

CHSE Odisha · +2 Science

INFORMATION

TECHNOLOGY

+2 2nd Year (Class XII) · As per CHSE Syllabus 2023-24

Theory in simple language · Formula boxes
Solved problems · Exam Q&A · Practice & revision

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INFORMATION TECHNOLOGY

+2 2nd Year (Paper II) · Theory 70 + Practical 30

Exam Pattern & How to Study

GOLDEN RULES FOR WRITING ANSWERS

- Always write the **formula first**, then substitute values, then the answer **with units**.
- Underline or box the final answer. Examiners mark step-by-step, so even a wrong final answer earns step marks.
- For theory answers, use short points and draw a diagram wherever possible.
- Attempt questions you know best first, but keep their numbering exactly as in the paper.

Unit	Topic	Marks
1	Networking & Open Standards (Networking 10, Internet 10, Security 10)	30
2	Programming (Fundamentals 10, HTML 6)	16
3	RDBMS (Database fundamentals 8, MySQL 6)	14
4	IT Applications	10

Practical (30): Java problem 10, SQL queries 5, Record 5, Project 5, Viva 5.

IT-1. Computer Networking

Idea: A **network** is two or more computers connected to share data, resources (printer, internet) and to communicate. The internet is the biggest network of networks.

Advantages: resource sharing, communication (email, chat), data sharing, centralised data and backup, reduced cost, reliability. **Disadvantages:** security threats, viruses spread quickly, setup cost, depends on server.

Network devices

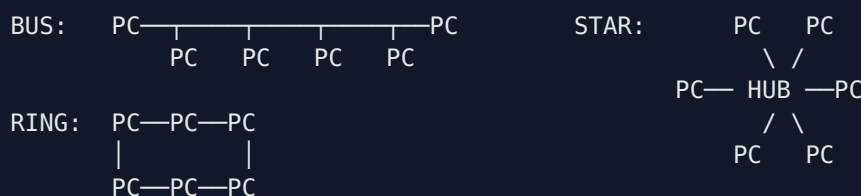
Device	Function
NIC (Network Interface Card)	Card in each computer that connects it to the network; has a unique MAC address
Modem	MOdulator-DEModulator: converts digital signals to analog (and back) for telephone lines
Hub	Connects many computers in a LAN; broadcasts data to all ports (less efficient)
Switch	Like a hub but intelligent: sends data only to the intended computer using MAC address
Repeater	Regenerates/amplifies weak signals so they travel longer distances
Bridge	Connects two similar LAN segments and filters traffic
Router	Connects different networks and chooses the best path for data packets (uses IP address)
Gateway	Connects networks using different protocols ; acts as entry/exit point (e.g. LAN to internet)

Types of networks

Type	Full form	Area	Example
PAN	Personal Area Network	About 10 m around a person	Mobile + Bluetooth earphones
LAN	Local Area Network	A room, building or campus (up to ~1 km)	College computer lab
MAN	Metropolitan Area Network	A city (up to ~50 km)	Cable TV network of a city
WAN	Wide Area Network	Country or world	Internet, bank networks

Network topologies (layout of connections)

Topology	Description	Advantages	Disadvantages
Bus	All computers connected to one main cable (backbone) with terminators at ends	Cheap, easy to install, less cable	Backbone failure stops the whole network; hard to find faults
Star	All computers connected to a central hub/switch	Easy to add nodes; one cable fault affects only one node; easy fault detection	Hub failure stops the network; more cable
Ring	Each computer connected to two neighbours forming a circle; data travels in one direction	Equal access; no collisions	One break can stop the network; adding nodes disturbs it
Tree	Groups of star networks connected to a bus backbone (hierarchy)	Expandable; easy to manage groups	Backbone failure affects all; costly



Communication media

Wired (guided):

- **Twisted pair / Ethernet cable** (UTP, CAT-5/6 with RJ-45 connector): cheap, easy; used in LANs; affected by interference over long distances.
- **Coaxial cable:** central copper wire with insulation and metal shield; used for cable TV; better shielding than twisted pair.
- **Optical fibre:** sends data as light pulses through thin glass fibres; very high speed and bandwidth, no electrical interference, long distance, secure; but costly and delicate.

Wireless (unguided):

- **Bluetooth:** short range (~10 m), low power; connects phones, earphones, keyboards.
- **Infrared:** very short range, needs line of sight; TV remote.
- **Microwave:** high-frequency waves between towers in line of sight; long-distance telephone/TV links.
- **Radio link:** radio waves travel in all directions, pass through walls; FM radio, Wi-Fi, walkie-talkie.
- **Satellite link:** signals sent to a satellite which relays them to a far-off station; covers huge areas; used for TV broadcasting, GPS, weather; slight delay.

IT-2. Internet and its Applications

INTERNET

A worldwide network of networks that communicate using the TCP/IP protocol. It started as ARPANET (1969) in the USA. In India, public internet started in 1995 by VSNL.

Internet backbone: the high-speed main data routes (mostly optical fibre, including under-sea cables) between large networks and core routers, operated by major telecom companies.

Internet access

Type	Features
Dial-up	Uses telephone line and modem; slow (up to 56 kbps); phone busy while online
Direct / leased line	Permanent dedicated connection; used by large organisations; costly
Broadband	High speed, always on: DSL, cable, fibre (FTTH), 4G/5G, Wi-Fi

ISP (Internet Service Provider): a company that provides internet access to users for a fee, e.g. BSNL, Jio, Airtel. It gives connection, IP address, email accounts, web hosting and support.

Internet protocols

A **protocol** is a set of rules for communication between computers.

Protocol	Full form	Use
TCP/IP	Transmission Control Protocol / Internet Protocol	Basic protocol of the internet. TCP breaks data into packets and reassembles them; IP addresses and routes the packets.
HTTP / HTTPS	HyperText Transfer Protocol (Secure)	Transferring web pages between server and browser
FTP	File Transfer Protocol	Uploading/downloading files
TELNET	Telecommunication Network	Logging into a remote computer and using it as if local
WAIS	Wide Area Information Server	Searching indexed databases on remote computers
Gopher	—	Older menu-based system to find and retrieve documents (before the web)

Internet addressing

- **IP address:** a unique numeric address of each device on the internet. IPv4: four numbers 0–255 separated by dots, e.g. 192.168.1.10 (32 bits). IPv6 is 128 bits.
- **Domain name:** easy-to-remember name for an IP address, e.g. chseodisha.nic.in. **DNS** (Domain Name System) converts domain names to IP addresses. Top-level domains: .com (commercial), .org, .edu, .gov, .net, .in (India).
- **MAC address (Media Access Control):** a permanent 48-bit hardware address burnt into the NIC, written in hexadecimal, e.g. 00:1A:2B:3C:4D:5E.
- **URL (Uniform Resource Locator):** the complete address of a web resource. <https://www.india.gov.in/topics/education> → protocol (https), domain (www.india.gov.in), path (/topics/education).
- **E-mail address:** username@domain, e.g. student123@gmail.com.

Internet applications

Application	Meaning
WWW	World Wide Web: a huge collection of linked web pages on the internet, invented by Tim Berners-Lee (1989)
Website / web page	A web page is a single document (HTML); a website is a collection of related pages; the first page is the home page
E-mail	Electronic mail – sending messages and attachments over the internet
SMS	Short Message Service – text messages (160 characters) on mobile phones
Voice mail	Recorded voice messages stored for the receiver
Chatting / IRC	Real-time text conversation; IRC = Internet Relay Chat (group chat rooms)
Video conferencing	Live audio-video meeting among people in different places (Zoom, Google Meet)
Web browser	Software to view web pages: Chrome, Firefox, Edge, Safari
Search engine	Website that searches the web for information using keywords: Google, Bing

Wireless / mobile communication

Technology	Meaning
GSM	Global System for Mobile communication; uses SIM cards and time division (TDMA); most common 2G standard
CDMA	Code Division Multiple Access; each call gets a unique code, all share the same frequency; better security
WLL	Wireless in Local Loop; connects subscribers to the telephone exchange using radio instead of copper wire
3G	Third generation: mobile internet, video calls, ~2 Mbps
4G	Fourth generation: high-speed data (up to 100 Mbps+), HD video streaming, VoLTE

IT-3. Network Security on the Internet

Threats and prevention

Virus (Vital Information Resources Under Siege): a malicious program that attaches to files and spreads, damaging data. Other malware: **worm** (spreads by itself through networks), **Trojan horse** (looks useful but harmful), **spyware** (secretly collects information), **adware**, **ransomware** (locks files for money).

Prevention: install and update antivirus; do not open unknown attachments/links; download from trusted sites only; keep OS updated; use strong passwords; take regular backups; use a firewall; scan pen drives.

Cookies: small text files that a website stores on your computer to remember you (login, cart items, preferences). Useful, but can be misused to track browsing — clear cookies regularly and avoid "remember me" on shared computers.

Firewall: hardware or software that monitors incoming and outgoing network traffic and blocks unauthorised access according to security rules — like a security guard at the gate.

Digital signature: an electronic signature created using encryption (a private key) that proves the sender's identity and that the document was not altered. Used in income-tax returns, e-tenders, MCA filings. Legally valid in India under the IT Act 2000.

Cyber crimes

Crime	Meaning
Hacking	Unauthorised access to a computer or network to steal or damage data
Online fraud	Cheating people online — fake shopping sites, lottery scams, credit-card/OTP fraud, phishing emails
Pornography	Publishing or transmitting obscene material online — a punishable offence (strictly so for child abuse material)
Snooping	Secretly monitoring someone's data, messages or network traffic
Spoofing	Disguising identity — fake email address, caller ID or website to trick people
Cyber stalking	Repeatedly harassing or threatening a person online
Software piracy	Illegal copying, distribution or use of licensed software

Cyber laws: laws dealing with crimes and legal issues in cyberspace. In India, the **Information Technology Act, 2000** (amended 2008) gives legal recognition to electronic records and digital signatures and defines punishments for hacking, identity theft, cyber terrorism, publishing obscene content, etc. Victims can report at cybercrime.gov.in or helpline 1930.

Exam Q&A - Networking, Internet, Security

Q1. Which device connects networks with different protocols? [1]

Gateway.

Q2. Expand: TCP/IP, URL, ISP, FTP. [2]

Transmission Control Protocol/Internet Protocol; Uniform Resource Locator; Internet Service Provider; File Transfer Protocol.

Q3. Differentiate hub and switch. [2]

A hub broadcasts data to all connected computers; a switch sends data only to the destination computer using its MAC address, so it is faster and more secure.

Q4. Differentiate IP address and MAC address. [2]

IP address is a logical address given by the network/ISP and can change; MAC address is a permanent physical address fixed on the NIC by the manufacturer.

Q5. What is a firewall? [2]

A security system (hardware/software) that filters network traffic and blocks unauthorised access.

Q6. Explain star topology with advantages and disadvantages. [4]

See topology table above; draw the diagram.

Q7. Why is optical fibre preferred over copper cable? [2]

Much higher speed and bandwidth, no electromagnetic interference, longer distance without repeaters, more secure.

IT-4. Programming Fundamentals (Review + New Topics)

Revise data types, variables, operators, if/switch and loops from the 1st Year. New topics in the 2nd Year are below.

Classes, objects and access specifiers

Java is an **object-oriented** language. A **class** is a blueprint (like the design of a car); an **object** is an actual thing made from it (a particular car). A class has **data members** (variables) and **methods** (functions).

```
class Student {
    private int roll;           // data members
    private String name;
    public void setData(int r, String n) { // method
        roll = r; name = n;
    }
    public String getName() { return name; }
}
Student s1 = new Student();    // creating an object
s1.setData(101, "Anita");
```

Access specifier	Accessible from
public	Everywhere (any class)
private	Only inside the same class (data hiding)
protected	Same class, same package and sub-classes
default (no keyword)	Only within the same package

Inheritance

Inheritance lets a new class (**sub-class / child**) acquire the data and methods of an existing class (**super-class / parent**) using the keyword `extends`. It allows **reuse of code** and models "is-a" relationships.

```
class Person {
    String name;
    void display() { System.out.println("Name: " + name); }
}
class Teacher extends Person {    // Teacher IS-A Person
    String subject;
    void show() {
        display();                // inherited method
        System.out.println("Subject: " + subject);
    }
}
```

Types: single (one parent-one child), multilevel ($A \rightarrow B \rightarrow C$), hierarchical (one parent, many children). Java does not support multiple inheritance through classes.

String class methods

Method	Example	Result
length()	"Computer".length()	8
concat()	"Info".concat("rmation")	"Information"
toLowerCase()	"ODISHA".toLowerCase()	"odisha"
toUpperCase()	"java".toUpperCase()	"JAVA"
trim()	" CHSE ".trim()	"CHSE"
substring(a, b)	"Bhubaneswar".substring(0, 4)	"Bhub" (from a up to b-1)
substring(a)	"Bhubaneswar".substring(4)	"aneswar"
toString()	Integer.toString(25)	"25"

Math class methods

Math.pow(2, 3) → 8.0 Math.round(7.5) → 8 Math.round(7.4) → 7 Math.sqrt(49) → 7.0

Math.abs(-5) → 5

Accessing a MySQL database from Java (JDBC)

ODBC (Open Database Connectivity) is a standard interface by Microsoft for applications to access databases. **JDBC** (Java Database Connectivity) is Java's API for connecting a Java program to a database. For MySQL we add the **MySQL JDBC driver** (Connector/J) library to the NetBeans project.

STEPS FOR DATABASE CONNECTIVITY

1. Import packages: `import java.sql.*;`
2. Load/register the driver: `Class.forName("com.mysql.cj.jdbc.Driver");`
3. Open a connection: `Connection con = DriverManager.getConnection(url, user, password);`
4. Create a statement: `Statement stmt = con.createStatement();`
5. Execute a query: `ResultSet rs = stmt.executeQuery("SELECT ...");` (for INSERT/UPDATE/DELETE use `executeUpdate()`)
6. Process the result with `rs.next()`, `rs.getString()`, `rs.getInt()`.
7. Close: `rs.close(); stmt.close(); con.close();`

Program: Display all students from table "student" in a JTable when a button is clicked.

```
import java.sql.*;
import javax.swing.table.DefaultTableModel;
...
private void btnShowActionPerformed(java.awt.event.ActionEvent evt) {
    DefaultTableModel model = (DefaultTableModel) jTable1.getModel();
    model.setRowCount(0); // clear old rows
    try {
        Class.forName("com.mysql.cj.jdbc.Driver");
        Connection con = DriverManager.getConnection(
            "jdbc:mysql://localhost:3306/school", "root", "password");
        Statement stmt = con.createStatement();
        ResultSet rs = stmt.executeQuery("SELECT RollNo, Name, Marks FROM student");
        while (rs.next()) {
            model.addRow(new Object[] { rs.getInt("RollNo"),
                                         rs.getString("Name"),
                                         rs.getInt("Marks") });
        }
        rs.close(); stmt.close(); con.close();
    } catch (Exception e) {
        JOptionPane.showMessageDialog(null, e.getMessage());
    }
}
```

Program: Insert a new record from text fields.

```
String q = "INSERT INTO student VALUES (" + txtRoll.getText() + ", '"
    + txtName.getText() + "', " + txtMarks.getText() + ")";
stmt.executeUpdate(q);
JOptionPane.showMessageDialog(null, "Record saved");
```

Class	Important methods
DriverManager	getConnection()
Connection	createStatement(), close()
Statement	executeQuery(), executeUpdate()
ResultSet	next(), first(), last(), getString(), getInt()
Exception	getMessage()
System	exit()
DefaultTableModel	addRow(), getRowCount(), removeRow()

IT-5. HTML – Creating Web Pages

HTML (HyperText Markup Language) is the language used to create web pages. It uses **tags** inside angle brackets. Most tags come in pairs: opening `<b>` and closing `</b>`. Some are empty (no closing tag): `<br>`, `<hr>`, `<img>`. An HTML file is saved with extension **.html** or **.htm** and opened in a browser.

Basic structure

```
<html>
  <head>
    <title>My First Page</title>
  </head>
  <body bgcolor="lightyellow" text="navy">
    <h1>Welcome to Odisha</h1>
    <p>Odisha is famous for its temples and beaches.</p>
  </body>
</html>
```

Common tags

Tag	Use	Attributes
<html>	Starts and ends the document	—
<head>, <title>	Header information; title shown on the browser tab	—
<body>	Visible content	bgcolor, background, text
<h1> ... <h6>	Headings (h1 biggest, h6 smallest)	align
<p>	Paragraph	align (left/center/right)
 	Line break	—
<hr>	Horizontal line (section separator)	size, width, color, noshade
	Text style	face, size (1-7), color
, <i>, <u>	Bold, italic, underline	—
	Insert picture	src, alt, width, height, border
<a>	Hyperlink	href

Lists

```
<ul type="disc">
  <li>Mathematics</li>
  <li>Chemistry</li>
</ul>
<ol type="1" start="1">
  <li>Switch on computer</li>
  <li>Open browser</li>
</ol>
```

UL (unordered) type: disc, circle, square. OL (ordered) type: 1, A, a, I, i.

Tables

```
<table border="1" cellpadding="5" cellspacing="0">
  <caption>Marks</caption>
  <tr> <th>Name</th> <th>Marks</th> </tr>
  <tr> <td>Anita</td> <td>450</td> </tr>
  <tr> <td colspan="2" align="center">End of list</td> </tr>
</table>
```

<tr> = table row, <th> = header cell, <td> = data cell; **colspan** / **rowspan** merge cells.

