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| **Bachelor of Technology (Artificial Intelligence & Data Science)** |
| **Credit Based Scheme of Studies/Examination** |
| **Semester III (w.e.f Session 2022-2023)** |
| **S.No.** | **Course Code** | **Subject** | **L:T:P** | **Hours/Week** | **Credits** | **Examination Schedule (Marks)** | **Duration of exam (Hrs)** |
| **Major Test** | **Minor Test** | **Practical** | **Total** |
| **1** | **AI-DS-201A** | **Introduction to Data Science** | **3:0:0** | **3** | **3** | **75** | **25** | **0** | **100** | **3** |
| **2** | **AI-DS-203A** | **Computer Networks** | **3:0:0** | **3** | **3** | **75** | **25** | **0** | **100** | **3** |
| **3** | **AI-DS-205A** | **Sensor Technology** | **3:0:0** | **3** | **3** | **75** | **25** | **0** | **100** | **3** |
| **4** | **AI-DS-207A** | **Design & Analysis of Algorithm** | **4:0:0** | **4** | **4** | **75** | **25** | **0** | **100** | **3** |
| **5** | **AI-DS-209A** | **Object Oriented Programming using C++** | **4:0:0** | **4** | **4** | **75** | **25** | **0** | **100** | **3** |
| **6** | **AI-DS-211LA** | **Object Oriented Programming using C++ Lab** | **0:0:3** | **3** | **1.5** | **--** | **40** | **60** | **100** | **3** |
| **7** | **AI-DS-213LA** | **Design & Analysis of Algorithm Lab** | **0:0:3** | **3** | **1.5** | **--** | **40** | **60** | **100** | **3** |
| **8** | **AI-DS-215LA** | **Data Science Lab** | **0:0:2** | **2** | **1** | **--** | **40** | **60** | **100** | **3** |
|  |  | **Total** |  | **25** | **21** | **375** | **245** | **180** | **800** |  |
| **9** | **SIM-201A\*** | **Seminar on Summer Internship** | **2:0:0** | **2** |  | **0** | **50** | **0** | **50** |  |

**\*Note: SIM-201A\* is a mandatory credit-less course in which the students will be evaluated for the**

**Summer Internship (training) undergone after 2nd semester and students will be required to get passing**

**marks to qualify.**

1. **Regarding the course SIM-201A\* (Seminar on Summer Internship) is a part of the curriculum of**

**B.Tech – 2nd Semester. Since the students are admitted directly through LEET (Lateral Entrance**

**Examination Test) in the B.Tech. – 3rd Semester, therefore, they need not to undergo this course.**

1. **In the D.M.C for LEET students it may be mentioned**

**\*NOT APPLICABLE**

**\* ADMITTED UNDER LEET**

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| **AI-DS-201A** | **Introduction to Data Science** |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 hrs** |
| **Purpose** | **To familiarize the students with the basics of Data Science** |
| **Course Outcomes(CO)** |
| **CO 1** | Provide with the knowledge and expertise to become a proficient data scientist. |
| **CO 2** | Explain how data is collected, managed and stored for data science |
| **CO 3** | Demonstrate an understanding of statistics and machine learning concepts that are vital for data science |
| **CO 4** | Critically evaluate data visualizations based on their design and use for communicating stories from data |

1. **UNIT-I**
2. **Overview:** Data science in a big data world: Benefits and uses of data science and big data, Facts of Data,
3. The Data Science process The big data ecosystem and data science,
4. **Introduction to core concepts and technologies**: Introduction, Terminology, data science process, data
5. science toolkit, Types of data, Example applications, difference between R, data science and Machine
6. learning
7. **UNIT-II**
8. **Data collection and management:** Introduction, Sources of data, Data collection and APIs, Data storage
9. and management, Using multiple data sources

**Data Science process:** Overview of Data Science process

Machine learning: What is Machine Learning, Modeling Process, Types of Machine Learning, Semi-Supervised learning

**UNIT- III**

1. **Data analysis:** Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and
2. distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning
3. algorithms, Linear regression, SVM, Naive Bayes.
4. **Handling large Data on a single Computer:** the problem facing for handling large data, General
5. techniques for handling large volumes of data, general programming for dealing with large data sets, case studies
6. **UNIT-IV**
7. **Data visualization**: Introduction, Types of data visualization, Data for visualization: Data types, Data
8. encodings, Retinal variables, Mapping variables to encodings, Visual encodings.
9. **Suggested Books:**

1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O’Reilly.

2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

3. Davy Cielen, Arno D. B. Meysman, Mohamed Ali “Introducing Data Science”, MANNING SHELTER ISLAND

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| **AI-DS-203A** | **Computer Networks** |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To introduce the architecture and layers of computer network, protocols used at differentLayers. |
| **Course Outcomes(CO)** |
| **CO1** | To understand the basic concept of networking, types, networking topologies and layered architecture. |
| **CO2** | To understand data link layer and MAC sub-layer` |
| **CO3** | To understand the network Layer functioning |
| **CO4** | To understand the transport layer and application layer operation |

**Unit -I**

**Introduction to Computer Networks :** Data Communication System and its components, Data Flow, Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and Wired networks, broadcast and point-to-point networks, Network topologies, protocols, interfaces and services, ISO- OSI reference model, TCP/IP architecture.

**Physical Layer**: Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Multiplexing : Frequency Division, Time Division, Wavelength Division, Transmission Media: Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared),

**Unit –II**

**Transport layer**: Process to process delivery; UDP; TCP, RPC, Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, Quality of service: techniques to improve QoS.

