

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

**Subject Code: MCIT-118**  
**Subject Name: Health Informatics**

<b>Programme:</b> M. Tech.	<b>L:3T:0 P:0</b>
<b>Semester:</b> 3	<b>Teaching Hours:</b> 36
<b>Theory/Practical:</b> Theory	<b>Credits:</b> 3
<b>Internal Marks:</b> 50	<b>Percentage of Numerical/Design Problems:</b> 20%
<b>External Marks:</b> 100	<b>Duration of End Semester Exam(ESE):</b> 3 Hours
<b>Total Marks:</b> 150	<b>Course Type:</b> Programme Elective-V

**Course Outcomes:**

**On completion of the course the student will have the ability to:**

1. Understand the problems and challenges that health informatics addresses.
2. Introduce students to the research and practice of health informatics
3. Lead students in discussion around ethical and diversity issues in health informatics
4. Analysis and understanding the real case studies and examining the digital evidence related to health sciences.
5. Assess information and knowledge needs of health care professionals, patients and their families

**Prerequisites:** Programming Knowledge and basic data mining tools.

**Additional Material Allowed in ESE:** NIL (Mention anything like graph, calculator etc, if required in exam)

**Detailed Contents:**

**Part- A**

**Health Informatics:**

Epidemiology and Biostatistics, Comparative Health Systems and International Health, Human Biology & Medical, Organization and Administration of Clinical & Support services, Global Week-International Healthcare Mgt Faculty, Quality in Healthcare, Health Economics, Health Mgt Information Systems, Health Insurance and Emerging Domains in Healthcare. [10 Hours]

**Health IT & Analytics Specialization:**

Introduction to Programming & Healthcare Databases, Healthcare Information Technology Standards and Interoperability, Clinical Healthcare Applications, Healthcare Information Technology Standards adoption across the globe, Healthcare Information Systems Analysis & Design, Healthcare Applications for Administrative Support & Customer Relationships, Telemedicine and Innovations in Healthcare Ecosystem, Project Management in Healthcare IT and Strategic Use of IT applications in Healthcare Industry.[10 Hours] .

**Part-B**

**Public Health:**

Managing large scale public health programmes, Monitoring & Evaluation, Advance Research and Analysis skills, Total Quality Management-Tools & Techniques, International NGOs and

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

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their work in Public Health, Epidemiology and Biostatistics-Advanced, Health Economics & Health Financing-Advanced, Project Report writing, Public Health Management-Tools and Techniques and Public Health Legislations and Ethics.[8 Hours]

**Health informatics Standards:**

DICOM, PACS, EHR, Digital imaging, Telemedicine and Technological innovations in healthcare, HL7 Standards, HL7 Messaging, HMIS and CDSS, FHIR standards, Emergency Domains in Health healthcare, Healthcare software Engineering and System Analysis and Design Programming.[8 Hours]

**Health Information Policy and Security:**

Security Principles, Data Security in the Cloud, Security Breaches and Attacks, Health Informatics Ethics, Laws and Cultures as well as their International Considerations, Code of Individual Countries. Mobile Technology in Health Informatics, Online Medical Resources and their subscriptions, Patient Safety and Health Information Technology.[8 Hours]

**Text Books:**

1. Health Informatics – Practical Guide for Healthcare and Information Technology Professionals, Sixth Edition, Robert E. Hoyt, Ann K. Yoshihashi, Informatics Education.
2. Health Informatics – A Review, edited by Evelyn J. S. Hovenga, M. R. Kidd, Sebastian Garde, IOS Press, 2018.

**Reference Books:**

1. Book Cover of Charlotte A. Weaver, Marion J. Ball, George R. Kim, Joan M. Kiel - Healthcare Information Management Systems: Cases, Strategies, and Solutions (Health Informatics).
2. Healthcare Information Management Systems, Cases, Strategies, and Solutions, Charlotte A. Weaver, Marion J. Ball, George R. Kim, Joan M. Kiel, 2015

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

**Subject Code: LMCIT-118**

**Subject Name: Health Informatics Laboratory**

<b>Programme:</b> M. Tech.	<b>L:0T:0 P:2</b>
<b>Semester:</b> 3	<b>Teaching Hours:</b> 24
<b>Theory/Practical:</b> Practical	<b>Credits:</b> 1
<b>Internal Marks:</b> 50	<b>Percentage of Numerical/Design Problems:</b> 100%
<b>External Marks:</b> 50	<b>Duration of End Semester Exam(ESE):</b> 1.5 Hours
<b>Total Marks:</b> 100	<b>Course Type:</b> Programme Elective-V

**Course Outcomes:**

**On completion of the course the student will have the ability to:**

1. Understand the process of data cleaning.
2. Apply data mining techniques on health care data
3. Design and prepare the documentation of health care application.
4. Design architecture and apply security policies on Health information application.
5. Apply testing and create final report.