Forms

```
<form action="submit.php" method="post">
  Name: <input type="text" name="nm"> <br>
  Password: <input type="password" name="pw"> <br>
  Gender: <input type="radio" name="g" value="M"> Male
         <input type="radio" name="g" value="F"> Female <br>
  Hobbies: <input type="checkbox" name="h1"> Reading
          <input type="checkbox" name="h2"> Music <br>
  Stream: <select name="st">
         <option>Science</option> <option>Commerce</option>
        </select> <br>
  Address: <textarea rows="3" cols="30"></textarea> <br>
  <input type="submit" value="Send"> <input type="reset">
</form>
```

Static vs dynamic pages, DHTML and XML

- **Static page:** content is fixed and the same for every visitor (plain HTML).
- **Dynamic page:** content changes based on user action, time or database (created using server scripts such as PHP/JSP, or client-side JavaScript).
- **DHTML (Dynamic HTML):** combination of HTML + CSS + JavaScript + DOM to make pages interactive without reloading (menus that drop down, images that change on mouse-over).
- **XML (eXtensible Markup Language):** used to **store and transport data**, not to display it. Tags are user-defined, case-sensitive, and every tag must be closed.

```
<student>
  <roll>101</roll>
  <name>Anita</name>
  <stream>Science</stream>
</student>
```

HTML	XML
Displays data	Stores/transport data
Predefined tags	User-defined tags
Not case-sensitive	Case-sensitive
Some tags need no closing	All tags must be closed

Practical: Write HTML for a page about your college with a heading, an image, a list of streams and a link.

```
<html><head><title>My College</title></head>
<body bgcolor="#e8f4ff">
  <h1 align="center"><font color="maroon">ABC Higher Secondary School</font></h1>
  <hr size="3" color="blue">
  
  <p>Our college was established in 1985. It offers the following streams:</p>
  <ol type="I"> <li>Science</li> <li>Commerce</li> <li>Arts</li> </ol>
  <p>Visit <a href="https://chseodisha.nic.in">CHSE Odisha</a> for results.</p>
</body></html>
```

Exam Q&A – Programming & HTML

Q1. What is inheritance? [2]

A feature of OOP by which a class acquires the properties and methods of another class using extends; it promotes code reuse.

Q2. What is the difference between private and public members? [2]

Private members are accessible only within their class; public members are accessible from any class.

Q3. What is JDBC? [1]

Java Database Connectivity – an API that allows Java programs to connect to and work with databases.

Q4. Which tag inserts a horizontal line? [1]

<hr>.

Q5. Name the attributes of the tag. [1]

face, size, color.

Q6. Give the output of "Odisha".substring(1, 4). [1]

"dis".

Q7. Differentiate executeQuery() and executeUpdate(). [2]

executeQuery() runs SELECT and returns a ResultSet; executeUpdate() runs INSERT/UPDATE/DELETE/DDDL and returns the number of rows affected.

IT-6. Database Fundamentals (2nd Year)

Database transactions

A **transaction** is a group of SQL operations that must be completed together as one unit — all or nothing. Example: transferring Rs 1000 from account A to B needs two updates (debit A, credit B); if one fails, both must be cancelled.

ACID properties: **A**tomicity (all or none), **C**onsistency (database remains correct), **I**solation (transactions don't interfere), **D**urability (committed changes are permanent).

```
START TRANSACTION;
UPDATE account SET balance = balance - 1000 WHERE accno = 'A';
UPDATE account SET balance = balance + 1000 WHERE accno = 'B';
COMMIT;           -- saves changes permanently
-- or
ROLLBACK;         -- cancels all changes since START TRANSACTION
SAVEPOINT s1;     -- marks a point; ROLLBACK TO s1 undoes only after it
```

MySQL normally runs in **autocommit** mode (every statement is committed at once). `SET AUTOCOMMIT = 0;` turns it off.

Group (aggregate) functions

Work on a set of rows and return a single value.

Function	Returns
SUM(col)	Total of values
AVG(col)	Average
MAX(col) / MIN(col)	Largest / smallest value
COUNT(col)	Number of non-NULL values in the column
COUNT(*)	Number of rows (including NULLs)
COUNT(DISTINCT col)	Number of different non-NULL values

GROUP FUNCTIONS AND NULL

All group functions except COUNT(*) **ignore NULL values**. AVG(Salary) divides by the count of non-NULL salaries only.

GROUP BY and HAVING

GROUP BY divides rows into groups having the same value in a column, and group functions are applied to each group. **HAVING** filters groups (WHERE filters rows before grouping; HAVING filters after).

Consider table **EMP**:

EmpNo	Name	Dept	Salary	City
1	Ramesh	Sales	30000	Cuttack
2	Sunita	HR	45000	Bhubaneswar
3	Manoj	Sales	25000	Puri
4	Rekha	IT	60000	Bhubaneswar
5	Amit	IT	NULL	Sambalpur
6	Priya	Sales	35000	Cuttack

Queries with output

```

SELECT COUNT(*) FROM emp;           -- 6
SELECT COUNT(Salary) FROM emp;      -- 5 (NULL ignored)
SELECT SUM(Salary), MAX(Salary), MIN(Salary) FROM emp;  -- 195000, 60000, 25000
SELECT AVG(Salary) FROM emp;        -- 39000 (195000/5)
SELECT COUNT(DISTINCT City) FROM emp; -- 4
SELECT Dept, COUNT(*) FROM emp GROUP BY Dept;
    -- HR 1, IT 2, Sales 3
SELECT Dept, AVG(Salary) FROM emp GROUP BY Dept;
    -- HR 45000, IT 60000, Sales 30000
SELECT Dept, SUM(Salary) FROM emp GROUP BY Dept HAVING SUM(Salary) > 50000;
    -- IT 60000, Sales 90000
SELECT City, COUNT(*) FROM emp WHERE Salary > 26000 GROUP BY City;
    -- Bhubaneswar 2, Cuttack 2

```

Displaying data from multiple tables

Second table **DEPT**:

Dept	DName	Location
Sales	Sales & Marketing	Floor 1
HR	Human Resource	Floor 2
IT	Information Tech	Floor 3

- **Cartesian product (cross join):** `SELECT * FROM emp, dept;` — every row of EMP is combined with every row of DEPT: $6 \times 3 = 18$ rows; degree = $5 + 3 = 8$ columns. Mostly meaningless.
- **Equi-join:** join rows where a common column is equal:
`SELECT emp.Name, dept.DName, dept.Location FROM emp, dept WHERE emp.Dept = dept.Dept;` → 6 meaningful rows.
- **Table alias:** `SELECT E.Name, D.Location FROM emp E, dept D WHERE E.Dept = D.Dept;`
- **Foreign key:** EMP.Dept refers to DEPT.Dept (primary key of DEPT). It enforces **referential integrity** — you cannot enter a department in EMP that does not exist in DEPT.
- **UNION:** combines results of two SELECTs with the same number/type of columns and removes duplicates: `SELECT City FROM emp UNION SELECT City FROM customers;`

```
CREATE TABLE dept (Dept VARCHAR(10) PRIMARY KEY, DName VARCHAR(30), Location VARCHAR(15));
CREATE TABLE emp (
    EmpNo INT PRIMARY KEY, Name VARCHAR(25), Dept VARCHAR(10),
    Salary DECIMAL(8,2), City VARCHAR(20),
    FOREIGN KEY (Dept) REFERENCES dept(Dept));
```

IT-7. More MySQL

Working with NULL

NULL means unknown/missing — not zero or blank. Use IS NULL / IS NOT NULL (never = NULL). Any arithmetic with NULL gives NULL. IFNULL(Salary, 0) replaces NULL with 0.

ORDER BY - sorting

```
SELECT * FROM emp ORDER BY Salary;           -- ascending (default, ASC)
SELECT * FROM emp ORDER BY Salary DESC;       -- descending
SELECT Name, Salary*12 AS Annual FROM emp ORDER BY Annual; -- by alias
SELECT * FROM emp ORDER BY Dept, Salary DESC; -- multiple columns
```

Changing data - UPDATE and DELETE (DML)

```
UPDATE emp SET Salary = 28000 WHERE EmpNo = 3;
UPDATE emp SET Salary = Salary * 1.10 WHERE Dept = 'Sales'; -- 10% raise
UPDATE emp SET Salary = 40000 WHERE Salary IS NULL;
DELETE FROM emp WHERE City = 'Puri';
DELETE FROM emp; -- removes ALL rows, table structure remains
```

CAREFUL

UPDATE or DELETE without WHERE affects every row. DROP TABLE removes the table itself; DELETE removes only rows.

Restructuring a table - ALTER TABLE (DDL)

```
ALTER TABLE emp ADD Phone VARCHAR(12); -- add a column
ALTER TABLE emp ADD (Age INT, Gender CHAR(1)); -- add many
ALTER TABLE emp DROP COLUMN Phone; -- delete a column
ALTER TABLE emp MODIFY Name VARCHAR(40); -- change data type/size
```

MySQL functions

String functions

Function	Example	Output
ASCII(str)	ASCII('A')	65
CHAR(n,...)	CHAR(72, 105)	'Hi'
CONCAT(a, b)	CONCAT('Odi', 'sha')	'Odisha'
INSTR(str, sub)	INSTR('Computer', 'put')	4
LCASE / LOWER	LCASE('CHSE')	'chse'
UCASE / UPPER	UCASE('chse')	'CHSE'
LENGTH(str)	LENGTH('Puri')	4
LEFT(str, n)	LEFT('Cuttack', 3)	'Cut'
RIGHT(str, n)	RIGHT('Cuttack', 4)	'tack'
MID / SUBSTR(str, pos, n)	MID('Bhubaneswar', 5, 4)	'anes'
LTRIM / RTRIM / TRIM	TRIM(' IT ')	'IT'

Mathematical functions

Function	Example	Output
POWER(x, y) / POW	POWER(2, 4)	16
ROUND(x, d)	ROUND(15.678, 1)	15.7
ROUND(x)	ROUND(15.5)	16
ROUND(x, -1)	ROUND(1546, -2)	1500
TRUNCATE(x, d)	TRUNCATE(15.678, 1)	15.6 (just cuts, no rounding)
MOD(a, b)	MOD(17, 5)	2
SQRT(x)	SQRT(81)	9

Date and time functions

Function	Returns	Example (if today is 2026-10-04)
CURDATE()	Current date	2026-10-04
NOW()	Current date and time (when statement starts)	2026-10-04 10:15:30
SYSDATE()	Exact date and time when the function runs	2026-10-04 10:15:32
DATE(dt)	Date part	DATE(NOW()) → 2026-10-04
MONTH(d)	Month number	10
YEAR(d)	Year	2026
DAYOFMONTH(d)	Day of month	4
DAYOFWEEK(d)	1 = Sunday ... 7 = Saturday	1 (Sunday)
DAYOFYEAR(d)	Day number in the year (1-366)	277

Write queries on EMP:

```
-- Names in capital letters with first three letters
SELECT UCASE(Name), LEFT(Name, 3) FROM emp;
-- Names having more than 5 characters
SELECT Name FROM emp WHERE LENGTH(Name) > 5;
-- Salary rounded to nearest thousand
SELECT Name, ROUND(Salary, -3) FROM emp;
-- Name and city joined: "Ramesh-Cuttack"
SELECT CONCAT(Name, '-', City) FROM emp;
-- Employees whose name has 'e' as the 2nd letter
SELECT Name FROM emp WHERE MID(Name, 2, 1) = 'e';      -- Rekha
```

IT-8. IT Applications (2nd Year)

e-Business and e-Commerce

DEFINITIONS

e-Business: carrying out all business activities (buying, selling, customer service, supply chain, payments, collaboration) using the internet and ICT. **e-Commerce** is the buying and selling part of e-business.

Type	Meaning	Example
B2C (Business to Consumer)	Company sells to individuals	Amazon, Flipkart
B2B (Business to Business)	Company sells to company	IndiaMART, Alibaba
C2C (Consumer to Consumer)	Individuals sell to individuals	OLX, Quikr
C2B (Consumer to Business)	Individuals offer products/services to businesses	Freelancers on Upwork, stock photographers
B2G / G2C	Business/government interactions	GeM portal, e-tendering

Benefits: 24×7 shopping from home; wider choice and price comparison; reach global customers; lower costs (no physical shop); home delivery and digital payment (UPI, cards); quick customer feedback.

Salient features of e-business websites: attractive, easy navigation; search and filters; product images and descriptions; shopping cart; secure payment gateway (HTTPS); order tracking; customer reviews; return policy and help desk.

Social impact: new jobs (delivery, IT, digital marketing), growth of small sellers and artisans, convenience — but also decline of local shops, online fraud, privacy concerns, impulse buying.

Challenges: security of payments, lack of trust, poor internet in rural areas, logistics, returns, cyber fraud, legal issues.

Front-end interface

The **front-end** is the part of an application the user sees and interacts with — forms, buttons, menus (built with Java Swing in NetBeans, or HTML for web). A good front-end is simple, consistent, attractive and **validates** input.

Control	Use in an application	Validation example
Text box	Name, address, amount	Not empty; numeric only for amount
Radio button	One choice: gender, payment mode	One must be selected
Check box	Multiple options: hobbies, add-ons	—
List / combo box	Select from a fixed list: district, stream	A valid item chosen
Password field	Login	Minimum length
Table / label	Display results	—

Back-end database

The **back-end** is the database (MySQL) where data is stored permanently. The user never sees it directly. **Purpose:** store, organise, protect and retrieve data efficiently. While designing, identify the tables needed, their columns (attributes), data types, primary keys and relationships (foreign keys).

Front-end and database connectivity

Connectivity links the front-end form to the back-end database (via JDBC in Java), so that data entered in the form is saved to the database and results from the database are displayed on the form. **Benefits:** data is stored permanently and centrally, many users can access it, easy searching and reports, data validation, security through login.

Development of an e-Governance application - demonstration

Example: Online Birth Certificate Application

Front-end form fields: Applicant name (text), Child's name (text), Date of birth (text/date), Gender (radio: Male/Female/Other), Place of birth (combo box of districts), Hospital name (text), Father's and mother's names (text), Mobile (text, 10 digits), Submit and Reset buttons, a table to show application status.

Back-end table: CREATE TABLE birth_app (AppNo INT PRIMARY KEY, ChildName VARCHAR(40), DOB DATE, Gender CHAR(1), District VARCHAR(20), Hospital VARCHAR(40), Father VARCHAR(40), Mother VARCHAR(40), Mobile CHAR(10), Status VARCHAR(15));

Connectivity: On Submit → validate fields → INSERT into birth_app with Status = 'Pending' → show the application number. On "Check Status" → SELECT Status FROM birth_app WHERE AppNo = ... → display.

Similar projects (for the practical project, groups of 2-3): Library management (e-learning), Online shopping cart (e-business), Electricity bill payment, Hostel admission, Hospital OPD registration.

Exam Q&A - RDBMS & IT Applications

Q1. What is the use of COMMIT and ROLLBACK? [2]

COMMIT makes the changes of a transaction permanent; ROLLBACK cancels the changes made since the last COMMIT/START TRANSACTION.

Q2. Differentiate WHERE and HAVING. [2]

WHERE filters individual rows before grouping and cannot use group functions; HAVING filters groups after GROUP BY and can use group functions.

Q3. Differentiate COUNT(*) and COUNT(column). [2]

COUNT(*) counts all rows; COUNT(column) counts only non-NULL values in that column.

Q4. If table A has 4 rows, 3 columns and table B has 5 rows, 2 columns, find the degree and cardinality of their Cartesian product. [2]

Degree = $3 + 2 = 5$; cardinality = $4 \times 5 = 20$.

Q5. Give outputs: ROUND(25.367, 2), TRUNCATE(25.367, 2), MOD(23, 4), LENGTH('IT Lab'). [2]

25.37, 25.36, 3, 6.

Q6. Differentiate DELETE and DROP. [2]

DELETE (DML) removes rows but keeps the table structure; DROP (DDL) removes the entire table with its structure.

Q7. What is e-commerce? Explain its types. [4]

Buying and selling goods/services over the internet. Types B2C, B2B, C2C, C2B with examples — see table above.

Q8. What is a foreign key? [2]

A column in one table that refers to the primary key of another table, linking the two and maintaining referential integrity.

QB-1. Computer Networking – Question Bank

Key points to remember

- A **network** is a group of two or more computers (nodes) connected to share data, hardware, software and to communicate.
- A **node** is any device on a network (computer, printer, phone). A **server** provides services; a **client** uses them.
- Network types by area: **PAN** (about 10 m) < **LAN** (building/campus, up to about 1 km) < **MAN** (city, up to about 50 km) < **WAN** (country/world).
- **Topology** = physical or logical layout of the network: bus, star, ring, tree (and mesh).
- Devices: NIC (connects a computer, has MAC address), modem (digital ↔ analog), hub (broadcasts to all), switch (sends to one using MAC), repeater (boosts signal), bridge (joins two similar LAN segments), router (joins different networks, uses IP, chooses best path), gateway (joins networks with different protocols).
- Guided media: twisted pair (cheapest), coaxial (cable TV), optical fibre (fastest, light pulses, no interference).
- Unguided media: Bluetooth (about 10 m), infrared (line of sight, TV remote), microwave (towers in line of sight), radio (all directions, Wi-Fi), satellite (very large area, slight delay).
- **Bandwidth** is the capacity of a channel, measured in bits per second (bps, kbps, Mbps, Gbps).

MEMORY TRICK FOR DEVICES

"**H**ub **H**ollers to everyone, **S**witch **S**elects one, **R**outer **R**outes between networks, **G**ateway **G**ives translation between protocols, **R**epeater **R**e-strengthens."

A. Multiple choice questions (1 mark each)

1. A network spread over a building or a college campus is a (a) PAN (b) LAN (c) MAN (d) WAN
(b) LAN
2. The internet is an example of (a) LAN (b) MAN (c) WAN (d) PAN
(c) WAN
3. Which device sends data only to the destination computer? (a) hub (b) switch (c) repeater (d) modem
(b) switch
4. Which device converts digital signals into analog signals? (a) router (b) modem (c) bridge (d) NIC
(b) modem
5. In which topology are all nodes connected to a central hub? (a) bus (b) ring (c) star (d) tree
(c) star

6. Which topology uses a single backbone cable with terminators? (a) bus (b) star (c) ring (d) mesh

(a) bus

7. Which medium transmits data as light? (a) coaxial cable (b) twisted pair (c) optical fibre (d) microwave

(c) optical fibre

8. The connector used with an Ethernet (UTP) cable is (a) RJ-11 (b) RJ-45 (c) BNC (d) USB

(b) RJ-45

9. A device that regenerates weak signals is a (a) repeater (b) gateway (c) switch (d) router

(a) repeater

10. Which device connects networks that use different protocols? (a) hub (b) bridge (c) gateway (d) repeater

(c) gateway

11. Range of Bluetooth is about (a) 1 m (b) 10 m (c) 1 km (d) 100 km

(b) 10 m

12. A TV remote uses (a) radio waves (b) infrared (c) microwave (d) satellite

(b) infrared

13. Which topology is a combination of star networks joined by a bus? (a) ring (b) mesh (c) tree (d) bus

(c) tree

14. The MAC address is stored in the (a) router (b) NIC (c) modem (d) hard disk

(b) NIC

15. Which device uses IP addresses to choose the best path for data packets? (a) hub (b) switch (c) router (d) repeater

(c) router

16. In a ring topology, data travels (a) in all directions (b) in one direction around the ring (c) only to the hub (d) randomly

(b) in one direction around the ring

17. Which of these is a guided medium? (a) radio (b) microwave (c) coaxial cable (d) satellite

(c) coaxial cable

18. Bandwidth is measured in (a) hertz only (b) bits per second (c) bytes (d) metres

(b) bits per second

19. Mobile phone connected to wireless earphones forms a (a) LAN (b) PAN (c) MAN (d) WAN

(b) PAN

20. Which medium is best for very long distance with high speed? (a) twisted pair (b) coaxial (c) optical fibre (d) infrared

(c) optical fibre

B. Very short answer questions (1 mark)**1. What is a network?**

Two or more computers connected together to share data, resources and to communicate.