**Application layer**: DNS; SMTP, SNMP, FTP, HTTP & WWW; Firewalls, Bluetooth, Email, S/MIME, IMAP,

**Network Security**: Cryptography, user authentication,digital signatures

**Unit-III**

**Network layer**: Addressing : Internet address, sub-netting; Routing techniques, static vs. dynamic routing , routing table, DHCP, IEEE standards 802.x, Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IGMP, IPV6.

**Unit-IV**

**Data link layer**: Error Control, Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, sliding window protocols, Selective repeat ARQ, HDLC;

**Medium access sub layer**: Point to point protocol, FDDI, token bus, token ring; Reservation, polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA, LLC

**Suggested Books:**

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw Hill, Fourth Edition, 2011.
2. Computer Networks, 4th Edition, Pearson Education by Andrew S. Tanenbaum
3. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Elsevier, Fifth Edition, 2012.
4. William Stallings, “Data and Computer Communication”, Eighth Edition,Pearson Education, 2007.
5. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring the Internet”, Pearson Education, 2005.

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| **AI-DS-205A** | **Sensor Technology** |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs** |
| **Purpose** | **To familiarize the students with the Sensor Technology** |
| **Course Outcomes(CO)** |
| **CO 1** | Architect sensor networks for various application setups |
| **CO 2** | Devise appropriate data dissemination protocols and model links cost. |
| **CO 3** | Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers. |
| **CO 4** | Evaluate the performance of sensor networks |

1. **UNIT-I**

**Introduction to Sensor Networks:** Introduction: The vision of Ambient Intelligence, Applications, types of Applications, Performance metrics, Challenges for WSNs, Why are sensor networks different, Enabling technologies for wireless sensor networks

1. **UNIT-II**
2. **Architecture**: **Single-node architecture:** Hardware components, Energy consumption of sensor nodes,
3. Operating systems and execution environments, examples of sensor nodes. **Network architecture:**
4. Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs, Service
5. interfaces of WSNs, Gateway concepts
6. **UNIT- III**
7. **Communication Protocols: Physical layer**: Introduction, Wireless channel and communication
8. Fundamentals, Physical layer and transceiver design considerations in WSNs
9. **MAC protocols:** Fundamentals of (wireless) MAC protocols, Contention-based protocols, Schedule
10. based protocols, The IEEE 802.15.4 MAC protocol.
11. **UNIT-IV**
12. **Routing protocols:** Introduction, MANET protocols; Routing protocols for WSN: Resource-aware
13. routing, Data-centric, Geographic Routing, Broadcast, Multicast Opportunistic Routing Analysis:
14. Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks.
15. **Suggested Books:**

 1. W. Dargie and C. Poellabauer, “Fundamentals of Wireless Sensor Networks –Theory and Practice”, Wiley 2010. 2. KazemSohraby, Daniel Minoli and TaiebZnati, “wireless sensor networks -Technology, Protocols, and Applications”, Wiley Interscience 2007.

3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, “Wireless Sensor Network Technologies for the Information Explosion Era”, springer 2010.

4.Holger Karl, Andreas Willig “PROTOCOLS AND ARCHITECTURES FOR WIRELESS SENSOR NETWORKS’, John Wiley & Sons Ltd, ISBN: 0-470-09510

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| **AI-DS-207A** | **Design and Analysis of Algorithm** |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **4** | **0** | **0** | **4** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To introduce advanced data structures and algorithms concepts involving their implementation for solving complex applications. |
| **Course Outcomes (CO)** |
| **CO1** | To introduce the basic concepts of Data Structures and their analysis. |
| **CO2** | To study the concept of Dynamic Programming and various advanced Data Structures. |
| **CO3** | To introduce various Graph algorithms and concepts of Computational complexities. |
| **CO4** | To study various Flow and Sorting Networks |

### Unit 1: Introduction

Review:- Elementary Data Structures, Algorithms and its complexity(Time and Space), Analysing Algorithms, Asymptotic Notations, Priority Queue, Quick Sort.

Recurrence relation:- Methods for solving recurrence(Substitution , Recursion tree, Master theorem), Strassen multiplication.

### Unit 2: Advanced Design and analysis Techniques

Flow and Sorting Networks Flow networks, Ford- Fulkerson method, Maximum Bipartite matching, Sorting Networks, Comparison network, The zero- One principle, Bitonic sorting network, Merging networks

### Unit 3: Graph Algorithms

Review of graph algorithms:-Traversal Methods(Depth first and Breadth first search),Topological sort, Strongly connected components, Minimum spanning trees- Kruskal and Prims, Single source shortest paths, Relaxation, Dijkstras Algorithm, Bellman- Ford algorithm, Single source shortest paths for directed acyclic graphs, All pairs shortest paths- shortest paths and matrix multiplication, Floyd-Warshall algorithm.

### Unit 4: Network and Sorting Algorithms

Dynamic programming:- Elements, Matrix-chain multiplication, longest common subsequence,

Greedy algorithms:- Elements , Activity- Selection problem, Huffman codes, Task scheduling problem, Travelling Salesman Problem.

