

# FIRST SEMESTER EXAMINATION

**Paper Code: <BCA-101> Fundamentals of Computers & IT**  
**Subject: FCIT (Foundations & Applications)**

**Maximum Marks: 40**  
**Time: 2 Hours**

## COURSE OUTCOMES:

**CO1:** Comprehend Von Neumann architecture, memory hierarchy, & data encoding.

**CO3:** Analyze network topologies, transmission media, & protocol suites.

**CO5:** Master UNIX/Linux CLI shell utilities, permissions, & the Vi editor.

**CO2:** Contrast OS architectures, multi-programming paradigms, & kernel services.

**CO4:** Evaluate relational DBMS versus legacy file systems & normalization.

**CO6:** Synthesize cybersecurity mitigation & Internet service protocols.

*Note: Attempt all questions. Internal choice is indicated. (Total: 40 Marks)*

| SECTION A  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          |           |               |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------|-----------|---------------|
| Q. No.     | Questions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Marks | Unit No. | CO Mapped | Bloom's Level |
| <b>Q1</b>  | <b>Answer all parts (Short Notes / Conceptual Analysis):</b> [5 × 2 = 10 Marks]                                                                                                                                                                                                                                                                                                                                                                                                             |       |          |           |               |
| (a)        | Differentiate between <b>SRAM</b> and <b>DRAM</b> in terms of internal cell architecture, operational latency, refreshing overhead, and system hierarchical placement.                                                                                                                                                                                                                                                                                                                      | 2     | 1        | CO1       | 2             |
| (b)        | Explain the principle of <b>Two's Complement arithmetic</b> . Show how it uniquely detects arithmetic overflow condition during signed binary addition.                                                                                                                                                                                                                                                                                                                                     | 2     | 1        | CO1       | 3             |
| (c)        | Distinguish between a <b>Monolithic Kernel</b> and a <b>Microkernel</b> architecture in operating system design, citing performance and stability trade-offs.                                                                                                                                                                                                                                                                                                                               | 2     | 2        | CO2       | 2             |
| (d)        | Compare <b>Circuit Switching</b> versus <b>Packet Switching</b> technologies with respect to path reservation, latency predictability, and channel throughput.                                                                                                                                                                                                                                                                                                                              | 2     | 3        | CO3       | 2             |
| (e)        | State the function of the <b>umask</b> in Linux file permission systems. Calculate the effective permissions of a directory created under <code>umask 027</code> .                                                                                                                                                                                                                                                                                                                          | 2     | 4        | CO5       | 3             |
| SECTION B  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          |           |               |
| Q. No.     | Questions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Marks | Unit No. | CO Mapped | Bloom's Level |
| <b>Q2.</b> | (a) Illustrate the <b>Von Neumann Architecture</b> with an interconnected block diagram showing CPU registers (PC, MAR, MBR, IR, ACC), System Bus, and Memory. Trace a complete Instruction Machine Cycle (Fetch, Decode, Execute).<br>(b) Perform binary conversion: Convert <b>(247.625)<sub>10</sub></b> into equivalent Hexadecimal and Binary representations.                                                                                                                         | 10    | 1        | CO1       | 3             |
| <b>OR</b>  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          |           |               |
|            | (a) Elaborate the <b>Memory Hierarchy</b> in contemporary computers. Detail the concepts of Locality of Reference (Spatial vs. Temporal) and Cache hit/miss ratio.<br>(b) Describe IEEE 754 single-precision (32-bit) <b>Floating-Point Representation</b> . Represent decimal number <b>-13.375</b> in IEEE 754 single-precision format.                                                                                                                                                   | 10    | 1        | CO1       | 3             |
| <b>Q3.</b> | (a) Critically differentiate between traditional <b>Flat File Management Systems (FMS)</b> and <b>Database Management Systems (DBMS)</b> , addressing data redundancy, concurrency control, and ACID compliance.<br>(b) Compare <b>Multiprogramming, Multiprocessing, and Multitasking</b> operating systems in terms of CPU scheduling overhead and hardware prerequisites.                                                                                                                | 10    | 2        | CO2, CO4  | 4             |
| <b>OR</b>  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          |           |               |
|            | (a) Compare <b>Compilers, Interpreters, and Assemblers</b> with respect to execution speed, memory footprint, diagnostic capability, and intermediate object code generation.<br>(b) Discuss the classification of computer software (System Software vs. Application Software vs. Utility Software) with clear architectural examples.                                                                                                                                                     | 10    | 2        | CO2       | 3             |
| <b>Q4.</b> | (a) Detail the <b>OSI 7-Layer Reference Model</b> versus the <b>TCP/IP Model</b> . Differentiate between IPv4 and IPv6 addressing schemes, explaining why IPv4 address exhaustion occurred.<br>(b) Explain Star, Mesh, and Hybrid <b>Network Topologies</b> with comparative analysis on fault tolerance, cabling cost, and scalability.                                                                                                                                                    | 10    | 3, 4     | CO3, CO6  | 4             |
| <b>OR</b>  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          |           |               |
|            | (a) Explain the modal architecture of the <b>Vi/Vim Editor</b> (Command Mode, Insert Mode, Ex Mode). List essential commands for pattern searching, global text replacement, and saving/quitting.<br>(b) Illustrate the syntax and concrete execution examples for the following UNIX commands:<br>(i) <code>grep -in "pattern" file.txt</code> , (ii) <code>chmod 754 script.sh</code> , (iii) <code>find / -name "*.conf"</code> , and (iv) <code>tar -cvzf backup.tgz /var/data</code> . | 10    | 4        | CO5       | 3             |