SCHEME/SYLLABUS

For

M.TECH COURSE
In

COMPUTER SCIENCE & ENGINEERING
(w.e.f Session 2020)

DEPARTMENT OF COMPUTER ENGINEERING

FACULTY OF INFORMATICS & COMPUTING

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY

FARIDABAD

YMCA UNIVERSITY OF SCIENCE & TECHNOLOGY

VISION

YMCA University of Science and Technology aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

DEPARTMENT OF COMPUTER ENGINEERING

VISION

The department aims to make a place at both national and international level by producing high quality ethically rich computer engineers conversant with the state-of-the art technology with the ability to adapt the upcoming technologies to cater to the ever changing industrial demands and societal needs. It endeavors to establish itself as a centre of excellence by contributing to research areas having IT impact on the people‟s life and nation‟s growth.

MISSION

- To provide the future leaders in the area of computer engineering and information technology through the development of human intellectual potential to its fullest extent.
- To enable the students to acquire globally competence through problem solving skills and exposure to latest developments in IT related technologies.
- To educate the students about their professional and ethical responsibilities.
- To ensure continuous interaction with the industry and academia through collaborative research projects.

ABOUT THE PROGRAM

The Master of Technology (M.Tech) program in Computer Engineering is a two year post graduate program which is designed with an aim to provide the students in depth knowledge of various advanced concepts of computer engineering.

The program provides comprehensive knowledge which is sufficient enough to enhance the critical thinking skills and research ability of the students. Besides the theoretical and laboratory based curriculum, students complete an advanced programming project in the final year of the program including one full semester for research work.

PROGRAMME EDUCATION OBJECTIVES

PEO1	To enhance the competence level for tackling real world problems in industry, academia and research organizations
PEO2	To sharpen problem solving ability using in depth analysis based upon state-of-the-art concepts and technology
PEO3	To create awareness about professional ethics, multidisciplinary approach, entrepreneurial thinking and effective communication.

PROGRAMME OUTCOMES

PO1	Ability to learn & apply advance concepts to generate novel solutions for solving complex computational problems.
PO2	Ability to effectively adopt & adapt recent technology for finding efficient solutions to the contemporary problems.
PO3	Ability to act as an effective human resource in industry & academia for socio-economic growth.
PO4	Ability to pursue research and create knowledge to meet the present and upcoming challenges

PROGRAMME SPECIFIC OUTCOMES

PO1	Learn and apply advance concepts to envisage novel solutions for complex problems in the domain of Computer Engineering.
PO2	Effectively adapt state-of-the art technology like soft Computing and machine learning to improve the prevalent solutions in Computer Engineering.

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY
FARIDABAD
SYNOPSIS OF
SCHEME OF STUDIES & EXAMINATIONS
2 YEARS M.TECH SEMESTER I-IV (w.e.f 2020)

Total Credits: 67
Total Theory Subjects: 15
Total Labs (including Seminars & Projects):04
Total Dissertation: 02

Total Teaching Schedule:

Lectures	Practical	Total
44	70	114

Total Marks:

Sessionals	End Term	Total
760	1965	2725

Itemised Break-up:

Details	Hours	Marks	Credits
Theory Subjects	44	1500	32
Labs	16	400	8
Mini Projects with Seminar	2	25	1
Dissertation	52	800	26
Total	114	2725	67

Note : One MOOC course of twelve weeks duration (carrying minimum 3 credits) is compulsory for all students

YMCA University of Science and Technology, Faridabad M.Tech (Computer Engineering) Scheme of Studies / Examination Semester I

Course No.	Course Title	Teaching Schedule			Marks For Sessionals	Marks for End Term Examination		Total Marks	Credits
		L	P	TOTAL		THEORY	PRACTICAL		
MCS-18-101	Mathematical foundations of Computer Science	3	0	3	25	75	0	100	3
MCS-18-102	Advanced Data Structures	3	0	3	25	75	0	100	3
	Elective I	3	0	3	25	75	0	100	3
	Elective II	3	0	3	25	75	0	100	3
RMI-101	Research Methodology and IPR	2	0	2	25	75	0	100	2
	Audit Course-I	2	0	2	25	75	0	100	0
MCS-18-104	Laboratory 1: Advanced Data Structures Lab	0	4	4	30	0	70	100	2
	Laboratory 2 : (Based on Electives)	0	4	4	30	0	70	100	2
	Total	16	8	24	210	450	140	800	18

Elective I

- MCS-18-106 Machine Learning
- MCS-18-107 Introduction to Intelligent systems
- MCS-18-108 Parallel Programming tools and model
- MCS-18-109 Real time Systems

Elective II

- MCS-18-110 Data Science
- MCS-18-111 Distributed Systems
- MCS-18-112 Web Search & Information Retrieval

Laboratory 2 : (Based on Electives)

- MCS-18-106AMachine Learning Lab
- MCS-18-107 AIntroduction to Intelligent systems Lab
- MCS-18-108 AParallel Programming tools and model Lab
- MCS-18-109 AReal time Systems Lab

- MCS-18-111 ADistributed Systems Lab
- MCS-18-112 AWeb Search & Information Retrieval Lab

YMCA University of Science and Technology, Faridabad
M.Tech (Computer Engineering)
Scheme of Studies / Examination
Semester II

Course No	Course title	Teaching Schedule			Marks For sessionals	Marks for end term examination		Total marks	Credits
		L	P	TOTAL		THEORY	PRACTICAL		
MCS-18-201	Advance Algorithms	3	0	3	25	75	0	100	3
MCS-18-202	Soft Computing	3	0	3	25	75	0	100	3
	Elective III	3	0	3	25	75	0	100	3
	Elective IV	3	0	3	25	75	0	100	3
MCS-18-203	Mini Project with Seminar	0	2	2	25	0	0	25	1
	Audit Course-II	2	0	2	25	75	0	100	0
	Laboratory 3(based on Cores)	0	4	4	30	0	70	100	2
	Laboratory 4 : (based on Electives)	0	4	4	30	0	70	100	2
	Total	14	10	24	210	375	140	725	17

Elective III

- MCS-18-206 Big Data Analytics
- MCS-18-207 Secure Software Design & Enterprise Computing
- MCS-18-208 Computer Vision
- MCS-18-209 Software Testing

Elective IV

- MCS-18-210 Human and Computer Interaction
- MCS-18-211 Wireless Sensor Networks
- MCS-18-212 Advanced Wireless and mobile Networks
- MCS-18-213 Natural Language Processing

Laboratory 3 (Based on Cores)

- MCS-18-201AAdvance Algorithms Lab
- MCS-18-202 A Soft Computing lab

Laboratory 4 : (Based on Electives)

- MCS-18-206 A Big Data Analytics Lab
- MCS-18-207 A Secure Software Design & Enterprise Computing Lab
- MCS-18-208 A Computer Vision Lab
- MCS-18-209 A Software Testing Lab
- MCS-18-210 A Human and Computer Interaction Lab
- MCS-18-211 A Wireless Sensor Networks Lab
- MCS-18-212 A Advanced Wireless and mobile Networks lab
- MCS-18-213 A Natural Language Processing Lab

YMCA University of Science and Technology, Faridabad M.Tech (Computer Engineering) Scheme of Studies / Examination Semester III

Course No	Course title	Teaching schedule			Marks For sessionals	Marks for end term examination		Total marks	Credits
		L	P	TOTAL		THEORY	PRACTICAL		
	Elective V	3	0	3	25	75	0	100	3
	Open Elective	3	0	3	25	75	0	100	3
AC-02	Message of Bhagwat Gita	3	0	3	25	75	0	100	0
MCS-18-301	Dissertation/Industrial Project	0	20	20	90	0	210	300	10
	Total	9	20	29	165	225	210	600	16

Elective V

- MCS-18-302 Mobile Applications and Services
- MCS-18-303 Optimization Techniques
- MCS-18-304 Cloud Computing

Open Elective

- OEC-101A Business Analytics
- OEC-102A Industrial Safety
- OEC-103A Operations Research
- OEC-104A Cost Management of Engineering Projects
- OEC-105A Composite Materials
- OEC-106A Waste to Energy

YMCA University of Science and Technology, Faridabad
M.Tech (Computer Engineering) Scheme of Studies / Examination Semester IV

Course No	Course title	Teaching Schedule			Marks For sessionals	Marks for end term Examination		Total marks	Credits
		L	P	TOTAL		THEORY	PRACTICAL		
HSMC(H-02)	**Value Added Course** :: Universal Human Values 2— Understanding Harmony	3	0	3	25	75	0	100	0
MCS-18-401	Dissertation II	0	32	32	150	0	350	500	16
	Total	3	32	35	175	75	350	600	16

Audit Courses I & II

AUD-01A English for Research Paper Writing

AUD-02A Disaster Management

AUD-03A Sanskrit for Technical Knowledge

AUD-04A Value Education

AUD-05A Constitution of India

AUD-06A Pedagogy Studies

AUD-07A Stress Management by Yoga

AUD-08A Personality Development through Life Enlightenment Skills

AUD-10A French

AUD-11A German

CODE: MCS-18-101

SUBJECT NAME: Mathematical Foundation of Computer Science

NO OF CREDITS: 3

M.TECH SEMESTER I	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

1. 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.
2. To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design and concurrency.
3. To study various sampling and classification Problems.

