Google App Engine, Microsoft Azure, SalesForce. com Software as a Service(SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS.

Service Management in Cloud Computing: Service Level Agreements(SLAs) (Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud , Economics of scaling: Benefitting enormously, Managing Data, Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing Cloud Security: Infrastructure Security(Network level security, Host level security, Application level security), Data security and Storage (Data privacy and security Issues, Jurisdictional issues raised by Data location), Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

Suggested Readings:

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009
2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765,O'Reilly Media, September 2009

2CSMCE2-10: DIGITAL FORENSICS

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

Computer Crime: Criminalistics as it relates to the investigative process, 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, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Evidence Management & Presentation: 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.

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

Mobile Forensics: mobile forensics techniques, mobile forensics tools.

Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.

Suggested Readings:

1. John Sammons, The Basics of Digital Forensics, Elsevier.
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications.

2CSMCE3-12: RESEARCH METHODOLOGY

Research Methodology: Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Important of Research Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Definition of Research Problem, Problem Formulation, Necessity of Defining the Problem, Technique involved in Defining a Problem.

Literature Survey: Importance of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Literature Review: Need of Review, Guidelines for Review, Record of Research Review.

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Design of Experimental Set-up, Use of Standards and Codes.

Data Collection: Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data. Sample Design, Need for sampling, some important sampling definitions, Estimation of population, Role of Statistics for Data Analysis, Parametric V/s Non Parametric methods, Descriptive Statistics, Measures of central tendency and Dispersion, Hypothesis testing, Use of Statistical software. Data Analysis: Deterministic and random data, Uncertainty analysis, Tests for significance: Chi-square, student's t-test, Regression modeling, Direct and Interaction effects, ANOVA, F-test, Time Series analysis, Autocorrelation and Autoregressive modeling.

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids, Intellectual property, Plagiarism. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

Suggested Readings:

1. C.R Kothari, Research Methodology, Methods & Technique, New Age International Publishers, 2004.
2. R. Ganesan, Research Methodology for Engineers, MJP Publishers, 2011.
3. Ratan Khananabis and Suvasis Saha, Research Methodology, Universities Press, Hyderabad, 2015.
4. Y. P. Agarwal, Statistical Methods: Concepts, Application and Computation, Sterling Publs., Pvt., Ltd., New Delhi, 2004.
5. Vijay Upagade and Aravind Shende, Research Methodology, S. Chand & Company Ltd., New Delhi, 2009.
6. G. Nageswara Rao, Research Methodology and Quantitative methods, BS Publications, Hyderabad, 2012.
7. Naval Bajjai, Business Research Methods, Pearson 2011.
8. Prahalad Mishra, Business Research Methods, Oxford 2016.

2CSMCE1-13: NETWORK SIMULATION LABORATORY

1. Installation and configuration of NS2.
2. Creating a network: nodes, links and queues.
3. Creating connections, traffic and computing routers.
5. Insertion of errors and analysis of trace file.
6. Simple project on NS2 – wired, wireless and combination of wired and wireless.
7. Implementation of new protocols in NS2.

2CSMCE4-14: FIELD WORK

Student is required to work in the organization/industry concerned with his/her course.