### Suggested Books :

* Corman, Leiserson and Rivest : Introduction to Algorithms, 2/e, PHI
* Das Gupta :Algorithms, TMH.
* Horowitz, Ellis and Sahni, Sartaj: Fundamentals of Computer Algorithms. Galgotia Publications
* Aho, Hopcroft and Ullman: The Design and Analyses of Computer Algorithms. Addison Wesley.
* R.B.Patel: Expert Data Structures with C, Khanna Publications , Delhi, India, 2nd Edition 2004, ISBN 81- 87325-07-0.
* R.B.Patel and M.M.S Rauthan: Expert Data Structures with C++, Khana Publications, Delhi , India, 2nd Edition 2004,ISBN 87522-03-8

# Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

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| **AI-DS-209A** | **Object Oriented Programming using C++** |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **4** | **0** | **0** | **4** | **75** | **25** | **100** | **3 Hrs** |
| **Purpose** | To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System. |
| **Course Outcomes (CO)** |
| **CO1** | To introduce the basic concepts of object oriented programming language and the its representation. |
| **CO2** | To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation. |
| **CO3** | To introduce polymorphism, interface design and overloading of operator. |
| **CO4** | To handle backup system using file, general purpose template and handling of raised exception during programming. |

### Unit–1

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private),

###  Unit-2

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.

Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates and Non

- Type Template arguments.

### Unit-3

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding, Virtual Deconstructions.

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator ,Unary Operators, Binary Operators.

### Unit-4

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors,

Introduction of inheritance, Types of Inheritance, Overriding, Base Class Members in a Derived Class, Public, Protected and Private Inheritance.

### Suggested Books:

* The complete reference C ++ by Herbert shieldt Tata McGraw Hill.
* Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
* Shukla, Object Oriented Programming in c++, Wiley India.
* C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
* Programming with C++ By D Ravichandran, 2003, T.M.H.

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| **AI-DS-211LA** | **Object Oriented Programming Using C++ Lab** |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **3** | **1.5** | **40** | **60** | **100** | **3 Hrs.** |
| **Purpose** | To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System. |
| **Course Outcomes (CO)** |
| **CO1** | To introduce the basic concepts of object oriented programming language and the its representation. |
| **CO2** | To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation. |
| **CO3** | To introduce polymorphism, interface design and overloading of operator. |
| **CO4** | To handle backup system using file, general purpose template and handling of raised exception during programming. |

**Q1**. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power

( ) that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.

**Q2**. A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents a point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

Enter coordinates for P1: 3 4

Enter coordinates for P2: 5 7 Coordinates of P1 + P2 are : 8, 11

**Q3**. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be ‘Y’ or ‘N’. Some sample interaction with the program might look like this.

Enter first number, operator, and second number: 10/ 3 Answer = 3.333333

Do another (Y/ N)? Y

Enter first number, operator, second number 12 + 100 Answer = 112

Do another (Y/ N) ? N

**Q4**. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

* Enter your area code, exchange, and number: 415 555 1212
* My number is (212) 767-8900
* Your number is (415) 555-1212

**Q5**. Create two classes DM and DB which store the value of distances. DM stores distances in metres and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB objects, depending on the units in which the results are required. The display should be in the format of feet and inches or metres and cenitmetres depending on the object on display.

**Q6**. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions:

* + constructor with no arguments (default).
	+ constructor with two arguments.
	+ void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator.
	+ Overload + operator to add two rational number.
	+ Overload >> operator to enable input through cin.
	+ Overload << operator to enable output through cout. Write a main ( ) to test all the functions in the class.

**Q7**. Consider the following class definition class father {

protected : int age; public;

father (int x) {age = x;} virtual void iam ( )

{ cout < < “I AM THE FATHER, my age is : ”<< age<< end1:}

};

Derive the two classes son and daughter from the above class and for each, define iam ( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam ( ) through the pointer to demonstrate polymorphism in action.

**Q8**. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name ( a string of 30 or lesser no. of characters) and marks.

**Q9**. A hospital wants to create a database regarding its indoor patients. The information to store include

1. Name of the patient
2. Date of admission
3. Disease
4. Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

**Q10**. Make a class **Employee** with a name and salary. Make a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **to String** that prints the manager’s name, department and salary. Make a class **Executive** inherits from **Manager**. Supply a method **to String** that prints the string **“Executive”** followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

**Q11**. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.

**Q12**. Write a function called reversit ( ) that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit ( ) as an argument. Write a program to exercise reversit ( ). The program should get a string from the user, call reversit ( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon’s famous phrase, “Able was I ere I saw Elba)”.

**Q13**. Create some objects of the string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the forEach ( ) function and a user written display function. Then search the Deque for a particular string, using the first That ( ) function and display any strings that match. Finally remove all the items from the Deque using the getLeft ( ) function and display each item. Notice the order in which the items are displayed: Using getLeft ( ), those inserted on the left (head) of the Deque are removed in “last in first out” order while those put on the right side are removed in “first in first out” order. The opposite would be true if getRight ( ) were used.

**Q14**. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this derive the classes

cur\_acct and sav\_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

1. Accept deposit from a customer and update the balance.
2. Display the balance.
3. Compute and deposit interest.
4. Permit withdrawal and update the balance.
5. Check for the minimum balance, impose penalty, necessary and update the balance.
6. Do not use any constructors. Use member functions to initialize the class members.

**Q15**. Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get\_data( ) to initialize baseclass data members and another member function display\_area( ) to compute and display the area of figures. Make display\_area ( ) as a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.

Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:

Area of rectangle = x \* y Area of triangle = ½ \* x \* y

**NOTE:** A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

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| **AI-DS-213LA** | **Design and Analysis of Algorithm Lab** |
| **Lecture** | **Tutori al** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **3** | **1.5** | **40** | **60** | **100** | **3 Hrs** |
| **Purpose** | The student should be made to Learn the algorithm analysis techniques, become familiar with the different algorithm design techniques and Understand the limitations of Algorithm power. |
| **Course Outcomes (CO)** |
| CO1 | The student should be able to Design algorithms for various computing problems. |
| CO2 | The student should be able to Analyze the time and space complexity of algorithms. |
| CO3 | The student should be able to Critically analyze the different algorithm design techniques for a given problem. |

*The student should be able to Modify existing algorithms to improve efficiency.*

*CO4*

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the lIst to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Using Open, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. a. Obtain the Topological ordering of vertices in a given digraph.

b. Compute the transitive closure of a given directed graph using Warshall's algorithm.

1. Implement 0/1 Knapsack problem using Dynamic Programming.
2. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra’s algorithm.
3. Find Minimum Cost Spanning Tree of a given undirected graph using Kristal’s algorithm.
4. a. Print all the nodes reachable from a given starting node in a digraph using BFS method.

b. Check whether a given graph is connected or not using DFS method.

1. Find a subset of a given set S = {sl,s2, ,sn} of n positive integers whose sum is equal to a given

positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions{1,2,6}and{1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.

1. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
2. Find Minimum Cost Spanning Tree of a given undirected graph using Prim’s algorithm.
3. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using Open and determine the speed-up achieved.
4. Implement N Queen's problem using Back Tracking.
5. Use divides and conquers method to recursively implement Binary Search

**NOTE:** A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

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| **AI-DS-215LA** | **Data Science Lab** |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **40** | **60** | **100** | **3 Hrs** |
| **Purpose**  | **To familiarize the students with the basics of Data Science** |
| **Course Outcomes** |  |
| 1 | To understand basic DDL commands  |  |
|  2 | To learn about DML and DCL commands  |  |
|  3 | To understand the SQL queries using SQL operators  |  |
|  4 | To understand the concept of relational algebra  |  |
|  5 | To learn various queries using date and group functions  |  |
|  6 | To understand the nested queries  |  |
|  7 | To learn view, cursors and triggers.  |  |
| 8 | Study of basic Syntaxes in R |  |
| 9 | Implementation of vector data objects operations |  |
| 10 | Implementation of matrix, array and factors and perform via in R |  |

1. Write the queries for [Data Definition Language (DDL) in RDBMS.](http://enggedu.com/data_definition_language_DDL_commands_in_RDBMS/index.php)
2. Write the queries for Data Manipulation Language (DML) in RDBMS.
3. Write the queries for Data Control Language (DCL) in RDBMS.
4. To perform various integrity constraints on relational database.
5. Create a database and perform the following operations:-
6. Arithmetic and Relational operations
7. Group by & having clauses
8. Like predicate for pattern matching in database
9. Write SQL queries for relational algebra
10. Write SQL queries for extracting data from more than one table
11. Write SQL queries for sub queries, nested queries
12. Concepts for ROLL BACK, COMMIT & CHECK POINTS
13. Using two tables create a view, which shall perform natural join, equi join, outer joins.

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| **Bachelor of Technology (Artificial Intelligence & Data Science)** |
| **Credit Based Scheme of Studies/Examination** |
| **Semester IV (w.e.f Session 2022-2023)** |
| **S.No.** | **Course** Code | **Subject** | **L:T:P** | **Hours/Week** | **Credits** | **Examination Schedule (Marks)** | **Duration of exam (Hrs)** |
| **Major Test** | **Minor Test** | **Practical** | **Total** |
| 1 | AI-DS-202A | Database Management Systems | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 2 | AI-DS-204A | Object Oriented Software Engineering | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 3 | AI-DS-206A | Business Intelligence | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 4 | AI-DS-208A | Automata Theory | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 5 | HTM-901A | Universal Human ValuesII : UnderstandingHarmony | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 6 | AI-DS-210A | Data Visualization | 3:0:0 | 3 | 3 | 75 | 25 | 0 | 100 | 3 |
| 7 | AI-DS-212LA | Data Visualization Lab | 0:0:3 | 3 | 1.5 | -- | 40 | 60 | 100 | 3 |
| 8 | AI-DS-214LA | Database Management Systems Lab | 0:0:3 | 3 | 1.5 | -- | 40 | 60 | 100 | 3 |
| 9 | AI-DS-216LA | Soft Skills and Communication Lab | 0:0:2 | 2 | 1 | -- | -- | 50 | 50 | 3 |
|  |  | **Total** |  | **26** | **22** | **450** | **230** | **170** | **850** |  |
| 10 | MC-901A\* | Environmental Sciences | 3:0:0 | 3 | 0 | 75 | 25 | 0 | 100 | 3 |

\*MC-901A is a mandatory credit-less course and student has to get passing marks in order to qualify for the award of B.Tech. Degree.

Note: Students be encouraged to go to 6-8 weeks summer internships mandatory during the summer break after the completion of fourth semester exams.

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| **AI-DS-202A** | **Database Management Systems** |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | 3 | 75 | 25 | 100 | **3 Hour** |
| **Purpose**  | To familiarize the students with Data Base Management system  |  |
|  | **Course Outcomes** |  |
| **CO 1**  | To provide introduction to relational model and ER diagrams. |  |
| **CO 2**  | To realize about Query Processing and Transaction Processing. |  |
| **CO 3**  | To comprehend about the concept of functional dependencies. |  |
| **CO 4**  | To learn the concept of failure recovery and concurrency control.  |  |

# UNIT I

**Introduction:** Concept & Overview of DBMS, Data Models-, Network, Hierarchical and Relational Model, Levels of abstraction. Administrator, Database Users, Three Schema architecture of DBMS, Application.