MODULE-1:

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

MODULE-2:

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

MODULE-3:

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

MODULE-4: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

MODULE-5:Computer science and engineering applications

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

MODULE-6:

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

Course Outcomes:

After completion of course, students would be able to:

a. To understand the basic notions of discrete and continuous probability.

b. To understand the methods of statistical inference, and the role that sampling distributions play in those method.

c. To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

REFERENCES

1. John Vince, Foundation Mathematics for Computer Science, Springer.

2. K. Trivedi.Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.

3. M. Mitzenmacher and E. Upfal.Probability and Computing: Randomized Algorithms and Probabilistic Analysis.

4. Alan Tucker, Applied Combinatorics, Wiley

CODE:MCS-18-102

SUBJECT NAME: ADVANCED DATA STRUCTURES

NO OF CREDITS: 3

M.TECH SEMESTER I		**SESSIONAL:**	**25**
L	**T P**	**THEORY EXAM:**	**75**
3	**0 0**	**TOTAL :**	**100**

Pre-requisites: UG level course in Data Structures

Course Objectives:

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

MODULE-1: DICTIONARIES AND HASHING

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.

MODULE-2: SKIP LISTS

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

MODULE-3: TREES

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

MODULE-4: 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.

MODULE-5: COMPUTATIONAL GEOMETRY

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

MODULE-6:

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

Course Outcomes:

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

REFERENCES

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004

2. M T Goodrich Roberto Tamassia, Algorithm Design, John Willey, 2002

CODE:MCS-18-106

SUBJECT NAME: MACHINE LEARNING (ELECTIVE I)

NO OF CREDITS: 3

M.TECH SEMESTER I	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

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

MODULE-1: SUPERVISED LEARNING (REGRESSION/CLASSIFICATION)

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

MODULE-2: UNSUPERVISED LEARNING

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

MODULE-3:

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

MODULE-4:

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

MODULE-5:

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

MODULE-6:

Recent trends in various learning techniques of machine learning and classification methods for IOT applications, Various models for IOT applications.

Course Outcomes:

a. Extract features that can be used for a particular machine learning approach in various IOT applications.
b. To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
c. To mathematically analyse various machine learning approaches and paradigms.

REFERENCES

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012

2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)

3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

CODE: MCS-18-107

SUBJECT NAME: INTRODUCTION TO INTELLIGENT SYSTEMS (ELECTIVE I)

NO OF CREDITS: 3

M.TECH SEMESTER I	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites: Data Structures and Data Management or Data

Structures **Course Objectives:**

1. The aim of the course is 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. It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty, learning from experience and following problem solving strategies found in nature.

MODULE-1:

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

MODULE-2:

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

MODULE-3:

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, hillclimbing search. Optimisation and search such as stochastic annealing and genetic algorithm.

MODULE-4:

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.

MODULE-5:

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.

MODULE-6:

Recent trends in Fuzzy logic, Knowledge Representation

Course Outcomes:

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

REFERENCES

1. Luger G.F. and Stubblefield W.A. (2008). Artificial Intelligence: Structures and strategies for Complex Problem Solving. Addison Wesley, 6th edition.

2. Russell S. and Norvig P. (2009). Artificial Intelligence: A Modern Approach. Prentice-Hall, 3rd edition.

CODE: MCS-18-108

SUBJECT NAME: PARALLEL PROGRAMMING TOOLS AND MODEL (ELECTIVE I)

NO OF CREDITS: 3

M.TECH SEMESTER I	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites: Data Structure, Computer Architecture and Organization

Course Objectives:

1. Classify parallel architectures parameters that are essential for the classification of modern parallel processing systems.
2. Describe the methodologies employed for synchronization and memory consistency and cache coherence in shared memory systems.
3. Describe and compare the different types of interconnects employed in parallel processing systems.
4. Outline and analyse the features of micro-architecture parallel systems such as superscalar, VLIW, vector, multithreading, CMP multi-core and tile processors.
5. Describe how the performance of a parallel system can be measured, list possible sources for performance losses and propose ways to improve the performance of a system.

MODULE-1:

Introduction to Parallel Computing Architectures, parallel hardware/multi-cores, Processes and threads, Programming models: shared memory and message passing, Amdahl‟s Law.

MODULE-2:

Introduction to parallel hardware: Multi-cores and multiprocessors, shared memory and message passing architectures, cache hierarchy and coherence, sequential consistency.

MODULE-3:

Introduction to parallel software: Steps involved in developing a parallel program, Dependence analysis, Domain decomposition, Task assignment: static and dynamic, Performance issues: 4C cache misses, inherent and artifactual communication, false sharing, computation-to-communication ratio as a guiding metric for decomposition, hot spots and staggered communication.

MODULE-4:

Shared memory parallel programming: Synchronization Locks and barriers, Hardware primitives for efficient lock implementation, Lock algorithms, Relaxed consistency models, High-level language memory models (such Java and/or C++), Memory fences. Developing parallel programs with UNIX fork model: IPC with shared memory and message passing, UNIX semaphore and its all-or-none semantic.

Developing parallel programs with POSIX thread library, Thread creation, Thread join, Mutex, Condition variables. Developing parallel programs with OpenMP directives: Parallel for, Parallel section, Static, dynamic, guided, and runtime scheduling, Critical sections and atomic operations, Barriers Reduction

MODULE-5:

Introduction to GPU programming: GPU architecture, Introduction to CUDA programming, Concept of SIMD and SIMT computation, Thread blocks, Warps, Global memory, Shared memory, Thread divergence in control transfer.

MODULE-6:

Recent trends in Parallel Programming Models and Paradigms. Case study of parallel hardware which include shared memory architecture and message passing architectures for efficient computing

Course Outcomes:

a. Understand the methodologies employed for synchronization and memory consistency and cache coherence in shared memory systems.

REFERENCES

1. Peter S Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann,2011

2. M Herlihy and N Shavit, The Art of Multiprocessor Programming Morgan Kaufmann, 2008

3. JL Hennessy and DA Patterson, Computer Architecture: A Quantitative Approach,4th Ed., Morgan Kaufmann/Els India, 2006.

CODE: MCS-18-109

SUBJECT NAME: REAL TIME SYSTEMS (ELECTIVE II)

NO OF CREDITS: 3

M.TECH SEMESTER I	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre Requisites :

Course Objectives

1. The student has an understanding and practical experience with real time systems and design of embedded
systems.
2. The student has an understanding of embedded software development tools.
3. The students can identify the characteristics, issues in real-time systems design and understand the basic
concepts of real time operating systems.
4. The students should be able to choose suitable real time hardware and test algorithms.
5. To introduce the students with fault tolerant systems and issues in real time languages

MODULE-1: Embedded Systems
What is an embedded system? Categories: Stand-alone, Real-time, Networked appliances, mobile devices. Requirements of Embedded systems, Challenges and issues in Embedded software development. Embedded Software Development Tools: Host and Target machines, Linker/ locators for embedded software, Getting embedded software into target system.

MODULE-2: Real Time Embedded systems
Definition, characteristics, classification, release times, deadlines and timing constraints, temporal parameters of real-time workload, periodic ask model, issues involved in real time system design.

