M. TECH. (COMPUTER SCIENCE)

SYLLABUS

UNDER

CHOICE BASED CREDIT SYSTEM

FOR THE STUDENTS

TO BE ADMITTED IN THE SESSIONS

2019-2020, 2020-2021, 2021-2022

DEPARTMENT OF COMPUTER SCIENCE & IT,
UNIVERSITY OF JAMMU

M.TECH.(CS) COURSE STRUCTURE

Semester-Wise Distribution of Courses and Credits

SEMESTER-I

S. No.	Course Code	Course Title	*L-T-P	Credits	External Marks	Internal Marks	Total
1	PSMTTC-101	Advanced Data Structure	3-1-0	4	60	40	100
2	PSMTTC-102	Computer Architecture	3-1-0	4	60	40	100
3	PSMTTC-103	Operating System Concepts & Design	3-1-0	4	60	40	100
4	PSMTTC-104	Advanced Mathematical Structures	3-1-0	4	60	40	100
5	PSMTTC-105	Algorithmic Paradigms and Analysis	3-1-0	4	60	40	100
6	PSMTLC-106	Software-Lab-I (Based on the above courses)	0-0-13	6	75	75	150
		TOTAL	33	26	375	275	650

SEMESTER-II

S. No.	Course Code	Course Title	*L-T-P	Credits	External Marks	Internal Marks	Total
1	PSMTTC-201	Computer Graphics	3-1-0	4	60	40	100
2	PSMTTC-202	Network Security and Cryptography	3-1-0	4	60	40	100
3	PSMTTC-203	Data Warehousing and Data Mining	3-1-0	4	60	40	100
4	PSMTTC-204	Internet Technologies	3-1-0	4	60	40	100
5	PSMTTC-205	Optimization Techniques	3-1-0	4	60	40	100
6	PSMTLC-206	Software-Lab-II (Based on the courses above)	0-0-13	6	75	75	150
		TOTAL	33	26	375	275	650

SEMESTER-III

S. No.	Course Code	Course Title	*L-T-P	Credits	External Marks	Internal Marks	Total
1	As per course opted	Elective	3-1-0	4	60	40	100
2	PSMTTC-301	VLSI and Embedded Systems	3-1-0	4	60	40	100
3	PSMTTC-308	Research Methodology	2-2-0	4	60	40	100
4	PSMTLC-309	Software-Lab-III (Soft-Computing Lab)	0-0-13	6	75	75	150
5	PSMTDC-310	Dissertation (Phase-I)	0-2-0	2	50	50	100
6	Open Course*		--	4	60	40	100
		Total	31	24	365	285	650

*Students shall register for this Course from other Departments of University. He/she may opt for MOOC course of equivalent credits instead.

SEMESTER-IV

S. No.	Course Code	Course Title	*L-T-P	Credits	External Marks	Internal Marks	Total
1	PSMTDC-401	Dissertation (Phase-II)	0-12-24	24	350	200	550
		Total	36	24	350	200	550

*L- Lectures T- Tutorials P- Practical

Elective Courses

PSMTTE-302 Artificial Intelligence
PSMTTE -303 Image Processing
PSMTTE -304 Natural Language Processing
PSMTTE -305 Big Data Analytics using R
PSMTTE -306 Python
PSMTTE -307 Internet of Things

THE CREDITS INDICATED ARE COMPUTED AS FOLLOWS:

1 hour Lecture per week = 1 credits
1 hour Tutorial per week = 1 credit
1 hour Practical per week = 0.5 credits

CREDIT REQUIREMENTS FOR EARNING M. TECH. (CS) DEGREE

The total credits required for the M.Tech.(CS) programme are 100.The credits are distributed over three categories:

CATEGORIES	DESCRIPTION	CREDITS	
Post-graduate Semester Core Courses (PSCC)	Core Departmental Courses	92	96
Post-graduate Semester Elective Courses (PSEC)	Elective Departmental Courses	04	
Post-graduate Semester Open Category Courses (PSOCC)	Other Department Courses	04	
	TOTAL CREDITS	**100**	

Course credits assignment

Lectures and Tutorials: One lecture or tutorial hour per week per semester is assigned one credit.

Practical/Laboratory: One laboratory hour per week per semester is assigned half credit.

EVALUATION:

The evaluation system shall comprise of internal examination and university examination for theory papers and practicals for Semester I, II and III. The weightage in each theory and practical paper shall be as follows:

Weightage in each theory paper

Minor Tests : 40 Marks
Major Test : 60 Marks

Weightage in each practical paper

Internal Test : 75 marks
External Test : 75 marks

EXAMINATION:
The examination in each semester shall be as per the detail given below:

THEORY	**Syllabus to be covered in the examination**	**Time allotted for the exam.**	**Weightage (Marks)**
Minor Test I (after one month)	Upto 25%	1½ hours	20%
Minor Test II (after two months)	Upto 50%	1½ hours	20%
Major Test * (after end of semester)	Upto 100%	3 hours	60%
*(i) 80% weightage in Major Test shall be given to those units which have not been covered in the two Minor Tests. (ii) Certain questions may be framed in such a way which may require knowledge of more than one unit or one question may have multiple parts either subjective and/or objective from one or more units i.e. certain questions may be from across units.			
Total			**100**

PRACTICAL					
Daily evaluation of practical records/ Viva voce etc. (Internal Evaluation)	1.	Viva voce 1	15	35	75
	2.	Viva voce 2	15		
	3.	Practical File	5		
	4.	Internal Exam.+Viva voce 3	25+15	40	
Final Practical performance and viva voce(External Evaluation)	100% syllabus				75
Total					**150**

SCHEME FOR PAPER SETTING (MAJOR EXAMINATION)

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(5 x 3 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

Note: The Paper Setter/Examiner is requested to ensure that the question paper be set in such a manner that questions are uniformly distributed over the entire syllabus.

ATTENDANCE:

Each course (theory, practical etc.) shall be treated as an independent unit for the purpose of attendance. A student shall be required to attend a minimum of 75% of the total instruction hours in a course including tutorials and seminars in each semester. A student who fails to secure 75% attendance in a course shall not be eligible to appear in the semester examination in that course and shall be required to repeat that course.

CRITERIA FOR PROMOTION OF A STUDENT TO NEXT HIGHER SEMESTER:

A student will be eligible to proceed from 1st semester to 2nd semester, from 2nd semester to 3rd semester and from 3rd semester to 4th semester, if he/she has earned 50% credits in Theory/Practical Courses cumulatively in earlier semesters of the programme and has completed the minimum attendance requirements.

ABSOLUTE GRADE SYSTEM

Marks	Grades	Grade Points	Description
>=90	A+	10	Outstanding
>=80 and <90	A	9	Excellent
>=70 and <80	B+	8	Very good
>=60 and <70	B	7	Good
>=50 and <60	C	6	Average
<50	D	Fail	Poor

The ôDô grade stands for ***unsatisfactory performance***. The student shall have to repeat all the compulsory courses where D grade is obtained. The Weightage of ôDô grade shall not be counted in the SGPA or the CGPA. Other grades would include:

I	-	Incomplete
W	-	Withdrawal
X	-	Continued Project
S	-	Satisfactory Completion
Z	-	Non Completion

CONVERSION FROM CGPA TO PERCENTAGE

The conversion of SGPA or CGPA to Percent score will be carried out by multiplication of respective SGPA or CGPA by a factor of 9.17.
A CGPA of 6 shall be considered equivalent to 55% marks.

DISSERTATION EVALUATION

Each student shall be allotted a supervisor by the Dissertation Committee. The evaluation of the dissertation work phase-I (semester-3rd) shall be done by the dissertation committee including the supervisor.

For dissertation work phase-II (semester-4th), the internal evaluation of the dissertation work shall be done by the dissertation committee including the supervisor. The external evaluation shall be done jointly by the supervisor and the external examiner to be invited by the Head of the Department out of the panel recommended by the BOS. The supervisor shall act as internal examiner for evaluation of the dissertation as well as for the conduct of the viva voce. The head of the department shall remain the overall in charge for both internal as well as external examinations of the dissertation work. One examiner shall be invited for a maximum of ten dissertations depending on the specialization/domain of expertise of the examiner.

M. Tech. (Computer Science) Semester-I

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2019, 2020, 2021	
COURSE NO: PSMTTC-101	
COURSE TITLE: ADVANCED DATA STRUCTURES	

Course Objectives & Learning Outcomes:

- To understand the concepts of Data Structures.
- To design and analyze programming problem statements.
- Students would be able to comprehend and select algorithm design approaches in a problem specific manner.
- Students would be able to evaluate algorithms and data structures in terms of time and memory complexity of basic operations.

UNIT-I Linear Structures: Arrays, Linked Lists, Stack, Queue, Priority Queue, Memory Representation, Operations on these Structures, Operation Complexities, Computational and Asymptotic Complexities, Recursion and its types, Applications.

