PART A: Introduction				
Program: M.Sc.	Class: II SEM	Year: I Year	Session: 2025-26	
Subject: Computer Science with Data Science				
1.	Course Code	**MSC-21**		
2.	Course Title	**Theory of Computation**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core course**		
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of Computing Mathematics .		
5.	Course Learning Outcomes(CLO)	• Demonstrates Models, Turing Machine, Regular Expression, Push Down Automata. • Model, Compare and analyze different Computational Models. • Apply and Prove properties of Languages, Grammars and Automata. • Apply Knowledge of Computing and Mathematics to Solve Problem • Apply Mathematical Foundations, Algorithmic Principles and Computer Science Theory to the Modeling		
6.	Credit Value	5 Credit		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 01 Hours per day		
Total Lectures: 60 Hours		
Unit	Topics	No. of Lectures
I	Automata: Basic machine, FSM , Transition graph, Transition matrix, Deterministic and nondeterministic FSM'S, Equivalence of DFA and NDFA, minimization of finite automata, Construction of Finite Automata.	12
II	Finite automata and regular expression: Regular Expressions, Regular Expression to Finite Automata, Finite Automata to Regular Expression, Two-way Finite Automata, Crossing Sequence of Two way Finite Automata Finite Automata with Output, Closure Properties of Regular Sets.	12
III	Context Free Grammars: Motivation and Introduction, Context-free Grammars, Derivation trees and Ambiguity, Normal Forms (Chomsky Normal Form), Unit Production Chomsky Normal Forms, ambiguous context-free languages, Construction of Reduced Grammars, Elimination of null production.	12
IV	Pushdown Automata: Definition of PDA, Deterministic Pushdown Automata, PDA corresponding to given CFG, CFG corresponding to a given PDA. Context Free Languages: The pumping lemma for CFL's, Closure	12

	properties of CFL's, Decision problems involving CFL's.	
V	Turing Machines: Introduction, TM model, representation and languages acceptability of TM Design of TM, Universal TM & Other modification, Church's hypothesis, composite & iterated TM. ,Universal Turing Machine.	12

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: 1. Introduction to Automata Theory, Languages & Computation, J E Hopcraft & JD Ullman, Narosa Publications. 2. Theory of Computer Science, KLP Mishra & N Chandra Sekhar, PHI 3. Mathematical Foundations of Computer Science, Beckman 4. John C Martin, "Introdution to languages and theory of computation", McGraw Hill 5. Anami & Aribasappa , " Formal Languages and Automata Theory",Wiley India
Suggestive digital platform web links: https://onlinecourses.nptel.ac.in/noc19_cs79/preview https://onlinecourses.nptel.ac.in/noc23_cs31/preview https://www.classcentral.com/course/youtube-computer-science-theory-of-computation-47562
Suggested equivalent online courses: **https://archive.nptel.ac.in/courses/106/104/106104148/** **https://archive.nptel.ac.in/courses/106/104/106104028/**

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions (50 Words Each)	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction				
Program: M.Sc.		Class: II Sem	Year: I Year	Session: 2025-26
Subject: Computer Science with Data Science				
1.	Course Code	MSC-22		
2.	Course Title	Data Communication and Computer Network		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	Core		
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of Computers.		
5.	Course Learning Outcomes(CLO)	• Demonstrate the Basic Concepts of Networking, Networking Principles, Routing Algorithms, IP • Addressing and Working of Networking Devices. • Demonstrate the Significance, Purpose and application of Networking Protocols and Standards. • Describe, compare and contrast LAN, WAN, MAN, Intranet, Internet, AM, FM, PM and Various Switching Techniques. • Explain the working of Layers and apply the various protocols of OSI & TCP/IP model. • Analyze the Requirements for a Given Organizational Structure and Select the Most Appropriate Networking Architecture and Technologies. • Design the Network Diagram and Solve the Networking Problems of the Organizations with Consideration of Human and Environment. • Install and Configure the Networking Devices.		
6.	Credit Value	5 Credits		
7.	Total Marks	Max.Marks : 100	Min. Passing Marks:40	