 **Entity-Relationship Model:** : Entities, Attributes and Entity Sets, Relation and Relationships sets

# UNIT II

**Recovery System:** Types of Failures, Recovery Techniques, ARIES.

**Concurrency Control:** Serial and Serializable Schedules-Conflict Serializability –Enforcing Serializability by Locks-Locking Systems with Several Lock Modes-Concurrency Control by Timestamps, validation.

**UNIT III**

**Relational Database Design:**

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF.

**Internals of RDBMS:** Physical data structures, Query optimization: join algorithm, statistics and cost base optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols, two phase locking.

# UNIT IV

**Relational Model:** Structure of relational Databases, Relational Algebra and Relational Calculus, Operations on Relational Algebra, Operations on Relational Calculus, Tuple Relational Calculus, Domain Relational Calculus.

**SQL and Integrity Constraints:** Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, Introduction to views,.

**Suggested Books**:

* [RamezElmasri](http://www.flipkart.com/author/ramez-elmasri),[ShamkantB.Navathe](http://www.flipkart.com/author/shamkant-b-navathe),”Fundamentals of Database systems”, Pearson
* Korth, Silberschatz, Sudarshan: database concepts, MGH,
* R. Ramakrishnan and J. Gehrks database management system; MGH, International edition,
* C. J. Date, data base systems: 7th edition, Addison Wesley, Pearson Education,

Chakrabarti, Advance database management systems , Wiley Dreamtech

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|  **AI-DS-204A** | **Object Oriented Software Engineering**  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hour** |
| **Purpose** | To provide the thorough knowledge to use the concepts and their design attributes for Object Oriented Software Engineering approaches and platforms to solve real time problems. |
|  | **Course Outcomes** |  |
| **CO 1** | To learn the basic concepts of object oriented systems and software engineering. |
| **CO 2** | To get exposure of various object modeling methodologies, tools for analyzing and designing software based systems using UML. |
| **CO 3** | To explore problems using Use Cases, analyzing relations, responsibilities and collaborations among classes and their behavior in problem domain. |
| **CO 4** | To evaluate object oriented design processes using models, design patterns, interfaces designs and communication mechanisms for performing required tasks. |

**Unit-I**

An Overview of Object-Oriented system Development, Objects Basis, Class Hierarchy, Inheritance, Polymorphism, Object Relationships and Associations, Aggregations and Object Containment, Object Persistence, Meta-Classes, Object Oriented Systems Development Life Cycle: Software Development Process, Object Oriented Systems Development: A Use-Case Driven Approach.

**Unit-II**

Object Oriented Design process and Design Axioms, Corollaries, Design Patterns, Designing Classes: Object Oriented Design Philosophy, UML Object Constraint Language, Designing Classes: The Process, Class Visibility, Refining Attributes, Designing Methods and Protocols, Packages and Managing classes, View Layer: Designing Interface objects,Designing View layer Classes, Macro and Micro Level Interface Design Process.

**Unit-III**

Object Oriented Analysis Process, Use Case Driven Object Oriented Analysis, Use Case Model, Object Analysis: Classification, Classification Theory, Approaches for identifying classes, Responsibilities and Collaborators, Identifying Object Relationships, Attributes and Methods: Associations, Super-Sub Class relationships, A-Part-of-Relationships-Aggregation, Class Responsibilities, Object Responsibilities.

**Unit-IV**

Object Oriented Methodologies: Rumbaugh Methodology, Jacobson Methodology, BoochMethodology, Patterns, Frameworks, The Unified approach, Unified Modeling Language (UML)

**Suggested Books:**

* Ali Bahrami, Object Oriented Systems Development, McGraw Hill Publishing Company Limited, New Delhi, 2013.
* Rumbaugh et al., Object Oriented Modeling and Design, PHI, 2006.
* Robert Laganière and Timothy C. Lethbridge, Object‑Oriented Software Engineering: Practical Software Development, McGraw-Hill Publishing Company Limited, New Delhi, Sixth Print 2008.
* Ivar Jacobson, MagnosChristerson, Patrick Jonsson, Gunnar Overgaard, Object-oriented Software
* Engineering: A Use Case Driven Approach, Pearson Education, New Delhi, Seventh Edition Reprint, 2009.
* David C. Kung, Object-Oriented Software Engineering: An Agile Unified Methodology, McGraw-Hill Publishing Company Limited, New

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| **AI-DS-206A** | **Business Intelligence** |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3Hrs.** |
| **Purpose** | To make the students conversant with the basics concepts in management thereby leading to nurturing their managerial skills. |
| **Course Outcomes (CO)** |
| **CO1** | Students will be able understand who the entrepreneurs are and what competences needed to become an Entrepreneur. |
| **CO2** | Students will be able understand insights into the management, opportunity search, identification of a Product; market feasibility studies; project finalization etc. required for small business enterprises. |
| **CO3** | Students can be able to write a report and do oral presentation on the topics such as product identification, business idea, export marketing etc. |
| **CO4** | Students will be able to know the different financial and other assistance available for the small industrial units. |

### Unit –I

**Entrepreneurship :** Concept and Definitions; Entrepreneurship and Economic Development; Classification and Types of Entrepreneurs; Entrepreneurial Competencies; Factor Affecting Entrepreneurial Growth – Economic, Non-Economic Factors; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs; Manager Vs. Entrepreneur, Entrepreneurial challenges.