MODULE-3: Real Time Operating Systems
Typical structure of an RTOS, Scheduling strategies, priority structures, task management, memory management, code sharing, task co-operation and communication, interrupt routines in an RTOS environment, mutual exclusion, Liveness, Minimum operating system Kernel, capabilities of commercial RTOS: Vx Works, pSoS, Micro C/OSII.

MODULE-4: Task assignment and Scheduling

Allocation/ Scheduling problem, offline scheduling, online scheduling, pre-emptive/non-pre-emptive scheduling, static/dynamic scheduling, Rate-monotonic scheduling algorithm, problem of priority inversion, priority inheritance protocol, priority ceiling protocol, earliest-deadline-first scheduling algorithm

MODULE -5: Real-Time Language Issues
Real-time language requirements, data typing, control structures, facilitating hierarchical decomposition, synchronization, packages, exception handling, overloading and generics, multi tasking, low-level facilities

MODULE -6: Fault-Tolerance Techniques
Fault types, fault detection measures, fault detection mechanisms, fault and error containment, Redundancy: Hardware and software redundancy, time redundancy.

Course Outcomes:

a. The students will be able to understand the basics of real-time systems, issues and challenges in the embedded system design
b. The students will be able to understand the recent trends in embedded systems design, host and target machine.
c. Able to understand the release time, deadline, timing constraints and structure of RTOS together
with task and memory management.
d. Understand basic multi-task scheduling algorithms for periodic, aperiodic and sporadic tasks as well as understand the impact of the latter two on scheduling.
e. The students will be able to understand the concepts of h/w and s/w redundancy and characteristics of real time languages along with capabilities of commercially available RTOS like Vx Works etc.

CODE: MCS-18-110

SUBJECT NAME: DATA SCIENCE (ELECTIVE II)

NO OF CREDITS: 3

M.TECH SEMESTER I	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

1. Provide you with the knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital fordata science.
3. Produce Python code to statistically analyse a dataset.
4. Critically evaluate data visualisations based on their design and use for communicatingstories from data

MODULE-1:

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

MODULE-2:

Data collection and management: Introduction, Sources of data, Data collection andAPIs, Exploring and fixing data, Data storage and management, Using multiple dataSources.

MODULE-3:

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

MODULE-4:

Data visualisation:Introduction, Types of data visualisation,Data forvisualisation:Data types, Data encodings, Retinal variables, Mapping variables toencodings, Visual encodings.

MODULE-5:

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

MODULE-6:

Recent trends in various data collection and analysis techniques, variousvisualization techniques, application development methods of used in data science.

Course Outcomes:

After completion of course, students would be able to:

a. Explain how data is collected, managed and stored for data science;

b. Understand the key concepts in data science, including their real-world applications and the

c. toolkit used by data scientists;

d. Implement data collection and management scripts using MongoDB.

REFERENCES

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.

CODE: MCS-18-111

SUBJECT NAME: Distributed Systems (ELECTIVE II)

NO OF CREDITS: 3

M.TECH SEMESTER I	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites: Database Management Systems

Course Objectives:

1. 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.

MODULE-1:

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

MODULE-2:

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

MODULE-3:

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

MODULE-4:

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

MODULE-5:

PARALLEL DATABASE SYSTEMS
Parallel architectures; parallel query processing and optimization; load balancing

MODULE-6:

ADVANCED TOPICS
Mobile Databases, Distributed Object Management, Multi-databases

Course Outcomes:

a. Design trends in distributed systems.
b. Apply network virtualization.
c. Apply remote method invocation and objects.

REFERENCES

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.

2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

CODE: MCS-18-112

SUBJECT NAME: WEB SEARCH AND INFORMATION RETRIEVAL (ELECTIVE II)

NO OF CREDITS: 3

M.TECH SEMESTER	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites: Probability Theory, Database Management, Web Programming

Course Objectives

1. To build an understanding of the fundamental concepts of Information Retrieval 2. To familiarize students with the basic taxonomy and terminology of Indices
3. To understand Heap‟s Law forestimation and Zipf‟s law for modeling distribution of terms
4. To understand dictionary compression and posting list compression
5. To introduce the scoring ,tf-idf weighting and vector space model for scoring 6. To understand cluster pruning and tiered indices
7. To learn the elements of Web Search basics
8. To learn various language models for information retrieval and their types

Module 1 Introduction to Information Retrieval

Information retrieval problem, an inverted index, Processing Boolean queries ,The extended Boolean model versus ranked retrieval , an inverted index ,Bi-word indexes, Positional indexes, Combination schemes

Module 2 Index construction

Hardware basics, Blocked sort-based indexing , Single-passin-memory indexing ,Distributed indexing, Dynamic indexing, Other types of indexes

Index compression: Statistical properties of terms in information retrieval ,Heap‟s law: Estimatingthenumberofterms,Zipf‟slaw:Modelingthedistributionofterms,Dictionary compression, Dictionarys a string, Blocked storage, Postings file compression.

Module 3 Scoring , term weighting and the vector space model
Parametric and zone indexes ,Weighted zone scoring, Learning weights ,The optimal weight, Term frequency and weighting, Inverse document frequency, Tf-idf weighting, The vector space model for scoring, Variant tf-idf functions.

Module 4 Computing scores in a complete search system
Efficient scoring and ranking, In exact top *K* document retrieval, Index elimination ,Champion lists, Static quality scores and ordering ,Impact ordering ,Cluster pruning ,Component so fan information retrieval system, Tiered indexes

Module 5 Web search basics
Background and history, Web characteristics, The web graph, Spam, Advertising as the economic model, The search user experience, User query needs
Crawling, Crawler architecture, DNS resolution, The URL frontier, Link analysis, The Web as a graph, Anchor text and the web graph ,Page Rank, Markov chains, The Page Rank computation, Topic-specific Page Rank

Module 6 Language models for information retrieval
Language models, Finite automata and language models, Types of language models, Multinomial distributions over words , The query likelihood model, Using query like lihood language models in IR, Estimating the query generation probability ,Language modeling versus other approaches in IR

Course Outcomes

a. The students will be able to understand basic Information Retrieval Systems.
b. The students will be able to lean how Boolean queries are processed.
c. The students will be able to identify the different types of indices: inverted index, positional index, bi-word index etc
d. The student will be able to make estimations and model distribution of terms and compressions
e. The students will be able to enumerate various types of indices. And also understand the concept of efficient storage of indices.
f. The students will be able to learn tf-idf scoring and vector space model scoring for ranking
g. The students will be able to understand Static quality ordering , cluster pruning and tiered indices
h. The students will be able to understand the basic concept of Search Engines their architecture and various functional components.

i. The students will be able to understand the basic concept of Web crawlers and their architecture

j. The students will be able to understand various language models related to information retrieval

REFERENCES

1. C. D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008 (available at http://nlp.stanford.edu/IR-book).

2. Chakrabarti, S. (2002). Mining the web: Mining the Web: Discovering knowledge from hypertext data. Morgan-kaufman.

3. B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, Addison- Wesley, 2009 (available at http://ciir.cs.umass.edu/irbook/).

4. R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley, 2011 (2nd Edition).

5. An Introduction to Information Retrieval Christopher D. Manning,Prabhakar Raghavan, HinrichSchütze Cambridge UniversityPress

CODE: RMI-101

SUBJECT NAME: RESEARCH METHODOLOGY AND IPR

NO OF CREDITS: 2

M.TECH SEMESTER I	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
2 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today‟s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. 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
6. 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.

MODULE-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

MODULE-2:

Effective literature studies approaches, analysis Plagiarism, Research ethics

MODULE-3:

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

MODULE-4:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

MODULE-5:

Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications

MODULE-6:

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

Course Outcomes:

a. To identify sources of research problem and approaches of investigation for solutions for research problem
b. To learn various research ethics
c. To learn the concepts of Patents, procedure for granting patents and administration of patent system

REFERENCES

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction forscience & engineering students""

2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"

4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

5. Mayall , "Industrial Design", McGraw Hill, 1992.

6. Niebel , "Product Design", McGraw Hill, 1974.

7. Asimov, "Introduction to Design", Prentice Hall, 1962.

8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016

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

CODE: MCS-18-201

SUBJECT NAME: ADVANCE ALGORITHMS

NO OF CREDITS: 3

M.TECH SEMESTER II		**SESSIONAL:**	**25**
L T P		**THEORY EXAM:**	**75**
3 0 0		**TOTAL :**	**100**

Pre-requisites:UG level course in Algorithm Design and Analysis

Course Objectives:

1. Introduce students to the advanced methods of designing and analyzing algorithms.
2. The student should be able to choose appropriate algorithms and use it for a specific problem.
3. To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
4. Students should be able to understand different classes of problems concerning their computation difficulties.
5. To introduce the students to recent developments in the area of algorithmic design.