2. Expand NIC.

Network Interface Card.

3. Expand MODEM.

MOdulator-DEModulator.

4. What is a node?

Any device (computer, printer, phone) connected to a network.

5. What is topology?

The arrangement (layout) in which the nodes of a network are connected.

6. Give one example of a MAN.

The cable TV network of a city (or a city-wide network connecting all branches of a bank in Bhubaneswar).

7. Which cable is used for cable TV connections?

Coaxial cable.

8. What is a terminator in bus topology?

A device at each end of the backbone cable that absorbs signals so they do not bounce back.

9. Name the address that is permanently burnt into a NIC.

MAC (Media Access Control) address.

10. Which wireless medium needs line of sight between towers?

Microwave.

11. What is a server?

A powerful computer that provides services (files, printing, web pages, database) to other computers (clients) on the network.

12. Which network device is called an "intelligent hub"?

Switch.

13. What does a bridge do?

It joins two similar LAN segments and filters traffic between them.

14. Name the topology where failure of one cable affects only one computer.

Star topology.

15. What is the unit of data transfer speed?

bits per second (bps); larger units are kbps, Mbps and Gbps.

C. Short answer questions (2 marks)

1. Write any four advantages of networking.

(i) Resource sharing – one printer or internet connection can be used by all. (ii) Data sharing – files can be accessed from any computer. (iii) Communication – e-mail, chat and video calls. (iv) Centralised backup and reduced cost, since software and hardware need not be bought for every computer.

2. Differentiate LAN and WAN.

LAN	WAN
Covers a small area (room, building, campus)	Covers a country or the whole world
High speed, low error rate	Lower speed, more errors
Owned by one organisation	Often uses public/telecom lines
Example: school computer lab	Example: internet

3. Differentiate hub and switch.

A hub sends (broadcasts) the incoming data to all ports, which wastes bandwidth and is less secure. A switch reads the destination MAC address and sends data only to that port, so it is faster, more efficient and more secure.

4. Differentiate router and gateway.

A router connects two or more networks using the same protocol and chooses the best path for packets using IP addresses. A gateway connects networks using different protocols and translates data from one protocol to another; it is the entry/exit point of a network.

5. Write two advantages and two disadvantages of bus topology.

Advantages: cheap and needs less cable; easy to install for small networks.

Disadvantages: if the backbone cable breaks the whole network stops; difficult to find faults, and performance drops as more nodes are added.

6. Why is optical fibre preferred over copper cable?

It offers very high bandwidth and speed, carries signals over long distances without repeaters, is not affected by electrical/electromagnetic interference, is light and thin, and is difficult to tap, so it is secure.

7. What is satellite communication? Give two uses.

Signals are sent from an earth station to a satellite in space, which amplifies them and sends them back to another earth station far away. Uses: TV broadcasting (DTH), GPS navigation, weather forecasting, communication in remote areas.

8. Differentiate guided and unguided media.

Guided (wired) media carry signals through a physical path such as twisted pair, coaxial cable or optical fibre. Unguided (wireless) media carry signals through air/space as electromagnetic waves, such as radio, microwave, infrared and satellite.

9. What is the role of a repeater? Where is it needed?

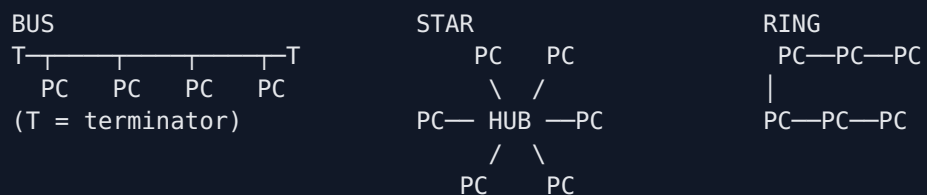
A repeater receives a weak signal and regenerates/amplifies it before sending it further. It is needed when cable length exceeds the limit (for example, more than about 100 m of Ethernet cable) so that the signal does not become too weak.

10. What is a MAN? Give an example.

A Metropolitan Area Network covers a city or a large town (up to about 50 km). It connects many LANs of the city. Example: cable TV network or a city-wide Wi-Fi network of a municipal corporation.

D. Long answer questions (4-5 marks)**1. What is network topology? Explain bus, star and ring topologies with diagrams, advantages and disadvantages.**

Topology is the geometric arrangement of computers (nodes) and connecting cables in a network.



Bus: all nodes are connected to one main cable called the backbone. Data travels along the backbone and every node checks whether it is meant for it. *Advantages:* cheap, less cable, simple. *Disadvantages:* backbone failure stops everything; hard to troubleshoot; slows down with heavy traffic.

Star: each node is connected by a separate cable to a central hub or switch. *Advantages:* easy to install and add nodes, failure of one cable affects only one node, easy fault detection. *Disadvantages:* more cable needed, failure of the hub stops the network.

Ring: each node is connected to exactly two neighbours forming a closed loop; data moves in one direction and is passed from node to node (often using a token). *Advantages:* no data collisions, equal chance for every node, works well under heavy load. *Disadvantages:* a break in any cable or a failed node can stop the network; adding or removing nodes disturbs the network.

2. Explain any five network devices.

(1) **NIC** – an expansion card that connects a computer to the network; it has a unique 48-bit MAC address. (2) **Modem** – converts digital data of the computer into analog signals (modulation) to send over telephone lines and converts them back (demodulation). (3) **Hub** – a central connecting device of a star LAN that broadcasts data to every port. (4) **Switch** – an intelligent hub that forwards data only to the destination port using MAC addresses. (5) **Router** – connects different networks and forwards packets along the best route using IP addresses; a home Wi-Fi router connects the home LAN to the ISP. (6) **Gateway** – connects dissimilar networks and converts protocols. (7) **Repeater** – regenerates signals to extend distance.

3. Describe the different wired and wireless communication media.

Wired: (i) *Twisted pair* – two insulated copper wires twisted together to reduce interference; UTP/STP; cheap; used in LAN and telephone lines; limited distance (about 100 m). (ii) *Coaxial cable* – central copper conductor, insulation, metallic braid shield and outer jacket; better noise protection; used in cable TV. (iii) *Optical fibre* – thin glass or plastic core carrying light pulses by total internal reflection; highest speed and bandwidth, no interference, long distance; costly and difficult to join.

Wireless: (i) *Bluetooth* – short range (10 m), low power, connects personal devices. (ii) *Infrared* – very short range, needs line of sight, cannot pass walls. (iii) *Radio waves* – travel in all directions, pass through walls; Wi-Fi, FM. (iv) *Microwave* – high-frequency, line-of-sight, towers placed on hills/tall buildings. (v) *Satellite* – covers huge areas, used for TV, GPS; has propagation delay and high cost.

4. Compare PAN, LAN, MAN and WAN in a table.

Feature	PAN	LAN	MAN	WAN
Area	About 10 m	Up to 1 km	Up to 50 km	Unlimited
Speed	Low-medium	Very high	High	Lower
Ownership	Single person	One organisation	City body / company	Many organisations
Media	Bluetooth, USB	Ethernet, Wi-Fi	Fibre, microwave	Fibre, satellite
Example	Phone + smartwatch	School lab	City cable TV	Internet

QB-2. Internet and Web Services – Question Bank

Key points to remember

- The **internet** is a global network of networks using **TCP/IP**. It began as **ARPANET** (1969, USA); public internet in India started in **1995** through VSNL.
- The **WWW** (World Wide Web) is a collection of linked web pages on the internet, invented by **Tim Berners-Lee** in 1989. Internet is the road; the web is one kind of traffic on it.
- **Protocols**: TCP/IP (basic internet), HTTP/HTTPS (web pages), FTP (file transfer), SMTP (send mail), POP3/IMAP (receive mail), TELNET (remote login), WAIS and Gopher (older search/document systems).
- **IP address** – logical numeric address; IPv4 is 32 bits (4 numbers 0–255), IPv6 is 128 bits. **DNS** converts domain names into IP addresses.
- **URL** = protocol + domain name + path, e.g. <https://www.india.gov.in/topics/education>.
- Access types: dial-up (slow, telephone line), leased line (dedicated, costly), broadband (DSL, cable, fibre, 4G/5G).
- Mobile technologies: GSM (SIM, TDMA), CDMA (unique code per call), WLL (radio in place of copper local loop), 3G (video calls), 4G (high speed data, VoLTE), 5G (very high speed, low delay).

A. Multiple choice questions

1. The internet started as (a) NSFNET (b) ARPANET (c) ERNET (d) VSNL

(b) ARPANET

2. WWW was invented by (a) Bill Gates (b) Tim Berners-Lee (c) Charles Babbage (d) Vint Cerf

(b) Tim Berners-Lee

3. Which protocol is used to transfer web pages? (a) FTP (b) SMTP (c) HTTP (d) TELNET

(c) HTTP

4. Which protocol is used to log in to a remote computer? (a) TELNET (b) HTTP (c) POP (d) FTP

(a) TELNET

5. An IPv4 address has (a) 16 bits (b) 32 bits (c) 64 bits (d) 128 bits

(b) 32 bits

6. DNS converts (a) IP address to MAC address (b) domain name to IP address (c) text to binary (d) URL to e-mail

(b) domain name to IP address

7. Which of these is a valid IPv4 address? (a) 192.168.1.300 (b) 10.0.0.1 (c) 256.1.1.1 (d) 1.2.3

(b) 10.0.0.1 (each part must be 0–255 and there must be four parts)

8. ".edu" domain is used by (a) government (b) commercial firms (c) educational institutions (d) networks

(c) educational institutions

9. Which is a web browser? (a) Google (b) Chrome (c) Yahoo Mail (d) Windows

(b) Chrome

10. Which is a search engine? (a) Firefox (b) Bing (c) Edge (d) Safari

(b) Bing

11. The protocol used to send e-mail is (a) SMTP (b) FTP (c) HTTP (d) TELNET

(a) SMTP

12. In the URL <https://www.cbse.gov.in/results>, "https" is the (a) domain (b) path (c) protocol (d) file

(c) protocol

13. Maximum speed of a dial-up connection is about (a) 56 kbps (b) 1 Mbps (c) 100 Mbps (d) 1 Gbps

(a) 56 kbps

14. A SIM card is used in (a) CDMA (b) GSM (c) WLL (d) Bluetooth

(b) GSM (modern CDMA phones may also use R-UIM cards, but the SIM is the identity of GSM)

15. VoLTE is a feature of (a) 2G (b) 3G (c) 4G (d) dial-up

(c) 4G

16. IRC stands for (a) Internet Relay Chat (b) Internal Remote Call (c) Internet Radio Channel (d) Indian Railway Computer

(a) Internet Relay Chat

17. Maximum characters in one SMS are (a) 100 (b) 140 (c) 160 (d) 200

(c) 160

18. The first page of a website is called (a) main page (b) home page (c) web page (d) index card

(b) home page

19. Which company is an ISP? (a) Microsoft (b) BSNL (c) Oracle (d) Adobe

(b) BSNL

20. Which of these is used to upload files to a web server? (a) FTP (b) SMS (c) DNS (d) GSM

(a) FTP

B. Very short answer questions

1. Expand: HTTP, FTP, URL, DNS.

HyperText Transfer Protocol; File Transfer Protocol; Uniform Resource Locator; Domain Name System.

2. What is an ISP? Give two examples.

Internet Service Provider – a company that provides internet connection for a fee. Examples: BSNL, Jio, Airtel.

3. What is a protocol?

A set of rules that computers follow to communicate with each other.

4. What is a website?

A collection of related web pages under one domain name, starting from a home page.

5. What is the internet backbone?

The high-speed main data routes (mostly optical fibre, including undersea cables) connecting major networks and routers of the internet.

6. Write the full form of GSM and CDMA.

Global System for Mobile communication; Code Division Multiple Access.

7. Expand WLL.

Wireless in Local Loop.

8. What is video conferencing?

A live audio-visual meeting between people at different locations using internet, camera and microphone (Google Meet, Zoom).

9. Identify the domain in: student@chseodisha.nic.in

chseodisha.nic.in (the part after @).

10. What is voice mail?

A recorded spoken message stored in a system so that the receiver can listen to it later.

11. What is a hyperlink?

Text or an image on a web page that, when clicked, takes the user to another page or location.

12. Name two top-level domains used in India.

.in and .gov.in (also .nic.in, .ac.in, .co.in).

C. Short answer questions**1. Differentiate internet and WWW.**

The internet is the physical global network of computers connected through TCP/IP – it is the infrastructure. The WWW is a service that runs on the internet: a collection of web pages linked by hyperlinks and accessed through browsers using HTTP. E-mail, FTP and chat are other internet services that are not part of the web.

2. Differentiate web browser and search engine.

A web browser is software installed on a computer to open and display web pages (Chrome, Firefox, Edge). A search engine is a website that searches the web for information using keywords and lists results (Google, Bing). We use a browser to open a search engine.

3. Explain the parts of the URL <https://www.odisha.gov.in/departments/education.html>

https – protocol (secure HTTP); **www.odisha.gov.in** – domain name of the server (www = web server, odisha = organisation, gov = government, in = India); **/departments/** – folder path; **education.html** – the file name of the web page.

4. Differentiate IP address and domain name.

An IP address is a numeric address of a computer on the internet, e.g. 164.100.140.1, difficult to remember. A domain name is a text name mapped to that IP address, e.g. india.gov.in, easy to remember. DNS translates domain names into IP addresses.

5. What is TCP/IP? How does it work?

TCP/IP is the basic protocol suite of the internet. TCP (Transmission Control Protocol) breaks a message into small packets at the sender, numbers them and reassembles them in order at the receiver, requesting resend of lost packets. IP (Internet Protocol) puts the destination address on each packet and routes it through the network.

6. Differentiate GSM and CDMA.

GSM divides each frequency into time slots (TDMA) and uses a SIM card to identify the user; it is widely used worldwide. CDMA allows all users to share the same frequency and gives each call a unique code; it offers better security and call quality but fewer handsets support it.

7. Write any four uses of the internet in daily life.

Online education (SWAYAM, DIKSHA), e-mail and messaging, online banking and UPI payments, e-shopping, booking railway tickets (IRCTC), checking exam results, government services (Odisha One), entertainment.

D. Long answer questions**1. Explain any five internet protocols.**

TCP/IP – the core protocol; TCP divides data into packets and ensures reliable delivery, IP addresses and routes packets. **HTTP** – used by browsers to request and receive web pages from web servers; **HTTPS** is its secure (encrypted) version, shown with a lock symbol. **FTP** – transfers files between computers; used to upload web pages to a server or download large files. **SMTP** – sends e-mail from the client to the mail server and between servers; POP3/IMAP are used to receive mail. **TELNET** – lets a user log in to a remote computer and work as if sitting in front of it (text based, not secure; SSH is the modern secure version). **WAIS** – searches indexed databases on remote servers. **Gopher** – an old menu-driven system to find documents, replaced by the web.

2. Describe the different types of internet connections.

Dial-up: computer dials the ISP through a telephone line and modem; slow (max 56 kbps); phone cannot be used while online; now outdated. **Leased line / direct connection:** a permanent dedicated line between the organisation and the ISP; always on, fixed high speed; costly; used by banks and offices. **Broadband:** high-speed always-on connection: DSL/ADSL (over telephone line, voice and data together), cable (cable TV network), fibre/FTTH (optical fibre to the home, up to 1 Gbps), wireless broadband – Wi-Fi hotspots, 4G/5G mobile data, satellite broadband for remote areas.

3. Write short notes on: (a) e-mail (b) chatting (c) video conferencing (d) search engine.

(a) **E-mail:** electronic messages sent through the internet to an address of the form username@domain; can carry attachments; fast, cheap, can be sent to many people. Examples: Gmail, Outlook. (b) **Chatting:** real-time exchange of text messages; IRC allows group chat rooms; modern apps add voice and images. (c) **Video conferencing:** live meeting with audio and video among people in different places; saves travel time and cost; used for online classes, interviews, court hearings. (d) **Search engine:** a website that uses programs called crawlers to index web pages and returns a list of relevant pages for keywords typed by the user, e.g. Google, Bing, DuckDuckGo.

QB-3. Network Security, Cyber Crime and Cyber Ethics – Question Bank

Key points to remember

- **Malware** = malicious software: virus (attaches to files, needs a host), worm (spreads by itself over networks), Trojan horse (looks useful but harmful), spyware (secretly collects data), adware (unwanted ads), ransomware (locks files and demands money).
- **Cookies** are small text files stored by websites on the user's computer to remember login, cart and preferences.
- **Firewall** filters incoming/outgoing traffic and blocks unauthorised access.
- **Digital signature** – electronic proof of identity of the sender and integrity of a document, based on encryption keys; legal under IT Act 2000.
- **Encryption** converts readable data (plain text) into unreadable form (cipher text); decryption reverses it.
- Cyber crimes: hacking, phishing, online fraud, spoofing, snooping, cyber stalking, cyber bullying, identity theft, software piracy, publishing obscene material.
- **IT Act 2000** (amended 2008) is India's cyber law. Report cyber crime at **cybercrime.gov.in** or call **1930**.
- **Cyber ethics**: respect privacy, do not copy others' work (plagiarism), use licensed software, do not spread fake news, be polite online (netiquette).
- **Intellectual Property Rights (IPR)**: copyright (books, software, music), patent (inventions), trademark (brand names and logos).

