DEPARTMENT OF DATA SCIENCE AND ARTIFICIAL INTELLIGENCE

HIMACHAL PRADESH UNIVERSITY SHIMLA

Syllabus for the Entrance Exam of M.Sc. Data Science and M.Sc. Artificial Intelligence

Sr. No	Contents	Marks
1.	ICT Awareness	60
2.	Mathematics	20
3.	General Logic Ability & Aptitude	20
Total		**100**

The minimum qualifying marks in the Entrance Examination (written test) for subsidized as well as non-subsidized seats will be as per university norms.

Detailed Syllabus

1. ICT Awareness

10 questions worth 1 mark each *will have to be set from each of the following six sections, for a total of* ***60 questions****.*

1. **Fundamentals of Computers**: Introduction to computers, types of computers, components of a computer system (hardware and software), basics of computer architecture, input and output devices, memory hierarchy and types of memory, types of software (system software, application software), binary and other number systems, evolution of computing generations, boot operation and fundamentals of digital logic (AND, OR, NOT gates).
2. **Operating System**: Functions of operating systems, types of operating systems (batch, time-sharing, distributed, real-time), basics of process management (process creation, scheduling algorithms, inter-process communication), memory management techniques (paging and segmentation), file systems and file management, basics of scheduling algorithms, deadlock prevention and handling, types of user interfaces (CLI, GUI), Linux and Windows operating system basics.
3. **Computer Networking and Data Communication**: Basics of computer networks, types of networks (LAN, MAN, WAN), network topologies, OSI and TCP/IP models, data encapsulation and packet switching, protocols (IP, TCP, UDP, HTTP, FTP, SMTP), types of transmission media (coaxial, fiber optic, wireless), network devices (router, switch, hub), error detection and correction techniques, data link and network layer functionalities, network security concepts (encryption, firewalls, VPNs), IPv4 and IPv6 addressing.
4. **Database Management System (DBMS)**: Basics of databases, types of databases (relational, NoSQL, hierarchical, object-oriented), entity-relationship (ER) modeling, relational database design, normalization (1NF, 2NF, 3NF, BCNF), SQL basics (queries, subqueries, joins, aggregation), database indexing, basics of transactions and concurrency control, ACID properties, introduction to stored procedures and triggers.
5. **Data Structures**: Types of data structures (arrays, linked lists, stacks, queues, trees, graphs), algorithm complexity (Big O), searching and sorting algorithms (linear search,

binary search, bubble sort, selection sort, merge sort, quicksort), operations on data structures (insertion, deletion, traversal), basics of recursion ,hashing and hash tables, binary trees, binary search trees.

6. **Software Engineering**: Introduction to software development lifecycle (SDLC), software development models (waterfall, agile, V-model), requirement analysis and specifications, software design concepts (modularity, cohesion, coupling, data flow diagrams), object-oriented analysis and design (OOAD), software testing methods (unit testing, integration testing, system testing, acceptance testing), maintenance and evolution, software project management basics (cost estimation, scheduling, risk analysis), introduction to software quality assurance, software metrics.

2. Mathematics

2 questions worth 1 mark each *will have to be set from each of the following 10 sections, for a total of* ***20 questions***

1. **Number System**: Types of numbers (natural, whole, integers, rational, irrational, prime), divisibility rules, factors and multiples, HCF and LCM, and basic operations.
2. **Fractions and Decimals**: Conversions between fractions and decimals, basic operations, and comparisons.
3. **Percentages**: Concepts of percentages, percentage change, increase and decrease, and applications in problem-solving.
4. **Ratios and Proportion**: Understanding ratio, proportion, direct and inverse variation, and their applications.
5. **Averages**: Calculation of averages, weighted averages, and applications in real-life scenarios.
6. **Simple and Compound Interest**: Basics of interest calculations, differences between simple and compound interest, and applications in finance problems.
7. **Profit, Loss, and Discounts**: Calculating profit and loss, percentage profit/loss, marked price, cost price, and discounts.
8. **Time and Work**: Basics of work and time, problems on work efficiency, combined work, and problems involving pipes and cisterns.
9. **Time, Speed, and Distance**: Concepts of speed, distance, and time, relative speed, and problems on trains, boats, and streams.
10. **Differentiation and Integration**: Basics of differentiation (simple rules, chain rule, product rule), basic integration (antiderivatives), applications in finding tangents, areas under curves, and solving problems related to rates of change.