**Prerequisites:** Programming Knowledge and basic data mining tools.

**Detailed Contents:**

1. Preparation of the health care dataset after collection of data and cleaning the data using various data cleaning techniques.
2. Implementation of Data Mining algorithms on health care data.
3. Preparation of Electronic Health Record database that will provide history, diagnosis and documentation of any patient in the database.
4. Design a Requirement Specification document for Healthcare Information System application.
5. Develop a design document describing the use cases and architecture of the healthcare information system application.
6. Implementation of various security and privacy policies on the Health care information application.
7. Developing, testing and demonstrating a working application, implementing the design document.
8. Creating a final report describing the application built.

**Mini Project:** - Student has to do a project assigned from course contents in a group of two or three students. The group of students must submit a project report of 8 to 10 pages (approximately) and the team will have to demonstrate as well as have to give a presentation of the same.

**Note:** It is recommended that mini project allocation to students be done within two-three weeks of the start of the semester. This is only the suggested list of Practical's. Instructor may also frame additional Practical's relevant to the course contents (if required).

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

**Subject Code: MCIT-119**

**Subject Name: Cloud Computing**

<b>Programme:</b> M. Tech.	<b>L:3T:0 P:0</b>
<b>Semester:</b> 3	<b>Teaching Hours:</b> 36
<b>Theory/Practical:</b> Theory	<b>Credits:</b> 3
<b>Internal Marks:</b> 50	<b>Percentage of Numerical/Design Problems:</b> 20%
<b>External Marks:</b> 100	<b>Duration of End Semester Exam(ESE):</b> 3 Hours
<b>Total Marks:</b> 150	<b>Course Type:</b> Programme Elective-V

**Prerequisites:** Basics of Networking, Operating System

**Additional Material Allowed in ESE: NIL**

**Course Outcomes:**

After completing this course students will be able

1. To assess existing hosting platforms and computing paradigms currently being used in industry and academia.
2. To comprehend need of data centre, its virtualization techniques, and types of clouds.
3. To demonstrate the implementation of cloud by using commercial and open-source cloud platforms and its virtualization.
4. To implement cloud-based data storage by considering issues of task partitioning, data partitioning, data synchronization, distributed file system, data replication etc.
5. Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud-based applications.
6. Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints, and business requirements.

**Detailed Contents:**

**Part-A**

**Defining Cloud Computing:** Utility Computing, Cloud Types, Examining the characteristics of Cloud Computing, Cloud Computing vs. Cluster computing vs. Grid computing, Assessing the roles of Open Standards [5]

**Assessing the Value proposition:** Measuring the Cloud's value, Avoiding Capital Expenditure, Computing the Total cost of ownership, Specifying Service level agreements, Defining Licensing Models [4]

**Understanding Cloud Architecture:** Exploring the Cloud Computing Stack, Connecting to the Cloud [5]

**Understanding Services and applications by Type:** Defining Infrastructure as a Service (IaaS), Defining Platform as a Service (PaaS), Defining Identity as a Service, Defining Compliance as a Service (CaaS) [4]

**Part-B**

**Understanding Abstraction and Virtualization:** Using virtualization Technologies, Load balancing and Virtualization, Understanding Hypervisors, Machine Imaging, Porting applications [4]

**Capacity Planning:** Defining Baseline and Metrics, Network Capacity, Scaling [3]

**Cloud Security:** Role of Security, Types of Attack, Network Security, Survey on Potential Cloud Barriers in adopting Cloud Computing, New Threats related to Cloud Computing, Security Stack,

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

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Gartner's Seven Cloud Computing Security Risks. Other Cloud Security Issues: Virtualization, Access Control & Identity Management, Application Security, Data Life Cycle Management. [5]

**Cloud Computing Platforms:** Study and comparison of various open source and commercial cloud platforms. Open-source cloud platforms: Openstack, Eucalyptus, and Nebula etc. Commercial cloud platforms: Amazon Elastic compute cloud (EC2), Google Cloud platform, and MS Azure etc. [5]