A. Multiple choice questions

1. A program that spreads by itself through a network without attaching to a file is a (a) virus (b) worm (c) Trojan (d) cookie
(b) worm
2. Malware that looks like useful software is (a) worm (b) spyware (c) Trojan horse (d) adware
(c) Trojan horse
3. Which locks a user's files and demands payment? (a) adware (b) ransomware (c) cookie (d) firewall
(b) ransomware
4. A firewall is used to (a) increase speed (b) block unauthorised access (c) store cookies (d) create websites
(b) block unauthorised access
5. Fake e-mails that trick users into revealing passwords are called (a) phishing (b) spamming (c) snooping (d) piracy
(a) phishing
6. The Indian law dealing with cyber crimes is (a) IPC 1860 (b) IT Act 2000 (c) RTI Act 2005 (d) Copyright Act 1957
(b) IT Act 2000

7. Illegal copying of software is (a) hacking (b) spoofing (c) piracy (d) cracking

(c) piracy

8. Small text files stored by a website on your computer are (a) viruses (b) cookies (c) firewalls (d) logs

(b) cookies

9. VIRUS stands for (a) Very Important Resource Under Search (b) Vital Information Resources Under Siege (c) Virtual Information Resource Used Securely (d) none

(b)

10. Secretly watching someone's data or messages is (a) snooping (b) spoofing (c) phishing (d) spamming

(a) snooping

11. Pretending to be someone else by faking an e-mail address is (a) snooping (b) spoofing (c) stalking (d) piracy

(b) spoofing

12. The national cyber crime helpline number in India is (a) 100 (b) 1930 (c) 108 (d) 1098

(b) 1930

13. Converting plain text into cipher text is (a) decryption (b) encryption (c) compression (d) encoding

(b) encryption

14. Which protects a brand name or logo? (a) patent (b) copyright (c) trademark (d) licence

(c) trademark

15. Which of the following is a strong password? (a) 123456 (b) password (c) Rk@2026#Blue (d) your name

(c)

16. The lock symbol in the browser address bar indicates (a) HTTP (b) HTTPS secure connection (c) FTP (d) virus

(b)

B. Very short answer questions

1. What is a computer virus?

A malicious program that attaches itself to files or programs, copies itself and damages data or slows the computer.

2. What is hacking?

Gaining unauthorised access to a computer system or network to steal, change or destroy data.

3. What is cyber stalking?

Repeatedly following, harassing or threatening a person through the internet (messages, social media, e-mail).

4. What is a digital signature?

An electronic signature created with encryption that verifies the sender's identity and proves the document was not altered.

5. Name two antivirus programs.

Quick Heal, Norton, McAfee, Windows Defender (any two).

6. What is cyber law?

The set of laws dealing with the use of computers and the internet, electronic records, digital signatures and cyber crimes.

7. What is spam?

Unwanted bulk e-mails or messages, usually advertisements or scams.

8. What is plagiarism?

Copying another person's work or ideas and presenting them as one's own without giving credit.

9. What is netiquette?

Good manners and rules of polite behaviour while communicating on the internet.

10. What is identity theft?

Stealing someone's personal information (Aadhaar, bank, password) and using it to commit fraud in their name.

C. Short answer questions**1. Differentiate virus and worm.**

A virus attaches itself to a host file and spreads only when that file is run or shared. A worm is an independent program that copies itself automatically across a network without any host file, often consuming bandwidth and slowing networks.

2. Write four ways to protect a computer from viruses.

(i) Install a good antivirus and update it regularly. (ii) Do not open e-mail attachments or links from unknown senders. (iii) Scan pen drives before use and download software only from trusted sites. (iv) Keep the operating system updated, use a firewall and take regular backups.

3. What are cookies? Are they harmful?

Cookies are small text files that a website stores in the browser to remember the user's login, preferences and shopping cart. They are not programs and cannot spread viruses, so they are usually harmless and useful. However, third-party cookies can be used to track browsing habits and invade privacy, and on a shared computer a saved login can be misused. Clearing cookies regularly is a good habit.

4. What is a firewall? Give its types.

A firewall is a security system that checks all data packets entering or leaving a network and allows or blocks them according to rules. Types: hardware firewall (a separate device or built into the router; protects the whole network) and software firewall (installed on a computer, e.g. Windows Defender Firewall; protects that computer).

5. Explain phishing with an example. How can you avoid it?

Phishing is a fraud in which criminals send fake e-mails/SMS that look as if they come from a bank or company and ask the user to click a link and enter passwords, OTP or card details. Example: "Your SBI account is blocked; click here to update KYC." Avoid it by never sharing OTP/PIN, checking the sender and website address, and contacting the bank directly.

6. What is software piracy? Why is it wrong?

Software piracy is copying, distributing or using software without a valid licence. It is illegal under the Copyright Act and IT Act, causes loss to developers, and pirated copies often contain malware. Use licensed or free and open source software instead.

D. Long answer questions**1. What is a cyber crime? Explain any five cyber crimes.**

A cyber crime is any illegal activity in which a computer, mobile or network is used as a tool or target. (1) **Hacking** – breaking into computer systems without permission. (2) **Online fraud/phishing** – cheating people using fake websites, lottery messages, OTP fraud. (3) **Spoofing** – faking identity through forged e-mail address, caller ID or a look-alike website. (4) **Snooping** – secretly monitoring someone's communication or data. (5) **Cyber stalking and bullying** – harassing, threatening or insulting someone online. (6) **Software piracy** – unauthorised copying of software. (7) **Pornography** – publishing or transmitting obscene material; child abuse material is a serious offence under Section 67B of the IT Act.

2. Explain the main provisions of the IT Act 2000.

The Information Technology Act, 2000 is India's main cyber law, amended in 2008. Its main provisions: (i) legal recognition of electronic records and e-commerce transactions; (ii) legal validity of digital signatures and appointment of Certifying Authorities; (iii) acceptance of electronic filing of documents with government; (iv) punishment for offences such as tampering with source code, hacking and data theft (Sections 43, 66), identity theft (66C), cheating by impersonation (66D), cyber terrorism (66F), publishing obscene material (67); (v) setting up of the Cyber Appellate Tribunal and CERT-In for handling cyber security incidents.

3. What do you mean by cyber ethics? Write any six rules of ethical computer use.

Cyber ethics is the set of moral principles that guide responsible behaviour while using computers and the internet. Rules: (1) Do not use a computer to harm others. (2) Do not snoop into other people's files or messages. (3) Do not use or copy software you have not paid for. (4) Give credit to the original author; avoid plagiarism. (5) Do not spread rumours, fake news or hate messages. (6) Respect privacy – do not share others' photos or personal data without permission. (7) Use strong passwords and never share them. (8) Follow netiquette – be polite, avoid writing in all capital letters (it means shouting).

QB-4. Java Fundamentals - Data Types, Operators and Control Structures

Key points to remember

- Java programs are compiled into **bytecode** (.class file) by `javac` and run by the **JVM** (Java Virtual Machine) - "write once, run anywhere".
- **Primitive data types (8)**: byte (1 byte), short (2), int (4), long (8), float (4), double (8), char (2, Unicode), boolean (true/false). **String** is a class, not a primitive type.
- **Identifiers** must start with a letter, `_` or `$`; cannot start with a digit; cannot be a keyword; are case-sensitive (Total and total are different).
- Operators: arithmetic (+ - * / %), relational (== != < > <= >=), logical (&& || !), assignment (= += -= *= /= %=), increment/decrement (++ --), ternary (condition ? a : b).
- int / int gives an int (7/2 = 3). If either operand is double, the result is double (7/2.0 = 3.5).
- **Post-increment** `a++` uses the value first and then increases; **pre-increment** `++a` increases first and then uses it.
- "+" with a String joins (concatenates): `10 + 20 + "IT" = "30IT"`, but `"IT" + 10 + 20 = "IT1020"`.
- Selection statements: if, if-else, if-else-if ladder, nested if, switch. Without **break**, switch cases "fall through" to the next case.
- Loops: **for** (count known), **while** (entry-controlled), **do-while** (exit-controlled, runs at least once). **break** leaves the loop; **continue** skips to the next iteration.
- Type conversion: implicit (widening, int → double automatically) and explicit casting (narrowing, (int) 9.99 gives 9).

Operator precedence (high to low)	Example
() brackets	$(2 + 3) * 4 = 20$
<code>++ -- !</code> (unary)	<code>!true = false</code>
<code>* / %</code>	$2 + 3 * 4 = 14$
<code>+ -</code>	$10 - 4 + 2 = 8$ (left to right)
<code>< > <= >=</code>	$5 > 3$ is true
<code>== !=</code>	$4 != 4$ is false
<code>&& then </code>	<code>true false && false = true</code>
<code>?: then = += -=</code>	assignment is done last

A. Multiple choice questions

1. Java source code is converted into (a) machine code directly (b) bytecode (c) assembly code (d) HTML

(b) bytecode

2. The size of a char in Java is (a) 1 byte (b) 2 bytes (c) 4 bytes (d) 8 bytes

(b) 2 bytes (Unicode)

3. Which is not a primitive data type? (a) int (b) boolean (c) String (d) double

(c) String

4. The value of $25 \% 7$ is (a) 3 (b) 4 (c) 3.57 (d) 18

(b) 4

5. Which is an invalid identifier? (a) _total (b) \$amt (c) 1stRank (d) rank1

(c) 1stRank

6. What is the value of $7 / 2.0$? (a) 3 (b) 3.5 (c) 4 (d) 3.0

(b) 3.5

7. Which operator is used for "not equal to"? (a) $<>$ (b) $!=$ (c) $=!$ (d) $\sim=$

(b) $!=$

8. Which loop is exit-controlled? (a) for (b) while (c) do-while (d) for-each

(c) do-while

9. The ternary operator is (a) $?:$ (b) $\&\&$ (c) $++$ (d) $::$

(a) $?:$

10. Which keyword skips the rest of the loop body and starts the next iteration? (a) break (b) exit (c) continue (d) return

(c) continue

11. switch in Java can work with (a) int, char, String (b) float only (c) double only (d) boolean only

(a) int, char, String (also byte, short and enum)

12. Output of `System.out.println(5 + 3 + "A" + 5 + 3);` (a) 8A8 (b) 53A53 (c) 8A53 (d) 16A

(c) 8A53

13. `(int) 9.99` gives (a) 10 (b) 9 (c) 9.0 (d) error

(b) 9

14. Default value of an int member variable is (a) 0 (b) null (c) 1 (d) garbage

(a) 0

15. Which of the following is a logical operator? (a) $\geq$ (b) $\&\&$ (c) $\%$ (d) $+=$

(b) $\&\&$

16. Which data type is best to store the value 3.14159265? (a) int (b) float (c) double (d) char

(c) double

17. The JVM stands for (a) Java Variable Method (b) Java Virtual Machine (c) Joint Virtual Memory (d) Java Visual Mode

(b) Java Virtual Machine

18. How many times does `for(int i = 0; i < 5; i++)` run? (a) 4 (b) 5 (c) 6 (d) infinite

(b) 5

B. Very short answer questions

1. What is a variable?

A named memory location that stores a value which can change during the program, e.g.

```
int marks = 85;
```

2. What is a constant? How is it declared in Java?

A value that cannot change; declared with `final`, e.g. `final double PI = 3.14159;`

3. What is a keyword? Give four examples.

A reserved word having a special meaning to the compiler: `class`, `int`, `if`, `while`, `return`, `new`, `public`, `static`.

4. Name the two types of comments in Java.

Single-line `//` comment and multi-line `/*` comment `*/` (also documentation comment `/** */`).

5. What is the output of: `int a = 5; a += a++ + ++a; System.out.println(a);`

17 (`a = 5 + (5 + 7)`).

6. Write the output: `char c = 'A'; System.out.println(c + 1);`

66 (`char` is converted to its Unicode number 65, then 1 is added).

7. Write the output: `System.out.println((char)('A' + 2));`

C

8. What is type casting?

Converting a value from one data type to another, e.g. `(int) 7.8` gives 7.

9. What is an infinite loop? Give an example.

A loop whose condition never becomes false, so it never ends: `while (true) { }` or `for ( ;; ) { }`

10. Which method converts a String to an int?

`Integer.parseInt()`; for double use `Double.parseDouble()`.

11. What is the output of `System.out.println(10 == 10.0);`

true (10 is widened to 10.0 before comparison).

12. Give the result of `-17 % 5` and `17 % -5` in Java.

-2 and 2 (the sign of the result follows the first operand).

C. Output-based questions

1. Write the output.

```
int x = 10, y = 3;
System.out.println(x / y + " " + x % y + " " + (double) x / y);
```

Output: 3 1 3.3333333333333335

2. Write the output.

```
for (int i = 1; i <= 10; i += 3)
    System.out.print(i + " ");
```

Output: 1 4 7 10 (i takes 1, 4, 7, 10; next 13 fails the condition).

3. Write the output (note the missing break).

```
int k = 2;
switch (k) {
    case 1: System.out.print("One");
    case 2: System.out.print("Two");
    case 3: System.out.print("Three"); break;
    default: System.out.print("Other");
}
```

Output: TwoThree – execution starts at case 2 and falls through to case 3 where break stops it.

4. How many times is the message printed?

```
int i = 10;
do {
    System.out.println(i);
    i++;
} while (i < 5);
```

Once – it prints 10. A do-while loop checks the condition after the body, so the body runs at least once even though $10 < 5$ is false.

5. Write the output.

```
for (int j = 1; j <= 10; j++) {
    if (j % 3 == 0) continue;
    if (j == 8) break;
    System.out.print(j + " ");
}
```

Output: 1 2 4 5 7 – 3 and 6 are skipped by continue; at 8 the loop ends.

6. Write the output.

```
int p = 5;  int q = p++ * 2;
System.out.println(p + " " + q);
int r = 5;  int t = ++r * 2;
System.out.println(r + " " + t);
```

Output:

6 10 (q uses old p = 5)
6 12 (r becomes 6 first)

7. Write the output.

```
int m = 7, n = 3;
System.out.println(m > n && n > 5);
System.out.println(m > n || n > 5);
System.out.println(!(m == 7));
```

Output: false, true, false (each on a new line).

8. Find the value of cnt.

```
int cnt = 0;
for (int u = 1; u <= 4; u++)
    for (int v = 1; v <= u; v++)
        cnt++;
System.out.println(cnt);
```

Inner loop runs $1 + 2 + 3 + 4 = 10$ times. Output: 10

9. Write the output.

```
int nn = 1234, sum = 0, rev = 0;
while (nn > 0) {
    int d = nn % 10;
    sum += d;
    rev = rev * 10 + d;
    nn /= 10;
}
System.out.println(sum + " " + rev);
```

Output: 10 4321 (sum of digits and reverse of the number).

10. Write the output.

```
double dd = 7 / 2;
System.out.println(dd);
System.out.println(7 / 2.0);
System.out.println((int) 'a');
```

Output: 3.0 (integer division happens first, then 3 is stored as 3.0), 3.5, 97.

D. Short answer questions**1. Differentiate while and do-while loops.**

while	do-while
Entry-controlled: condition is checked before the body	Exit-controlled: condition is checked after the body
Body may not run even once	Body runs at least once
while (c) { }	do { } while (c); - note the semicolon

2. Differentiate break and continue.

break immediately terminates the loop (or switch) and control goes to the statement after the loop. **continue** skips the remaining statements of the current iteration and goes to the next iteration of the loop.

3. Differentiate = and ==.

= is the assignment operator; it stores a value in a variable (a = 5). == is the relational operator that compares two values and returns true or false (a == 5).

4. Rewrite using switch:

```
if (ch == 'R') System.out.println("Red");
else if (ch == 'G') System.out.println("Green");
else System.out.println("Unknown");
```

```
switch (ch) {
    case 'R': System.out.println("Red"); break;
    case 'G': System.out.println("Green"); break;
    default: System.out.println("Unknown");
}
```

5. Rewrite the following for loop using while.

```
for (int i = 2; i <= 20; i += 2) System.out.print(i + " ");
```

```
int i = 2;
while (i <= 20) {
    System.out.print(i + " ");
    i += 2;
}
```

6. Use the ternary operator to store the larger of a and b in max.

```
int max = (a > b) ? a : b;
```

7. Find the errors and correct: int 2num = 10; if (2num = 10) System.out.println("Ten")

(i) Identifier cannot start with a digit – rename to num2. (ii) Use == for comparison. (iii) Missing semicolon at the end. Correct: int num2 = 10; if (num2 == 10) System.out.println("Ten");

8. Differentiate implicit and explicit type conversion.

Implicit (widening) conversion is done automatically by Java from a smaller type to a larger one: double d = 25; stores 25.0. Explicit conversion (casting) is done by the programmer from a larger type to a smaller one and may lose data: int n = (int) 25.9; stores 25.

QB-5. Arrays and Strings – Question Bank

Key points to remember

- An **array** is a collection of elements of the **same type** stored under one name and accessed by an **index** starting at 0.
- Declaration: `int marks[] = new int[5];` or with values `int a[] = {4, 7, 1, 9, 3};` The size is given by `a.length` (no brackets).
- Valid indices are 0 to `length – 1`. Using `a[5]` in an array of size 5 gives **ArrayIndexOutOfBoundsException**.
- Searching: **linear search** checks each element one by one (works on unsorted data); **binary search** repeatedly halves a **sorted** array.
- Sorting: **bubble sort** compares adjacent elements and swaps; **selection sort** selects the smallest and puts it in front.
- String methods: `length()`, `charAt(i)`, `indexOf()`, `lastIndexOf()`, `substring()`, `toUpperCase()`, `toLowerCase()`, `trim()`, `concat()`, `replace()`, `equals()`, `equalsIgnoreCase()`, `compareTo()`, `startsWith()`, `endsWith()`.
- Strings are **immutable** – methods return a new string; the original remains unchanged.
- Compare strings with `equals()`, not `==` (`==` compares memory references).