 **Unit-II**

**Role of Support Institutions and Management of Small Business :** DIC; SIDO; SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC; Venture Capital : Concept, venture capital financing schemes offered by various financial institutions in India.

### Unit –III

**Small Enterprises and Enterprise Launching Formalities :** Definition of Small Scale; Rationale; Objective; Scope; SSI; Registration; NOC from Pollution Board; Machinery and Equipment Selection , Role of SSI in Economic Development of India; major problem faced by SSI,MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes.

### Unit –IV

**Opportunity / Identification and Product Selection:** Entrepreneurial Opportunity Search and Identification; Criteria to Select a Product; Conducting Feasibility Studies; Sources of business ideas, Marketing Plan : Conducting of Marketing Research, Industry Analysis, Competitor analysis, market segmentation and positioning, building a marketing plan, marketing mix, launching a new product; export marketing, Methods of Project Appraisal, Project Report Preparation; Specimen of Project Report; Project Planning and Scheduling using Networking Techniques of PERT / CPM.

### Suggested Readings:

* “Entrepreneurship development small business enterprises”, Pearson, Poornima M Charantimath,2013.
* Roy Rajiv, “Entrepreneurship”, Oxford University Press, 2011.
* “Innovation and Entrepreneurship”,Harper business- Drucker.F, Peter, 2006.
* “Entrepreneurship”, Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012

# Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syl

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| **AI-DS-208A** | **Automata Theory** |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | 3 | 75 | 25 | 100 | **3 Hour** |
| **Purpose**  | To understand the challenges for Theoretical Computer Science and its contribution to other sciences |
|  | **Course Outcomes** |  |
| **CO 1**  | Students are able to explain and manipulate the different fundamental concepts in automata theory and formal languages. |
| **CO 2**  | Simplify automata and context-free grammars; Prove properties of languages, grammars and automata with rigorously formal mathematical methods, minimization. |
| **CO 3**  | Differentiate and manipulate formal descriptions of push down automata, its applications and transducer machines. |
| **CO 4**  | To understand basic properties of Turing machines and computing with Turing machine, the concepts of tractability and decidability. |

**Unit - I**

**Introduction to Automata:** Study and Central Concepts of Automata Theory, Applications of Finite Automata, An Introduction of Deterministic Finite Automata(DFA) and Non-Deterministic Finite Automata(NFA), Finite Automata with Epsilon (€) Transitions.

**Regular Expression and Languages:** Regular Expressions (RE), Finite Automata and Regular Expressions,Applications of Regular Expressions, Algebraic Laws of Regular Expressions, Closure Properties of Regular Languages, RE to NFA, DFA Conversion and DFA to RE, Equivalence and Minimization of NFA and DFA automata.

**Unit-II**

**Introduction to Turing Machine:** The Turing Machine, Programming Techniques for Turing Machine, Extensions of Turing Machine, Restricted Turing Machines, Universal Turing Machines and Designing of Turing Machines, Time and Tape Complexity Measures of Turing machines

**Unit-III**

**Mealey and Moore Machines:** Definitions, Representation, Equivalence of Moore and Mealey Machines and its Designing.

**Push Down Automata:** Introduction of Push Down Automata (PDA), Language of PDA, Equivalence of PDA’s and CFG’s, Deterministic Push Down Automata, Designing of PDA, Applications of PDA.

**Unit-IV**

**Context free Grammars and Languages:** Parse Trees, Context Sensitive Grammar, Context Free Grammar,Regular Grammar, Applications of Context Free Grammars, Ambiguity in Grammars and Languages. Closure Properties of CFL, Chomsky Theorem,Chomsky Hierarchy,Normal forms of context free grammars: Chomsky Normal Form, Greibach Normal Form.

**Suggested Books**:

* J.E.Hopcroft, R.Motwani and J.D.Ullman , "Introduction to Automata Theory Languages and
* computation", Pearson Education Asia , 2001.
* K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education, 2009.
* Peter Linz, "An Introduction to Formal Language and Automata", 4th Edition, Narosa Publishing house , 2006.
* M.Sipser; Introduction to the Theory of Computation; Singapore: Brooks/Cole, Thomson Learning, 1997.
* John.C.martin, "Introduction to the Languages and the Theory of Computation", Third edition, Tata McGrawHill, 2003

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| **HTM-901A** | **Universal Human Values II : Understanding Harmony** |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3.0** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To make the students conversant with the basics concepts of organizational culture and behavior for nurturing their managerial skills. |
| **Course Outcomes (CO)** |
| **CO1** | An overview about organizational behavior as a discipline and understanding the concept of individual behavior. |
| **CO2** | Understand the concept and importance of personality, emotions and its importance in decision making and effective leadership. |
| **CO3** | Enabling the students to know about the importance of effective motivation and its contribution in group dynamics and resolving conflicts. |
| **CO4** | Understand how to overcome organizational stress by maintaining proper organizational culture and effective communication. |

### Unit 1

**Introduction to Organizational Behavior:** Concept and importance of Organizational Behavior, Role of Managers in OB, Foundations or Approaches to Organizational Behavior, Challenges and Opportunities for OB. **Foundation of individual behavior**: Biographical characteristics, concept of Abilities and Learning , Learning and Learning Cycle, Components of Learning, concept of values and attitude, types of attitude, attitude and workforce diversity.

