A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Name of the Course: M. Tech. in Data Science **Subject: Advanced Data Structures**			
Course Code: PGIT(DS)102 & PGIT(DS)109	**Semester: I**		
Duration: 48 Hours	**Maximum Marks:100+100**		
Teaching Scheme	**Examination Scheme**		
Theory:**3**	End Semester Exam:**70**		
Tutorial:**0**	Attendance: **5**		
Practical:**4**	Continuous Assessment:**25**		
Credit: **3+2**	Practical Sessional internal continuous evaluation:**40**		
	Practical Sessional external examination:**60**		
Aim:			
Sl. No.			
1.	Single Linked, Double Linked Lists, Stacks, Queues, Searching and Sorting techniques, Trees, Binary trees, representation, traversal, Graphs- storage, traversal.		
2.	Dictionaries, ADT for List, Stack, Queue, Hash table representation, Hash functions, Priority queues, Priority queues using heaps, Search trees.		
3.	AVL trees, operations of AVL trees, Red- Black trees, Splay trees, comparison of search trees.		
Objective:			
Sl. No.			
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.		
Pre-Requisite:			
Sl. No.			
1.	UG level course in Data Structures		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**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.	**7**	**10**
02	**Skip Lists:** Need for Randomizing Data Structures and Algorithms, Search andUpdate Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists	**5**	**5**
03	**Trees:**	**9**	**10**

	Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees		
04	**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 CommonSubsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.	**12**	**20**
05	**Computational Geometry:** One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority SearchTree, Priority Range Trees, Quadtrees, k-D Trees.	**10**	**15**
06	Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem	**5**	**10**
	Sub Total:	**48**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**52**	**100**

Practical:
Skills to be developed:
Intellectual skills:

1. Skill to analyze algorithms and to determine algorithm correctness and their time efficiency.
2. Knowledge of tree and searching algorithms and their implementations.
3. Ability to implement algorithms to perform various operations on data structures.

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

Assignments: Based on Theory Lecture.

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Michael H. Goldwasser, Michael T. Goodrich, and Roberto Tamassia	Data Structures and Algorithms in Python	1118476735, 9781118476734	John Wiley & Sons
Rance D Necaise	Data Structures and Algorithms Using Python	9788126562169	John Wiley & Sons
Reference Books:			
Sartaj Sahni	DataStructures, Algorithms and applications in C++	Second Edition	Universities Press

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	Computer with moderate configuration

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the	**Subjective Questions**

		correct answer)					
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1,2,3,4,5,6**	**10**	**10**				
B				**5**	**3**	**5**	
C	**1,2,3,4,5,6**			**5**	**3**	**15**	**60**
	1,2,3,4,5,6						

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment(one for each group consisting 5 students)	**40**	
Viva voce	**10**	**60**