**Moving Applications to the Cloud:** Applications in the Clouds, Applications and Cloud API's [2]

Textbooks:

1. Barrie Sosinsky (2013), Cloud Computing Bible, Wiley India Pvt. Ltd.
2. Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski (2011), Cloud Computing: Principles and paradigms, Wiley India Pvt. Ltd.
3. Anthony Velte, Toby Velte, Robert Elsenpeter (2009), Cloud Computing: A practical Approach, Tata McGrawHill

Reference Books:

1. Michael Miller (2008), Cloud Computing, Que Publishing
2. Anthony Velte, Toby Velte and Robert Elsenpeter (2014), Cloud Computing: A practical Approach by Tata McGrawHill
3. Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper (2009), Cloud Computing for dummies.

Online Courses and Video Lectures

1.Cloud computing By Prof. Soumya Kanti Ghosh | IIT Kharagpur  
Available at: [https://swayam.gov.in/nd1\\_noc20\\_cs20/preview](https://swayam.gov.in/nd1_noc20_cs20/preview)

2.Google Cloud Computing Foundations Course  
By Prof. Soumya Kanti Ghosh, Multifaculty | IIT Kharagpur, Google Cloud  
Available at : [https://swayam.gov.in/nd1\\_noc20\\_cs55/preview](https://swayam.gov.in/nd1_noc20_cs55/preview)

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

**Subject Code: LMCIT-119**

**Subject Name: Cloud Computing Laboratory**

<b>Programme:</b> M. Tech.	<b>L:0T:0 P:2</b>
<b>Semester:</b> 3	<b>Teaching Hours:</b> 24
<b>Theory/Practical:</b> Practical	<b>Credits:</b> 1
<b>Internal Marks:</b> 50	<b>Percentage of Numerical/Design Problems:</b> 100%
<b>External Marks:</b> 50	<b>Duration of End Semester Exam(ESE):</b> 1.5 Hours
<b>Total Marks:</b> 100	<b>Course Type:</b> Programme Elective-V

Pre-requisites: Basic programming skills and computer fundamentals

Course Outcomes:

After studying this course, the student will be able to

1. Apply knowledge of software tools and techniques with hands-on experience for Cloud related applications.
2. Design solutions for the understanding of the virtual machines, networks and managing users in Cloud Infrastructure.
3. To conduct investigation and develop programming skills in Cloud Computing related applications.
4. Use the modern engineering tools/platforms such as Cloud Analyst for solving problems related to Cloud Computing.
5. Function on multi-disciplinary teams through mini projects for exploring applications of Cloud Computing in different sectors.

### **Detailed Contents**

Use CloudSim Toolkit to implement following cloud related simulations:

1. To create a datacenter with one host and run one cloudlet on it.
2. To create two datacenters with one host and a network topology each and run two cloudlets on them.
3. To create two datacenters with one host each and run cloudlets of two users with network topology on them.
4. To create two datacenters with one host each and run two cloudlets on them.
5. To create two datacenters with one host each and run cloudlets of two users on them.
6. To create a datacenter with one host and a network topology and and run one cloudlet on it.
7. To create two datacenters with one host and a network topology each and run two cloudlets on them.
8. To create two datacenters with one host each and run cloudlets of two users with network topology on them.

### **Cloudsim Project Code link:**

<http://code.google.com/p/cloudsim/downloads/list>

or

<https://github.com/Cloudslab/cloudsim/releases/tag/cloudsim-3.0.3>

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

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Architexa Link:

<http://www.architexa.com/>

Reference link to study material:

1. <https://www.superwits.com/library/cloudsim-simulation-framework>
2. <http://www.buyya.com/papers/CloudSim2010.pdf>
3. <http://www.cloudbus.org/papers/CloudSim-HPCS2009.pdf>
4. <https://code.google.com/p/cloudsim/wiki/FAQ>

By using various concepts of syllabus students required to prepare a project in a group of two to three students. The group of students must submit a project report of 8 to 10 pages (approximately) and the team will have to demonstrate the project as well as must give a presentation of the same.