**Unit 2**

**Introduction to Personality and Emotions**: Definition and Meaning of Personality, Determinants of Personality, Personality Traits Influencing OB, Nature and Meaning of Emotions, Emotions dimensions, concept of Emotional intelligence

**Perception and individual decision making**: Meaning of perception, factors influencing perception, Rational decision making process, concept of bounded rationality. Leadership- Trait approaches, Behavioral approaches, Situational approaches, and emerging approaches to leadership.

### Unit-3

**Motivation**: concept and theories of Motivation, theories of motivation-Maslow, Two Factor theory, Theory X and Y,ERG Theory, McClelland’s Theory of needs, goal setting theory, Application of theories in Organizational Scenario, linkage between MBO and goal setting theory, employee recognition and involvement program.

**Foundations of Group Behavior and conflict management** :Defining and classifying of Groups, stages of group development, Informal and Formal Groups – Group Dynamics, Managing Conflict and Negotiation , a contemporary perspective of intergroup conflict, causes of group conflicts, Managing intergroup conflict through Resolution.

**Unit-4**:

**Introduction to Organizational Communication**: Meaning and Importance of Communication process, importance of Organizational Communication, Effective Communication, Organizational Stress: Definition and Meaning , Sources and Types of Stress, Impact of Stress on Organizations, Stress Management Techniques.

**Introduction to Organization Culture**- Meaning and Nature of Organization Culture, Types of Culture, Managing Cultural Diversity, Managing Change and Innovation – Change at work, Resistance to change, A model for managing organizational change.

### Suggested Books

* Colquitt, Jason A., Jeffery A. LePine, and Michael Wesson. Organizational Behavior: Improving Performance and Commitment in the Workplace. 5th ed. New York: McGraw-Hill Education, 2017.
* Hitt, Michael A., C. Chet Miller, and Adrienne Colella. Organizational Behavior. 4th ed. Hoboken, NJ: John Wiley, 2015.
* Robbins, Stephen P., and Timothy Judge. Organizational Behavior. 17th ed. Harlow, UK: Pearson Education, 2017.
* Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
* Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley.

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| **AI-DS-210A** | **Data Visualization** |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To familiarize the students with the basics of Data Visualization** |
| **Course Outcomes(CO)** |
| **CO 1** | To understand and apply principles of data visualization. |
| **CO 2** | To acquire, parse, and analyze abstract data sets |
| **CO 3** | To design and implement standard visualization techniques |
| **CO 4** | To evaluate existing visualizations quantitatively and qualitatively |

**UNIT-I**

**Foundations for Data Visualization:** Introduction to Visualization, Good Graphics, Static Graphics, Data Visualization Through Their Graph Representations, Graph-theoretic Graphics, High-dimensional Data Visualization, Visualizing Data: Mapping Data onto Aesthetics, Costs and Benefits of Visualization, Types of Data

1. **UNIT-II**
2. **Multidimensional Visualization:** 1D, 2D, 3D, Multiple Dimensions scaling, Matrix Visualization, Coordinate Systems and Axes, Color Scales, Directory of Visualizations, Visualizing Amounts, Visualizing Distributions: Histograms and Density Plots, Trees – Web Works – Data Mapping: Document Visualization – Workspaces.
3. **UNIT- III**
4. **Visualizing Distributions:** Empirical Cumulative Distribution Functions and Q-Q Plots, Visualizing Many Distributions at Once, Visualizing Proportions, Visualizing Nested Proportions, Visualizing Associations Among Two or More Quantitative Variables, Visualizing Time Series and Other Functions of an Independent Variable, Visualizing Trends, Visualizing Geospatial Data, Visualizing Uncertainty
5. **UNIT-IV**
6. **Principles of Figure Design:** The Principle of Proportional Ink, Handling Overlapping Points, Common
7. Pitfalls of Color Use, Redundant Coding, Multipanel Figures, Titles, Captions, and Tables, Balance the
8. Data and the Context, Don’t Go 3D.
9. **Suggested Books:**
10. 1. Colin Ware, Information Visualization Perception for Design, 3rd edition, Morgan Kaufman 2012.
11. 2. Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, Readings in Information Visualization Using Vision to think, Morgan Kaufmann Publishers, 1999.
12. 3.Thomas Strothotte, Computer Visualization-Graphics Abstraction and Interactivity, Springer Verlag Berlin Heiderberg 1998.
13. 4.Claus O. Wilke, “Fundamentals of Data Visualization A Primer on Making Informative and Compelling Figures”, O’Reilly
14. 5. Chun-houh Chen, Wolfgang Härdle, Antony Unwin,“Handbook of Data Visualization”, Spri

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| **AI-DS-212LA** | **Data Visualization Lab** |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical**  | **Total** | **Time** |
| **0** | **0** | **3** | **1.5** | **40** | **60** | **100** | **3 Hrs.** |
| **Purpose** | To gain a broad understanding of the discipline of software engineering implementation. |
| **Course Outcomes(CO)** |
| **CO1** | 1. Learn pre-processing method for multi-dimensional data
 |
| **CO2** | 1. Practice on data cleaning mechanisms
 |
| **CO3** | 1. Learn various data exploratory analysis
 |
| **CO4** | 1. Develop the visualizations for clusters or partitions
 |