PART B: Content of the Course		
Total No. of Lectures(in hours per week): 1 Hour per Day		
Total Lectures: 6 Hours		
Unit	Topics	No. of Lectures
I	Network goals and application, Network structure, Network services, Example of networks and Network Standardization, Networking models: centralized, distributed and collaborative. Network Topologies: Bus, Star, Ring, Tree, Hybrid: Selection and Evaluation factors.	12
II	Theoretical Basis for Data communication, Transmission media, Twisted pair (UTP, STP), Coaxial Cable, Fiberoptics: Selection and Evaluation factors. Line of Sight Transmission, Communication Satellites. Analog	12

	and Digital transmission. Transmission and switching, frequency division and time division multiplexing, STDM, Circuit switching, packet switching and message switching,	
III	Brief Overview of LAN (Local Area Network) : Classification. Brief overview of Wide Area Network (WAN). Salient features and differences of LAN with emphasis on: Media, Topology, Speed of Transmission, Distance, Cost. Terminal Handling, Polling, Token passing, Contention. IEEE Standards: their need and developments.	12
IV	Open System: What is an Open System? Network Architectures, ISO-OSI Reference Model, Layers: Application, Presentation, Session, Transport, Network, Data Link & Physical. Physical Layer - Transmission, Bandwidth, Signaling devices used, media type. Data Link Layer - : Addressing, Media Access Methods, Logical link Control, Basic algorithms/protocols.	12
V	Network Layer: Routing: Fewest-Hops routing, Type of Service routing, Updating Gateway routing information. Brief overview of Gateways, Bridges and Routers, Gateway protocols, routing daemons. OSI and TCP/IP model. TCP/IP and Ethernet. The Internet: The structure of the Internet, the internet layers, Internetwork problems. Internet Standards.	12

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: 1. Tannanbaum, A.S.: Computer Networks, Prentice Hall, 1985.processing, Prentice Hall,1983. 2. Black : Computer Networks : Protocols, standords and Interfaces, Prentice Hall International 1. Tannanbaum, A.S.: Computer Networks, Prentice Hall, 1985.processing, Prentice Hall,1983.
Suggested Web Link: https://nptel.ac.in/courses/106/105/106105082/ http://cse.iitkgp.ac.in/~sandipc/courses/cs31006/slides/application_layer.pdf https://onlinecourses.nptel.ac.in/noc22_ee61/preview https://nptel.ac.in/course.html https://pll.harvard.edu/subject/computer-networking

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04 × 05 = 20 08 × 05= 40 **Total Marks: 60**

PART A: Introduction				
Program: M.Sc.		Class: II SEM	Year: I Year	Session: 2025-26
Subject: Computer Science with Data Science				
1.	Course Code	MSC-23		
2.	Course Title	Data Base Management System		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	Major III		
4.	Pre-Requisite (if any)	Students must have the basic Knowledge of computer systems and database.		
5.	Course Learning Outcomes(CLO)	Upon successful completion of this course, students will be able to: 1. Understand and describe the basic concepts and terminology of Database Management System. 2. Analyze and Design the database of applications using ER modelling and Normalization. 3. Evaluate business information problem and find out the data requirements of organization. 4. Demonstrate the database schema, data modelling and normalization process with the help of example. 5. Implement the database design using appropriate database tools.		
6.	Credit Value	5 Credit		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 01 Hours per day		
Total Lectures: 60 Hours		
Unit	Topics	No. of Lectures
I	DBMS Concepts and architecture Introduction, Review of file organization techniques, Database approach v/s Traditional tile accessing approach, Advantages of database systems, Data models, Schemas and instances, Data independence, Functions of DBA and designer. Entities and attributes, Entity types, Value, Sets, Key attributes, Relationships, Defining the E-R diagram of database, **Various data models:** Basic concepts of Hierarchical data model. Network data model, and Relational data model, Comparison between the three types of models.	12
II	**Relational Data models:** Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints, Intension and Extension, **Relational Query languages:** Relational algebra and relational calculus, Relational algebra operations like select, Project, Join, Division, outer union etc.	12

III	Types of relational calculus i.e. Tuple oriented and domain oriented relational calculus and its operations. SQL: Data definition in SQL, update statements and views in SQL QUEL & QBE: Data storage and definitions. Data retrieval queries and update statements etc.	12
IV	**Data Base Design:** Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and losslessjoin, problems with null valued and dangling tuples, multivalued dependencies. Distributed databases, protection, security and integrity constraints, concurrent operation on databases, recovery, transaction processing, basic concepts of object oriented data base system and design.	12
V	Case study of relational database management systems: Oracle and Microsoft access, Oracle tools.	12