Note: This is only the suggested list of Practical's. Instructor may also frame additional Practical's relevant to the course contents (if required)

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

**Subject Code: MCIT-120**

**Subject Name: Applications of Data Science**

<b>Programme:</b> M. Tech.	<b>L:3T:0 P:0</b>
<b>Semester:</b> 3	<b>Teaching Hours:</b> 36
<b>Theory/Practical:</b> Theory	<b>Credits:</b> 3
<b>Internal Marks:</b> 50	<b>Percentage of Numerical/Design Problems:</b> 20%
<b>External Marks:</b> 100	<b>Duration of End Semester Exam(ESE):</b> 3 Hours
<b>Total Marks:</b> 150	<b>Course Type:</b> Programme Elective-V

**Course Outcomes:**

**On completion of the course the student will have the ability to:**

1. Describe what Data Science is and the skill sets needed to be a data scientist.
2. Explain in basic terms what Statistical Inference means.
3. Explain the significance of exploratory data analysis (EDA) in data science.
4. Describe the Data Science Process and how its components interact.
5. Apply basic machine learning algorithms for predictive modeling.
6. Identify common approaches used for Feature Generation.
7. Identify and explain fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine.
8. Create effective visualization of given data (to communicate or persuade).
9. Work effectively in teams on data science projects.

**Prerequisites:** Basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics.

**Additional Material Allowed in ESE:** NIL (Mention anything like graph, calculator etc, if required in exam)

**Detained Contents:**

**Part-A**

**Introduction to Data Science:**

Big Data and Data Science hype and getting past the hype, Why now, Datafication, Current landscape of perspectives, Skill sets needed. [2 Hours]

**Statistical Inference:**

Populations and samples, Statistical modeling, probability distributions, fitting a model [2 Hours]

**Exploratory Data Analysis and the Data Science Process:**

Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process [3 Hours]

**Feature Generation and Feature Selection (Extracting Meaning from Data):**

Motivating application: user (customer) retention, Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms, Filters; Wrappers; Decision Trees; Random Forests [6 Hours]

**Recommendation Systems:**

Building a User-Facing Data Product , Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis [6 Hours]



**Part-B**

**Mining Social-Network Graphs:**

Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs[6 Hours]

**NLP:**

Foundational terms and concepts in NLP, Theory, Sentence Detection, Tokenization, Stop Words, Lemmatization, Word Frequency, Part of Speech Tagging [5 Hours]

**Data Visualization:**

Basic principles, ideas and tools for data visualization[2 Hours]

**Text Books:**

1. Cathy O’Neil and Rachel Schutt (2014), Doing Data Science, Straight Talk from The Frontline. O’Reilly.

**Reference Books:**

1. Jure Leskovek, AnandRajaraman and Jeffrey Ullman (2014), Mining of Massive Datasets. v2.1, Cambridge University Press.
2. Kevin P. Murphy (2013). Machine Learning: A Probabilistic Perspective.
3. Foster Provost and Tom Fawcett (2013). Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking.

**Online Courses and Video Lectures:**

1. Data Science for Engineers, By Prof. RaghunathanRengasamy& Prof. Shankar Narasimhan, IIT Madras, [https://swayam.gov.in/nd1\\_noc19\\_cs60/preview](https://swayam.gov.in/nd1_noc19_cs60/preview)
2. Practical Machine Learning with Tensorflow, By Prof. Ashish Tendulkar and Prof. BalaramanRavindran, Google and IIT Madras, [https://swayam.gov.in/nd1\\_noc19\\_cs81/preview](https://swayam.gov.in/nd1_noc19_cs81/preview)

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

**Subject Code: LMCIT-120**

**Subject Name: Applications of Data Science Laboratory**

<b>Programme:</b> M. Tech.	<b>L:0T:0 P:2</b>
<b>Semester:</b> 3	<b>Teaching Hours:</b> 24
<b>Theory/Practical:</b> Practical	<b>Credits:</b> 1
<b>Internal Marks:</b> 50	<b>Percentage of Numerical/Design Problems:</b> 100%
<b>External Marks:</b> 50	<b>Duration of End Semester Exam(ESE):</b> 1.5 Hours
<b>Total Marks:</b> 100	<b>Course Type:</b> Programme Elective-V

**Course Outcomes:**

**On completion of the course the student will have the ability to:**

1. Apply knowledge of software tools and techniques with hands-on experience for processing the raw data and convert into useful information
2. To conduct investigation and develop programming skills in Data Science related application
3. Use the modern engineering tools such as NumPy, Pandas, Matplotlib, Scikit, Seaborn etc. for solving problems related to Data Science
4. Explore data visualization methods and preprocessing tools.
5. Evaluate and compare solutions of various Data Science Techniques for a given problem
6. Create an application using various Data Science concepts for multidisciplinary fields