(10 HOURS)

UNIT-II Non-Linear Structures: Trees and Graphs, Binary Trees, Memory Representations, Operations on these Structures, Operation Complexities, Complete Binary Tree, Threaded Binary Trees, Spanning Trees, Topological Sorting, Shortest Path Algorithms, Applications.

(10 HOURS)

UNIT-III Search Lists: Skip Lists, Self organizing Lists, Binary Search Tree Models, Balanced Trees, AVL Trees, 2-3 Trees, 2-3-4 Trees, Red-Black Trees, Top-Down Rebalancing, Finger Trees, Joining and Splitting Balanced Search Trees, m-way Search Trees, B-Trees, B+ Trees, Applications.

(10 HOURS)

UNIT-1V Heaps: Heap, Array-Based Heaps, Heap-Ordered Trees, Half-Ordered Trees, Leftist Heaps, Skew Heaps, Binomial Heaps, Changing Keys in Heaps, Fibonacci Heaps, Heaps of Optimal Complexity, Double-Ended Heaps, Multidimensional Heaps, Applications.

(10 HOURS)

UNIT-V Data Structures for Strings: Strings and Pattern Matching Algorithms, Suffix Arrays, Suffix Trees, Tries, Compressed Tries, Dictionaries, Text Compression, Text Similarity Testing. Hashing**,** Hash Tables, Collision Resolution, Universal Families of Hash Functions, Perfect Hash Functions, One-way Hash Function, Hash Trees, Extendible Hashing, Membership Testers and Bloom Filters, Applications.

(10 HOURS)

M. Tech. (Computer Science) Semester-I

Contd.

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks

Examination to be held: December 2019, 2020, 2021

COURSE NO: PSMTTC-101

COURSE TITLE: ADVANCED DATA STRUCTURES

Text Books& References:

1. Vishal Goyal, "A Simplified Approach to Data Structures", Shroff Publishers Pvt. Ltd, 2014
2. GAV Pai, "Data Structures and Algorithms", Tata McGraw Hills, 2017
3. Seymour Lipschutz, "Data Structures with C", Schaum Outlines, 2011
4. Reema Thareja, "Data Structures using C", 2nd Edition, Oxford University Press, 2014
5. Peter Brass, "Advanced Data Structures", 1st Edition, Cambridge University Press, 2008.
6. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press (India) Pvt. Ltd, 2008
7. Yedidiah Langsam, Moshe J. Augenstein and Aaron M. Tenenbaum, "Data Structures using C and C++", 2nd Edition, Pearson Prentice Hall, 2007.
8. Adam Drozdek, "Data Structures and Algorithms in C++", 2nd Edition, Thomson Asia Pvt. Ltd, 2001.
9. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education India, 2001.
10. Jean-Paul Tremblay and Paul G. Sorenson, "Introduction to Data Structures with Application", 2nd Edition, Tata McGraw-Hill, 2001.

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-I

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2019, 2020, 2021	
COURSE NO: PSMTTC-102	
COURSE TITLE: COMPUTER ARCHITECTURE	

Course Objectives & Learning Outcomes:

- To study the organization and architecture of digital computers
- To conceptualize and understand instruction level parallelism.
- To analyze processor performance improvement using instruction level parallelism,
- To categorize memory organization and understand functions of memory hierarchy.

UNIT I-Pipeline: Linear And Nonlinear Pipeline Processor, Pipeline Performance, Instruction Pipeline Design, Instruction Pipeline, Mechanisms for Instruction Pipeline, Dynamic Instruction Scheduling, Branch Handling Techniques, Arithmetic Pipeline Design, Computer Arithmetic Principles.

(10 HOURS)

UNIT II-Memory Hierarchy & Organization: Cache Memories, Cache Coherence and its Issues, Cache Addressing Models, Direct Mapping And Associative Caches, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Hierarchical Memory Technology, Memory Capacity Planning, Virtual Memory Technology.

(10 HOURS)

UNIT III-Parallel Computer Models & Program Parallelism:
Parallel Processing and its Applications, Flynnôs Classification: SISD, SIMD&MIMD, its Architecture, Condition of Parallelism, Data and Resource Dependences, Conditions of Parallelism, Hardware And Software Parallelism, Program Partitioning & Scheduling, Grain Size Latency, Program Flow Mechanisms: Control Flow versus Data Control, Data Flow Architecture, Demand-Driven Mechanisms.
Vector Instruction Types, Vector Access Memory Schemes, Vector and Symbolic Processors.

(10 HOURS)

UNIT IV-Scalability and Performance evaluation: Principles of Scalable Performance, Performance Metrics And Measures, Speedup Performance Laws: Amdahlôs Law, Gustafsonôs Law, Scalability Analysis and Approaches, CPU Performance Evaluation.

(10 HOURS)

UNIT V-System Interconnection: Multiprocessor System Interconnection and Multi Computers, Network Properties and Routing, Hierarchical Bus Systems, Static Interconnection Networks, Dynamic Interconnection Networks.

(10 HOURS)

M. Tech. (Computer Science) Semester-I

Contd.

Total Marks = 100 — Minor Test I = 20 Marks
No. of Credits = 4 — Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours — Major Test = 60 marks
Examination to be held: December 2019, 2020, 2021
COURSE NO: PSMTTC-102
COURSE TITLE: COMPUTER ARCHITECTURE

Text Books& References:

1. Kai Hwang, "Advanced computer architecture", 2nd Edition, Tata McGraw Hill, 2010
2. Morris Manno, "Computer System Architecture", Revised 3rd Edition, Pearson Publications, 2017
3. J. P. Hayes, "Computer Architecture and Organization", 3rd Edition, Tata McGraw Hills, 2017
4. D. A. Patterson, J. L. Hennessy, "Computer Architecture: A quantitative approach", Morgan Kauffmann Publishers, 2011.
5. Hwang and Briggs, "Computer Architecture and Parallel Processing", Mc GrawHills.
6. R. W. Hockney, C. R. Jesshope, "Parallel Computer 2", 2nd Edition, Adam Hilger.

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-I

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2019, 2020, 2021	
COURSE NO: PSMTTC-103	
COURSE TITLE: OPERATING SYSTEM PRINCIPLES	

Course Objectives & Learning Outcomes:

- To explore the mechanisms of OS to handle processes, threads and their communication.
- To understand the mechanisms involved in memory management in contemporary OS.
- To gain knowledge on distributed operating system concepts that includes architecture, mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
- To brief the students about concepts of Unix/Linux using shell programming.

UNIT I-Introduction to Operating Systems

Evolution of operating systems, operating systems concepts, types of operating systems, different views of the operating system, operating system services, System calls, Types of system calls. Operating system Structure, Layered Approach, Microkernels, Virtual machines, Loader, Linker, Subroutine Linkage, Relocation.

(10 HOURS)

UNIT II-Process Management

Process concept, operation on processes, mutual exclusion, Process scheduling, Inter-process communication algorithms and its solutions like software based solutions (Dekkerôs Algorithm), Basic Concepts, Scheduling criteria, Scheduling algorithms

Process Synchronization, Inter process Synchronization, Critical section Problem, Semaphores, Monitors, Message passing.

Deadlocks: System Model, Characterization, Prevention, Avoidance, Recovery, Detection and Recovery.

(10 HOURS)

UNIT III-Memory Management

Memory management, swapping, contiguous memory allocation, relocation & protection, Memory management, Prepaging, Paging, Segmentation, Intel Pentium Segmentation, Intel Pentium Paging, Virtual memory, demand paging, performance of demand paging, Page replacement algorithms: FIFO, Optimal, LRU, Counting based page replacement.

(10 HOURS)

UNIT IV-File & I/O Management

Files system structure, file system implementation, Directory Implementation, Allocation Methods, contiguous allocation, Linked allocation, Indexed allocation Disk organization, disk space management, disk scheduling, Disk Management, RAID Structure.

(10 HOURS)

UNIT V-Introduction to LINUX/UNIX

Various parts of operating system, Kernel, Iimportant parts of kernel, Files and Directories: pathname; Directory Tree; current working directory; relative pathname, device files, Unix Process control commands like (ps, top, bg, fg, clear, history), Unix file system commands like (touch, cat, cp, mv, rm, mkdir), File permissions; Pipes; tees; mount, init, Files, Directories, Unix Utilities program commands, Unix File Permissions, Filters, Regular Expressions, Vi-Editor, Vi-editing commands.

Shell Programming, Shell Script, Logical Operators, If else Statement, Case structure, Looping.

Introduction to PERL language, Case study: LINUX/UNIX

(10 HOURS)

M. Tech. (Computer Science) Semester-I

Contd.