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Reading:

1.Data Base Management System by C.J. Date

2. Data Base Management System by Ullman

3. Fundamental of database system byElmasri/Navathe the Benjamin / Cunnings Publishing company inc.

4. Data base design by GioWiederhold, McGraw Hill

5. Fundamental of Data Base Management System by Leon & Leon, Vikas Publishing House Pvt. Ltd.

Suggestive digital platform web links:

https://nptel.ac.in/courses/106105175
https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/pages/lecture-notes/
https://nptel.ac.in/courses/106104135

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks : 100 Marks

Continuous Comprehensive Evaluation (CCE): 40 Marks

University Exam (UE): 60 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 25 08 × 05 = 45 **Total Marks: 70**

PART A: Introduction				
Program: M.Sc.		Class: II Sem	Year: I	Session: 2025-26
Subject: Computer Science with Data Science				
1.	Course Code	**MSC-24**		
2.	Course Title	**Object-Oriented Programming with Java**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**PC-I**		
4.	Pre-Requisite (if any)	Basic knowledge of computer and C, C++ language		
5.	Course Learning Outcomes(CLO)	1. To learn why Java is useful for the design of desktop and web applications. 2. To learn how to implement object-oriented designs with Java. 3. To identify Java language components and how they work together in applications. 4. To design and program stand-alone Java applications. 5. To learn how to design a graphical user interface (GUI) with Java Swing.		
6.	Credit Value	3		
7.	Total Marks	Max. Marks : 75(45+30)	Min. Passing Marks:30	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 1 Hours per Day		
Total Lectures: 60 Hours		
Unit	Topics	No. of Lectures
I	Java Evolution, Overview of Java Language : Java Program Structure, Java Tokens, Java Statements, Java Virtual Machine, Command Line Arguments. Constants, Variables and Data Types : Constants, Variables, Data Types, Scope of Variables, Symbolic Constants, Type Casting. Operators : Arithmetic, Relational, Logical, Assignment, Increment & Decrement, Conditional, Bitwise, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Type Conversions in Expressions, Operator Precedence and Associativity, Mathematical Functions.	12
II	Control Statements : Java's Selection Statements : If, Switch. Iterative Statements : While, Do-while, For, Some for loop variations, Nested Loops. Jump Statements : Using breaks, Using continue, return. Classes, Objects and Methods : Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, Visibility Control, The *this* Keyword, Garbage Collection, Overloading Methods, Recursion. Arrays, Strings and Vectors.	12
III	Inheritance : Inheritance basics, Using super, Creating Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using *final* with Inheritance, The Object Class. Packages and Interfaces : Java API	12

	Packages, Using System Packages, Creating & Accessing Packages, Hiding Classes, Access Protection, Importing Packages, Interfaces : Defining, Implementing, Applying Interfaces, Variables in Interfaces. Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exception, Using try and catch, Multiple catch Clause, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions. Multithreaded Programming: Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread.	
IV	Applet Programming : Preparing to write Applets, Building Applet Code, Applet Life Cycle, Creating and Executable Applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, Running the Applet, Passing parameters to Applet, Aligning the Display, Displaying Numerical values, Getting input from the User.	12
V	Introductory Graphics Programming : class, Lines , Rectangle, Circles, Ellipes, Arcs, Polygons, Line Graphs. I/O in Java : Streams, stream classes, Byte and Character stream classes. I/O exceptions, Interactive I/O. JDBC Connection and Implementation, Server side programming using Servlet and JSP.	12

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: 1. 1. JAVA: The Complete Reference, Third Edition, P. Naughton & H. Schildt, Tata McGraw Hill. 2. Programming with Java, Second Edition, E. Balagurusamy, Tata McGraw-Hill 3. Teach Yourself JAVA, Joseph O'Neil & Herb Schildt, McGraw-Hill.
Suggestive digital platform web links:

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **75** Continuous Comprehensive Evaluation (CCE): **30** Marks University Exam (UE): **45** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	15 15 **Total Marks: 30**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (B): Five Short Questions Section (C): Five Long Questio	03 × 05 = 15 06 × 05= 30 **Total Marks: 45**