MODULE-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.

MODULE-2:

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set, Application to MST.
Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path

MODULE-3:

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.
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, LUP-decomposition

MODULE-4:

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm, More examples of dynamic programming
Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation, Extension to polynomials, Application: Interpolation problem.
Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm, Schonhage-Strassen Integer Multiplication algorithm

MODULE-5:

Linear Programming: Geometry of the feasibility region and Simplex algorithm
NP-completeness: Examples, proof of NP-hardness and NP-completeness.
One or more of the following topics based on time and interest
Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm

MODULE-6:

Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Course Outcomes:

a. Analyze the complexity/performance of different algorithms.
b. Determine the appropriate data structure for solving a particular set of problems.
c. Categorize the different problems in various classes according to their complexity.
d. Students should have an insight of recent activities in the field of the advanced data structure

REFERENCES

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

CODE: MCS-18-202

SUBJECT NAME: Soft Computing

NO OF CREDITS: 3

M.TECH SEMESTER II	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites: Basic knowledge of mathematics

Course Objectives:

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

MODULE-1: INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS

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

MODULE-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

MODULE-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

MODULE-4: GENETIC ALGORITHMS

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition

MODULE-5: MATLAB/PYTHON LIB

Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

MODULE-6:
Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm, Implementation of recently proposed soft computing techniques

Course Outcomes:

a. Identify and describe soft computing techniques and their roles in building intelligent machines
b. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
c. Apply genetic algorithms to combinatorial optimization problems.
d. Evaluate and compare solutions by various soft computing approaches for a given problem.

REFERENCES

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing, Prentice:Hall of India, 2003.

2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications , Prentice Hall, 1995.

3. MATLAB Toolkit Manual

CODE: MCS-18-206

SUBJECT NAME: Big Data Analytics (ELECTIVE III)

NO OF CREDITS: 3

M.TECH SEMESTER II	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites: Data Structure, Computer Architecture and Organization

Course Objectives:

1. Understand big data for business intelligence. Learn business case studies for big data analytics.
2. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools

MODULE-1:

What is big data, why big data, convergence of key trends, unstructured data,industry examples of big data, web analytics, big data and marketing, fraud and bigdata, risk and big data, credit risk management, big data and algorithmic trading,big data and healthcare, big data in medicine, advertising and big data, big datatechnologies, introduction to Hadoop, open source technologies, cloud and bigdata, mobile business intelligence, Crowd sourcing analytics, inter and transfirewall analytics.

MODULE-2:

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

MODULE-3:

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadooppipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Javainterface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro,file-based data structures.

MODULE-4:

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy ofMapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce andYARN, job scheduling, shuffle and sort, task execution, MapReduce types, inputformats, output formats.

MODULE-5:

Hbase, data model and implementations, Hbase clients, Hbase examples,praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients,Hadoop integration.

MODULE-6:

Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts.Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation,HiveQL queries.

Course Outcomes:

After completion of course, students would be able to:

a. Describe big data and use cases from selected business domains.
b. Explain NoSQL big data management.
c. Install, configure, and run Hadoop and HDFS.
d. Perform map-reduce analytics using Hadoop.
e. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

REFERENCES

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: EmergingBusiness Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.

2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of

3. Polyglot Persistence", Addison-Wesley Professional, 2012.

4. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.

5. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

6. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

7. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

8. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.

9. Alan Gates, "Programming Pig", O'Reilley, 2011.

CODE: MCS-18-207

SUBJECT NAME: Secure Software Design & Enterprise Computing (ELECTIVE III)

NO OF CREDITS: 3

M.TECH SEMESTER II	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites: Computer Programming, Software Engineering

Course Objectives:

1. To fix software flaws and bugs in various software.
2. To make students aware of various issues like weak random number generation,information leakage, poor usability, and weak or no encryption on data traffic.
3. Techniques for successfully implementing and supporting network services on anenterprise scale and heterogeneous systems environment.
4. Methodologies and tools to design and develop secure software containing minimumvulnerabilities and flaws.

MODULE-1: Secure Software Design

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

MODULE-2:Enterprise Application Development

Describe the nature and scope of enterprise software applications, Designdistributed N-tier software application, Research technologies available for thepresentation, business and data tiers of an enterprise software application,Design and build a database using an enterprise database system, Developcomponents at the different tiers in an enterprise system, Design and develop amulti-tier solution to a problem using technologies used in enterprise system,Present software solution.

MODULE-3:Enterprise Systems Administration

Design, implement and maintain a directory-based server infrastructure in aheterogeneous systems environment, Monitor server resource utilization forsystem reliability and availability, Install and administer network services(DNS/DHCP/Terminal Services/Clustering/Web/Email).

MODULE-4:

Obtain the ability to manage and troubleshoot a network running multipleservices, Understand the requirements of an enterprise network and how to goabout managing them.

MODULE-5:

Handle insecure exceptions and command/SQL injection, Defend web andmobile applications against attackers, software containing minimumvulnerabilities and flaws.

MODULE-6:

Case study of DNS server, DHCP configuration and SQL injection attack.

Course Outcomes:

After completion of course, students would be able to:

a. Differentiate between various software vulnerabilities.
b. Software process vulnerabilities for an organization.
c. Monitor resources consumption in a software.
d. Interrelate security and software development process.

REFERENCES

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett.

2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security,Addison Wesley.

CODE: MCS-18-208

SUBJECT NAME: Computer Vision (ELECTIVE III)

NO OF CREDITS: 3

M.TECH SEMESTER II		**SESSIONAL:**	**25**
L T P		**THEORY EXAM:**	**75**
3 0 0		**TOTAL :**	**100**

Pre-requisites: Linear algebra, vector calculus, Data structures and Programming.

Course Objectives:

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

MODULE-1:

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

MODULE-2:

Edge detection, Edge detection performance, Hough transform, corner detection.

MODULE-3:

Segmentation, Morphological filtering, Fourier transform.

MODULE-4:

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

MODULE-5:Pattern Analysis

Clustering: K-Means, K-Medoids, Mixture of GaussiansClassification: Discriminant Function, Supervised, Un-supervised, Semisupervised
Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA,ICA, and Non-parametric methods.

MODULE-6:

Recent trends inActivity Recognition, computational photography, Biometrics.

Course Outcomes:

a. Developed the practical skills necessary to build computer vision applications.
b. To have gained exposure to object and scene recognition and categorization from images.

REFERENCES

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.

CODE: MCS-18-209

SUBJECT NAME: SOFTWARE TESTING (ELECTIVE III)
NO OF CREDITS: 3

M.TECH SEMESTER II	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives

1. To get familiar the students about basic concepts of software testing and its techniques.
2. To study the concepts of Verification and validation activities.
3. To study in detail the process of performing the black box and white box testing approaches with examples.
4. To get familiar the students with the concept of regression testing, various testing automation and debugging tools and case studies.
5. To study the basic and advanced concepts of object oriented testing

MODULE-1: Testing terminology and Methodology
Definition of testing, goals, psychology ,model for testing, effective testing, limitations of testing, Importance of Testing, Definition of Failure, faults or bug, error, incident, test case, test ware, life cycle of bug, bug effects, bug classification, test case design, testing methodology, development of test strategy, verification, validation, Static testing: Inspection, Review and Walk through, dynamic testing ,testing life cycle model, testing techniques, testing principles, Testing Metrics.

MODULE -2: Verification and validation
Verification activities, verification of requirements, verification of HL design, verification of data design, verification of architectural design, verification of UI design, verification of LL design, introduction to validation activities

MODULE -3: Dynamic testing
White Box testing: Boundary value analysis, equivalence class portioning, state table based testing, decision table based, error guessing.

Black Box Testing: Logic coverage criteria, basic path testing, graph matrices.