Expression (s = "Information")	Result
<code>s.length()</code>	11
<code>s.charAt(5)</code>	'm'
<code>s.indexOf('o')</code>	3
<code>s.lastIndexOf('o')</code>	9
<code>s.substring(2, 6)</code>	"form"
<code>s.startsWith("Info")</code>	true
<code>s.replace('n', 'N')</code>	"INformation"
<code>"Odisha".replace('a', 'A')</code>	"OdishA"
<code>"CHSE".equals("chse")</code>	false
<code>"CHSE".equalsIgnoreCase("chse")</code>	true
<code>"apple".compareTo("banana")</code>	-1 ('a' – 'b')

A. Multiple choice questions

1. The index of the first element of an array is (a) 1 (b) 0 (c) -1 (d) any

(b) 0

2. For `int a[] = new int[10];` the last index is (a) 10 (b) 9 (c) 11 (d) 0

(b) 9

3. The number of elements in array `arr` is given by (a) `arr.length()` (b) `arr.size()` (c) `arr.length` (d) `length(arr)`

(c) arr.length

4. Binary search works only on (a) unsorted arrays (b) sorted arrays (c) strings (d) char arrays

(b) sorted arrays

5. "Computer".charAt(3) returns (a) 'm' (b) 'p' (c) 'u' (d) 'o'

(b) 'p' (C0 o1 m2 p3)

6. "JAVA".substring(1, 3) is (a) "JA" (b) "AV" (c) "AVA" (d) "JAV"

(b) "AV"

7. Which method removes leading and trailing spaces? (a) strip (b) cut (c) trim() (d) clean()

(c) trim()

8. "Hello".indexOf('z') returns (a) 0 (b) -1 (c) null (d) error

(b) -1 (not found)

9. Default value of elements of a new int array is (a) 1 (b) 0 (c) null (d) garbage

(b) 0

10. Which compares two strings ignoring case? (a) equals() (b) compareTo() (c) equalsIgnoreCase() (d) ==

(c) equalsIgnoreCase()

11. " Hi ".trim().length() is (a) 6 (b) 4 (c) 2 (d) 0

(c) 2

12. Which sort compares adjacent elements and swaps them? (a) selection (b) bubble (c) insertion (d) merge

(b) bubble**B. Very short and output questions**

1. Declare an array to store the names of 30 students.

```
String names[] = new String[30];
```

2. Give the output: `int ar[] = {4, 7, 1, 9, 3}; System.out.println(ar[1] + ar[3]);`

16 (7 + 9).

3. Give the output: `System.out.println("Bhubaneswar".toUpperCase().indexOf("NES"));`

5

4. Give the output: `System.out.println("12" + "8");`
`System.out.println(Integer.parseInt("12") + Integer.parseInt("8"));`

128 and **20**.

5. What does "Odisha".length() return?

6

6. Write the output: `"CHSE".concat(" Odisha").toLowerCase()`

chse odisha

7. Write the output: `"Cuttack".endsWith("ck")` and `"Cuttack".startsWith("cut")`

true and **false** (case-sensitive).

8. What exception is thrown by: `int a[] = new int[3]; a[3] = 5;`

ArrayIndexOutOfBoundsException (valid indices are 0, 1, 2).

C. Short answer questions

1. Write a code segment to find the largest element and sum of an array.

```
int ar[] = {4, 7, 1, 9, 3};
int max = ar[0], sum = 0;
for (int i = 0; i < ar.length; i++) {
    if (ar[i] > max) max = ar[i];
    sum = sum + ar[i];
}
System.out.println("Largest = " + max + ", Sum = " + sum);
```

Output: Largest = 9, Sum = 24

2. Write a code segment to reverse the string "CHSE".

```
String w = "CHSE", res = "";
for (int i = w.length() - 1; i >= 0; i--)
    res = res + w.charAt(i);
System.out.println(res);    // ESHC
```

3. Differentiate linear search and binary search.

Linear search	Binary search
Checks elements one by one from the start	Compares with the middle element and discards half each time
Array may be unsorted	Array must be sorted
Slow for large data (up to n comparisons)	Fast (about $\log_2 n$ comparisons)

4. Differentiate equals() and compareTo().

equals() returns a boolean – true if two strings have exactly the same characters.
compareTo() returns an int – 0 if equal, a negative number if the first string comes before the second in dictionary order, and a positive number if it comes after.

5. Show the passes of bubble sort on {5, 1, 4, 2}.

Pass 1: (5,1) swap → 1 5 4 2; (5,4) swap → 1 4 5 2; (5,2) swap → 1 4 2 5.

Pass 2: (1,4) no swap; (4,2) swap → 1 2 4 5.

Pass 3: no swaps → sorted: **1 2 4 5**.

QB-6. Classes, Objects, Methods and Constructors – Question Bank

Key points to remember

- **OOP features:** encapsulation (wrapping data and methods together, data hiding with private), abstraction (showing only essential features), inheritance (reuse via extends), polymorphism (one name, many forms – overloading and overriding).
- A **class** is a blueprint; an **object** is an instance created with `new`. One class can create many objects.
- A **method** is a named block of code that performs a task. Syntax: `access returnType name(parameters) { body }`. **void** means it returns nothing.
- **Parameters** (formal) are in the method definition; **arguments** (actual) are values passed in the call.
- **Method overloading:** same method name with different number or type of parameters in the same class.
- A **constructor** has the same name as the class, has no return type (not even void), and is called automatically when an object is created. Types: default (no parameters) and parameterised. Constructors can be overloaded.
- If no constructor is written, Java supplies a default constructor that sets members to default values (0, null, false).
- **static** members belong to the class, not to individual objects; they are shared by all objects and called using the class name (`Math.sqrt()`).
- **this** refers to the current object, e.g. `this.name = name;`

```
class Rectangle {
    private int length, breadth;           // data members
    Rectangle() { length = 1; breadth = 1; } // default constructor
    Rectangle(int l, int b) {               // parameterised constructor
        length = l; breadth = b;
    }
    int area() { return length * breadth; } // method returning int
    void show() { System.out.println("Area = " + area()); }
}
// in main:
Rectangle r1 = new Rectangle();           // Area = 1
Rectangle r2 = new Rectangle(5, 4);       // Area = 20
```

A. Multiple choice questions

1. An object is created using the keyword (a) class (b) new (c) create (d) object

(b) new

2. A constructor has (a) return type int (b) return type void (c) no return type (d) return type of class

(c) no return type

3. Wrapping data and methods into a single unit is (a) inheritance (b) encapsulation (c) polymorphism (d) abstraction

(b) encapsulation

4. Two methods with the same name but different parameters in a class is (a) overriding (b) overloading (c) inheritance (d) hiding

(b) overloading

5. The keyword that refers to the current object is (a) super (b) this (c) self (d) me

(b) this

6. A method that does not return any value has return type (a) null (b) void (c) 0 (d) empty

(b) void

7. Members declared private are accessible (a) everywhere (b) in the same package (c) only within the class (d) in sub-classes

(c) only within the class

8. A class is (a) an instance of an object (b) a blueprint for objects (c) a variable (d) a method

(b) a blueprint for objects

9. Which method is the starting point of a Java application? (a) start() (b) run() (c) main() (d) init()

(c) main()

10. Static methods are called using (a) object name only (b) class name (c) this (d) super

(b) class name**B. Very short answer questions****1. Define object.**

An instance of a class that has its own state (values of data members) and behaviour (methods).

2. What is a method signature?

The method name together with the number, type and order of its parameters.

3. Write the prototype of a method *calc* that takes two doubles and returns a double.

```
double calc(double a, double b)
```

4. What is the use of the return statement?

It sends a value back to the calling statement and ends the method.

5. What is polymorphism?

The ability of one name (method) to take many forms – e.g. overloaded methods behave differently for different arguments.

6. Give the output: `static int sq(int n) { return n * n; } System.out.println(sq(4) + sq(3)); System.out.println("" + sq(4) + sq(3));`

25 and **169** (the second joins "16" and "9").

C. Short answer questions

1. Differentiate class and object.

Class	Object
Blueprint/template	Real instance made from the class
Declared once with keyword class	Many can be created with new
Does not occupy memory for data	Occupies memory
Example: Car	Example: myCar, yourCar

2. Differentiate constructor and method.

A constructor has the same name as the class, has no return type, and runs automatically once when an object is created; it is used to initialise the object. A method can have any name, must have a return type (or void), and runs only when called explicitly; it performs a task and may be called many times.

3. Explain constructor overloading with an example.

Having more than one constructor in a class with different parameter lists.

```
class Box {
    int side;
    Box()      { side = 1; }
    Box(int s) { side = s; }
    int volume() { return side * side * side; }
}
Box b1 = new Box();      // volume 1
Box b2 = new Box(3);     // volume 27
```

4. Write a method that returns true if a number is even.

```
boolean isEven(int n) {
    return n % 2 == 0;
}
```

5. What are actual and formal parameters?

Formal parameters are variables listed in the method definition, e.g. `int add(int a, int b)` – a and b. Actual parameters (arguments) are values passed when the method is called, e.g. `add(5, 7)` – 5 and 7 are copied into a and b.

D. Long answer question

Define a class Student with data members roll, name and marks of three subjects. Include a parameterised constructor, a method total() and a method display() which prints the details and grade (A if average ≥ 80 , B if ≥ 60 , else C). Create two objects in main.

```
class Student {
    int roll; String name; int m1, m2, m3;
    Student(int r, String n, int a, int b, int c) {
        roll = r; name = n; m1 = a; m2 = b; m3 = c;
    }
    int total() { return m1 + m2 + m3; }
    void display() {
        double avg = total() / 3.0;
        char grade;
        if (avg >= 80) grade = 'A';
        else if (avg >= 60) grade = 'B';
        else grade = 'C';
        System.out.println(roll + " " + name + " Total=" + total() + " Grade=" +
grade);
    }
}
public class StudentDemo {
    public static void main(String[] args) {
        Student s1 = new Student(1, "Anita", 85, 90, 78);
        Student s2 = new Student(2, "Rahul", 55, 62, 70);
        s1.display();
        s2.display();
    }
}
```

Output:

```
1 Anita Total=253 Grade=A
2 Rahul Total=187 Grade=B
```

(253/3 = 84.33 → A; 187/3 = 62.33 → B)

QB-7. Inheritance and Exception Handling – Question Bank

Key points to remember

- **Inheritance**: the child (sub/derived) class acquires the members of the parent (super/base) class using `extends`. Private members are not directly accessible in the child.
- Types supported with classes: **single**, **multilevel**, **hierarchical**. **Multiple inheritance** (one class extending two classes) is **not** allowed with classes; it is achieved with **interfaces** (implements).
- **super** calls the parent constructor (`super(a, b)` – must be the first statement) or a parent method (`super.show()`).
- When a child object is created, the **parent constructor runs first**, then the child constructor.
- **Method overriding**: the child class redefines a parent method with the same name and parameters. The version that runs depends on the actual object (run-time polymorphism).
- A **final** class cannot be inherited; a final method cannot be overridden.
- An **exception** is an abnormal event during execution (run-time error). Handling it prevents the program from crashing.
- Keywords: **try** (code that may fail), **catch** (handles the error), **finally** (always runs), **throw** (raise an exception manually), **throws** (declare that a method may raise an exception).
- Common exceptions: `ArithmeticException` (divide by zero), `ArrayIndexOutOfBoundsException`, `NumberFormatException` (`Integer.parseInt("abc")`), `NullPointerException`, `SQLException`, `ClassNotFoundException` (JDBC driver missing).

Error type	When found	Example
Syntax (compile-time) error	By the compiler	Missing semicolon, misspelt keyword
Run-time error (exception)	While running	Division by zero, wrong index
Logical error	By checking wrong output	Using + instead of * in a formula

A. Multiple choice questions

1. Inheritance is achieved with the keyword (a) implements (b) extends (c) inherits (d) super

(b) extends

2. Java does not support which inheritance through classes? (a) single (b) multilevel (c) multiple (d) hierarchical

(c) multiple

3. $A \rightarrow B \rightarrow C$ is (a) single (b) multilevel (c) hierarchical (d) hybrid

(b) multilevel

4. The keyword used to call the parent class constructor is (a) this (b) super (c) parent (d) base

(b) super

5. Which block always executes whether or not an exception occurs? (a) try (b) catch (c) finally (d) throw

(c) finally

6. `10 / 0` (integers) throws (a) `NullPointerException` (b) `ArithmeticException` (c) `NumberFormatException` (d) `IOException`

(b) ArithmeticException

7. `Integer.parseInt("12a")` throws (a) `ArithmeticException` (b) `NumberFormatException` (c) `SQLException` (d) no exception

(b) NumberFormatException

8. A class that cannot be inherited is declared (a) static (b) final (c) private (d) abstract

(b) final

9. Redefining a parent method in the child class is (a) overloading (b) overriding (c) hiding (d) casting

(b) overriding

10. Which keyword is used to manually raise an exception? (a) throws (b) throw (c) catch (d) raise

(b) throw

B. Output-based questions

1. Write the output.

```
class A {  
    A() { System.out.println("A constructor"); }  
    void show() { System.out.println("Show of A"); }  
}  
class B extends A {  
    B() { System.out.println("B constructor"); }  
    void show() { System.out.println("Show of B"); }  
}  
// in main:  
A o = new B();  
o.show();
```

Output:

```
A constructor  
B constructor  
Show of B
```

The parent constructor runs first. Although the reference is of type A, the object is B, so the overridden `show()` of B runs.

2. Write the output.

```
try {
    int z = 10 / 0;
    System.out.println("after");
} catch (ArithmeticException e) {
    System.out.println("Error: " + e.getMessage());
} finally {
    System.out.println("Finally block");
}
```

Output:

```
Error: / by zero
Finally block
```

"after" is never printed because control jumps to catch as soon as the exception occurs.

3. What is printed?

```
try {
    int arr[] = new int[3];
    arr[3] = 5;
    System.out.println("Stored");
} catch (ArrayIndexOutOfBoundsException e) {
    System.out.println("Index error");
}
```

Output: Index error

C. Short answer questions**1. Differentiate method overloading and overriding.**

Overloading	Overriding
Same name, different parameters	Same name and same parameters
Within the same class	In parent and child classes
Decided at compile time	Decided at run time
Inheritance not needed	Inheritance needed

2. Write any four advantages of inheritance.

(i) Code reusability – common code is written once in the parent. (ii) Less time and effort in development. (iii) Easy maintenance – a change in the parent reflects in all children. (iv) Supports method overriding and run-time polymorphism; models real-world "is-a" relationships.

3. Differentiate throw and throws.

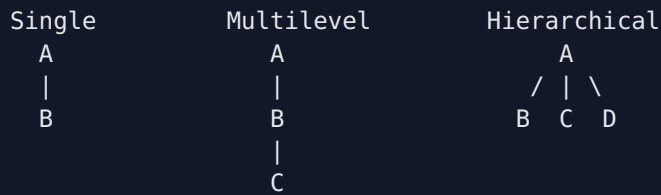
throw is used inside a method to actually raise an exception object: `throw new ArithmeticException("Invalid");`. throws is written in the method heading to declare that the method may pass an exception to its caller: `void connect() throws SQLException`.

4. Why is exception handling necessary in database programs?

Many things can go wrong at run time – the MySQL server may be off, the password may be wrong, the JDBC driver may be missing (`ClassNotFoundException`) or the SQL may contain a mistake (`SQLException`). A try-catch block catches these errors, shows a friendly message with `e.getMessage()`, and prevents the application from crashing.

D. Long answer question

Explain the types of inheritance with diagrams and write a program for multilevel inheritance.



Single: one child from one parent. **Multilevel:** a child becomes the parent of another class (grandparent → parent → child). **Hierarchical:** many children from one parent. **Multiple** (one child, two parents) is possible only through interfaces.

```
class Person {
    String name = "Sita";
    void showName() { System.out.println("Name: " + name); }
}
class Employee extends Person {
    double salary = 30000;
    void showSalary() { System.out.println("Salary: " + salary); }
}
class Manager extends Employee {
    String dept = "Sales";
    void showAll() {
        showName(); showSalary();
        System.out.println("Dept: " + dept);
    }
}
public class Multi {
    public static void main(String[] args) {
        new Manager().showAll();
    }
}
```

Output:

```
Name: Sita
Salary: 30000.0
Dept: Sales
```

QB-8. JDBC – Connecting Java with MySQL

Key points to remember

- **JDBC** (Java Database Connectivity) is the Java API (package `java.sql`) used to connect a Java program (front-end) with a database (back-end) such as MySQL.
- **ODBC** (Open Database Connectivity) is a language-independent standard by Microsoft for accessing databases.
- A **JDBC driver** (for MySQL: Connector/J, class `com.mysql.cj.jdbc.Driver`) translates Java calls into database commands. It must be added to the project's Libraries in NetBeans.
- Connection URL format: `jdbc:mysql://localhost:3306/databaseName` (3306 is the default MySQL port).
- Seven steps: import `java.sql.*` → load driver (`Class.forName`) → get connection (`DriverManager.getConnection`) → create statement (`createStatement`) → execute (`executeQuery` / `executeUpdate`) → process `ResultSet` (`next`, `getString`, `getInt`) → close.
- `executeQuery()` is for `SELECT` and returns a **ResultSet**. `executeUpdate()` is for `INSERT`, `UPDATE`, `DELETE` and `DDL` and returns an **int** (number of rows affected).
- A **ResultSet** is a table of data returned by a query, with a **cursor** initially positioned **before the first row**; `next()` moves it forward and returns `false` when no rows remain.
- Columns can be read by name (`rs.getString("Name")`) or by position starting at 1 (`rs.getString(2)`).
- Exceptions to catch: `ClassNotFoundException` (driver missing) and `SQLException` (wrong query, password, server off).

```
import java.sql.*;
public class ShowStudents {
    public static void main(String[] args) {
        try {
            Class.forName("com.mysql.cj.jdbc.Driver"); // step 2
            Connection con = DriverManager.getConnection(
                "jdbc:mysql://localhost:3306/school", "root", "tiger"); // step 3
            Statement st = con.createStatement(); // step 4
            ResultSet rs = st.executeQuery(
                "SELECT RollNo, Name, Marks FROM student ORDER BY Marks DESC"); // step 5
            while (rs.next()) { // step 6
                System.out.println(rs.getInt("RollNo") + " "
                    + rs.getString("Name") + " " + rs.getInt("Marks"));
            }
            rs.close(); st.close(); con.close(); // step 7
        } catch (Exception e) {
            System.out.println("Error: " + e.getMessage());
        }
    }
}
```

A. Multiple choice questions

1. JDBC stands for (a) Java Data Base Control (b) Java Database Connectivity (c) Joint Database Connection (d) Java Driver Base Code

(b)

2. The package to be imported for JDBC is (a) java.io (b) java.sql (c) java.net (d) javax.swing
(b) java.sql
3. Which method loads the JDBC driver? (a) DriverManager.load() (b) Class.forName() (c) Connection.open() (d) Driver.start()
(b) Class.forName()
4. Which method returns a Connection object? (a) createStatement() (b) getConnection() (c) executeQuery() (d) next()
(b) getConnection()
5. Which method is used to execute a SELECT query? (a) executeUpdate() (b) executeQuery() (c) execute() only (d) runQuery()
(b) executeQuery()
6. executeUpdate() returns (a) ResultSet (b) boolean (c) int (d) String
(c) int – number of rows affected
7. Initially the ResultSet cursor is (a) on the first row (b) before the first row (c) on the last row (d) after the last row
(b) before the first row
8. The default port number of MySQL is (a) 80 (b) 8080 (c) 3306 (d) 1521
(c) 3306
9. rs.next() returns (a) int (b) boolean (c) String (d) ResultSet
(b) boolean
10. If the MySQL driver jar is not added, the exception thrown is (a) SQLException (b) ClassNotFoundException (c) ArithmeticException (d) IOException
(b) ClassNotFoundException
11. Which class has the method addRow()? (a) ResultSet (b) Statement (c) DefaultTableModel (d) Connection
(c) DefaultTableModel
12. The column index in rs.getString(1) starts at (a) 0 (b) 1 (c) –1 (d) any
(b) 1

B. Very short answer questions

1. What is a ResultSet?

An object that holds the rows returned by a SELECT query, read row by row with a cursor.