**Pre-requisites:** Basic programming skills and computer fundamentals and algorithms

**Detailed Contents:**

1. Familiarity with Python Libraries- NumPy, Pandas, Matplotlib, Scikit, Seaborn
2. Implementation of reading and writing from files using Pandas.
3. Familiarity with Combining Data in Pandas With merge (), join (), and concat ()
4. Implementation of Using NumPy's *np.arange()* Effectively
5. Explore the dataset using Pandas and python to Discover and handle incorrect data, inconsistencies, and missing values.
6. Implementation of various Feature Selection algorithms
7. Implementation of various correlation calculations.
8. Implementation of statistic fundamentals on any dataset to calculate measure of central tendency, variability.
9. Implementation related to Grouping Data using Pandas's GroupBy() function.
10. Histogram plotting by using any Python libraries.
11. Build a Recommendation Engine with Collaborative Filtering
  - a) To Find Similar Users on the Basis of Ratings
  - b) To Calculate the Ratings
12. Implementation of social-Network analysis for various parameters
13. Natural Language Processing With spacy in Python
14. Implementation of Python Plotting with Matplotlib for creating visualizations

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

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**Mini Project:** By using various concepts of syllabus students required to prepare a project in a group of two to three students. The group of students must submit a project report of 8 to 10 pages (approximately) and the team will have to demonstrate the project as well as must give a presentation of the same.

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**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

**Subject Code: MOIT-301**

**Subject Name: Introduction to Python Programming**

<b>Programme:</b> M. Tech.	<b>L:3T:0 P:0</b>
<b>Semester:</b> 3	<b>Teaching Hours:</b> 36
<b>Theory/Practical:</b> Theory	<b>Credits:</b> 3
<b>Internal Marks:</b> 50	<b>Percentage of Numerical/Design Problems:</b> 20%
<b>External Marks:</b> 100	<b>Duration of End Semester Exam(ESE):</b> 3 Hours
<b>Total Marks:</b> 150	<b>Course Type:</b> Open Elective

**Course Outcomes:**

**On completion of the course the student will have the ability to:**

1. Master Object-oriented programming to create programs using various constructs.
2. Identify, formulate, and solve engineering problems using software development process.
3. Apply the knowledge of language constructs to program complex real life solutions.
4. Function on multi-disciplinary teams through case studies.
5. Design real-world problems and think creatively about solutions of them.

**Prerequisites:** Knowledge of Programming for Problem Solving

**Additional Material Allowed in ESE:** NIL (Mention anything like graph, calculator etc, if required in exam)

**Detained Contents:**

**Part-A**

**Introduction Python Programming Language:-** History and Origin of Python Language, Python version numbering scheme, Features, Advantages and disadvantages, Major Applications of Python, Installing Python, Setting up Path and Environment Variables, Getting started with Python Programming, Python Interactive Help Feature.

**Software Development, Data types, Operators and Expressions:-** The software Development Process, Case study: income tax Calculator, strings, Assignment and Comments, numeric Data types and Character sets, Operators in Python, Expressions, Precedence, Associativity, Non Associative Operators, using modules. [10 Hours]

**Loops and Selection Statements:** Definite Iteration: The for Loop, Formatting Text for Output, Case Study: An Investment Report, Selection: if and if-else Statements, Conditional Iteration: The while Loop, Case Study: Approximating Square Roots.

**Strings and Text Files:** Accessing Characters and Sub-strings in Strings, Data Encryption, Strings and Number Systems, String Methods, Text Files, Case Study: Text Analysis. [9 Hours]

**Part-B**

**Lists and Dictionaries:** Lists, Defining Simple Functions, Case Study: Generating Sentences, Dictionaries, Case Study: Non-directive Psychotherapy.