3. General Logic Ability and Aptitude

2 questions worth 1 mark each *will have to be set from each of the following 10 sections, for a total of* ***20 questions****.*

1. **Analogy**: Identifying relationships between words, numbers, or shapes and selecting the correct analogy.
2. **Classification**: Grouping similar items or figures based on certain characteristics, and identifying the odd one out.
3. **Series Completion**: Finding the next number, letter, or shape in a given series based on a pattern.

4. **Coding-Decoding**: Understanding and interpreting codes, where letters or numbers are substituted for other letters or numbers, and solving related puzzles.
5. **Blood Relations**: Solving problems based on familial relationships, determining relationships between different family members.
6. **Direction Sense**: Problems involving directions (north, south, east, west), distance, and the relative positions of objects or people.
7. **Syllogism**: Understanding statements and conclusions, and solving problems based on logical deductions using Venn diagrams.
8. **Puzzle Test**: Solving problems involving arrangement or sequencing based on given conditions (e.g., seating arrangement, order of events).
9. **Logical Venn Diagrams**: Solving problems based on the relationships between different sets of objects, with the help of Venn diagrams.
10. **Statement and Assumptions**: Interpreting and solving problems involving given statements and assumptions, determining whether the assumption follows from the statement.

SAMPLE QUESTION PAPER

Below is a **sample question paper** with **2 multiple-choice questions from each section**
Each question includes **four answer options**.

1. ICT Awareness

Fundamentals of Computers

- Which of the following is an input device?
  A. Printer
  B. Monitor
  C. Keyboard
  D. Speaker
- The primary memory of a computer is:
  A. Hard Disk
  B. RAM
  C. CD-ROM
  D. USB Drive

Operating System

- Which of the following is *not* a function of an operating system?
  A. Managing memory
  B. Creating web pages
  C. Handling files
  D. Process management
- Linux is an example of a:
  A. System software
  B. Application software
  C. Utility software
  D. Firmware

Computer Networking and Data Communication

- Which of the following is a network device used to connect different networks?
  A. Switch
  B. Hub
  C. Router
  D. Modem
- In the OSI model, the function of data encryption is performed at the:
  A. Physical layer
  B. Network layer
  C. Transport layer
  D. Presentation layer

Database Management System (DBMS)

- Which of these is a property of a relational database?
  A. Uses object inheritance
  B. Organized in tables
  C. Uses HTML tags
  D. Stores data in a flat file
- The command used to retrieve data from a database is:
  A. UPDATE
  B. SELECT
  C. DELETE
  D. INSERT

Data Structures

- A linear data structure where elements are inserted at one end and removed from the other is called:
  A. Stack
  B. Array
  C. Queue
  D. Graph
- The time complexity of binary search in a sorted array is:
  A. O(n)
  B. O(log n)
  C. $O(n^2)$
  D. O(1)

Software Engineering

- In which software model is each phase completed before the next one begins?
  A. Agile
  B. Waterfall
  C. Spiral
  D. V-Model
- What does SDLC stand for?
  A. Software Data Learning Cycle

B. Structured Design Logic Code
C. Software Development Life Cycle
D. System Debugging Lifecycle

2. Mathematics

Number System

- Which of the following is a prime number?
  A. 21
  B. 17
  C. 33
  D. 27
- HCF of 18 and 24 is:
  A. 2
  B. 3
  C. 6
  D. 12

Fractions and Decimals

- 0.25 is equal to:
  A. 1/2
  B. 1/4
  C. 3/4
  D. 1/8
- 2/5 + 3/10 equals:
  A. 5/10
  B. 4/5
  C. 7/10
  D. 1

Percentages

- 25% of 160 is:
  A. 40
  B. 60
  C. 20
  D. 80
- A number increases from 80 to 100. The percentage increase is:
  A. 20%
  B. 25%
  C. 18%
  D. 22%

Ratios and Proportion

- If A : B = 2 : 3, and B : C = 4 : 5, then A : C is:
  A. 8 : 15
  B. 2 : 5

C. 3 : 10
D. 4 : 9

- If 5 pens cost Rs. 60, then 8 pens will cost:
  A. Rs. 90
  B. Rs. 96
  C. Rs. 100
  D. Rs. 120

Averages

- The average of 4, 6, and 10 is:
  A. 6
  B. 7
  C. 8
  D. 9
- The average of five numbers is 20. The sum is:
  A. 80
  B. 100
  C. 120
  D. 140