2. What is a JDBC driver?

Software that translates JDBC calls from a Java program into commands understood by a particular database.

3. Write the statement to connect to database "shop" of local MySQL with user root and password abc.

```
Connection con = DriverManager.getConnection("jdbc:mysql://localhost:3306/shop", "root", "abc");
```

4. Name the method used to close a connection.

```
con.close()
```

5. Which method of DefaultTableModel removes all rows?

setRowCount(0); a single row is removed with removeRow(index).

6. Which method moves the ResultSet cursor to the last row?

rs.last() (and rs.first() to the first row).

7. What is a front-end and a back-end?

Front-end: the user interface (Java form/HTML page) through which the user enters and sees data. Back-end: the database (MySQL) where data is stored.

C. Short answer questions

1. Write the steps for connecting a Java application to a MySQL database.

(1) Add the MySQL Connector/J jar to the Libraries of the project. (2) Write import java.sql.*; (3) Register the driver: Class.forName("com.mysql.cj.jdbc.Driver"); (4) Create a connection with DriverManager.getConnection(url, user, pwd). (5) Create a Statement with con.createStatement(). (6) Execute SQL using executeQuery() or executeUpdate(). (7) Process the ResultSet in a while(rs.next()) loop. (8) Close ResultSet, Statement and Connection.

2. Differentiate executeQuery() and executeUpdate().

executeQuery()	executeUpdate()
Used for SELECT	Used for INSERT, UPDATE, DELETE, CREATE, ALTER, DROP
Returns a ResultSet	Returns an int (rows affected)
rs = st.executeQuery("SELECT * FROM emp");	n = st.executeUpdate("DELETE FROM emp WHERE City='Puri'");

3. Write code to delete a record whose roll number is entered in txtRoll, and show how many rows were deleted.

```
int r = Integer.parseInt(txtRoll.getText());
int n = st.executeUpdate("DELETE FROM student WHERE RollNo = " + r);
JOptionPane.showMessageDialog(null, n + " record(s) deleted");
```

4. Write code to update the marks of a student (roll in txtRoll, new marks in txtMarks).

```
String q = "UPDATE student SET Marks = " + txtMarks.getText()
    + " WHERE RollNo = " + txtRoll.getText();
st.executeUpdate(q);
JOptionPane.showMessageDialog(null, "Marks updated");
```

5. Write code to search a student by name (txtName) and display marks in txtMarks.

```
ResultSet rs = st.executeQuery("SELECT Marks FROM student WHERE Name = '"  
                                + txtName.getText() + "'");  
if (rs.next())  
    txtMarks.setText("" + rs.getInt("Marks"));  
else  
    JOptionPane.showMessageDialog(null, "No such student");
```

Note: text values in SQL must be inside single quotes.

6. Name the classes/interfaces used in JDBC with one method each.

DriverManager – getConnection(); Connection – createStatement(), close(); Statement – executeQuery(), executeUpdate(); ResultSet – next(), getString(), getInt(), first(), last(); Class – forName(); Exception – getMessage().

QB-9. HTML and Web Page Design – Question Bank

Key points to remember

- **HTML** (HyperText Markup Language) describes the structure of web pages using **tags**. It is not a programming language and is not case-sensitive.
- **Container tags** have opening and closing parts (`<b></b>`); **empty tags** have no closing tag (`<br>`, `<hr>`, `<img>`).
- **Attributes** give extra information inside the opening tag: `<body bgcolor="yellow">`.
- Structure: `<html>` → `<head>` (with `<title>`) → `<body>`.
- Headings `<h1>` (largest) to `<h6>` (smallest); `<p>` paragraph; `<br>` line break; `<hr>` horizontal rule.
- Lists: `<ul>` (bullets: disc, circle, square), `<ol>` (numbers: 1, A, a, I, i; start attribute), `<dl><dt><dd>` (definition list).
- Links: `<a href="url">text</a>`; `target="_blank"` opens in a new tab; `mailto:` opens e-mail.
- Images: ``.
- Tables: `<table border cellpadding cellspacing>`, `<tr>` row, `<th>` header cell, `<td>` data cell, `colspan` and `rowspan` to merge cells, `<caption>` title.
- Forms: `<form action method>` with `<input type= text, password, radio, checkbox, submit, reset>`, `<select><option>`, `<textarea rows cols>`.
- **XML** stores and carries data with user-defined, case-sensitive tags that must all be closed. **DHTML** = HTML + CSS + JavaScript + DOM for interactive pages.

A. Multiple choice questions

1. HTML stands for (a) Hyper Text Making Language (b) HyperText Markup Language (c) High Text Markup Language (d) Hyperlink Text Mark Language
(b)
2. The largest heading tag is (a) `<h6>` (b) `<head>` (c) `<h1>` (d) `<heading>`
(c) `<h1>`
3. Which is an empty tag? (a) `<p>` (b) `<br>` (c) `<b>` (d) `<table>`
(b) `<br>`
4. The attribute to set the background colour of a page is (a) background (b) bgcolor (c) color (d) text
(b) bgcolor
5. Which tag creates a hyperlink? (a) `<link>` (b) `<a>` (c) `<href>` (d) `<url>`
(b) `<a>`
6. Which attribute of `<img>` gives the file name? (a) href (b) src (c) alt (d) file
(b) src
7. To merge two columns in a table we use (a) rowspan (b) colspan (c) merge (d) cellspan
(b) colspan

8. `<ol type="I">` numbers items as (a) 1, 2, 3 (b) A, B, C (c) I, II, III (d) i, ii, iii
(c) I, II, III
9. Which input type hides the typed characters? (a) text (b) hidden (c) password (d) secret
(c) password
10. Which control allows only one choice from a group? (a) checkbox (b) radio (c) textarea (d) submit
(b) radio (all buttons in a group share the same name)
11. The default type of an unordered list bullet is (a) circle (b) square (c) disc (d) none
(c) disc
12. Range of the size attribute of `<font>` is (a) 1-6 (b) 1-7 (c) 0-10 (d) 8-72
(b) 1-7 (default 3)
13. XML is mainly used to (a) display data (b) store and transport data (c) design forms (d) create games
(b)
14. Which tag is used for a table heading cell? (a) `<td>` (b) `<th>` (c) `<tr>` (d) `<thead>` only
(b) `<th>`
15. The text in the `<title>` tag appears on (a) the body (b) the browser tab/title bar (c) status bar (d) nowhere
(b)

B. Very short answer questions

1. What is a tag?

An HTML command written inside angle brackets that tells the browser how to display content, e.g. `<b>`.

2. What is an attribute? Give an example.

Extra information given inside an opening tag as `name="value"`, e.g. `<hr width="50%">`.

3. Write the HTML to open www.google.com in a new tab.

```
<a href="https://www.google.com" target="_blank">Google</a>
```

4. What is the use of the alt attribute?

It shows alternative text when the image cannot be displayed and helps visually impaired users.

5. Write the code to insert a red horizontal line of thickness 4.

```
<hr size="4" color="red">
```

6. Write the tag to create an e-mail link.

```
<a href="mailto:office@school.in">Mail us</a>
```

7. Name the two values of the method attribute of a form.

get and post.

8. What is a static web page?

A page whose content is fixed and is the same for every visitor.

9. What is the extension of an HTML file?

.html or .htm

10. Which tags make text bold, italic and underlined?

, <i> and <u>.

C. Short answer questions**1. Differentiate container and empty tags.**

Container tags have a starting and an ending tag and enclose content: <p>text</p>, text. Empty tags have only a starting tag and do not enclose content:
, <hr>, .

2. Differentiate HTML and XML.

HTML displays data, uses predefined tags, is not case-sensitive and some tags need not be closed. XML stores and transports data, allows user-defined tags, is case-sensitive and all tags must be closed and properly nested.

3. Differentiate static and dynamic web pages.

A static page shows the same fixed content to every visitor and is written in plain HTML (e.g. "About us" page). A dynamic page changes its content according to the user, time or database (e.g. exam result page, online shopping cart) and is created with scripts like JavaScript, PHP or JSP.

4. Differentiate and .

 makes an unordered (bulleted) list where order does not matter; type = disc/circle/square. makes an ordered (numbered) list where order matters; type = 1/A/a/I/i and start sets the first number.

5. Write HTML to create the following table.

```
+-----+
|      Class XII Result      |
+-----+-----+
| Stream | Pass % |
+-----+-----+
| Science | 82    |
| Commerce | 85    |
+-----+-----+
```

```
<table border="1">
  <tr><th colspan="2">Class XII Result</th></tr>
  <tr><th>Stream</th><th>Pass %</th></tr>
  <tr><td>Science</td><td>82</td></tr>
  <tr><td>Commerce</td><td>85</td></tr>
</table>
```

6. What is DHTML? Name its components.

Dynamic HTML is not a language but a combination of technologies used to make web pages interactive and animated without reloading: HTML (structure), CSS (style), JavaScript (behaviour) and DOM (Document Object Model, which lets scripts change page elements).

QB-10. Database Concepts and SQL – Question Bank

Key points to remember

- **Database:** organised collection of related data. **DBMS:** software to create and manage databases. **RDBMS** stores data in tables (relations) – MySQL, Oracle, PostgreSQL.
- Terms: **relation** = table, **tuple** = row/record, **attribute** = column/field, **degree** = number of columns, **cardinality** = number of rows, **domain** = set of allowed values of a column.
- Keys: **primary key** (unique + not null, identifies each row), **candidate key** (any column that can be a primary key), **alternate key** (candidate keys not chosen), **foreign key** (refers to the primary key of another table).
- SQL categories: **DDL** – CREATE, ALTER, DROP; **DML** – INSERT, UPDATE, DELETE, SELECT; **TCL** – COMMIT, ROLLBACK, SAVEPOINT.
- Constraints: PRIMARY KEY, NOT NULL, UNIQUE, DEFAULT, CHECK, FOREIGN KEY.
- Data types: INT, DECIMAL(p,s), CHAR(n) (fixed length), VARCHAR(n) (variable length), DATE ('YYYY-MM-DD').
- Operators in WHERE: =, <>, >, <, BETWEEN (inclusive), IN (list), LIKE ('%' any number of characters, '_' exactly one), IS NULL, AND, OR, NOT.
- Aggregate functions: SUM, AVG, MAX, MIN, COUNT – ignore NULLs except COUNT(*).
- Clause order: **SELECT - FROM - WHERE - GROUP BY - HAVING - ORDER BY**.
- Join: Cartesian product gives $m \times n$ rows and $(c1 + c2)$ columns; equi-join adds WHERE $t1.col = t2.col$.

Use this table **BOOK** for the questions below.

BookID	Title	Author	Subject	Price	Qty
B01	Let Us Java	Kanetkar	Computer	350	5
B02	Odia Sahitya	Mohanty	Literature	220	3
B03	MySQL Basics	Sharma	Computer	410	2
B04	Physics Vol 1	Verma	Science	500	4
B05	Chemistry Today	Sharma	Science	450	NULL
B06	Web Design	Kanetkar	Computer	300	6

A. Multiple choice questions

1. The degree of table **BOOK** is (a) 6 (b) 5 (c) 36 (d) 12

(a) 6 (six columns; cardinality is also 6 rows)

2. Which command removes the table along with its structure? (a) DELETE (b) DROP TABLE (c) REMOVE (d) TRUNCATE ROW

(b) DROP TABLE

3. Which is a DDL command? (a) INSERT (b) UPDATE (c) ALTER (d) SELECT

(c) ALTER

4. The wildcard for exactly one character in LIKE is (a) % (b) _ (c) * (d) ?

(b) _

5. SELECT COUNT(Qty) FROM book; gives (a) 6 (b) 5 (c) 20 (d) NULL

(b) 5 (NULL is ignored)

6. Which clause is used with GROUP BY to filter groups? (a) WHERE (b) HAVING (c) ORDER BY (d) LIMIT

(b) HAVING

7. A primary key column cannot contain (a) numbers (b) duplicate or NULL values (c) text (d) dates

(b)

8. Price BETWEEN 300 AND 410 includes how many books? (a) 2 (b) 3 (c) 4 (d) 5

(b) 3 – 350, 410, 300 (both ends included)

9. Which keyword removes duplicate values from output? (a) UNIQUE (b) DISTINCT (c) DIFFERENT (d) SINGLE

(b) DISTINCT

10. Default sorting order of ORDER BY is (a) DESC (b) ASC (c) random (d) by primary key

(b) ASC

11. A column that refers to the primary key of another table is (a) candidate key (b) alternate key (c) foreign key (d) super key

(c) foreign key

12. Which command saves a transaction permanently? (a) SAVE (b) COMMIT (c) ROLLBACK (d) END

(b) COMMIT

B. Write SQL queries with output (table BOOK)

1. Display titles and prices of Computer books.

```
SELECT Title, Price FROM book WHERE Subject = 'Computer';
```

Output: Let Us Java 350 | MySQL Basics 410 | Web Design 300

2. Display books sorted by price in descending order.

```
SELECT * FROM book ORDER BY Price DESC;
```

Order: B04 (500), B05 (450), B03 (410), B01 (350), B06 (300), B02 (220).

3. Display titles starting with 'M' or ending with 'n'.

```
SELECT Title FROM book WHERE Title LIKE 'M%' OR Title LIKE '%n';
```

Output: MySQL Basics, Web Design

4. Display the number of books and total quantity for each subject.

```
SELECT Subject, COUNT(*), SUM(Qty) FROM book GROUP BY Subject;
```

Subject	COUNT(*)	SUM(Qty)
Computer	3	13
Literature	1	3
Science	2	4

5. Display authors who have written more than one book.

```
SELECT Author, COUNT(*) FROM book GROUP BY Author HAVING COUNT(*) > 1;
```

Output: Kanetkar 2 | Sharma 2

6. Display the book whose quantity is not known.

```
SELECT Title FROM book WHERE Qty IS NULL;
```

Output: Chemistry Today

7. Display average, maximum and minimum price.

```
SELECT AVG(Price), MAX(Price), MIN(Price) FROM book;
```

Output: 371.6667 (2230 ÷ 6), 500, 220

8. Increase the price of all Science books by 10%.

```
UPDATE book SET Price = Price * 1.10 WHERE Subject = 'Science';
```

B04 becomes 550, B05 becomes 495.

9. Display title and stock value (Price × Qty) as "Value".

```
SELECT Title, Price * Qty AS Value FROM book;
```

Let Us Java 1750, Odia Sahitya 660, MySQL Basics 820, Physics Vol 1 2000, Chemistry Today NULL, Web Design 1800.

10. Display the different subjects.

```
SELECT DISTINCT Subject FROM book;
```

Output: Computer, Literature, Science

C. Short answer questions

1. Differentiate primary key and foreign key.

A primary key uniquely identifies each row of its own table and cannot be NULL or repeated. A foreign key is a column in one table whose values must match the primary key values of another (parent) table; it can repeat and links the two tables, maintaining referential integrity.

2. Differentiate CHAR and VARCHAR.

CHAR(n) is fixed length – every value uses n characters (padded with spaces); good for fixed-size data like PIN code or gender. VARCHAR(n) is variable length – uses only as much space as the actual data up to n; good for names and addresses.

3. Differentiate DDL and DML with two examples each.

DDL (Data Definition Language) defines or changes the structure of database objects: CREATE TABLE, ALTER TABLE, DROP TABLE. DML (Data Manipulation Language) works with the data in tables: INSERT, UPDATE, DELETE, SELECT.

4. Write a CREATE TABLE command for table BOOK with BookID as primary key and Title not null.

```
CREATE TABLE book (  
    BookID CHAR(3) PRIMARY KEY,  
    Title VARCHAR(40) NOT NULL,  
    Author VARCHAR(25),  
    Subject VARCHAR(15),  
    Price DECIMAL(7,2),  
    Qty INT  
);
```

5. Table STUDENT has 5 rows and 4 columns; table CLUB has 3 rows and 2 columns. Find degree and cardinality of their Cartesian product.

Degree = $4 + 2 = 6$; Cardinality = $5 \times 3 = 15$.

6. What are ACID properties of a transaction?

Atomicity – all statements of a transaction are done or none is done. Consistency – the database moves from one valid state to another. Isolation – simultaneous transactions do not interfere with each other. Durability – once committed, changes survive even a power failure.

QB-11. IT Applications – e-Governance, e-Business, e-Learning

Key points to remember

- **e-Governance:** use of ICT by government to deliver services, information and transactions to citizens (G2C), businesses (G2B), employees (G2E) and other governments (G2G). Examples: DigiLocker, UMANG, passport seva, income tax e-filing, Odisha One, e-District, land records (Bhulekh Odisha), CHSE online results.
- **e-Business:** running all business activities online; **e-commerce** is the buying and selling part. Models: B2C, B2B, C2C, C2B, B2G. Examples: Amazon, Flipkart, IndiaMART, OLX, GeM.
- **e-Learning:** learning with electronic media and the internet – online courses, videos, virtual classrooms, quizzes. Examples: SWAYAM, DIKSHA, NPTEL, e-Pathshala, Khan Academy. Synchronous (live) vs asynchronous (recorded, self-paced).
- An IT application has a **front-end** (user interface: forms, buttons) and a **back-end** (database), linked by **connectivity** (JDBC).
- Good front-end: simple, consistent, attractive, error messages, input validation. Good back-end: proper tables, keys, data types, security, backups.