MODULE -4: Validation Testing
Unit testing, drivers, stubs, integration testing, methods, functional testing, system testing, recovery testing, security testing, stress testing, performance testing, usability testing

MODULE -5: Regression Testing
Objectives of regression testing, Regression test process, Regression testing techniques.

MODULE -6: Test Automation and debugging
Software measurement and testing, testing metrics and tools.
Case Study: Testing for Object-oriented and web-based systems

MODULE -7: Object-Oriented Testing Use-case based testing;
Class testing, Testing Exception handling

Course Outcomes:

a. The students will be able to understand the concepts of software testing, its techniques, verification andvalidation activities.
b. Study of black box, white box testing, regression testing and its techniques.
c. Study of object oriented testing techniques and testing metrics.
d. Study of case studies and various testing automation and debugging tools.

REFERENCES

1. G.J Myers, The Art of Software Testing, John Wiley & Sons, 1979
2. Naresh Chauhan, Software Testing Principles and Practices, OXFORD University Press.

CODE: MCS-18-210

SUBJECT NAME: Human and Computer Interaction (ELECTIVE IV)

NO OF CREDITS: 3

M.TECH SEMESTER II	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

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

MODULE1:

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

MODULE2:

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. EvaluationTechniques – UniversalDesign.

MODULE 3:

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

MODULE4:

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

MODULE5:Platforms and Additional Issues

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

MODULE 6:

Recent Trends: Speech Recognition and Translation, Multimodal

System **Course Outcomes:**

After completion of course, students would be able to:

a. Understand the structure of models and theories of human computer interaction and vision.

b. Design an interactive web interface on the basis of models studied.

REFERENCES

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)

2. Brian Fling, "Mobile Design and Development", First Edition, OReilly Media Inc., 2009 (UNIT –IV)

3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, OReilly, 2009.(UNIT-V).

CODE: MCS-18-211

SUBJECT NAME: Wireless Sensor Networks (ELECTIVE IV)

NO OF CREDITS: 3

M.TECH SEMESTER II	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	TOTAL : 100

Pre-requisites: Wireless Communication

Course Objectives:

1. Architect sensor networks for various application setups.
2. Devise appropriate data dissemination protocols and model links cost.
3. Understanding of the fundamental concepts of wireless sensor networks and have a basicknowledge of the various protocols at various layers.
4. Evaluate the performance of sensor networks and identify bottlenecks.

MODULE-1:

Introduction to Wireless Sensor Networks: Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors.
Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture.
Hardware Platforms: Motes, Hardware parameters.

MODULE-2:

Introduction to ns-3: Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.

MODULE-3:

Medium Access Control Protocol design: Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled.
Introduction to Markov Chain: Discrete time Markov Chain definition,properties, classification and analysis
MAC Protocol Analysis: Asynchronous duty-cycled. X-MAC Analysis(Markov Chain)**.**

MODULE-4:

Security: Possible attacks, countermeasures, SPINS, Static and dynamic keydistribution.

MODULE-5:

Routing protocols: Introduction, MANET protocols
Routing protocols for WSN: Resource-aware routing, Data-centric, GeographicRouting, Broadcast, Multicast
Opportunistic Routing Analysis: Analysis of opportunistic routing (MarkovChain)Advanced topics in wireless sensor networks.

MODULE-6:

ADVANCED TOPICS
Recent development in WSN standards, software applications.

Course Outcomes:

After completion of course, students would be able to:

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

REFERENCES

1. W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks –Theory andPractice", Wiley 2010

2. KazemSohraby, Daniel Minoli and TaiebZnati, "wireless sensor networks - Technology,Protocols, and Applications", Wiley Interscience 2007

3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor NetworkTechnologies for the Information Explosion Era", springer 2010

CODE: MCS-18-212

SUBJECT NAME: Advanced Wireless and Mobile Networks (ELECTIVE IV)

NO OF CREDITS: 3

M.TECH SEMESTER II	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites: Computer Networks

Course Objectives:

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

MODULE1:

INTRODUCTION:
Wireless Networking Trends, Key Wireless Physical Layer Concepts, MultipleAccess Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies,Frequency reuse, Radio Propagation and Modelling, Challenges in MobileComputing: 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, FadingEffects in Indoor and outdoor WLANs, WLAN Deployment issues.

MODULE2:

WIRELESS CELLULAR NETWORKS:
1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over WirelessNetworks, Cellular architecture, Frequency reuse, Channel assignmentstrategies, Handoff strategies, Interference and system capacity, Improvingcoverage and capacity in cellular systems, Spread spectrum Technologies.

MODULE3:

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE802.22Wireless Regional Area Networks, IEEE 802.21 Media Independent HandoverOverview .

WIRELESS SENSOR NETWORKS

Introduction, Application, Physical, MAC layer and Network Layer, PowerManagement, Tiny OS Overview.

MODULE4:

WIRELESS PANs

Bluetooth AND Zigbee, Introduction to Wireless Sensors.

MODULE5:

SECURITY

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

MODULE6:

ADVANCED TOPICS

IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular AdhocNetworks.

Course Outcomes:

After completion of course, students would be able to:

a. Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
b. Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
c. Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
d. Design wireless networks exploring trade-offs between wire line and wireless links.
e. Develop mobile applications to solve some of the real world problems.

REFERENCES

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

CODE: MCS-18-213

SUBJECT NAME: NATURAL LANGUAGE PROCESSING (ELECTIVE IV)

NO OF CREDITS: 3

M.TECH SEMESTER II	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives

1. To introduce the students difference levels/ stages of natural language processing/understanding and their applications and concept of Formal languages and grammars such Chomsky hierarchy and problems associated with them.
2. To introduce the top down and the bottom up parsing techniques such as CKY, Earley & Tomita‟s
3. To introduce the Finite state models and morphology of natural languages.
4. To make the students familiar with Semantics-knowledge and strategies for semantic understanding.
5. To make the students familiar with speech recognition and issues associated with it. And solving problems using HMM and Python language

MODULE-1: Introduction to NLP and Grammars
Applications of NLP &NLU, open problem, Differences levels of Language Analysis and Ambiguities, Introduction of different classes of grammar such Chomsky hierarchy, LFG, GPSG, HPSG, TAG, GB Theory.

MODULE -2: Syntactic Processing
Linguistic Background –Outline of English and Hindi Syntax, Basic Top down &Bottom up parsers: CKY, Earley & Tomita‟s, Finite state models and morphological processing, Syntactic processing using RTN &ATN,

MODULE -3: Semantic Introduction
Semantic and logical form, Ambiguity, speech acts and embedded Sentences, other strategies for Semantic Interpretation.

MODULE -4: Speech Recognition and Spoken language
Issues in Speech Recognition, sound structure, Signal processing, HMM model, NLP using Python language, NLU and speech Recognition.

Course Outcomes:

After successful completion of the course student will be able to:

a. Understand the difference levels/ stages and applications of natural language processing/understanding and know and apply the concept of Formal languages and grammars: such as Chomsky hierarchy and problems associated with them.

b. Perform, computationally, top down and the bottom up parsing like CKY, Earley & Tomita‟s

c, Develop finite state and morphological models for language processing.

d. PerformSemantics-Analysis using suitable approach.

e. Understand the issues associated with speech recognition and solve Speech and Language Processing problems using HMM and Python language.