PART A: Introduction				
Program: M.Sc.		Class: II Sem	Year: I	Session: 2025-26
Subject: Computer Science with Data Science				
1.	Course Code	**MSC-24 P**		
2.	Course Title	**Object-Oriented Programming with Java**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**PC-I**		
4.	Pre-Requisite (if any)	Basic knowledge of computer and C, C++ language		
5.	Course Learning Outcomes(CLO)	6. To learn why Java is useful for the design of desktop and web applications. 7. To learn how to implement object-oriented designs with Java. 8. To identify Java language components and how they work together in applications. 9. To design and program stand-alone Java applications. 10. To learn how to design a graphical user interface (GUI) with Java Swing.		
6.	Credit Value	2		
7.	Total Marks	Max. Marks : 25(10+15)	Min. Passing Marks: 10	

PART B: Content of the Course

No. of Lab Practicals (in hours per week): **2 hours per week**

Total No. of Lab.: **60 Hrs.**

	Suggestive list of Practicals	No. of Labs.
	Given the problem statement, students are required to write code in Java, execute and test it. Students should be given assignments on following: 1. Write a Java program to print Hello World. 2. Write a Java program to illustrates a Java application with two classes. 3. Write a Java program to demonstrate the use of command line arguments. 4. Write a Java program to demonstrate how to read different types of data from the keyboard 5. Write a Java program to perform arithmetic operations on two numbers. 6. Write a Java program to check whether a number is even or odd. 7. Write a Java program to find largest of three numbers. 8. Write a Java program to demonstrate the use of if…else ladder in analyzing mark list. 9. Write a Java program to find factorial of a number using loop. 10. Write a Java program to display multiplication table. 11. Write a Java program to display patterns using nested loops. 12. Write a Java program to demonstrate class and object. 13. Write a Java program to demonstrate constructor. 14. Write a Java program to demonstrate method overloading.	60

	15. Write a Java program to demonstrate static data member. 16. Write a Java program to demonstrate nesting of methods 17. Write a Java program to demonstrate single inheritance. 18. Write a Java program to demonstrate method overriding. 19. Write a Java program to sort an array. 20. Write a Java program to demonstrate the use of string methods. 21. Write a Java program to demonstrate the use of vectors. 22. Write a Java program to demonstrate the use of wrapper class methods. 23. Write a Java program to define and implement an interface. 24. Write a Java program to define and implement an interface to demonstrate multiple inheritance. 25. Write a Java program to demonstrate package creation and usage. 26. Write a Java program to demonstrate multithreading using Thread class. 27. Write a Java program to demonstrate thread priority. 28. Write a Java program to demonstrate multithreading using Runnable interface. 29. Write a Java applet program to display "Hello Java". 30. Write a Java program to demonstrate passing parameters to applet.	

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Naughton & Schildt "The Complete Reference Java 2", Tata McGraw Hill
Java EE 6 for Beginners, Sharanam Shah, Vaishali Shah, Shroff Publishers and Distributors
Reference Books:
Java EE Project using EJB 3, JPA and struts 2 for beginners, Shah, SPD
Java Programming A practical Approach, C Xavier, McGraw Hill
Java Server Faces A practical Approach for beginners, B M Harwani, Eastern Economy Edition (PHI).
Advanced Java Technology, Savaliya, Dreamtech.

Suggestive digital platform web links

Suggestive digital platform web links
https://www.youtube.com/watch?v=CFD9EFcNZTQ
https://www.youtube.com/watch?v=7WhnYwoBY24
Suggested equivalent online courses

PART D: Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE) : **10Marks**		**External Assessment**: University Exam (UE) : **15 Marks** Time : **02.00 Hours**	
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Hands-on Lab Practice	2 Marks	Practical record file	5 Marks
Viva	3 Marks	Viva voce practical	5 Marks
Lab Test from practical list	2 Marks	Table works/ Exercise Assigned (02) in practical exam	2 Marks
Assignments (Charts/ Model)/ Technology	3 Marks	Reports of excursion/ Lab visits/ Industrial training/	3 Marks

Dissemination/ Excursion/ Lab visit/ Industrial Training		Survey/ Collection/ Models	
Total ***Excursion/ Lab visits/ Industrial Training is compulsory***	**10 Marks**	**Total**	**15 Marks**