A. Multiple choice questions

1. DigiLocker is an example of (a) e-business (b) e-governance (c) e-learning (d) social media
(b) e-governance
2. Flipkart selling to a customer is (a) B2B (b) B2C (c) C2C (d) G2C
(b) B2C
3. OLX is an example of (a) B2B (b) C2C (c) G2B (d) B2G
(b) C2C
4. SWAYAM is a platform for (a) e-shopping (b) e-learning (c) e-banking (d) e-tendering
(b) e-learning
5. The user interface of an application is called (a) back-end (b) front-end (c) database (d) server
(b) front-end
6. Payment of income tax online is (a) G2C/C2G service (b) B2B (c) C2C (d) e-learning
(a)
7. A live online class at a fixed time is (a) asynchronous (b) synchronous (c) offline (d) blended
(b) synchronous
8. GeM portal is used for (a) government purchase from businesses (b) music (c) games (d) mail
(a) – Government e-Marketplace (B2G)

B. Very short answer questions

1. Define e-governance.

Application of ICT to provide government services and information to citizens, businesses and other government bodies efficiently and transparently.

2. Expand ICT, G2C, B2B.

Information and Communication Technology; Government to Citizen; Business to Business.

3. Name two e-governance portals of Odisha.

Odisha One, Bhulekh (land records), e-District Odisha, SAMS Odisha (online admission), Odisha e-Procurement.

4. What is a payment gateway?

A secure online service that transfers payment details between the customer, the e-commerce site and the bank (e.g. via UPI, card, net banking).

5. What is a virtual classroom?

An online environment where teacher and students meet live through video, chat and shared whiteboard.

C. Short answer questions

1. Write any four benefits of e-governance.

(i) Services available 24 × 7 from home, saving time and travel. (ii) Transparency – less corruption since files and status are visible online. (iii) Faster processing and less paperwork. (iv) Reaches rural citizens through Common Service Centres; reduces cost for both government and citizens.

2. Write any four advantages and two limitations of e-learning.

Advantages: learn anytime, anywhere; self-paced – videos can be replayed; access to the best teachers and free courses; cheaper than travelling for coaching; quizzes give instant feedback. Limitations: needs devices and good internet; less face-to-face interaction and practical work; requires self-discipline.

3. What features should a good e-business website have?

Attractive and easy navigation; search and filter; clear product images, descriptions and prices; shopping cart; secure payment (HTTPS, payment gateway) with many options; order tracking; reviews and ratings; easy return and refund policy; customer support; privacy policy.

4. Explain front-end, back-end and connectivity with an example.

In an online library system, the **front-end** is the Java/HTML form where a student types the book ID and clicks "Issue". The **back-end** is the MySQL database containing tables BOOK, MEMBER and ISSUE. **Connectivity** (JDBC) carries the request from the form to the database – it inserts a row into ISSUE and reduces the quantity in BOOK, then shows "Book issued" on the form.

D. Long answer question

Design an e-governance application for "Online Scholarship Application": list the front-end controls, the back-end table and the connectivity steps.

Front-end form: Text fields – Student name, Roll number, Aadhaar (12 digits), Bank account no., Annual family income, Percentage in Class X; Radio buttons – Gender, Category (General/OBC/SC/ST); Combo box – District, Institution type; Check box – "I declare that information is true"; Buttons – Submit, Reset, Check Status, Exit; Label/ Table – status message.

Back-end table:

```
CREATE TABLE scholarship (  
    AppID      INT PRIMARY KEY AUTO_INCREMENT,  
    Name       VARCHAR(40) NOT NULL,  
    RollNo     VARCHAR(15),  
    Aadhaar    CHAR(12) UNIQUE,  
    Gender     CHAR(1),  
    Category   VARCHAR(8),  
    District   VARCHAR(20),  
    Income     DECIMAL(10,2),  
    Percent    DECIMAL(5,2),  
    Status     VARCHAR(12) DEFAULT 'Pending'  
);
```

Connectivity steps: On Submit: validate (name not empty, Aadhaar 12 digits, declaration ticked) → connect with JDBC → executeUpdate("INSERT INTO scholarship (Name, RollNo, Aadhaar, Gender, Category, District, Income, Percent) VALUES (values taken from the form)") → show "Application submitted". On Check Status: executeQuery("SELECT Status FROM scholarship WHERE Aadhaar = '" + txtAadhaar.getText() + "'") → display the status. The officer's form can run UPDATE scholarship SET Status = 'Approved' WHERE Percent >= 60 AND Income <= 250000.

PR-1. Java Practical Programs with Outputs

HOW TO USE THIS SECTION

Each program below is complete: save it with the file name shown (same as the public class), compile with `javac FileName.java` and run with `java FileName`. Every output shown was produced by actually running the program. In the practical examination write the aim, the program, the output and a short note, exactly in this order.

Program 1. Sum of digits, reverse and palindrome number

File name: DigitOps.java

```
public class DigitOps {
    public static void main(String[] args) {
        int n = 12321, temp = n, sum = 0, rev = 0;
        while (temp > 0) {
            int d = temp % 10;    // last digit
            sum = sum + d;
            rev = rev * 10 + d;
            temp = temp / 10;    // remove last digit
        }
        System.out.println("Number : " + n);
        System.out.println("Sum : " + sum);
        System.out.println("Reverse : " + rev);
        if (rev == n)
            System.out.println(n + " is a palindrome number");
        else
            System.out.println(n + " is not a palindrome number");
    }
}
```

Output:

```
Number : 12321
Sum : 9
Reverse : 12321
12321 is a palindrome number
```

% 10 extracts the last digit and / 10 removes it. The loop runs once for every digit (5 times here). A number equal to its reverse is a palindrome.

Program 2. Armstrong numbers between 100 and 999

File name: Armstrong.java

```
public class Armstrong {
    public static void main(String[] args) {
        System.out.print("Armstrong numbers: ");
        for (int n = 100; n <= 999; n++) {
            int t = n, s = 0;
            while (t > 0) {
                int d = t % 10;
                s = s + d * d * d;
                t = t / 10;
            }
            if (s == n)
                System.out.print(n + " ");
        }
        System.out.println();
    }
}
```

Output:

```
Armstrong numbers: 153 370 371 407
```

A 3-digit number is an Armstrong number if the sum of the cubes of its digits equals the number, e.g. $153 = 1 + 125 + 27$.

Program 3. First 12 terms of the Fibonacci series

File name: Fibonacci.java

```
public class Fibonacci {
    public static void main(String[] args) {
        int a = 0, b = 1;
        System.out.print(a + " " + b);
        for (int i = 3; i <= 12; i++) {
            int c = a + b;
            System.out.print(" " + c);
            a = b;
            b = c;
        }
        System.out.println();
    }
}
```

Output:

```
0 1 1 2 3 5 8 13 21 34 55 89
```

Every term is the sum of the previous two. The variables a and b always hold the last two terms; they are shifted forward after each new term.

Program 4. Prime numbers from 1 to 50 and their count

File name: PrimeRange.java

```
public class PrimeRange {
    static boolean isPrime(int n) {
        if (n < 2) return false;
        for (int i = 2; i * i <= n; i++)
            if (n % i == 0) return false;
        return true;
    }
    public static void main(String[] args) {
        int count = 0;
        for (int n = 1; n <= 50; n++) {
            if (isPrime(n)) {
                System.out.print(n + " ");
                count++;
            }
        }
        System.out.println();
        System.out.println("Total primes = " + count);
    }
}
```

Output:

```
2 3 5 7 11 13 17 19 23 29 31 37 41 43 47
Total primes = 15
```

Checking divisors only up to the square root ($i * i \leq n$) is enough, because a factor larger than the square root must pair with one smaller than it. 1 is not prime.

Program 5. HCF (GCD) and LCM of two numbers using Euclid's method

File name: GcdLcm.java

```
public class GcdLcm {
    public static void main(String[] args) {
        int a = 36, b = 60;
        int x = a, y = b;
        while (y != 0) {
            int r = x % y;
            x = y;
            y = r;
        }
        int gcd = x;
        int lcm = (a * b) / gcd;
        System.out.println("GCD of " + a + " and " + b + " = " + gcd);
        System.out.println("LCM of " + a + " and " + b + " = " + lcm);
    }
}
```

Output:

```
GCD of 36 and 60 = 12
LCM of 36 and 60 = 180
```

Euclid: $\text{GCD}(36, 60) = \text{GCD}(60, 36) = \text{GCD}(36, 24) = \text{GCD}(24, 12) = \text{GCD}(12, 0) = 12$.
Then $\text{LCM} = \text{product} / \text{GCD} = 2160 / 12 = 180$.

Program 6. Factorial using a recursive method

File name: FactRec.java

```
public class FactRec {
    static long fact(int n) {
        if (n <= 1)
            return 1; // base case
        return n * fact(n - 1); // recursive call
    }
    public static void main(String[] args) {
        for (int i = 1; i <= 10; i += 3)
            System.out.println(i + "! = " + fact(i));
        System.out.println("15! = " + fact(15));
    }
}
```

Output:

```
1! = 1
4! = 24
7! = 5040
10! = 3628800
15! = 1307674368000
```

A recursive method calls itself with a smaller value until it reaches the base case. long is used because $15!$ (about 1.3×10^{12}) is too large for int.

Program 7. Floyd's triangle and a star pyramid

File name: Floyd.java

```
public class Floyd {  
    public static void main(String[] args) {  
        int num = 1;  
        for (int i = 1; i <= 4; i++) {  
            for (int j = 1; j <= i; j++) {  
                System.out.print(num + " ");  
                num++;  
            }  
            System.out.println();  
        }  
        System.out.println();  
        int rows = 4;  
        for (int i = 1; i <= rows; i++) {  
            for (int s = 1; s <= rows - i; s++)  
                System.out.print(" ");  
            for (int k = 1; k <= 2 * i - 1; k++)  
                System.out.print("*");  
            System.out.println();  
        }  
    }  
}
```

Output:

```
1  
2 3  
4 5 6  
7 8 9 10  
  
  *  
 ***  
*****  
*****
```

The outer loop controls rows, the inner loop controls columns. In the pyramid, row i has $(rows - i)$ spaces followed by $(2i - 1)$ stars.

Program 8. Multiplication table using a while loop

File name: Table.java

```
public class Table {  
    public static void main(String[] args) {  
        int n = 7, i = 1;  
        while (i <= 10) {  
            System.out.println(n + " x " + i + " = " + (n * i));  
            i++;  
        }  
    }  
}
```

Output:

```
7 x 1 = 7  
7 x 2 = 14  
7 x 3 = 21  
7 x 4 = 28  
7 x 5 = 35  
7 x 6 = 42  
7 x 7 = 49  
7 x 8 = 56  
7 x 9 = 63  
7 x 10 = 70
```

The brackets around `n * i` are not required here (`*` has higher precedence than `+`) but they make the code clearer. Without them in an expression like `n + i`, the numbers would be joined as strings.

Program 9. Simple interest and compound interest

File name: Interest.java

```
public class Interest {  
    public static void main(String[] args) {  
        double p = 10000, r = 8, t = 3;  
        double si = p * r * t / 100;  
        double amount = p * Math.pow(1 + r / 100, t);  
        double ci = amount - p;  
        System.out.println("Simple Interest    = " + si);  
        System.out.printf("Compound Amount    = %.2f%n", amount);  
        System.out.printf("Compound Interest = %.2f%n", ci);  
    }  
}
```

Output:

```
Simple Interest    = 2400.0  
Compound Amount    = 12597.12  
Compound Interest = 2597.12
```

`Math.pow(x, y)` returns x^y as a double. `printf` with `%.2f` prints a value rounded to 2 decimal places and `%n` gives a new line.

Program 10. Grade of students using an if-else-if ladder

File name: Grade.java

```
public class Grade {  
    static char grade(int m) {  
        if (m >= 90) return 'O';  
        else if (m >= 80) return 'E';  
        else if (m >= 70) return 'A';  
        else if (m >= 60) return 'B';  
        else if (m >= 50) return 'C';  
        else if (m >= 30) return 'D';  
        else return 'F';  
    }  
    public static void main(String[] args) {  
        int[] marks = {95, 82, 67, 45, 28};  
        for (int m : marks)  
            System.out.println("Marks " + m + " -> Grade " + grade(m));  
    }  
}
```

Output:

```
Marks 95 -> Grade O  
Marks 82 -> Grade E  
Marks 67 -> Grade B  
Marks 45 -> Grade D  
Marks 28 -> Grade F
```

The conditions are tested from top to bottom and only the first true branch runs, so the order of conditions (highest first) matters. The enhanced for loop `for (int m : marks)` visits every element.

Program 11. Day name from day number using switch

File name: DayName.java

```
public class DayName {  
    public static void main(String[] args) {  
        int[] days = {1, 4, 7, 9};  
        for (int d : days) {  
            String name;  
            switch (d) {  
                case 1: name = "Sunday"; break;  
                case 2: name = "Monday"; break;  
                case 3: name = "Tuesday"; break;  
                case 4: name = "Wednesday"; break;  
                case 5: name = "Thursday"; break;  
                case 6: name = "Friday"; break;  
                case 7: name = "Saturday"; break;  
                default: name = "Invalid day";  
            }  
            System.out.println(d + " : " + name);  
        }  
    }  
}
```

Output:

```
1 : Sunday  
4 : Wednesday  
7 : Saturday  
9 : Invalid day
```

break after each case stops fall-through. default handles any value not matched by a case (here 9).

Program 12. Linear search in an array

File name: LinearSearch.java

```
public class LinearSearch {  
    public static void main(String[] args) {  
        int[] a = {23, 45, 12, 67, 34, 89};  
        int key = 67, pos = -1;  
        for (int i = 0; i < a.length; i++) {  
            if (a[i] == key) {  
                pos = i;  
                break;  
            }  
        }  
        if (pos >= 0)  
            System.out.println(key + " found at index " + pos + " (position " + (pos +  
1) + ")");  
        else  
            System.out.println(key + " not found");  
    }  
}
```

Output:

```
67 found at index 3 (position 4)
```

Linear search compares the key with each element one by one. It works on unsorted arrays. Worst case: n comparisons.

Program 13. Binary search in a sorted array (with steps)

File name: BinarySearch.java

```
public class BinarySearch {
    public static void main(String[] args) {
        int[] a = {5, 12, 18, 25, 33, 47, 58, 69, 74};
        int key = 58, low = 0, high = a.length - 1, found = -1;
        while (low <= high) {
            int mid = (low + high) / 2;
            System.out.println("low=" + low + " high=" + high + " mid=" + mid + "
a[mid]=" + a[mid]);
            if (a[mid] == key) { found = mid; break; }
            else if (key > a[mid]) low = mid + 1;
            else high = mid - 1;
        }
        System.out.println("Element found at index " + found);
    }
}
```

Output:

```
low=0 high=8 mid=4 a[mid]=33
low=5 high=8 mid=6 a[mid]=58
Element found at index 6
```

Binary search works only on a sorted array. Each step halves the search range, so at most about $\log_2 n$ comparisons are needed (here 2 steps instead of 7 for linear search).

Program 14. Bubble sort (ascending) showing each pass

File name: BubbleSort.java

```
public class BubbleSort {
    public static void main(String[] args) {
        int[] a = {64, 25, 12, 22, 11};
        int n = a.length;
        for (int pass = 1; pass < n; pass++) {
            for (int j = 0; j < n - pass; j++) {
                if (a[j] > a[j + 1]) {
                    int t = a[j];
                    a[j] = a[j + 1];
                    a[j + 1] = t;
                }
            }
            System.out.print("After pass " + pass + ": ");
            for (int x : a) System.out.print(x + " ");
            System.out.println();
        }
    }
}
```

Output:

```
After pass 1: 25 12 22 11 64
After pass 2: 12 22 11 25 64
After pass 3: 12 11 22 25 64
After pass 4: 11 12 22 25 64
```

In each pass adjacent elements are compared and swapped if out of order, so the largest remaining element "bubbles" to the end. n elements need at most $n - 1$ passes.

Program 15. Selection sort (descending)

File name: SelectionSort.java

```
public class SelectionSort {  
    public static void main(String[] args) {  
        int[] a = {29, 72, 98, 13, 87, 66};  
        for (int i = 0; i < a.length - 1; i++) {  
            int maxPos = i;  
            for (int j = i + 1; j < a.length; j++)  
                if (a[j] > a[maxPos]) maxPos = j;  
            int t = a[i]; a[i] = a[maxPos]; a[maxPos] = t;  
        }  
        System.out.print("Descending order: ");  
        for (int x : a) System.out.print(x + " ");  
        System.out.println();  
    }  
}
```

Output:

```
Descending order: 98 87 72 66 29 13
```

Selection sort selects the largest (or smallest) element of the unsorted part and places it at the front. It makes at most one swap per pass.

Program 16. Addition and transpose of 3 x 3 matrices

File name: MatrixOps.java

```
public class MatrixOps {
    static void show(int[][] m) {
        for (int i = 0; i < m.length; i++) {
            for (int j = 0; j < m[i].length; j++)
                System.out.print(m[i][j] + "\t");
            System.out.println();
        }
    }
    public static void main(String[] args) {
        int[][] a = {{1, 2, 3}, {4, 5, 6}, {7, 8, 9}};
        int[][] b = {{9, 8, 7}, {6, 5, 4}, {3, 2, 1}};
        int[][] sum = new int[3][3];
        int[][] tr = new int[3][3];
        for (int i = 0; i < 3; i++)
            for (int j = 0; j < 3; j++) {
                sum[i][j] = a[i][j] + b[i][j];
                tr[j][i] = a[i][j];
            }
        System.out.println("A + B :");
        show(sum);
        System.out.println("Transpose of A :");
        show(tr);
    }
}
```

Output:

```
A + B :
10    10    10
10    10    10
10    10    10
Transpose of A :
1     4     7
2     5     8
3     6     9
```

A 2-D array is an array of arrays; `m.length` gives rows and `m[i].length` gives columns. In the transpose, row `i` becomes column `i`. `\t` is the tab escape sequence.