Total Marks = 100 — Minor Test I = 20 Marks
No. of Credits = 4 — Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours — Major Test = 60 marks
Examination to be held: December 2019, 2020, 2021
COURSE NO: PSMTTC-103
COURSE TITLE: OPERATING SYSTEM PRINCIPLES

Text books& References:

1. Silberschart, Galvin, Gagne, "Operating System Concepts", 9th Edition, WSE Wiley, 2016.
2. Andrew. S. Tanenbaum, "Modern operating systems" 4th Edition, Pearson Prentice Hall, 2018
3. Milan Milenkovic, "Operating system-concepts and design", 2nd Edition, McGraw Hill International Edition, 2005
4. A. S. Godbole, "Operating systems", 3rd Edition, Tata McGraw hill, 2017
5. Deitel H. M, "Operating System", 3rd Edition, Pearson Publications, 2012
6. Madnick & Donovan, "Operating Systems", Tata McGraw Hill, 2003
7. Sumitabha Das, "UNIX Concepts and Application, 4th Edition, Tata McGraw Hill, 2017
8. Richard L. Petersen, "The Complete Reference Linux", 6th Edition, Tata McGraw Hill, 2010.
9. Yashwant Kanetkar, "Unix Shell programming", BPB publications
10. Gary Nutt, "Operating System: A Modern Perspective", Addison-Wesley, University of Virginia
11. J. Peek, J. Strang, G. Todino, "Learning the Unix Operating System", 5th Edition, O'Reilly, 2001

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-I

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2019, 2020, 2021	
COURSE NO: PSMTTC-104	
COURSE TITLE: ADVANCED MATHEMATICAL STRUCTURES	

Course Objectives & Learning Outcomes:

- To comprehend and evaluate the concepts of different mathematical models.
- To identify and apply properties of combinatorial structures and properties.
- To understand properties about the structure based on the observations.
- Students would gain conceptual background needed to identify structures of algebraic properties.

UNIT I-Counting Techniques: Basics of Counting, Pigeon Hole Principles, Permutation and Combination, Recurrence Relations & their Solution (Homogeneous & Non-Homogenous), Decision Trees, Divide & Conquer Relations Function.

(10 HOURS)

UNIT II-Posets, Hasse Diagram and Lattices: Introduction of Ordered Set, Hasse Diagram of Partially Ordered Set, Isomorphic Ordered Set, Well Ordered Set, Properties of Lattices and Complemented Lattices. Introduction to Fuzzy Systems, Fuzzy Sets, Equality of Fuzzy Sets, Normal Fuzzy Sets, Containment, Support of Fuzzy Set, Alpha-Level Sets, Basic Operation of Fuzzy Sets.

(10 HOURS)

UNIT III-Graphs: Introduction to Graphs, Incidence and Degree, Handshaking Lemma, Isomorphism, Subgraphs and Union of Graphs, Connectedness, Walks, Paths and Circuits, Components, Connectedness Algorithm, Shortest Path Algorithms, Eulerian Graph, Fleuryôs Algorithms, Hamiltonian Graph - Necessary Conditions And Sufficient Conditions, Travelling Salesman Problem, Bipartite Graphs, Directed Graphs, Binary Relations, Connectedness in Directed Graph, Matrix Representations Of Graph: Incidence, Adjacency Matrices and their Properties etc.

(10 HOURS)

UNIT IV-Trees: Properties of Trees, Pendant Vertices in a Tree, Center of a Tree, Rooted an Binary Trees, Spanning Trees-Spanning Tree Algorithms, Fundamental Circuits, Spanning Trees of a Weighted Graph, Cutsets and Cut-Vertices, Fundamental Cutsets, Connectivity and Separativity etc.

(10 HOURS)

UNIT V-Planar graphs & Colouring: Combinatorial and Geometric Dual, Kuratowski's Graphs, Detection of Planarity, Thickness and Crossings. Colouring of Graphs: Vertex Colouring, Chromatic Number, Chromatic Polynomial, The Four Colour Problem, Edge Coloring, Colouring Algorithms etc.

(10 HOURS)

M. Tech. (Computer Science) Semester-I

Contd.

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks

Examination to be held: December 2019, 2020, 2021

COURSE NO: PSMTTC-104

COURSE TITLE: ADVANCED MATHEMATICAL STRUCTURES

Text books&References:

1. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall, 2018.
2. B. Kolman, R. Busby, "Discrete Mathematical Structures", 6th Edition, Pearson Publications, 2015.
3. F. Harary, "Graph Theory", Addison - Wesley Publications Camp, 2001
4. J. P Trembly and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", 1st Edition, McGraw Hill.
5. V. Krishnamurthy, "Combinatorics Theory and Applications", Affiliated East-West Press Pvt. Ltd, 2008

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-I

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2019, 2020, 2021	
COURSE NO: PSMTTC-105	
COURSE TITLE: ALGORITHMIC PARADIGMS AND ANALYSIS	

Course objectives & Learning Outcomes:

- The course aims at design and analysis of various algorithms used in computer science and engineering.
- Students would be able to learn the significance and various aspects of development of algorithms.
- Students would be able to analyze and compare the algorithms on the basis of complexity and design efficient algorithms

UNIT I-Fundamentals of Design & Analysis of Algorithm: Algorithms & Available Tools, Principle of Mathematical Induction, Concept of Efficiency of an Algorithm, Performance Analysis, Space Complexity, Time Complexity, Amortized Complexity, Asymptotic Notations, Best Case, Worst Case, Average Case and Amortized Analysis, Master Theorem, Mathematical Analysis of Non-recursive and Recursive Algorithms. Analysis and Practical Implementation of well known Sorting and Searching Techniques.

(10 HOURS)

UNIT II-Recurrence Relations: The Fibonacci Sequences, Tower of Hanoi, Catalan Numbers, Divide and Conquer Methods, Solving Recurrences, Linear Homogeneous Recurrences, Linear Non- Homogeneous Recurrences, Methods of Inspection, Telescoping Sums, Iteration and Substitution, Practical Implementation of Important Problems.

(10 HOURS)

UNIT III-Design Paradigms: Basic Concept of Greedy Technique and Problems: Job sequencing with Deadlines, Single- Source Shortest Paths, Defective Chessboard and Multiplication of Large Integers.
Dynamic Programming concept and problems: All-Pairs Shortest Paths, The Travelling Salesperson Problem.

(10 HOURS)

UNIT IV-Backtracking&Branch and Bound: Defective Chessboard and Multiplication of Large Integers, Backtracking Concept and Applications: The N-queens Problem, Graph Coloring and Sum of Subsets Problem, Analysis and Practical Implementation of Important Problems.

(10 HOURS)

UNIT V-Models for Executing Algorithms: Regular expressions, Finite automata, Context Free Grammars, Derivation trees, Pushdown Finite Automata, Turing Machine, Algorithmically Unsolvable Problems. Nondeterministic Algorithms, Classification of Problems, P, NP, NP-Hard and NP-Complete Problems, Establishing NP-Completeness of Problems.

(10 HOURS)

M. Tech. (Computer Science) Semester-I

Contd.

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks

Examination to be held: December 2019, 2020, 2021

COURSE NO: PSMTTC-105

COURSE TITLE: ALGORITHMIC PARADIGMS AND ANALYSIS

Text books&References:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rdEdition, MIT Press, 2009.
2. E. Horowitz , S. Sahni , S. Rajasekaran, "Computer Algorithms", 2ndEdition, Universities Press, 2008.
3. R. C. T. Lee, S. S. Tseng, R. C. Chang & Y. T. Tsai, "Introduction to the Design and Analysis of Algorithms: A Strategic Approach", 2nd Edition, Tata McGraw-Hill, 2009
4. M. T. Goodrich and R. Tomassia, "Algorithm Design Foundations, Analysis and Internet examples", 1st Edition, John Wiley and sons, 2006
5. Aho, Ullman and Hopcroft, "Design and Analysis of algorithms", 3rd Edition, Pearson Education, 2008

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-I

Total Marks = 150	Internal Evaluation = 75 Marks
No. of Credits = 6	External Evaluation = 75 Marks
Examination to be held: December 2019, 2020, 2021	
COURSE NO: PSMTLC-106	
COURSE TITLE: Software-Lab-1 (C++) (Programming Lab)	

Practicals will be based on the courses being taught in the current semester. The distribution of marks shall be as per the scheme given below.

PRACTICAL					
Daily evaluation of practical records/ Viva voce etc. (Internal Evaluation)		Viva voce 1	15	35	75
	2.	Viva voce 2	15		
	3.	Practical File	5		
	4.	Internal Exam.+Viva voce 3	25+15	40	
Final Practical performance and viva voce(External Evaluation)	100% syllabus				75
				Total	150

-x-

M. Tech. (Computer Science) Semester-II

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: May2020, 2021, 2022	
COURSE NO: PSMTTC-201	
COURSE TITLE: COMPUTER GRAPHICS	

Course Objectives & Learning Outcomes:

- ŏ To introduce the components of a graphics system and make students familiar with building approach of graphics system and algorithms.
- ŏ To implement various algorithms to scan and convert various geometrical transformations.
- ŏ To comprehend and analyze the fundamentals of animation, underlying technologies, principles and concepts used in computer graphics.
- ŏ Students would be able to implement the application of computer graphics concepts in the development of computer games, information visualization and business applications.