Simple and Compound Interest

- Simple interest on Rs. 1000 at 5% for 2 years is:
  A. Rs. 50
  B. Rs. 100
  C. Rs. 200
  D. Rs. 75
- The compound interest on Rs. 1000 at 10% per annum for 2 years is:
  A. Rs. 200
  B. Rs. 210
  C. Rs. 220
  D. Rs. 100

Profit, Loss, and Discounts

- A person bought an item for Rs. 200 and sold it for Rs. 250. The profit percentage is:
  A. 20%
  B. 25%
  C. 30%
  D. 50%
- If the marked price is Rs. 500 and the discount is 10%, selling price is:
  A. Rs. 450
  B. Rs. 400
  C. Rs. 480
  D. Rs. 470

Time and Work

- If A can do a job in 6 days and B in 12 days, together they can finish it in:
  A. 2 days
  B. 3 days
  C. 4 days
  D. 5 days
- Two taps can fill a tank in 12 and 15 minutes. Together, they take:
  A. 6.5 min
  B. 6 min
  C. 7 min
  D. 7.5 min

Time, Speed, and Distance

- A car travels 60 km in 1.5 hours. Its speed is:
  A. 40 km/h
  B. 50 km/h
  C. 60 km/h
  D. 80 km/h
- A train 100 meters long crosses a pole in 10 seconds. Its speed is:
  A. 10 m/s
  B. 20 m/s
  C. 100 m/s
  D. 15 m/s

Differentiation and Integration

- Derivative of x^2 is:
  A. x
  B. 2x
  C. x^3
  D. $3x^2$
- Integral of 2x dx is:
  A. $x^2 + C$
  B. $x^3 + C$
  C. $2x^2 + C$
  D. x^2

3. General Logic Ability and Aptitude

Analogy

- Book : Reading :: Fork : ?
  A. Drawing
  B. Writing
  C. Stirring
  D. Eating
- Moon : Satellite :: Earth : ?
  A. Star

B. Planet
C. Galaxy
D. Orbit

Classification

- Which one is different from the rest?
  A. Apple
  B. Banana
  C. Carrot
  D. Mango
- Find the odd number:
  A. 2
  B. 3
  C. 5
  D. 9

Series Completion

- 2, 4, 8, 16, ?
  A. 18
  B. 24
  C. 32
  D. 30
- A, C, E, G, ?
  A. H
  B. I
  C. J
  D. K

Coding-Decoding

- If CAT = 24, then DOG = ?
  A. 26
  B. 30
  C. 28
  D. 22
- In a certain code, FLOW is written as GMPX. How is RAIN written?
  A. SBLM
  B. SBJO
  C. QZHM
  D. RAKO

Blood Relations

- If A is B's mother and B is C's father, what is A to C?
  A. Aunt
  B. Sister
  C. Grandmother
  D. Cousin

- If X is the brother of Y and Y is the sister of Z, then how is X related to Z?
  A. Cousin
  B. Brother
  C. Uncle
  D. Cannot be determined

Direction Sense

- A man walks north, then turns right, then right again. In which direction is he now?
  A. South
  B. East
  C. West
  D. North
- If east becomes north, what does north become?
  A. West
  B. East
  C. South
  D. South-East

Syllogism

- All pens are blue. Some blue things are round. Conclusion: Some pens are round. Is it:
  A. True
  B. False
  C. Can't say
  D. Both A and B
- No cats are dogs. All dogs are animals. So, some animals are not cats. Is this:
  A. True
  B. False
  C. Can't say
  D. None

Puzzle Test

- Four friends sit in a row. A is left to B but right to C. Who is in the middle?
  A. A
  B. B
  C. C
  D. Can't be determined
- If Monday is the first day of the month, what day will the 15th be?
  A. Tuesday
  B. Wednesday
  C. Monday
  D. Sunday

Logical Venn Diagrams

- Which group best represents: Men, Fathers, Engineers?
  A. All are separate

B. Men ⊃ Fathers ⊃ Engineers
C. Engineers ⊂ Fathers ⊂ Men
D. Engineers ⊃ Men ⊃ Fathers

- Choose the best Venn diagram: Doctors, Males, Humans.
  A. All overlapping circles
  B. Non-overlapping
  C. One inside another
  D. Two inside one

Statement and Assumptions

- Statement: "Use eco-friendly bags." Assumption:
  A. Plastic bags are harmful
  B. All people use plastic
  C. Bags are free
  D. Eco-friendly bags are expensive
- Statement: "Join the evening yoga class." Assumption:
  A. People are free in the evening
  B. Everyone loves yoga
  C. Yoga is for old people
  D. The class is free