REFERENCES

1. James Allen,“ Natural Language Understanding”, Pearson education, 2003
2. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, “Natural Language Processing: APaninian Perspectives”, PHI
3. Daniel Jurafsky and James Martin, “Speech and Language Processing”, 2nd Edition, PHI
4. Rajeev S., Zevarsky, “Speech processing and Recognition , PHI, 2002
5. Steven Bird, Ewan Klein and Edward Loper.“Natural Language Processing with Python”, O‟Reilly

CODE: MCS-18-302

SUBJECT NAME: Mobile Applications and Services (ELECTIVE V)

NO OF CREDITS: 3

M.TECH SEMESTER III	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

1. This course presents the three main mobile platforms and their ecosystems, namelyAndroid, iOS, and PhoneGap/WebOS.
2. It explores emerging technologies and tools used to design and implement feature-richmobile applications for smartphones and tablets.
3. 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

MODULE-1: Introduction

Introduction to Mobile Computing, Introduction to AndroidDevelopment Environment, Factors in Developing Mobile Applications, MobileSoftware Engineering, Frameworks and Tools,Generic UI DevelopmentAndroid User

MODULE-2:More on Uis

VUIs and Mobile Apps, Text-to-Speech Techniques,Designing the Right UI, Multichannel and Multimodal Uis, Storing andRetrieving Data, Synchronization and Replication of Mobile Data, Getting theModel Right, Android Storing and Retrieving Data, Working with a Content Provider

MODULE-3:

Communications via Network and the Web:State Machine, CorrectCommunications Model, Android Networking and Web, TelephonyDeciding Scope of an App, Wireless Connectivity and Mobile Apps, AndroidTelephony

Notifications and Alarms: Performance, Performance and Memory Management,Android Notifications and Alarms, Graphics, Performance and Multithreading,Graphics and UI Performance, Android Graphics

MODULE-4:Putting It All Together

Packaging and Deploying, Performance BestPractices, Android Field Service App, Location Mobility and Location BasedServices AndroidMultimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia

MODULE-5:Platforms and Additional Issues

Development Process, Architecture,Design, Technology Selection, Mobile App Development Hurdles, Testing,Security and Hacking, Active Transactions, More on Security, Hacking Android.

MODULE-6:

Recent trends inCommunication protocols for IOT nodes, mobilecomputing techniques in IOT, agents based communications in IOT

Course Outcomes:

After completion of course, students would be able to:

a. identify the target platform and users and be able to define and sketch a mobile application.

b. understand the fundamentals, frameworks, and development lifecycle of mobileapplication platforms including iOS, Android, and PhoneGap

c. Design and develop a mobile application prototype in one of the platform (challengeproject).

REFERENCES

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

CODE: MCS-18-303

SUBJECT NAME: Optimization Techniques (ELECTIVE V)

NO OF CREDITS: 3

M.TECH SEMESTER III	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

1. The objective of this course is to provide insight to the mathematical formulation of real worldproblems.
2. To optimize these mathematical problems using nature based algorithms. And the solution isuseful specially for NP-Hard problems.

MODULE-1:

Engineering application of Optimization, Formulation of design problems asmathematical programming problems.

MODULE-2:

General Structure of Optimization Algorithms, Constraints, The FeasibleRegion.

MODULE-3:

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

MODULE-4:

Optimization Algorithms like Genetic Optimization, Particle SwarmOptimization, Ant Colony Optimization etc.

MODULE-5:

Real life Problems and their mathematical formulation as standardprogramming problems

MODULE-6:

Recent trends: Applications of ant colony optimization, genetics and linear andquadratic programming in real world applications.

Course Outcomes:

After completion of course, students would be able to:

a. Formulate optimization problems.

b. Understand and apply the concept of optimality criteria for various types of optimizationproblems.

c. Solve various constrained and unconstrained problems in Single variable as well asmultivariable.

d. Apply the methods of optimization in real life situation.

REFERENCES

1. Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366-9.

2. Practical Optimization Algorithms and Engineering Applications Andreas Antoniou.

3. An Introduction to Optimization Edwin K., P. Chong & Stanislaw h. Zak.

4. Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. Dynamic Ideas.ISBN 978-0-9759146-2-5.

5. John K. Karlof (2006). Integer programming: theory and practice. CRC Press. ISBN 978-0-8493-1914-3.

6. H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387-92279-9.

7. Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser; William R.Pulleyblank; Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009). 50 Yearsof Integer Programming 1958-2008: From the Early Years to the State-of-the- Art. Springer.ISBN 978-3-540-68274-5.

8. Der-San Chen; Robert G. Batson; Yu Dang (2010). Applied Integer Programming: Modelingand Solution. John Wiley and Sons. ISBN 978-0-470-37306-4.

CODE: MCS-18-304

SUBJECT NAME: Cloud Computing (ELECTIVE V)

NO OF CREDITS: 3

M.TECH SEMESTER III	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites: Computer Networks

Course Objectives:

1. The student will also learn how to apply trust-based security model to real-world security problems.
2. An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
3. Students will learn the basic Cloud types and delivery models and develop anunderstanding of the risk and compliance responsibilities and Challenges for each Cloudtype and service delivery model.

MODULE-1:

Introduction to Cloud Computing
Online Social Networks and Applications, Cloud introduction andoverview, Different clouds, Risks, Novel applications of cloud computing.

MODULE-2:

Cloud Computing Architecture
Requirements, Introduction Cloud computing architecture, On DemandComputing Virtualization at the infrastructure level, Security in Cloudcomputing environments, CPU Virtualization, A discussion on HypervisorsStorage Virtualization Cloud Computing Defined, The SPI Frameworkfor Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model.

Cloud Deployment Models
Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users,Governance in the Cloud, Barriers to Cloud Computing Adoption in theEnterprise.

MODULE-3:

Security Issues in Cloud Computing
Infrastructure Security, Infrastructure Security: The Network Level, TheHost Level, The Application Level, Data Security and Storage, Aspects ofData Security, Data Security Mitigation Provider Data and Its Security.

Identity and Access Management
Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards andProtocols for Cloud Services, IAM Practices in the Cloud, Cloud AuthorizationManagement.

MODULE-4:

Security Management in the Cloud
Security Management Standards, Security Management in the Cloud,Availability Management:SaaS, PaaS, IaaS
Privacy Issues
Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud,Protecting Privacy, Changes to Privacy Risk Management and Compliancein Relation to Cloud Computing, Legal and Regulatory Implications, U.S.Laws and Regulations, International Laws and Regulations.

MODULE-5:

Audit and Compliance
Internal Policy Compliance, Governance, Risk, and Compliance (GRC),Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloudfor Compliance, Security-as-a-Cloud.

MODULE-6:
ADVANCED TOPICS
Recent devlopments in hybrid cloud and cloud security.

Course Outcomes:

After completion of course, students would be able to:

a. Identify security aspects of each cloud model
b. Develop a risk-management strategy for moving to the Cloud
c. Implement a public cloud instance using a public cloud service provider
d. Apply trust-based security model to different layer

REFERENCES

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

CODE: OEC-101A

SUBJECT NAME: Business Analytics (OPEN ELECTIVE)

NO OF CREDITS: 3

M.TECH SEMESTER III	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites: Computer Networks

Course Objectives:

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationshipsbetween the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solvebusiness problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools/Operations research techniques.
6. Mange business process using analytical and management tools.
7. Analyze and solve problems from different industries such as manufacturing, service, retail,software, banking and finance, sports, pharmaceutical, aerospace etc.

MODULE-1:

Business analytics: Overview of Business analytics, Scope of Businessanalytics, Business Analytics Process, Relationship of Business AnalyticsProcess and organisation, competitive advantages of Business Analytics.
Statistical Tools: Statistical Notation, Descriptive Statistical methods,Review of probability distribution and data modelling, sampling andestimation methods overview.

MODULE-2:

Trendiness and Regression Analysis: Modelling Relationships and Trends inData, simple Linear Regression.
Important Resources, Business Analytics Personnel, Data and models forBusiness analytics, problem solving, Visualizing and Exploring Data,Business Analytics Technology.

MODULE-3:

Organization Structures of Business analytics, Team management,Management Issues, Designing Information Policy, Outsourcing, EnsuringData Quality, Measuring contribution of Business analytics, ManagingChanges.
Descriptive Analytics, predictive analytics, predicative Modelling, Predictiveanalytics analysis, Data Mining, Data Mining Methodologies, Prescriptiveanalytics and its step in the business analytics Process, PrescriptiveModelling, nonlinear Optimization.

MODULE-4:

Forecasting Techniques: Qualitative and Judgmental Forecasting, StatisticalForecasting Models, Forecasting Models for Stationary Time Series,Forecasting Models for Time Series with a Linear Trend, Forecasting TimeSeries with Seasonality, Regression Forecasting with Casual Variables,Selecting Appropriate Forecasting Models.
Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation UsingAnalytic Solver Platform, New-Product Development Model, NewsvendorModel, Overbooking Model, Cash Budget Model.

MODULE-5:

Decision Analysis: Formulating Decision Problems, Decision Strategies withthe without Outcome Probabilities, Decision Trees, The Value ofInformation, Utility and Decision Making.

MODULE-6:

Recent Trends in : Embedded and collaborative business intelligence, Visualdata recovery, Data Storytelling and Data journalism.