**Design with Functions:** Function components, Problem Solving with Top-Down Design, Design with Recursive Functions, Case Study: Gathering Information from a File System, Managing a Program's Namespace. [9 Hours]

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

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**Graphical User Interfaces:** The Behavior of Terminal-Based Programs and GUI-Based Programs, Coding Simple GUI-Based Programs, Windows and Window Components, Command Buttons and Responding to Events, Input and Output with Entry Fields, Defining and Using Instance Variables, Case Study: The Guessing Game Revisited, Useful GUI Resources.[8 Hours]

**Text Books:**

1. Kenneth A. Lambert, Martin Osborne, “Fundamentals of Python First Programs”, 2<sup>nd</sup> Edition, Cengage Learning, 2019.
2. Kenneth A. Lambert, Martin Osborne, “Fundamentals of Python: First Programs through Data Structures”, 1<sup>st</sup> Edition, Cengage Learning, 2010.

**Reference Books:**

1. Martin C. Brown, “Python The complete Reference”, McGraw Hill Education.
2. Allen B. Downey, “Think Python”, 1<sup>st</sup> Edition, Green Tea Press, 2012.

**E-Books and Online Learning Material:**

1. Fundamentals of Python First Programs by Kenneth A. Lambert  
<https://archive.org/details/FundamentalsOfPythonFirstPrograms2ndEdition> Accessed on Feb. 20, 2019
2. Learning Python by Fabrizio Romano <http://www.allitebooks.com/learning-python/> Accessed on Feb 20, 2019
3. Python Essential Reference by Beazley <http://lib.myilibrary.com?id=267855> Accessed on Feb 20, 2019
4. Starting Out with Python by Gaddis <http://lib.myilibrary.com?id=265135> Accessed on Feb 20, 2019
5. Beginning Programming with Python For Dummies by John Paul Mueller <http://www.allitebooks.com/beginning-programming-with-python-for-dummies-2nd-edition> Accessed on Feb 20, 2019

**Online Courses and Video Lectures**

1. <https://nptel.ac.in/courses/115104095> Accessed on Feb 20, 2019
2. <https://nptel.ac.in/courses/106106145> Accessed on Feb 20, 2019
3. <https://nptel.ac.in/courses/106106182> Accessed on Feb 20, 2019
4. <https://www.coursera.org/learn/python> Accessed on Feb 20, 2019
5. <https://www.coursera.org/learn/interactive-python-1> Accessed on Feb 20, 2019

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

**Subject Code: MOIT-302**

**Subject Name: Data Structures**

<b>Programme:</b> M. Tech.	<b>L:3T:0 P:0</b>
<b>Semester:</b> 3	<b>Teaching Hours:</b> 36
<b>Theory/Practical:</b> Theory	<b>Credits:</b> 3
<b>Internal Marks:</b> 50	<b>Percentage of Numerical/Design Problems:</b> 20%
<b>External Marks:</b> 100	<b>Duration of End Semester Exam(ESE):</b> 3 Hours
<b>Total Marks:</b> 150	<b>Course Type:</b> Open Elective

**Course Outcomes:**

**On completion of the course the student will have the ability to:**

1. Create and evaluate new algorithms to solve complex engineering problems.
2. Illustrate various data structures to solve multi-disciplinary projects.
3. Utilize the templates for modularity.
4. Compare and classify various data structures
5. Demonstrate the reusability of data structures for implementing complex iterative problems

**Prerequisites:** Knowledge of Programming for Problem Solving

**Additional Material Allowed in ESE:** NIL (Mention anything like graph, calculator etc, if required in exam)

**Detained Contents:**

**Part-A**

**Introduction:** Definition and brief description of various data structures, operations on data structures, Algorithm development, Complexity analysis, Big O notation, Time space trade-off [4 Hours]

**Arrays:** Linear and Multi-dimensional arrays and their representation, operations on arrays, Linear Search, Binary Search, Sparse matrices and their storage [4 Hours]

**Stacks:** Array Representation and Implementation of Stacks, Operations on Stacks, Application of stacks: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack, balanced parenthesis checking. [4 Hours]

**Recursion:** Recursive definition and examples of recursion, Tower of Hanoi Problem, tail Recursion [2 Hours]

**Queues:** Sequential representation of queue, linear queue, circular queue, operations on linear and circular queue, deque, priority queue. [5 Hours]

**Part- B**

**Linked Lists:** Linear linked list, operations on linear linked list, doubly linked list, operations on doubly linked list, Circular Linked list, Garbage collection and Compaction, Linked representation of Stack, Linked representation of a Queue. [6 Hours]

**Trees:** Basic terminology, sequential and linked representations of trees, traversing a binary tree, brief introduction to threaded binary trees, AVL trees and B-trees, Heap Trees. [4 Hours]

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

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**Binary Search Trees:** Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm [4 Hours]

**Graphs:** Basic terminology, representation of graphs (adjacency matrix, adjacency list), traversal of a graph (breadth - first search and depth - first search) [3 Hours]

**Text Books:**

1. Seymour Lipschitz, "Data Structures", Schaum's Outline series, Tata McGraw Hill.
2. Y. Langsam, M. J. Augenstein, A. M. Tanenbaum "Data Structures using C and C++", PrenticeHall of India.
3. SartajSahni, "Data Structures, Algorithms and Applications in C++", Tata McGraw Hill.