UNIT I-Introduction to Computer Graphics: Computer Graphics and its Applications, Graphics Input and Output Devices, Graphic Display Devices: Refreshing Display Devices, Random Scan Display Device, Raster Scan Devices, Color Models, Graphics Software Standards, Graphics Kernel System, PHIGS, OpenGL.

(10 HOURS)

UNIT II-Graphic Primitives: Basic concepts of Points, Lines, Circle etc , Scan Conversion Algorithms of Line: DDA and Bressenham Algorithm, Circle: Bressenham Circle Generation, Mid Point, Side Effects of Scan Conversion, Polygon Filling, Point and Line Clipping, Line Clipping Algorithms: Cohen Sutherland and Cyrus ï Beck.

(10 HOURS)

UNIT III-Transformations: Introduction to 2D transformations, Composite Transformations, Transformations using Homogeneous Coordinate Systems. 3D transformations, Orientation Representation, Viewing Transformation.

(10 HOURS)

UNIT IV-Projections: Concept of Projections, Parallel, Orthographic and Oblique Projections, Isometric and Perspective Projections, Various Illumination Models, Shading.

(10 HOURS)

UNIT V-Curves and Surfaces: Polygon representation methods**,** Hermite, Bezier and B-spline Curves and their Properties. Fractals, Surface of Revolution. Concept of Visible Surface Detection. Methods of Visible Surface Detection: Backface Removal, Z-Buffer, Painters Algorithm. Wireframe model, 3D Rendering Techniques, Ray-Tracing, Radio city.

(10 HOURS)

M. Tech. (Computer Science) Semester-II

Contd.

Total Marks = 100 — Minor Test I = 20 Marks
No. of Credits = 4 — Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours — Major Test = 60 marks
Examination to be held: May 2020, 2021, 2022
COURSE NO: PSMTTC-201
COURSE TITLE: COMPUTER GRAPHICS

Text Books & References:

1. Hearn, D. Baker, "Computer Graphics", 2nd Edition Prentice-Hall, 2013
2. A. P Godse, "Computer Graphics", 4th edition , Technical publications Pune, 2015.
3. Newman, W. Sproul, R. F. , "Principles of Interactive Computer Graphics", 2nd Edition, McGraw Hill, 2001
4. Rogers, D. F, "Procedural Elements for Computer Graphics, 2nd Edition McGraw-Hill, 2003
5. Rogers, D. F. McGraw Hill: Mathematical Elements of Computer Graphics", 2nd Edition, McGraw Hill Education, 2017
6. R. A. Plastock and G. Kalley, "Computer Graphics", McGraw Hill, 2017.

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-II

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: May 2020, 2021, 2022	
COURSE NO: PSMTTC-202	
COURSE TITLE: NETWORK SECURITY AND CRYPTOGRAPHY	

Course Objectives & Learning Outcomes:

- To understand the fundamentals of Cryptography and some key encryption techniques.
- To be able to secure a message over insecure channel by various means.
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To design security applications in the field of computer science and Information technology

UNIT I-Foundation: Cryptography, Principle, Key, Design Principles, Substitution and Transposition, Breaking Substitution and Transposition Cipher, Modular Arithmetic, Totient Function, Fermatôs and Eulerôs Function, One-way Function, Invertible Function, Euclidôs Algorithm, Gallios Field (2^n), FIPS and NIST standards.

(10 HOURS)

UNIT II-Symmetric Key Cryptography: Concept of Private key, Block Ciphers: Modes of Operation, Data Encryption Standard (DES), Double DES, Triple DES, International Data Encryption Algorithm (IDEA), Advanced Encryption Standard (AES)- Rijndael Algorithm, Twofish, Blowfish, RC2, RC5, Stream Ciphers , RC4, One Time Pads.

(10 HOURS)

UNIT III-Asymmetric Key Cryptography: Concept of Public key, Rabin Cryptosystem, ElGamal Cryptosystem, Knapsack Cryptosystem, RSA, Attacks on these Cryptosystems, Optimal Asymmetric Encryption Padding, Elliptic Curve Cryptography.

(10 HOURS)

UNIT IV-Authentication Protocol: Authentication using Symmetric and Asymmetric Key Cryptography, Reflection Attack, Man-in-the-Middle Attack, DOS and DDOS attacks: Types and mitigation methods, Zero Knowledge Protocol**.**

Diffie-Hellman Key Exchange, Key Distribution Center, Kerberos, X. 509 directory Authentication service, PGP, S/MIME.

(10 HOURS)

UNIT V-Digital Signature: Hash function, Secure Hash Algorithm, Message digest Algorithm, HMAC, HMAC specifications, MD5, SHA-1, Digital signatures, Digital signature standards.

(10 HOURS)

M. Tech. (Computer Science) Semester-II

Contd.

Total Marks = 100 — Minor Test I = 20 Marks
No. of Credits = 4 — Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours — Major Test = 60 marks
Examination to be held: May 2020, 2021, 2022

COURSE NO: PSMTTC-202

COURSE TITLE: NETWORK SECURITY AND CRYPTOGRAPHY

Text Books & References:

1. Atul Kahate. , "Cryptography and Network Security", 3rd Edition, Tata McGraw-Hill Education, 2013
2. William Stallings, "Cryptography and Network Security", 4th Edition, Pearson Education Inc. , 2017
3. Behrouz A. Forouzan, "Cryptography and Network Security", 4th Edition, McGraw Hills, 2017.
4. Charlie Kufman, Radia Perlman and Mike Speciner, "Network Security", 2nd Edition, PHI, 2005.
5. Bruce Schneier, Neils Ferguson, "Practical Cryptography", First Edition , Wiley Dreamtech India Pvt Ltd, 2003.
6. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education Asia, 2003.
7. www. ocw. mit. edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6857Fall2003/Course/Home /index. html

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-II

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: May 2020, 2021, 2022	
COURSE NO: PSMTTC-203	
COURSE TITLE: DATA WAREHOUSING AND DATA MINING	

Course Objectives & Learning outcomes:

- To introduce students to the basic concepts and techniques of Data Mining.
- To develop skills of using recent data mining software for solving practical problems.
- Students would gain experience of doing independent study and research in data mining.

UNIT I-Database Introduction: Database Management System Concepts and Architecture, Normalization, RDBMS, Concurrency Control etc.

(10 HOURS)

UNIT II-Data Warehouse and OLAP Technology for Data Mining: Introduction to Data Warehouses, Differences between Operational Database Systems and Data Warehouses, Multidimensional Data Model, Three-tier Data Warehouse Architecture, Schemas -Stars, Snowflakes and Fact Constellations, Steps for the Design and Construction of Data Warehouses, Physical and Logical Data Models, Data Marts, Metadata, OLTP & OLAP, OLAP Operations, Categorization of OLAP Tools.

(10 HOURS)

UNIT III-Data Preprocessing: Advanced Database System and its Applications, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation. Data Mining Primitives, Concept Description, Data Generalization and Summarization Based Characterization, Analytical Characterization, Mining Frequent Patterns, Association and Correlations, Basic concepts and Methods-Apriori Algorithm.

(10 HOURS)

UNIT IV-Motivation, importance, Data type for Data Mining : Data Mining: Introduction, Motivation, Importance, Knowledge Discovery Process, Data Mining vs. Query Tools, What Kind of Data can be mined, Mining Interesting Patterns.

(10 HOURS)

UNIT V-Data mining Functionalities: Concept/Class description, Association Analysis, Classification & Prediction, Decision Tree Induction, Bayes Classification Methods, Rule ï Based Classification. Cluster Analysis, Types of data, Partitioning methods (K-means), Outlier Analysis, Hierarchical Methods, Evolution Analysis, other Data Mining Algorithm.

(10 HOURS)

M. Tech. (Computer Science) Semester-II

Contd.

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks

Examination to be held: May 2020, 2021, 2022

COURSE NO: PSMTTC-203

COURSE TITLE: DATA WAREHOUSING AND DATA MINING

Text Books & References:

1. Jiawei Han, Micheline Kamber and Jian Pei, ñData Mining: Concepts and Techniquesò, 3rd Edition, Elsevier, 2011.
2. Elmasri, Navathe, Somayajulu, Gupta: ñFundamentals of Database Systemsò, 6th Edition, Addison Wesley, Pearson Education,
3. Alex Berson and Stephen J. Smith, ñ Data Warehousing, Data Mining & OLAPò, 1st Edition, Tata McGraw ï Hill Edition, 2004.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, ñIntroduction To Data Miningò, 2nd Edition, Pearson Education.
5. K. P. Soman, Shyam Diwakar and V. Ajay ñ, Insight into Data mining Theory and Practiceò, Easter Economy Edition, Prentice Hall of India, 2006.
6. G. K. Gupta, ñIntroduction to Data Mining with Case Studiesò, 2nd Edition, Prentice Hall of India, 2011
7. Daniel T. Larose, ñData Mining Methods and Modelsò, 2nd Edition, Wiley Interscience, 2016.