Course Outcomes:

After completion of course, students would be able to:

a. Students will demonstrate knowledge of data analytics.
b. Students will demonstrate the ability of think critically in making decisions based on dataand deep analytics.
c. Students will demonstrate the ability to use technical skills in predicative and prescriptivemodeling to support business decision-making.
d. Students will demonstrate the ability to translate data into clear, actionable insights.

REFERENCES

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

CODE: OEC-102A

SUBJECT NAME: Industrial Safety (OPEN ELECTIVE)

NO OF CREDITS: 3

M.TECH SEMESTER III	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

MODULE-1:

Industrial safety: Accident, causes, types, results and control, mechanical and electricalhazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressurevessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

MODULE-2:

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering,Primary and secondary functions and responsibility of maintenance department, Types ofmaintenance, Types and applications of tools used for maintenance, Maintenance cost & its relationwith replacement economy, Service life of equipment.

MODULE-3:

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reductionmethods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravitylubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition,principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

MODULE-4:

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need andapplications, sequence of fault finding activities, show as decision tree, draw decision tree forproblems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment‟slike, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi. Electrical motors, Types of faults in machine tools and their general causes.

MODULE-5:

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

REFERENCES

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall L

CODE: OEC-103A

SUBJECT NAME: Operations Research (OPEN ELECTIVE)

NO OF CREDITS: 3

M.TECH SEMESTER III	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

MODULE-1:

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

MODULE-2:

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplexmethod - sensitivity analysis - parametric programming.

MODULE-3:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

MODULE-4:

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

MODULE-5:

Competitive Models,Single and Multi-channel Problems, Sequencing Models, DynamicProgramming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Course Outcomes:

After completion of course, students would be able to:

a. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
b. Students should able to apply the concept of non-linear programming.
c. Students should able to carry out sensitivity analysis.
d. Student should able to model the real world problem and simulate it.

REFERENCES

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

CODE: OEC-104A

SUBJECT NAME: Cost Management of Engineering Projects (OPEN ELECTIVE)

NO OF CREDITS: 3

M.TECH SEMESTER III	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

MODULE-1:

Introduction and Overview of the Strategic Cost Management Process

MODULE-2:

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunitycost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operationalcontrol; Provision of data for Decision-Making.

MODULE-3:

Project: meaning, Different types, why to manage, cost overruns centres, various stages of projectexecution: conception to commissioning. Project execution as conglomeration of technical and nontechnicalactivities.Detailed Engineering activities. Pre project execution main clearances anddocuments Project team: Role of each member. Importance Project site: Data required withsignificance. Project contracts.Types and contents. Project execution Project cost control. Bar chartsand Network diagram. Project commissioning: mechanical and process.

MODULE-4:

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis.Various decision-makingproblems.Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Targetcosting, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material RequirementPlanning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement ofDivisional profitability pricing decisions including transfer pricing.

MODULE-5:

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Course Outcomes:

REFERENCES

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

CODE: OEC-105A
SUBJECT NAME: Composite Materials (OPEN ELECTIVE)
NO OF CREDITS: 3

M.TECH SEMESTER III	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

MODULE-1: Introduction

Definition – Classification and characteristics of Composite materials.Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall compositeperformance.

MODULE-2: **Reinforcements**
Preparation-layup, curing, properties and applications of glassfibers, carbon fibers, Kevlar fibers and Boron fibers.Properties and applications of whiskers, particlereinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures.Isostrain and Isostress conditions.

MODULE-3: **Manufacturing of Metal Matrix Composites**
Casting – Solid State diffusion technique,Cladding – Hot isostatic pressing.Properties and applications. Manufacturing of Ceramic MatrixComposites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carboncomposites: Knitting, Braiding, Weaving. Properties and applications.

MODULE-4:**Manufacturing of Polymer Matrix Composites**
Preparation of Moulding compounds andprepregs – hand layup method – Autoclave method – Filament winding method – Compressionmoulding – Reaction injection moulding. Properties and applications.

MODULE-5: Strength
Laminar Failure Criteria-strength ratio, maximum stress criteria, maximumstrain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insightstrength; Laminate strength-ply discount truncated maximum strain criterion; strength design usingcaplet plots; stress concentrations.

Course Outcomes:

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, WestGermany.
2.Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

REFERENCES

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W.Tasi.

CODE:OEC-106A

SUBJECT NAME: Waste to Energy (OPEN ELECTIVE)

NO OF CREDITS:

M.TECH SEMESTER III	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

MODULE-1: Introduction to Energy from Waste

Waste: Classification of waste as fuel – Agro based, Forest residue,Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

MODULE-2:Biomass Pyrolysis

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yieldsand application – Manufacture of pyrolytic oils and gases, yields and applications

MODULE-3:Biomass Gasification

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermalheating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration ingasifier operation.

MODULE-4:Biomass Combustion

Biomass stoves – Improved chullahs, types, some exotic designs, Fixedbed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction andoperation - Operation of all the above biomass combustors.

MODULE-5:Biogas

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology andstatus - Bio energy system - Design and constructional features - Biomass resources and theirclassification - Biomass conversion processes - Thermo chemical conversion – Directcombustion -biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion – Typesof biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban wasteto energy conversion - Biomass energy programme in India

Course Outcomes:

REFERENCES

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, TataMcGraw Hill Publishing Co. Ltd., 1983.

3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons,1996.

Audit Courses I & II

CODE: AUD-01A

SUBJECT NAME: English for Research Paper Writing

NO OF CREDITS:

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability.
2. Learn about what to write in each section.
3. Understand the skills needed when writing a Title.

Ensure the good quality of paper at very first-time submission

MODULE-1:

Planning and Preparation, Word Order, Breaking up long sentences,Structuring Paragraphs and Sentences, Being Concise and RemovingRedundancy, Avoiding Ambiguity and Vagueness.

MODULE-2:

Clarifying Who Did What, Highlighting Your Findings, Hedging andCriticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts.Introduction

MODULE-3:

Review of the Literature, Methods, Results, Discussion, Conclusions, theFinal Check

MODULE-4:

Key skills are needed when writing a Title, key skills are needed whenwriting an Abstract, key skills are needed when writing an Introduction,skills needed when writing a Review of the Literature

MODULE-5:

Skills are needed when writing the Methods, skills needed when writing theResults, skills are needed when writing the Discussion, skills are neededwhen writing the Conclusions.

MODULE-6:

Useful phrases, how to ensure paper is as good as it could possibly be thefirst- time submission

Course Outcomes:

REFERENCES

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman‟sbook .

4. Adrian Wallwork , English for Writing Research Papers, Springer New York DordrechtHeidelberg London, 2011

CODE: AUD-02A

SUBJECT NAME: Disaster Management

NO OF CREDITS:

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

Students will be able to

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction andhumanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice frommultiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance inspecific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

MODULE-1: Introduction

Disaster: Definition, Factors And Significance; Difference Between HazardAnd Disaster; Natural And Manmade Disasters: Difference, Nature, Types AndMagnitude.

MODULE-2:Repercussions Of Disasters And Hazards

Economic Damage, Loss OfHuman 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.

MODULE-3:Disaster Prone Areas In India

Study Of Seismic Zones; Areas Prone To Floods And Droughts, LandslidesAnd Avalanches; Areas Prone To Cyclonic And Coastal Hazards With SpecialReference To Tsunami; Post-Disaster Diseases And Epidemics.

MODULE-4:Disaster Preparedness And Management

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

MODULE-5:Risk Assessment

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

MODULE-6: Disaster Mitigation

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

Course Outcomes:

REFERENCES

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues andstrategies ““NewRoyal book Company.

2. Sahni, Pardeep Et.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall OfIndia, New Delhi.

3. Goel S. L. , Disaster Administration And Management Text And Case Studies” ,Deep &DeepPublication Pvt. Ltd., New Delhi

CODE: AUD-03A

SUBJECT NAME: Sanskrit for Technical Knowledge

NO OF CREDITS:

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

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

MODULE-1:

Alphabets in Sanskrit, Past/Present/Future Tense,Simple

Sentences **MODULE-2:**

Order, Introduction of roots, Technical information about Sanskrit Literature

MODULE-3:

Technical concepts of Engineering-Electrical, Mechanical,Architecture, Mathematics

Course Outcomes:

After completion of course, students would 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

REFERENCES

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri,Rashtriya SanskritSansthanam, New Delhi Publication

3. “India‟s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.Course Output

CODE: AUD-04A

SUBJECT NAME: Value Education

NO OF CREDITS:

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

Students will be able to

1. Understand value of education and self- development.
2. Imbibe good values in students.
3. Let the should know about the importance of

MODULE-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 Judgments

MODULE-2:

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

MODULE-3:

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

MODULE-4:

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

Course Outcomes:

After completion of course, students would be able to:

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality.