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| **1** | DATA PRE-PROCESSING AND DATA CUBEData preprocessing methods on student and labor datasets Implement data cube for data warehouse on 3-dimensional data | PO1 |
| **2** | DATA CLEANINGImplement various missing handling mechanisms, Implement various noisy handling mechanisms | PO1 |
| **3** | EXPLORATORY ANALYSISDevelop k-means and MST based clustering techniques, Develop the methodology for assessment of clusters for given dataset | PO2 |
| **4** | ASSOCIATION ANALYSISDesign algorithms for association rule mining algorithms | PO2 |
| **5** | HYPTOTHYSIS GENERATIONDerive the hypothesis for association rules to discovery of strong association rules; Use confidence and support thresholds. | PO1 |
| **6** | TRANSFORMATION TECHNIQUESConstruct Haar wavelet transformation for numerical data, Construct principal component analysis (PCA) for 5-dimensional data. | PO7 |
| **7** | DATA VISUALIZATIONImplement binning visualizations for any real time dataset, Implement linear regression techniques | PO2 |
| **8** | CLUSTERS ASSESSMENTVisualize the clusters for any synthetic dataset, Implement the program for converting the clusters into histograms | PO7 |
| **9** | HIERARCHICAL CLUSTERINGWrite a program to implement agglomerative clustering technique ,Write a program to implement divisive hierarchical clustering technique | PO7 |
| **10** | SCALABILITY ALGORITHMSDevelop scalable clustering algorithms ,Develop scalable a priori algorithm | PO2 |

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| **AI-DS-214LA** | **Database Management Systems Lab** |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical** | **Total** | **Time** |
| **0** | **0** | **3** | **1.5** | **40** | **60** | **100** | **3 Hours** |
| **Purpose**  | **To familiarize the students with the basics of Data base management system.** |
| **Course Outcomes** |  |
| CO1  | To understand basic DDL commands  |  |
| CO 2  | To learn about DML and DCL commands  |  |
| CO 3  | To understand the SQL queries using SQL operators  |  |
| CO 4  | To understand the concept of relational algebra  |  |
| CO5  | To learn various queries using date and group functions  |  |
| CO6  | To understand the nested queries  |  |
| CO7  | To learn view, cursors and triggers.  |  |

1. Write the queries for [Data Definition Language (DDL) in RDBMS.](http://enggedu.com/data_definition_language_DDL_commands_in_RDBMS/index.php)
2. Write the queries for Data Manipulation Language (DML) in RDBMS.
3. Write the queries for Data Control Language (DCL) in RDBMS.
4. To perform various integrity constraints on relational database.
5. Create a database and perform the following operations:-
6. Arithmetic and Relational operations
7. Group by & having clauses
8. Like predicate for pattern matching in database
9. Write SQL queries for relational algebra
10. Write SQL queries for extracting data from more than one table
11. Write SQL queries for sub queries, nested queries
12. Concepts for ROLL BACK, COMMIT & CHECK POINTS
13. Using two tables create a view, which shall perform natural join, equi join, outer joins.
14. Write a procedure for computing income tax of employee on the basic of following conditions:-
	1. if gross pay<=40,000 then I.T rate is 0%.
	2. if gross pay>40,000 but <60000 then I.T rate is 10%.
	3. if gross pay>60,000 but <1,00,0000 then I.T rate is 20%.
	4. if gross pay>1,00,0000 then I.T rate is 30%.

 For this purpose create a table with name, ssn, gross salary and income tax of the employee.

1. Write trigger for before and after insertion, deletion and updation process.

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| **AI-DS-216LA** | **Soft Skills and Communication Lab** |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Minor Test** | **Practical**  | **Total** | **Time** |
| **0** | **0** | **2** | **1** | **-** | **50** | **50** | **3 Hrs.** |
| **Purpose** | To gain a broad understanding of the discipline of software engineering implementation. |
| **Course Outcomes(CO)** |
| **CO1** | To understand the basic concepts of Communication  |
| **CO2** | To understand Verbal and Non verbal Communication |
| **CO3** | To understand Group Discussion. |
| **CO4** | To understand different types of Management |

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| 1. Self assessment and development (Resume, SOP, Goal analysis, SWOT analysis)
2. Verbal And Non Verbal Communication (write up , a document on extempore topic)
3. Personal Interview and Group Discussion ( write up, a document on any one GD topic )
4. Team Building ( write up , activity sheet )
5. Stress Management ( write up on yoga , a feedback document on stress management session )
6. Book Review and PPT ( a review on any book in form of PPT 5 slides )
7. Technical Report writing/ Email etiquettes/ Language Lab/ Letter writing
8. Assertively Test and score.
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| **MC-901A\*** |  **Environmental Sciences** |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **0** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To learn the multidisciplinary nature, scope and importance of Environmental sciences. |
| **Course Outcomes (CO)** |
| **CO1** | The students will be able to learn the importance of natural resources. |
| **CO2** | To learn the theoretical and practical aspects of eco system. |
| **CO3** | Will be able to learn the basic concepts of conservation of biodiversity. |
| **CO4** | The students will be able to understand the basic concept of sustainable development. |

**UNIT 1**

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

1. Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, mining, dams and their effects on forests and tribal people.
2. Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
3. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
4. Food Resources: World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
5. Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
6. Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

## UNIT II

**Ecosystem-Concept of an ecosystem**. Sturcture and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, esturaries

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

## UNIT III

**Biodiversity and its conservation:** Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversityof global, National and local levels. India as a mega- diversity nation Hot spots of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man- wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex- Situ conservation of biodiversity.

**Environmental Pollution Definition:** Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

## UNIT IV

**Social Issues and the Environment**. From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depressan drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

## Suggested Books

* Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
* Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
* Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
* Environmental Science- Botkin and Keller. 2012. Wiley , India

## Note: The Examiner will be given the question paper template to set the question paper.