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-II

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: May 2020, 2021, 2022	
COURSE NO: PSMTTC-204	
COURSE TITLE: INTERNET TECHNOLOGIES	

Course Objectives & Learning Outcomes:

- To develop responsive web applications
- To implement interactive web page(s) using HTML, CSS and JavaScript.
- To build Dynamic web sites using server side PHP Programming and Database connectivity.
- Students would be able to create ASP. Net applications using standard . net controls.

UNIT I-Markup and Scripting Languages:

HTML & XHTML: Basic Layout of HTML, Head Section: Title, Base, Link, Meta. Body Section: Text Formatting and Alignment, Fonts, Colors, Ordered and Unordered Lists, Links, Images, Sounds, Video, Background, Tables, Forms, Frames. Introduction to XHTML

DHTML**:** Cascading Style Sheet, Inline Styles, Embedded Style, Linking External Style Sheets, Positioning Elements, User Style Sheets, Document Object Model. Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script

XML**:** Structuring Data, XML Namespaces, DTD and Schemas, XML Variables, DOM Methods, Simple API for XML, Web Services, Application of XML.

(10 HOURS)

UNIT II-Socket programming:

Networking Classes and Interfaces, Inetaddress, TCP/IP Client Sockets, URL Connection, HTTP URL Connection, Datagrams.

(10 HOURS)

UNIT III-Web servers and Servlets:

Tomcat Server Installation & Testing. Lifecycle of a Serverlet, JSDK Servelet API, Javax. Servelet Package, Reading Servelet Parameters, Reading Initialization Parameters, The Javax. Servelet HTTP Package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues, Servlet-Database Programming using JDBC, Problem with Servlets.

(10 HOURS)

UNIT IV-JSP:

Introduction to JSP: JSP Processing, Lifecycle JSP Application Design with MVC Architecture. JSP, Scripting Elements, JSP Expression, JSP Declaration, Predefined Variables/Objects Working with Databases using JSP, Inserting, Updating, and Deleting Database Records.

(10 HOURS)

UNIT V-Case Study:

Introduction to . NET Frame Work , Components of . NET , Introduction of ASP. NET, Server Pages: Creating Server Pages, Page Life Cycle, HTTP Request Object, HTTP Response Object, Post Back, Tracing & Debugging ASP. NET Page, State Management and Types of State Management, HTTP Cookies, HTTP Session, HTTP Application, Query String Method, State Management using Post Back URL, View State.

(10 HOURS)

M. Tech. (Computer Science) Semester-II

Contd.

Total Marks = 100 — Minor Test I = 20 Marks
No. of Credits = 4 — Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours — Major Test = 60 marks
Examination to be held: May 2020, 2021, 2022
COURSE NO: PSMTTC-204
COURSE TITLE: INTERNET TECHNOLOGIES

Text Books & References:

1. Chris bates, ñWeb Programmingò, 2nd Edition, Wiley Dreamtech India, 2006.
2. Ramesh Bangia, ñMultimedia and Web Technologyò, 2nd Edition, Firewall Media, 2007.
3. D. Flanagan, ñJavascript-The Definative Guideò, 6th Edition, O Reilly Publication, 2011.
4. James Jaworski , ñMastering Javascript and Jscriptò , 2nd Edition, BPB
5. Phil Hana , òJSP : The complete Referenceò, Osborne/McGraw-Hill, 2001
6. Jeff Rule, ñDynamic HTMLò, 1st Edition, Dreamtech Press
7. Jose Annunziato and Stephanie Fesler Kaminaris, òJava Server pages in 24 Hoursò, 1st Edition, Techmedia
8. https: //www. w3schools. com/
9. https: //www. Javatpoint. com/

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-II

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: May 2020, 2021, 2022	
COURSE NO: PSMTTC-205	
COURSE TITLE: OPTIMIZATION TECHNIQUES	

Course Objectives & Learning Outcomes:

- To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems
- To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology
- To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

UNIT I-Linear programming: Overview of Optimization Techniques, Tools, Phases, Limitations and Applications. Formulation of A Linear Programming Problem with Different Types of Constraints, Requirements, Assumptions, Merits and Demerits, Applications of LP, Graphical Analysis, Graphical Solution, Multiple, Unbounded Solution and Infeasible Problems and Its Applications

Simplex Method: Principle, Computational Aspect, SM With Several Decision Variables. Two Phase LP Problem, Multiple, Unbounded Solution, Infeasible Problems, Dual Simplex Problems, Sensitivity and Duality Analysis in LP.

(10 HOURS)

UNIT II-Transportation Problem (TP): Structure and Formulation of TP, Procedure for TP, Methods for Finding Initial Solution and Optimality, Unbalanced, Maximization, Degeneracy, Transshipment in TP.

Assignment Problem (AP): Approach, Procedure and Maximization, Unbalanced and Crew Assignment Problems.

Network Analysis: Shortest Path Problem, Minimum Spanning Tree Problem, Maximum Flow Problem, Minimum Cost Flow Problem, Project Planning and Control with PERT and CPM.

(10 HOURS)

UNIT III-Sequencing problems: Processing N-Jobs through Two, Three, M Machines, Processing of N-Jobs through M Machines.

Replacement decisions: Replacement of Items that Deteriorate with Time (With and without Change in Money Value), Staff Replacement Problem.

(10 HOURS)

UNIT IV-Integer and dynamic programming: Integer Programming, Formulation Techniques, Unimodularity, Cutting Plane Method, Branch and Bound Method.

Dynamic programming: Methodology and its Programming Applications.

(10 HOURS)

UNIT V-Non linear programming: Solution of Non-Linear Programming, Convex and Concave Functions, Quadratic and Separable Programming, Cohn Tucker Conditions for Constraint Optimization.

(10 HOURS)

M. Tech. (Computer Science) Semester-II

Contd.

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks

Examination to be held: May 2020, 2021, 2022

COURSE NO: PSMTTC-205

COURSE TITLE: OPTIMIZATION TECHNIQUES

Textbooks& References:

1. V. K Kapoor, ñOperations Research, Techniques for Managementò, 5th Edition, Sultan Chand and Sons, 2012.
2. H. A. Taha, ñOperations Research-An introductionò, Pearson , 9th Edition 2010.
3. JK Sharma, ñOperations Research , Theory and Applicationsò, Laxmi, 6th Edition, Publications, 2017
4. S S Rao, ñOptimization theory and applicationsò, Wiley Eastern ltd, New Delhi.
5. S. D. Sharma, ñOperations research, Kedar Nathò, Ram Nath & Co.
6. Kanti Swarup, P. K. Gupta and Man Mohan, ñOperations Researchò, Sultan chand and sons, New Delhi.

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-II

Total Marks = 150	Internal Evaluation = 75 Marks
No. of Credits = 6	External Evaluation = 75 Marks
Examination to be held: May 2020, 2021, 2022	
COURSE NO: PSMTLC-206	
COURSE TITLE: Software-Lab-II (Internet Technology Lab)	

Practicals will be based on the courses being taught in the current semester. The distribution of marks shall be as per the scheme given below.

PRACTICAL					
Daily evaluation of practical records/ Viva voce etc. (Internal Evaluation)		Viva voce 1	15	35	75
	2.	Viva voce 2	15		
	3.	Practical File	5		
	4.	Internal Exam.+Viva voce 3	25+15	40	
Final Practical performance and viva voce(External Evaluation)	100% syllabus				75
				Total	150

-x-

M. Tech. (Computer Science) Semester-III

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTTC-301	
COURSE TITLE: VLSI AND EMBEDDED SYSTEMS	

Course Objectives & Learning Outcomes:

- To provide in-depth knowledge of hardware and software of embedded systems
- To understand the concepts of hardware descriptive languages(VHDL)
- To make familiar with platforms and simulators for VHDL for concurrent programming and building complex sequential and combinational blocks.

UNIT I-Review of Digital Systems: Boolean Algebra: Axioms, Relation with Set Algebras. Combinational Boolean Functions: Truth Tables, Representation of Boolean Functions as Boolean Formulas, Minimization of Sum-of-Product Boolean Formulas, Multi-Level Boolean Formulas, Shannon Decomposition of a Boolean Function, Logic Gates, Implementation of Boolean Formulas Using Logic Gates, More complex building blocks: Multiplexors, Decoders, Encoders and their uses in Combinational Function Implementations

(10 HOURS)

UNIT II-The Platforms and Simulators: Introduction to Linux Workstations, Working with GCC Development Tools, Overview and Working with GHDL VHDL Simulator, Understanding FPGA Synthesis Tool Set.

(10 HOURS)

UNIT III-Sequential Systems and MOS transistor as an ideal switch:
Synchronous Sequential Systems: Synchronous Finite State Mealy and Moore Machines. Memory Elements: Level-Triggered Latches, Edge-Triggered, Registers.
Transistors ï Bipolar, Unipolar, Characteristics, Comparison, Design and Implementation.

(10 HOURS)

UNIT IV-Hardware description language (VHDL):
VHDL ï Overview, Standards and Applications, VHDL ï Language, Syntax ï Entities, Architectures Structural Elements, Data Types, Operators, Sequential and Concurrent Statements, Sub-programs examples.