REFERENCES

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford UniversityPress, New Delhi

CODE: AUD-05A

SUBJECT NAME: Constitution of India

NO OF CREDITS:

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights
2. To address the growth of Indian opinion regarding modern Indian intellectuals" constitutionalrole and entitlement to civil and economic rights as well as the emergence of nationhood inthe early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the BolshevikRevolution in 1917 and its impact on the initial drafting of the Indian Constitution

MODULE-1: History of Making of the Indian Constitution

History, Drafting Committee, (Composition & Working)

MODULE-2:Philosophy of the Indian Constitution:

Preamble, Salient Features

MODULE-3: 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.

MODULE-4: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

MODULE-5: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

MODULE-6: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

Course Outcomes:

After completion of course, students would be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before thearrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualizationof social reforms leading to revolution in India.
- Discuss the intellectual origins of the framework of argument that informed the conceptualizationof social reforms leading to revolution in India.
- Discuss the passage of the Hindu Code Bill of 1956

REFERENCES

1. The Constitution of India, 1950 (Bare Act), Government Publication.

2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

CODE: AUD-06A

SUBJECT NAME: Pedagogy Studies

NO OF CREDITS:

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

1. Review existing evidence on the review topic to inform programme design and policymaking undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

MODULE-1: Introduction and Methodology:

Aims and rationale, Policy background, Conceptual framework andterminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching

MODULE-2:

Thematic overview: Pedagogical practices are being used by teachers informal and informal classrooms in developing countries, Curriculum, Teacher education

MODULE-3:

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?, 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

MODULE-4:

Professional development: alignment with classroom practices and followupsupport, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes

MODULE-5:Research gaps and future directions

Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact

Course Outcomes:

After completion of course, students would be able to understand

a. What pedagogical practices are being used by teachers in formal and informal classrooms indeveloping countries?

b. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, andwith what population of learners?

c. How can teacher education (curriculumand practicum) and the school curriculum and guidancematerials best support effective pedagogy?

REFERENCES

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal ofCurriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher educationresearch project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basicmaths and reading in Africa: Does teacher preparation count? International Journal EducationalDevelopment, 33 (3): 272–282.

5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education.Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, „learning to read" campaign.

7. www.pratham.org/images/resource%20working%20paper%202.pdf.

CODE: AUD-07A

SUBJECT NAME: Stress Management by Yoga

NO OF CREDITS:

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

1. To achieve overall health of body
2. To overcome stress.

MODULE-1:

Definitions of Eight parts of yog. (Ashtanga)

MODULE-2:

Yam and Niyam, Do`s and Don‟t‟s in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

MODULE-3:

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

Course Outcomes:

After completion of course, students would be able to:

a. Develop healthy mind in a healthy body thus improving social health also.

b. Improve efficiency.

REFERENCES

1. „Yogic Asanas for Group Tarining-Part-I” : Janardan Swami Yogabhyasi Mandal, Nagpur

2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama(Publication Department), Kolkata

CODE: AUD-08A

SUBJECT NAME: Personality Development through Life Enlightenment Skills

NO OF CREDITS:

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Pre-requisites:

Course Objectives:

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination.
3. To awaken wisdom in students

MODULE-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

MODULE-2:

- 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.

MODULE-3:

- 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

Course Outcomes:

After completion of course, students would be able to:

a. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.
b. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
c. Study of Neetishatakam will help in developing versatile personality of students.

REFERENCES

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata

2. Bhartrihari‟s Three Satakam (Niti-sringar-vairagya) by P.Gopinath,Rashtriya Sanskrit Sansthanam, New Delhi.

CODE: AUD- 10 A

SUBJECT NAME: FRENCH

NO OF CREDITS:

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Description du materiel

1 objectifs communicatifs

- S'initier a'la culture francaise
- De'crire line personne
- Dire la nationalite'
- Parler des saisons
- Localizer des objects
- Demander l donner des goûts et des préférences

2 Grammaire/ vocabulaire

- Les verbes en(er)
- Les pronoms sujels
- Les articles definis
- Le corps humain
- Les verbes en(ir)
- Les articles inde'finis
- La negation
- Les verbes en (ger)
- Le fe'minim et le pluriel
- Les expressions avec faire
- Les (nombres) (1-100)
- Les prepositions
- L'interrogations

- Les verbs en (re) et irreguliers
- Les repas francais
- Les adjectifs possessifs
- De'crire une ville

References:

1) Books referred: a) APPRENONS LE FRANCAIS Methode de Francais by Mahitha Ranjit , Monica Singh
   b) LE NOUVEAU SANS FRONTIERES Methode de Francais by Philippe Domonique, Jacky Girardet
2) Took reference from Bhartia Vidya Bhawan institute of foreign languages.

CODE: AUD- 11 A

SUBJECT NAME:

GERMAN

NO OF CREDITS:

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

Unit-1	• Introduction • Basic Greetings in German
Unit-2	• Counting 1-100 • Basic questions in German • Introduce yourself
Unit-3	• Personal Pronouns • Verb conjugations (regular verbs)
Unit-4	• Articles- der, die, das • Vocabulary (classroom objects with articles)
Unit-5	• Days, months, seasons + im/am • Time (formal & informal) • Counting 1000+
Unit-6	• Verb Conjugations (Irregular verbs) • Separable Verbs

Reference Books:

Netzwerk A1 by Paul Rusch

Studio d A1 by Funk, Kuhn, Demme

CODE: AC-02

SUBJECT NAME: MESSAGE OF BHAGWAT GITA

M.TECH SEMESTER IV	**SESSIONAL: 25**
L T P	**THEORY EXAM: 75**
3 0 0	**TOTAL : 100**

OBJECTIVES:

To enable the students to create an awareness on Message of Bhagwat Gita to instill Moral, Social Values and to appreciate the Karma Yoga.

Unit I

Introduction: Relevance of Bhagavad Gita today- Background of Mahabharatha.
Arjuna Vishada Yoda: Arjuna's Anguish and Confusion- Symbolism of Arjuna's Chariot.
Sankhya Yoga: Imporance of Self-Knowledge- Deathlessness : Indestructibility of Consiousness- Being Established in Wisdom – Qualities of a Sthita-prajna.

Unit 2

Karma Yoga: Yoga of Action – Living in the present- Dedicated Action without Anxiety over Results – Concept of Swadhrma
Dhyana Yoga: Tuning the Mind- Quantity, Quality and Direction of Thoughts- Reaching Inner Silence.

Unit 3

Bhakti Yoga: Yoga of Devotion – Form and Formless Aspects of the Divine- Inner Qualities of a True Devotee.
Ganatraya Vibhaga Yoga: Dynamics of the Three Gunas: Tamas, Rajas, Sattva- Going Beyond the Three Gunas- Description of A Gunatheetha.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to realize the Relevance of Bhagavad Gita today Yoga to devotion, realize the responsibilities and duty in the society.

Textbooks

Swami Chinmayananda, : The Holy Geeta", Central Chinmaya Mission Trust 2002.
Swami Chinmayananda, " A Manual of Self Unfordment", Central Chinmaya Mission Trust, 2001.

CODE: HSMC(H-102)

SUBJECT NAME: UNIVERSAL HUMAN VALUES 2-UNDERSTANDING HARMONY

OBJECTIVE:
The objective of the course is four fold:
1.Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human – Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and selfregulation in nature
3. Understanding Existence as Co-existence of mutually interacting units in all pervasive space
4. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. 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, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
7. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

REFERENCES

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2 Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4 The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews
7 Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

ASSESSMENT CRITERIA

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.
Example:
Assessment by faculty mentor : 10 marks
Self –assessment : 10 marks
Assessment by peers : 10 marks
Socially relevant project/Group Activities/Assignments :20 marks
Semester End Examination : 50 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.