**Guru Nanak Dev Engineering College, Ludhiana**  
**Department of Information Technology**  
**M. Tech (Computer Science and Information Technology) Scheme 2020**

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**Subject Code: MOIT-303**

**Subject Name: Database Management System**

<b>Programme:</b> M. Tech.	<b>L:3T:0 P:0</b>
<b>Semester:</b> 3	<b>Teaching Hours:</b> 36
<b>Theory/Practical:</b> Theory	<b>Credits:</b> 3
<b>Internal Marks:</b> 50	<b>Percentage of Numerical/Design Problems:</b> 20%
<b>External Marks:</b> 100	<b>Duration of End Semester Exam(ESE):</b> 3 Hours
<b>Total Marks:</b> 150	<b>Course Type:</b> Open Elective

**Course Outcomes:**

**On completion of the course the student will have the ability to:**

1. Design Physical and object relational database.
2. Identify, formulate database design, Functional dependencies and Recovery techniques.
3. Use the techniques, skills and tools such as query handling, normalized relations
4. Apply the Applications of spatial and multimedia databases for real world.
5. Apply knowledge of database system, Data warehouse, data mining and SQL Structure.

**Prerequisites:** Basic knowledge of algorithms and reasonable programming experience and some familiarity with basic linear algebra and basic probability and statistics.

**Additional Material Allowed in ESE:** NIL (Mention anything like graph, calculator etc, if required in exam)

**Detained Contents:**

**Part-A**

**Introduction to Database System:** Database Systems versus File Systems, View of Data, Data Models, database languages, Database Users and Administrators, Transaction Management, Components of a Database management Distributed Processing and Client Basic Concepts, Keys, Design Issues, ER Diagrams [5 Hours]

**Relational Model:** Structures of relational databases, Integrity Constraints, Logical database Design, Tables, Views, Data Dictionary. Relational Algebra, Relational Calculus. SQL: Basic Structures, Query Handling, Embedded SQL, Triggers, Security and Authorization. [10 Hours]

**Part-B**

**Relational Database Design:** Functional Dependencies, Multivalued Dependencies, Normal Forms (1NF ,2NF, 3NF, BCNF, 4NF and 5NF), Decomposition into Normalized Relations. [6 Hours].

**Transaction Management and Concurrency Control:** Transaction Management and Concurrency Control ACID properties, failure and recovery, concurrency control, Serializability, Two phase locking protocols, Timestamp and Validation based protocols, deadlocks, logs and logging protocol [5 Hours]

**Recovery Systems:** Failure Classification, Recovery and Atomicity, Log Based Recovery, Shadow Paging, Recovery with Concurrent Transactions [4Hours]



**Guru Nanak Dev Engineering College, Ludhiana**  
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**M. Tech (Computer Science and Information Technology) Scheme 2020**

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**Data Mining:** Introduction to Data Mining, Process of Data Mining, Applications of Data Mining, Data Warehousing, Advantages of Data Warehousing, Data Marts, Introduction and Applications of Spatial and Multimedia Databases. [6Hours]

**Text Books:**

1. Abraham Silberschatz, S. Sudarshan, Henry F. Korth, “Database System Concepts”, 6th Edition, Tata McGraw - Hill Education, 2011.
2. Shamkant B. Navathe, RamezElmasri, “Fundamentals of Database Systems”, 6th Edition, Addison Wesley Pub Co Inc, 2010.
3. Connolly, “Specifications of Database Systems: A Practical Approach to Design, Implementation and Management”, 4th Edition, Pearson India, 2008.

**Reference Books:**

1. Essentials of Data Base Management System - Alexis Leon and Mathews Leon - Vikas Publishing Limited, Chennai First Edition, 2009
2. SQL and PL/SQL – Sharad MaheswariRuchin Jain - Firewall Media New Dehi First Edition 2010