(10 HOURS)

UNIT V-Embedded Systems:
Introduction, Embedded Processors:8-Bit Accumulator Processors, Microcontrollers, Data Processors, RISC Processors, Digital Signal Processors, Real Time Operating Systems-Scheduling Algorithms and Memory Models, Interrupts and Exceptions, Buffering, Writing Software For Embedded Systems, Emulation and Debugging Techniques.
(10 HOURS)

M. Tech. (Computer Science) Semester-III

Contd.

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks

Examination to be held: December 2020, 2021, 2022

COURSE NO: PSMTTC-301

COURSE TITLE: VLSI AND EMBEDDED SYSTEMS

Assignments and projects during this course may be done on one or more following tools -

1. Linux workstations, gcc development tools.
2. GHDL VHDL simulator
3. Xilinx ISE (FPGA synthesis tool set).
4. IMAGE simulation accelerator (FPGA based co-simulation environment) etc

.

Textbooks & References:

1. D. L. Perry, "VHDL programming by Example", Fourth Edition,McGraw Hill Education.
2. Steve Heath, "Embedded Systems Design", Second edition, Elsevier *(ISBN 9780750655460).*
3. Peter J. Ashenden, "The Designers guide to VHDL", Morgan Kaufmann, Third Edition, 2011.
4. Stanley Major and Patricia Langstraat, "A Guide to VHDL", Springer.
5. Moris Mano, "Digital Design", Fifth Edition, Pearson, 2017.

Recommended readings:

1. PIC16F84A data sheet
2. http://www.eeherald.com/section/design-guide/esmod.html

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-III

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTTE-302 (Elective)	
COURSE TITLE: ARTIFICIAL INTELLIGENCE	

Course Objectives & Learning Outcomes

- ŏ To provide a strong foundation of fundamental concepts in Artificial Intelligence
- ŏ To analyze and design a real world problem for implementation and understanding dynamic behavior of a system.
- ŏ To enable the student to apply these techniques in applications which involve perception, reasoning and learning.
- ŏ To use different machine learning techniques to design AI machine and enveloping applications for real world problems.

UNIT I-Introduction

Introduction to AI, History of AI, Basic Elements of AI, Introduction to Turing Machine, Turing Test and Rational Agent Approaches; State Space Representation of Problems, Game Playing, Min-Max Search, Alpha Beta Cutoff Procedures.

Introduction to Expert system, Expert System Life Cycle, Study of existing expert systems like MYCIN and DENDRAL.

(10 HOURS)

UNIT II-Searching Techniques

Heuristic Search techniques-Hill Climbing, Best first search: OR graph, A* algorithm, Problem Reduction: AND-OR graph, The AO* Algorithm. Constraint satisfaction: Introduction and algorithm.

(10 HOURS)

UNIT III-Knowledge Representation

Knowledge Representation Structures: Prepositional Logic, First Order Predicate Logic, CNF, DNF, Prenex Normal Form, Resolution, Unification, Inference Mechanisms Semantic Nets, Frames, Scripts, conceptual dependences, Procedural & Declarative knowledge, Reasoning, Uncertainty.

(10 HOURS)

UNIT IV-Multi Agent Systems and Genetic Algorithms

Multi Agent Systems: Agents and Objects; Agents and Expert Systems; Generic Structure of Multiagent System, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools.

Genetic Algorithms (GA): Encoding Strategies, Genetic Operators, Fitness Functions and GA Cycle; Problem Solving using GA.

(10 HOURS)

UNIT V-Understanding Natural Languages& Artificial Neural Networks

Understanding Natural Languages: Parsing techniques, context free and transformational grammars, transition nets, augmented transition nets, Fillmore's grammar; grammar-freeanalyzers, sentence generation.

Basic structure of ANNs, Activation functions, Learning Rules, Types of ANN: feed forward and feedback, applications of neural networks, Fuzzy Logic: Introduction, Membership functions and basic operations.

(10 HOURS)

M. Tech. (Computer Science) Semester-III

Contd.

Total Marks = 100 — Minor Test I = 20 Marks
No. of Credits = 4 — Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours — Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022
COURSE NO: PSMTTE-302 (Elective)
COURSE TITLE: ARTIFICIAL INTELLIGENCE

Textbook & References:

1. Kevin Knight, Elaine Rich, B. Nair , "Artificial Intelligence", Third Edition, McGraw Hill Education, 2017
2. Charniak, E. , "Introduction of Artificial Intelligence", Narosa Publishing House
3. George F. Luger, "Artificial Intelligence", 6th Edition, Pearson Education, 2009
4. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems",PHI.
5. Marcellus, " Expert System Programming in TURBO PROLOG", Prentice-Hall-Inc.
6. Clark, K. L. & McCabe, F. G, "Micro-prolog", Prentice-Hall, India.
7. Neural Networks and Learning Machines Prentice Hall, Third Edition, 2008.
8. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Fourth Edition, John Wiley & Sons, 2010.
9. Clockskin, W. and Mellish, "Programming in Prolog", Springer, 2003.

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-III

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTTE-303 (Elective)	
COURSE TITLE: IMAGE PROCESSING&PATTERN RECOGNITION	

Course Objectives & Learning Outcomes:

- To study Fundamental concepts of a Digital Image Processing System.
- To understand and review image transforms.
- To analyse Compression Techniques and Morphological concepts

UNIT I-Digital image fundamentals: Introduction, an image model, sampling and quantization, basic relationships between pixels, image geometry.
Image enhancement: Back ground, enhancement by point processing histogram processing, spatial filtering, introduction to image transforms, image enhancement in frequency domain.
Image Restoration: Basic model, estimating the degradation function, restoration techniques.

(10 HOURS)

UNIT II-Image Compression and Segmentation: Image Compression: Fundamentals, information theory, compression techniques.
Image Segmentation: Edge Detection: Region, Crack Edge Detection, Edge Linking, Gradient operators, Compass and Laplace operators. Threshold detection methods, optimal thresholding, multispectral thresholding, edge based image segmentation, edge image thresholding, region based segmentation, border tracing, border detection.

(10 HOURS)

UNIT III-Pattern Recognition Introduction: Machine perception, pattern recognition example, pattern recognition systems, the design cycle, feature extraction, learning and adaptation
Bayesian Decision Theory : Introduction, continuous features ï two categories classifications, minimum error-rate classification- zeroï one loss function, classifiers, discriminate functions, and decision surfaces , Decision rule, maximum likelihood and Bayesian parameter estimation.

(10 HOURS)

UNIT IV-Un-supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering, similarity measures, criteria function for clustering.

(10 HOURS)

UNIT V-Pattern recognition using discrete hidden Markov models: Discrete-time Markov process, Extensions to hidden Markov models, three basic problems of HMMs, types of HMMs, Continuous hidden Markov models , Continuous observation densities, multiple mixtures per state, speech recognition applications.

(10 HOURS)

M. Tech. (Computer Science) Semester-III

Contd.

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks

Examination to be held: December 2020, 2021, 2022

COURSE NO: PSMTTE-303 (Elective)

COURSE TITLE: IMAGE PROCESSING & PATTERN RECOGNITION

Textbooks & References:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", 3rd Edition, Addison Wesley, 2014.
2. Sanjay Sharma , "Digital Image processing" , 4th Edition , 2016
3. Richard O. Duda, Peter E. Hart and David G. Stroke, "Pattern classifications", Wiley student edition (*ISBN:978-0-471-05669-0*).
4. A. K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India.
5. M. Anji Reddy, "Digital Image Processing", BS Publications.
6. Earl Gose, Richard John Baugh and Steve Jost, "Pattern Recognition and Image Analysis" PHI.

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-III

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTTE-304 (Elective)	
COURSE TITLE: NATURAL LANGUAGE PROCESSING	

Course Objectives & Learning Outcomes:

- To understand significance of natural language processing tools and applications for the development of the technologies of the regional language.
- To get acquainted with the application and databases descriptions of the popular languages.
- To conceive basics of knowledge representation, inference, and relations to the machine learning.

UNIT I-Introduction and Overview: Introduction to NLP, Definition, History, Applications, Goals. NLP and linguistics, Syntax and semantics, Pragmatics and context, Tasks and super tasks, Linguistic tools, Sentence delimiters and tokenizers, Stemmers and taggers, Noun phrase and name recognizers, Parsers and grammar.

(10 HOURS)

UNIT II-Regular Expressions and CFG: Regular expressions, Morphology and Finite State Transducers, N-grams, HMMs Word Classes and Part-of Speech Tagging, Parsing, Context-Free Grammars.

(10 HOURS)

UNIT III-Word Sense Disambiguation: Introduction to Word Sense Disambiguation, Selection Restriction Based Disambiguation, Machine Learning, Supervised Learning Approaches, Bootstrapping Approaches, Unsupervised Methods, Dictionary Based Approaches.