Program 17. Multiplication of two matrices

File name: MatrixMul.java

```
public class MatrixMul {  
    public static void main(String[] args) {  
        int[][] a = {{1, 2}, {3, 4}};  
        int[][] b = {{5, 6}, {7, 8}};  
        int[][] c = new int[2][2];  
        for (int i = 0; i < 2; i++)  
            for (int j = 0; j < 2; j++)  
                for (int k = 0; k < 2; k++)  
                    c[i][j] += a[i][k] * b[k][j];  
        for (int[] row : c) {  
            for (int x : row) System.out.print(x + " ");  
            System.out.println();  
        }  
    }  
}
```

Output:

```
19 22  
43 50
```

$c[0][0] = 1 \times 5 + 2 \times 7 = 19$, $c[0][1] = 1 \times 6 + 2 \times 8 = 22$, $c[1][0] = 3 \times 5 + 4 \times 7 = 43$, $c[1][1] = 3 \times 6 + 4 \times 8 = 50$. The number of columns of A must equal the number of rows of B.

Program 18. Count vowels, consonants, digits and spaces in a string

File name: StringCount.java

```
public class StringCount {  
    public static void main(String[] args) {  
        String s = "CHSE Odisha Exam 2025";  
        int v = 0, c = 0, d = 0, sp = 0;  
        String low = s.toLowerCase();  
        for (int i = 0; i < low.length(); i++) {  
            char ch = low.charAt(i);  
            if ("aeiou".indexOf(ch) >= 0) v++;  
            else if (ch >= 'a' && ch <= 'z') c++;  
            else if (Character.isDigit(ch)) d++;  
            else if (ch == ' ') sp++;  
        }  
        System.out.println("Vowels = " + v + ", Consonants = " + c);  
        System.out.println("Digits = " + d + ", Spaces = " + sp);  
    }  
}
```

Output:

```
Vowels = 6, Consonants = 8  
Digits = 4, Spaces = 3
```

indexOf(ch) returns -1 if the character is not present, so "aeiou".indexOf(ch) >= 0 is a short vowel test. charAt(i) returns the character at index i.

Program 19. Palindrome string check and reversing words

File name: StrPalin.java

```
public class StrPalin {  
    public static void main(String[] args) {  
        String[] words = {"Madam", "Level", "Java"};  
        for (String w : words) {  
            String rev = new StringBuilder(w).reverse().toString();  
            if (w.equalsIgnoreCase(rev))  
                System.out.println(w + " is a palindrome");  
            else  
                System.out.println(w + " is not a palindrome (reverse: " + rev + ")");  
        }  
        String line = "Information Technology is fun";  
        String[] parts = line.split(" ");  
        String out = "";  
        for (int i = parts.length - 1; i >= 0; i--)  
            out = out + parts[i] + " ";  
        System.out.println(out.trim());  
    }  
}
```

Output:

```
Madam is a palindrome  
Level is a palindrome  
Java is not a palindrome (reverse: avaJ)  
fun is Technology Information
```

`StringBuilder.reverse()` reverses the characters; `equalsIgnoreCase` ignores the case difference between M and m. `split(" ")` breaks a sentence into a String array of words.

Program 20. Capitalise each word and print initials of a name

File name: Initials.java

```
public class Initials {  
    public static void main(String[] args) {  
        String name = "subhash chandra bose";  
        String[] w = name.split(" ");  
        String cap = "", ini = "";  
        for (int i = 0; i < w.length; i++) {  
            String first = w[i].substring(0, 1).toUpperCase();  
            cap = cap + first + w[i].substring(1) + " ";  
            ini = ini + first + ".";  
        }  
        System.out.println("Capitalised : " + cap.trim());  
        System.out.println("Initials      : " + ini);  
        System.out.println("Length       : " + name.length());  
        System.out.println("Words       : " + w.length);  
    }  
}
```

Output:

```
Capitalised : Subhash Chandra Bose  
Initials    : S.C.B.  
Length      : 20  
Words       : 3
```

substring(0, 1) gives the first character as a String, substring(1) gives the rest. trim() removes the extra space at the end. length() of a String counts spaces too.

Program 21. Class BankAccount with constructor, deposit and withdraw

File name: BankDemo.java

```
class BankAccount {
    private int accNo;
    private String holder;
    private double balance;

    BankAccount(int accNo, String holder, double balance) {
        this.accNo = accNo;
        this.holder = holder;
        this.balance = balance;
    }
    void deposit(double amt) {
        balance += amt;
        System.out.println("Deposited " + amt + ", balance = " + balance);
    }
    void withdraw(double amt) {
        if (amt > balance)
            System.out.println("Insufficient balance! Cannot withdraw " + amt);
        else {
            balance -= amt;
            System.out.println("Withdrawn " + amt + ", balance = " + balance);
        }
    }
    void display() {
        System.out.println("A/c " + accNo + " | " + holder + " | Balance " + balance);
    }
}

public class BankDemo {
    public static void main(String[] args) {
        BankAccount ac = new BankAccount(1001, "Ritika", 5000);
        ac.display();
        ac.deposit(2500);
        ac.withdraw(10000);
        ac.withdraw(3000);
        ac.display();
    }
}
```

Output:

```
A/c 1001 | Ritika | Balance 5000.0
Deposited 2500.0, balance = 7500.0
Insufficient balance! Cannot withdraw 10000.0
Withdrawn 3000.0, balance = 4500.0
A/c 1001 | Ritika | Balance 4500.0
```

This shows **encapsulation**: data members are private and can be changed only through public methods. `this.accNo` refers to the instance variable when a parameter has the same name. The constructor runs automatically when `new` creates the object.

Program 22. Method overloading - area of different shapes

File name: Overload.java

```
public class Overload {  
    static double area(double r) {  
        return 3.14 * r * r;  
    }  
    static int area(int side) {  
        return side * side;  
    }  
    static int area(int l, int b) {  
        return l * b;  
    }  
    public static void main(String[] args) {  
        System.out.println("Circle    : " + area(7.0));  
        System.out.println("Square    : " + area(6));  
        System.out.println("Rectangle : " + area(8, 5));  
    }  
}
```

Output:

```
Circle    : 153.86  
Square    : 36  
Rectangle : 40
```

Overloaded methods have the same name but different parameter lists (number or type). The compiler chooses the correct version at compile time – this is **compile-time (static) polymorphism**. $3.14 \times 49 = 153.86$.

Program 23. Abstract class and method overriding (runtime polymorphism)

File name: ShapeDemo.java

```
abstract class Shape {
    String name;
    Shape(String name) { this.name = name; }
    abstract double area();
    void show() {
        System.out.println(name + " area = " + area());
    }
}
class Circle extends Shape {
    double r;
    Circle(double r) { super("Circle"); this.r = r; }
    double area() { return Math.PI * r * r; }
}
class Rect extends Shape {
    double l, b;
    Rect(double l, double b) { super("Rectangle"); this.l = l; this.b = b; }
    double area() { return l * b; }
}
public class ShapeDemo {
    public static void main(String[] args) {
        Shape[] list = { new Circle(1), new Rect(4, 2.5) };
        for (Shape s : list)
            s.show();
    }
}
```

Output:

```
Circle area = 3.141592653589793
Rectangle area = 10.0
```

An abstract class cannot be instantiated; it may contain abstract methods without a body. Each subclass overrides `area()`. A Shape reference calls the overriding version of the actual object at run time – **dynamic method dispatch**. `super("Circle")` calls the parent constructor.

Program 24. Interface implemented by two classes

File name: InterfaceDemo.java

```
interface Payable {
    double RATE = 0.10;           // public static final by default
    double pay();
}
class Employee implements Payable {
    double salary;
    Employee(double s) { salary = s; }
    public double pay() { return salary + salary * RATE; }
}
class Contractor implements Payable {
    int hours; double perHour;
    Contractor(int h, double p) { hours = h; perHour = p; }
    public double pay() { return hours * perHour; }
}
public class InterfaceDemo {
    public static void main(String[] args) {
        Payable p1 = new Employee(20000);
        Payable p2 = new Contractor(40, 250);
        System.out.println("Employee pay   : " + p1.pay());
        System.out.println("Contractor pay : " + p2.pay());
    }
}
```

Output:

```
Employee pay   : 22000.0
Contractor pay : 10000.0
```

Interface variables are automatically public, static and final; interface methods are public, so the implementing method must also be declared public. A class can implement many interfaces – this is how Java supports multiple inheritance of type.

Program 25. Static variable to count objects

File name: StaticCount.java

```
class Student {
    static int count = 0;    // shared by all objects
    int roll;
    String name;
    Student(String name) {
        count++;
        roll = count;
        this.name = name;
    }
}

public class StaticCount {
    public static void main(String[] args) {
        Student s1 = new Student("Anil");
        Student s2 = new Student("Bina");
        Student s3 = new Student("Chitra");
        System.out.println(s1.roll + " " + s1.name);
        System.out.println(s2.roll + " " + s2.name);
        System.out.println(s3.roll + " " + s3.name);
        System.out.println("Objects created = " + Student.count);
    }
}
```

Output:

```
1 Anil
2 Bina
3 Chitra
Objects created = 3
```

A **static** variable has one copy for the whole class, while each object has its own copy of instance variables (roll, name). Static members can be accessed using the class name.

Program 26. Multiple catch blocks and finally

File name: ExcDemo.java

```
public class ExcDemo {
    static void test(int choice) {
        try {
            if (choice == 1) {
                int x = 10 / 0;
            } else if (choice == 2) {
                int[] a = new int[3];
                a[5] = 7;
            } else if (choice == 3) {
                int n = Integer.parseInt("12a");
            } else {
                System.out.println("No error in choice " + choice);
            }
        } catch (ArithmeticException e) {
            System.out.println("Arithmetic error: " + e.getMessage());
        } catch (ArrayIndexOutOfBoundsException e) {
            System.out.println("Array index error");
        } catch (NumberFormatException e) {
            System.out.println("Invalid number format");
        } finally {
            System.out.println("finally runs for choice " + choice);
        }
    }
    public static void main(String[] args) {
        for (int i = 1; i <= 4; i++)
            test(i);
    }
}
```

Output:

```
Arithmetic error: / by zero
finally runs for choice 1
Array index error
finally runs for choice 2
Invalid number format
finally runs for choice 3
No error in choice 4
finally runs for choice 4
```

Only the matching catch block runs. The **finally** block runs every time, whether or not an exception occurs, so it is used for clean-up work such as closing files or database connections.

Program 27. User-defined exception with throw and throws

File name: CustomExc.java

```
class InvalidAgeException extends Exception {
    InvalidAgeException(String msg) { super(msg); }
}
public class CustomExc {
    static void checkVoter(int age) throws InvalidAgeException {
        if (age < 18)
            throw new InvalidAgeException("Age " + age + " is below 18");
        System.out.println("Age " + age + ": eligible to vote");
    }
    public static void main(String[] args) {
        int[] ages = {25, 15};
        for (int a : ages) {
            try {
                checkVoter(a);
            } catch (InvalidAgeException e) {
                System.out.println("Exception: " + e.getMessage());
            }
        }
    }
}
```

Output:

```
Age 25: eligible to vote
Exception: Age 15 is below 18
```

throw actually raises an exception object; **throws** in the method header declares that the method may pass the exception to its caller. A user-defined checked exception is made by extending the Exception class.

Program 28. Decimal to binary, octal and hexadecimal conversion

File name: DecToBin.java

```
public class DecToBin {
    public static void main(String[] args) {
        int n = 45, t = n;
        String bin = "";
        while (t > 0) {
            bin = (t % 2) + bin;    // remainder added in front
            t = t / 2;
        }
        System.out.println("Decimal " + n + " = Binary " + bin);
        System.out.println("Using library   : " + Integer.toBinaryString(n));
        System.out.println("Octal          : " + Integer.toOctalString(n));
        System.out.println("Hexadecimal   : " + Integer.toHexString(n).toUpperCase());
        System.out.println("Binary 101101 to decimal: " + Integer.parseInt("101101",
2));
    }
}
```

Output:

```
Decimal 45 = Binary 101101
Using library   : 101101
Octal          : 55
Hexadecimal    : 2D
Binary 101101 to decimal: 45
```

Repeated division by 2: remainders read from bottom to top give the binary number.
Integer.parseInt(s, 2) converts a binary string back to decimal.

Program 29. Perfect numbers below 1000

File name: PerfectNum.java

```
public class PerfectNum {
    public static void main(String[] args) {
        for (int n = 2; n < 1000; n++) {
            int sum = 0;
            for (int i = 1; i <= n / 2; i++)
                if (n % i == 0) sum += i;
            if (sum == n)
                System.out.println(n + " is a perfect number");
        }
    }
}
```

Output:

```
6 is a perfect number
28 is a perfect number
496 is a perfect number
```

A perfect number equals the sum of its proper divisors: $6 = 1 + 2 + 3$; $28 = 1 + 2 + 4 + 7 + 14$. No proper divisor can be greater than $n/2$.

Program 30. Electricity bill with slab rates

File name: ElectricBill.java

```
public class ElectricBill {
    static double bill(int units) {
        double amt;
        if (units <= 50)
            amt = units * 3.0;
        else if (units <= 200)
            amt = 50 * 3.0 + (units - 50) * 4.8;
        else
            amt = 50 * 3.0 + 150 * 4.8 + (units - 200) * 5.8;
        return amt + 20; // fixed meter rent
    }
    public static void main(String[] args) {
        int[] u = {40, 150, 320};
        for (int x : u)
            System.out.printf("Units %d : Rs. %.2f\n", x, bill(x));
    }
}
```

Output:

```
Units 40 : Rs. 140.00
Units 150 : Rs. 650.00
Units 320 : Rs. 1586.00
```

Slabs: first 50 units at Rs 3, next 150 at Rs 4.80, above 200 at Rs 5.80, plus Rs 20 meter rent. For 150 units: $150 + 100 \times 4.8 + 20 = 650$.

Program 31. Temperature conversion table using a for loop

File name: Temperature.java

```
public class Temperature {  
    public static void main(String[] args) {  
        System.out.println("Celsius   Fahrenheit");  
        for (int c = 0; c <= 100; c += 20) {  
            double f = c * 9.0 / 5 + 32;  
            System.out.printf("%5d    %8.1f%n", c, f);  
        }  
    }  
}
```

Output:

Celsius	Fahrenheit
0	32.0
20	68.0
40	104.0
60	140.0
80	176.0
100	212.0

Writing 9.0 instead of 9 forces floating-point division. In %5d and %8.1f the numbers give the field width, so the columns line up.

Program 32. Largest, smallest, average and second largest in an array

File name: ArrayStats.java

```
public class ArrayStats {
    public static void main(String[] args) {
        int[] m = {72, 85, 64, 91, 58, 85, 77};
        int max = m[0], min = m[0], sum = 0;
        for (int x : m) {
            if (x > max) max = x;
            if (x < min) min = x;
            sum += x;
        }
        int second = Integer.MIN_VALUE;
        for (int x : m)
            if (x > second && x < max) second = x;
        double avg = (double) sum / m.length;
        System.out.println("Max = " + max + ", Min = " + min);
        System.out.println("Sum = " + sum + ", Average = " + avg);
        System.out.println("Second largest = " + second);
    }
}
```

Output:

```
Max = 91, Min = 58
Sum = 532, Average = 76.0
Second largest = 85
```

The cast (double) sum is needed, otherwise integer division would drop the fraction. The second loop ignores values equal to max, so a repeated maximum is not counted twice.

Program 33. Multilevel inheritance with super and constructor order

File name: Inherit3.java

```
class Vehicle {
    Vehicle() { System.out.println("Vehicle constructor"); }
    void info() { System.out.println("General vehicle"); }
}
class Car extends Vehicle {
    Car() { System.out.println("Car constructor"); }
    void info() {
        super.info();
        System.out.println("Car with 4 wheels");
    }
}
class ElectricCar extends Car {
    ElectricCar() { System.out.println("ElectricCar constructor"); }
    void info() {
        super.info();
        System.out.println("Runs on battery");
    }
}
public class Inherit3 {
    public static void main(String[] args) {
        ElectricCar e = new ElectricCar();
        System.out.println("-----");
        e.info();
    }
}
```

Output:

```
Vehicle constructor
Car constructor
ElectricCar constructor
-----
General vehicle
Car with 4 wheels
Runs on battery
```

Constructors run from the top of the hierarchy downward (parent first). `super.info()` calls the overridden method of the immediate parent, so the messages appear from Vehicle down to ElectricCar.

PRACTICE & REVISION

Information Technology · +2 2nd Year (Class XII)

IT – Quick Revision (2nd Year)

Abbreviation	Full form	Abbreviation	Full form
LAN / MAN / WAN / PAN	Local / Metropolitan / Wide / Personal Area Network	NIC	Network Interface Card
ISP	Internet Service Provider	DNS	Domain Name System
HTTP	HyperText Transfer Protocol	FTP	File Transfer Protocol
URL	Uniform Resource Locator	MAC	Media Access Control
GSM	Global System for Mobile communication	CDMA	Code Division Multiple Access
WLL	Wireless in Local Loop	IRC	Internet Relay Chat
WAIS	Wide Area Information Server	SMS	Short Message Service
JDBC	Java Database Connectivity	ODBC	Open Database Connectivity
DHTML	Dynamic HTML	XML	eXtensible Markup Language
B2C / B2B / C2C	Business-to-Consumer / Business / Consumer-to-Consumer	IT Act	Information Technology Act, 2000

SQL output practice (EMP table from the RDBMS chapter):

```

SELECT Dept, MAX(Salary) FROM emp GROUP BY Dept;      -- HR 45000, IT 60000, Sales 35000
SELECT Name FROM emp ORDER BY Salary DESC LIMIT 2;   -- Rekha, Sunita
SELECT UCASE(MID(City,1,3)) FROM emp WHERE EmpNo=2;  -- BHU
SELECT ROUND(AVG(Salary),-3) FROM emp;               -- 39000

```

Last-Minute Exam Tips

Information Technology

- SQL: end every query with a semicolon; put text and dates in single quotes ('Science', '2026-10-04').
- Use IS NULL, not = NULL. Remember group functions ignore NULL (except COUNT(*)).
- In Java, always convert text to numbers with Integer.parseInt()/Double.parseDouble() before calculating.
- Draw diagrams for network topologies; write full forms of abbreviations.
- For HTML questions, write the complete structure (<html>, <head>, <title>, <body>).

THE NIGHT BEFORE THE EXAM

Revise only formula boxes, name reactions, grammar rules and your own mistake list. Sleep well — a fresh mind solves problems faster than a tired one. Carry admit card, two pens, pencil, scale, eraser and a geometry box. Good luck!