(10 HOURS)

UNIT IV-Machine Translation: Introduction, Language Similarities and Differences, Approaches, Steps involved in machine translation system design.

(10 HOURS)

UNIT V-Perl: Uses of Perl, Perl on Linux, windows, Perl Fundamentals, Control structure and loops, Useful/necessary functions to memorize, Regular Expressions basics, Array Functions, Hash Functions, Array and hash manipulation, Regular Expressions basics, File Handling, Introduction to Modules and Packages.

(10 HOURS)

M. Tech. (Computer Science) Semester-III

Contd.

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks

Examination to be held: December 2020, 2021, 2022

COURSE NO: PSMTTE-304 (Elective)

COURSE TITLE: NATURAL LANGUAGE PROCESSING

Text Books & References:

1. Jurafsky, D. & J. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition" Prentice Hall, (*ISBN:0130950696*).
2. Grosz, B. J. , Sparck Jones, K. & Webber, B. L. , "Readings in natural language processing", Los Altos, CA: Morgan Kaufmann.
3. Allen,J. ,"Natural language understanding", Second Edition, Redwood City, CA: Benjamin/Cummings.
4. Bharti, Akshar, Chaitanya Vineet and Sangal Rajeev, "Natural Language Processing", Prentice Hall.
5. Brian D Foy, " Effective Perl Programming: Ways to Write Better, More Idiomatic Perl", O'Reilly,2010.
6. Jay Kuri, "Perl For Absolute Beginner", Apress,*(ISBN 978-1430227151*).

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

.

M. Tech. (Computer Science) Semester-III

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTTE-305 (Elective)	
COURSE TITLE: BIG DATA ANALYTICS USING R	

Course Objectives& Learning Outcomes

- ð To know the fundamental concepts of big data and analytics.
- ð To explore tools and practices for working with big data.
- ð To know about the research that requires the integration of large amounts of data.
- ð To work with big data tools and its analysis techniques.
- ð To analyze data by utilizing clustering and classification algorithms.

UNIT I-Introduction To Big Data

Evolution of Big data ï Best Practices for Big data Analytics ï Big data characteristics ï Validating ï The Promotion of the Value of Big Data ï Big Data Use Cases- Characteristics of Big Data Applications ï Perception and Quantification of Value -Understanding Big Data Storage ï A General Overview of High-Performance Architecture ï HDFS ï MapReduce and YARN ï Map Reduce Programming Model.

(10 HOURS)

UNIT II-Clustering And Classification

Advanced Analytical Theory and Methods: Overview of Clustering ï K-means ï Use Cases ï Overview of the Method ï Determining the Number of Clusters ï Diagnostics ï Reasons to Choose and Cautions - Classification: Decision Trees ï Overview of a Decision Tree ï The General Algorithm ï Decision Tree Algorithms ï Evaluating a Decision Tree ï Decision Trees in R ï Naïve Bayes ï Bayes' Theorem ï Naïve Bayes Classifier.

(10 HOURS)

UNIT III-Association And Recommendation System

Advanced Analytical Theory and Methods: Association Rules ï Overview ï Apriori Algorithm ï Evaluation of Candidate Rules ï Applications of Association Rules ï Finding Association& finding similarity ï Recommendation System: Collaborative Recommendation- Content Based Recommendation ï Knowledge Based Recommendation- Hybrid Recommendation Approaches.

(10 HOURS)

UNIT IV-Stream Theory

Introduction to Streams Concepts ï Stream Data Model and Architecture ï Stream Computing, Sampling Data in a Stream ï Filtering Streams ï Counting Distinct Elements in a Stream ï Estimating moments ï Counting oneness in a Window ï Decaying Window ï Real time Analytics Platform (RTAP) applications ï Case Studies ï Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics.

(10 HOURS)

UNIT V-Nosql Data Management For Big Data And Visualization

NoSQL Databases: Schema-less Modelsð Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores ï Tabular Stores ï Object Data Stores ï Graph Databases Hive ï Sharding ï Hbase ï Analyzing big data with twitter ï Big data for E-Commerce Big data for blogs ï Review of Basic Data Analytic Methods using R.

(10 HOURS)

Tools and Platforms: Hadoop

M. Tech. (Computer Science) Semester-III

Contd.

Total Marks = 100 — Minor Test I = 20 Marks
No. of Credits = 4 — Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours — Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022
COURSE NO: PSMTTE-305 (Elective)
COURSE TITLE: BIG DATA ANALYTICS USING R

Textbooks & References:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.
3. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
4. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
5. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
6. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.
7. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-III

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTTE-306 (Elective)	
COURSE TITLE: PYTHON	

Course Objectives & Learning Outcomes:

- ŏ To understand the basic and advanced features of core language built-ins.
- ŏ To implement various packages of python library.
- ŏ To communicate using sockets, write client and server side scripts.
- ŏ To design and implement basic applications with database connectivity.
- ŏ Students will gain basic and advanced programming concepts of Python.

UNIT I- Introduction

Installing and working with python, Data Types: Identifiers and keywords, integral types, floating-point types, strings, Sequence types: Tuples, Named tuples, lists, Set Types: Sets, Frozen sets, Mapping types: dictionaries, iterating and copying collections. Control structures: conditional branching, looping, Exception handling: catching and raising exceptions, custom exceptions, custom functions: names and docstring, argument and parameter unpacking.

(10 HOURS)

UNIT II-Modules and Packages

Modules and packages, Overview of python standard library, Classes in python, inheritance, odds and ends, iterators, generators, generator expression.

(10 HOURS)

UNIT III-File Handling and Database programming

Writing and Reading Binary Data, Writing and Parsing Text Files, Writing and Parsing XML Files, Random Access Binary Files, DBM data bases, SQL databases.

(10 HOURS)

UNIT IV-Networking and Web programming

Sockets introduction, Creating a socket, using a socket, disconnecting, non-blocking sockets, CGI, Server client program using CGI, mod_python, FastCGI and SCGI, mod_wsgi, WSGI, MVC, Templates, Data persistence, Frameworks-Django, Turbogears, Zope, etc.

(10 HOURS)

UNIT V-Python Django Framework

Introduction to Django Web Framework, features of Django, Installing Django, MVC model, HTTP concepts, Views, URL Mapping, Creating Template Objects, Form validation and Error Messages, Form Display, Django Models, Model Fields, Model Inheritance, CRUD on DB, Session and Caching, Dynamic WebPages, Toggle Hidden Content.

(10 HOURS)

M. Tech. (Computer Science) Semester-III

No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTTE-306 (Elective)	
COURSE TITLE: PYTHON	

Textbooks & References:

1. Brian K. Jones, “Python Cookbook", O'Reilly, 2013
2. Brandon Rhodes and John Gorezen,"Foundations of Python Networking Programming",Apress,2014.
3. Alex Martelli, “Python in a nutshell", O'Reilly.
4. E.Balaguruswamy, "Introduction to Computing and Problem solving using Python", McGraw Hill, 2016.
5. Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford Publications,2017.

Recommended Readings:

1. Python online documentation: www. python. org/doc
2. William S.Vincent, "Django for Beginners",2019
3. http://anh.cs.luc.edu/python/hands-on/3.1/Hands-onPythonTutorial.pdf

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-III

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTTE-307 (Elective)	
COURSE TITLE: INTERNET OF THINGS	

Course Objectives & Learning Outcomes

- ŏ To understand the basics of Internet of Things (IoT) and its application sectors.
- ŏ Understand M2M and Internet of Things.
- ŏ Understand and become proficient in Internet of Things platforms.
- ŏ Understand and apply Internet of Things protocols appropriately.
- ŏ Design and develop Internet of Things based applications.

UNIT I-Introduction and Concepts of IoT

Introduction to IoT, definition and characteristics of IOT, Architecture of Internet of Things, Physical and logical design of IoT, IoT enabling technologies, IoT levels and deployment templates, Domain specific IoTs, home automation, cities, environment, Domain specific IoTs, Energy, retail, agriculture, industry, health and lifestyle.

(10 HOURS)

UNIT II- IoT and M2m Communication

M2M, difference between IoT and M2M, ETSI M2M Architecture, system architecture, ETSI M2M SCL resource structure, Security in ETSI M2M framework, SDN and NFV for IoT, IoT system management, need for IoT system management, SNMP, Network operator requirements, NETCONF-YANG, IoT system management with NETCONF-YANG, IoT Design methodology-case study on IoT system for Weather Monitoring.

(10 HOURS)

UNIT III-IoT Platforms

Introduction to Hardware used for IoT: Microcontrollers, Microprocessors, SoC, Sensors 2 C, I 3 1 8. Introduction to Arduino, Pi, Spark, Intel Galileo etc.

(10 HOURS)

UNIT IV- IoT Technical Standards and Protocols

RF Protocols: RFID, NFC; IEEE 802. 15. 4: ZigBee, Z-WAVE, THREAD; Bluetooth Low Energy (BLE), IPv6 for Low Power and Lossy Networks (6LoWPAN) and Routing Protocol for Low power and lossy networks (RPL), CoAP, XMPP, Web Socket, AMQP, MQTT, WebRTC, PuSH, Architectural Considerations in Smart Object Networking.

(10 HOURS)

UNIT V-Developing Internet of Things

IoT platforms design methodology, IoT Physical devices and endpoints, IoT Systems: Logical design using Python, IoT physical servers and cloud offerings (Cloud computing for IoT)

(10 HOURS)

M. Tech. (Computer Science) Semester-III

Contd.

Total Marks = 100 — Minor Test I = 20 Marks
No. of Credits = 4 — Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours — Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022
COURSE NO: PSMTTE-307 (Elective)
COURSE TITLE: INTERNET OF THINGS

Textbooks & References:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things, A Hands -on Approach", University Press, First Edition 2015.
2. Oliver Hersent, David Boswarthick, Omar Elloumy, "The Internet of Things", First Edition, 2015.
3. Michael Miller, "The Internet of Things, How Smart TVs, Smart Cars, Smart Homes, and Smart Cities are changing the World", Pearson, First edition, 2015.

Recommended readings:

https: //thingsee. com/blog/quality-hardware-list-for-your-iot-projects, as on date: 25/04/16.

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

-x-

M. Tech. (Computer Science) Semester-III

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTTC-308	
COURSE TITLE: RESEARCH METHODOLOGY	

Course Objectives & Learning Outcomes:

- To enable students in conducting research work and formulating research synopsis and report.
- To familiarize students with Statistical packages such as SPSS.
- To impart knowledge for enabling students to develop data analytics skills to solve the business/Research problem.
- To write a research report and thesis in a more appropriate manner.

UNIT-I Research Design-I:

Research: Concept, need, types - basic, applied and action.

Reviewing Literature: Need, Sources, Purposes and Scope of Review, Steps in conducting review

Identifying and defining research problem: Locating, Analyzing stating and evaluating problem etc.

Method of Research: Descriptive research design-survey, case study, content analysis, Ex-post Facto Research, Correlational and Experimental Research.

(10 HOURS)

UNIT-II Research Design-II:

Hypothesis: Meaning, Criteria for constructing hypothesis, Testing Hypothesis and its types.

Sampling Techniques: Concept of population and sample, sampling techniques, determining size of sample etc.

Design and development of measuring instruments: Tests, questionnaires, checklists, observation, schedules, selecting a standardized test etc.

Procedure of data collection, Procedure for writing a research proposal, Procedure for writing a research report etc.

(10 HOURS)

UNIT-III System Simulation & Modeling:

System and system environment, components of system, discrete and continuous systems, static and dynamic systems, model of a system, steps required in deriving a model of a system. Verification and validation of simulation model, stochastic nature of the output data.

Introduction to Simulation, why and when simulation is an appropriate tool, advantages and disadvantages of Simulation, Areas of application, general steps followed in simulation experiment etc, Factor Analysis: Introduction, Objective and types.

(10 HOURS)

UNIT- IV Statistical analysis through SPSS:

Introduction, basic steps of data analysis, SPSS environment, running an analysis, viewing results etc.

Quantitative and qualitative analysis techniques, hypothesis testing, chi-square test, t-test, correlation and regression analysis, analysis of variance(ANOVA), choosing appropriate techniques etc. (10 HOURS)

UNIT-V MATLAB:

Introduction and key features, Workspace, Variables, Numbers, Character strings, Matrices and Arrays (creation, operations and indexing), Expressions, Functions, etc.

Control Structures: Loop Control, Conditional Control. M-files: Script files and function files, Managing M-files. Basic plotting functions, 2-D and 3-D Plots.

(10 HOURS)

M. Tech. (Computer Science) Semester-III

Contd.

Total Marks = 100	Minor Test I = 20 Marks
No. of Credits = 4	Minor Test II = 20 Marks
Time allotted for Major Test = 3 hours	Major Test = 60 marks

Examination to be held: December 2020, 2021, 2022

COURSE NO: PSMTTC-308

COURSE TITLE: RESEARCH METHODOLOGY

Textbooks&References:

1. C.R Kothari and Gaurav Garg,"Reserach Methodology:Methods and Techniques",New Age International Publishers,2013.
2. William M. K. Trochim, “Research Methods", Second Edition, Biztantra Dreamtech Press, 2006.
3. Patel R. S, ”Research Methodology”, Third Edition, Jay Publication, 2019
4. Patel R. S, ”Statistical Method”, Jay Publicaton, 2011.
5. W. Borg, M. Gall, “Educational Research: An Introduction”, New York, Longman, 2003.
6. Ram Ahuja, Research Methods, Rawat publications, 2001.
7. Wiersma William, “Research Methods in Education- An Introduction”, London, Allyn and Bacon, Inc.
8. M. N. Borse, “Research Methodology- modern, tools and techniques”, Hand Book, Shree Niwas Publications, 2005.
9. S. P. Gupta, “Statisitcal Methods", Fourth edition, Sultan Chand & sons, 2011.
10. Darren George, Paul Mallery, “SPSS for windows step by step: a simple guide and reference”, Allyn & Bacon, Inc.
11. B. R. hunt, R. L. Lipsman, J. M. Rosenberg, “A guide to MATLAB for beginners and experienced users”, 2E, Cambridge University Press, 2006.
12. “MATLAB Primer”,The MathWorks, Inc.

SCHEME FOR PAPER SETTING

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

Section A

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

Section B

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

Section C

There shall be 3 long answer type questions each set from Unit ï III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

.

M. Tech. (Computer Science) Semester-III

Total Marks = 150	Internal Evaluation = 75 Marks
No. of Credits = 6	External Evaluation = 75 Marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTLC-309	
COURSE TITLE: Software-Lab-III	

Practicals will be based on the courses being taught in the current semester. The distribution of marks shall be as per the scheme given below.

PRACTICAL					
Daily evaluation of practical records/ Viva voce etc. (Internal Evaluation)		Viva voce 1	15	35	75
	2.	Viva voce 2	15		
	3.	Practical File	5		
	4.	Internal Exam.+Viva voce 3	25+15	40	
Final Practical performance and viva voce(External Evaluation)	100% syllabus				75
				Total	150

-x-

M. Tech. (Computer Science) Semester-III

Total Marks = 100	Internal Evaluation = 50 Marks
No. of Credits = 2	External Evaluation = 50 Marks
Examination to be held: December 2020, 2021, 2022	
COURSE NO: PSMTDC-310	
COURSE TITLE: Dissertation (Phase-I)	

a) Guidelines for preparing Synopsis

- Students shall choose a topic from an emerging research area in computer science or in a related field. Each candidate should work independently on a chosen topic of research under the guidance of a teacher (Guide/Supervisor) allotted to the candidate by Dissertation Committee constituted by the department.
- The students are expected to review an extensive literature in his/her area of interest. Students should study a significant number of research papers in the respective area and should regularly be in- touch with the supervisor allocated to him/her.
- The student will prepare and submit the synopsis of the research work at the end of the semester to the department.
- After the submission of synopsis, the students may have to make presentations of the work, before the Dissertation Committee for final approval.

b) Format for preparing the synopsis

Title of the Research Work

i. Introduction
ii. Theory/Problem Statement
    a. Background/ Literature Review
    b. Hypothesis Testing (if any)
iii. Expected Contribution of the study
    a. Justification
    b. Objectives
iv. Research Methodology
v. References

-x-

M. Tech. (Computer Science) Semester-IV

Total Marks = 550	Internal Evaluation = 200 Marks
No. of Credits = 24	External Evaluation = 350 Marks
Examination to be held: May 2021, 2022, 2023	
COURSE NO: PSMTDC-401	
COURSE TITLE: Dissertation (Phase-II)	

i. After the completion of the 3rd semester examination, the student will continue with the dissertation work as per the synopsis submitted and work carried out in the third semester.
ii. The progress of the dissertation work should continuously be monitored by concerned guide/Supervisor.
iii. There will be a midterm presentation of the dissertation work before the members of the Dissertation Committee.
iv. After the completion of the semester the students have to submit the dissertation in the form of a report duly authenticated by the allocated guide.
v. The students are required to present M. Tech. research work in front of the Dissertation Committee before the final submission of the thesis.
vi. The students are required to complete his/her M. Tech. dissertation work as per the satisfaction of the examiner within 4-5 months period from the date of commencement of the semester.
vii. The student is required to publish at least one research paper in Reputed/Refereed/Peer reviewed/indexed Journals before the final submission of the dissertation.

The dissertation may be prepared and arranged in the sequence consisting of the following

(a) Top Sheet of transparent plastic
(b) Top cover
(c) Preliminary pages
    i. Title page
    ii. Certification page
    iii. Certificate by the Guide
    iv. Acknowledgment
    v. Abstract
    vi. Table of Content
    vii. List of Figures/Photographs and Tables

(d) Chapters
(e) Appendices, if any
(f) Bibliography/References
(g) Back Cover (Blank sheet)
(h) Back Sheet of Plastic (May be opaque or transparent)