Code: BCA-1002T (For theory) BCA-1002P (For practical)	CC-II	Computer Architecture	3L+T:4P	5 Credits (45 hours theory and 60 hours practical)

Max Marks; Theory: 100 (Int: 25; Ext: 75); Practical: 100

Course Outcomes: Upon completion of the course, the student will be able to

CO1: Understand the basics of Digital Electronics and Binary Number System
CO2: Learn the implementation of Combinational Circuit.
CO3: Learn the implementation of Sequential Circuit.
CO4: Understand the Organization of basic computers.
CO5: Understand the concept of parallel processing.
CO6: Understand the concept of memory organization.

Unit	Topics	Purposed lectures
I	**Digital Principles:** Definition of digital signals, digital logic, digital computers, Von Neumann Architecture, Boolean Laws, and Theorems. **K-Map:** Truth tables to K-Map, 2, 3, and 4-variable K-Map, K-Map simplifications, Don't care conditions, SOP and POS. **Number Systems:** Decimal, Binary, Octal, Hexadecimal number systems, number system conversions, binary arithmetic, addition and subtraction of BCD, octal arithmetic, hexadecimal arithmetic. Binary Codes: Decimal codes, error detecting and correcting codes, ASCII, EBCDIC, Excess-3 Code, Gray Code.	11
II	**Combinational Circuits:** Half Adder, Full Adder, Subtractor, Decoders, Encoder, Multiplexer, Demultiplexer. **Sequential Circuits:** Flip-Flops-SR Flip-Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop. **Registers:** 4-bit register with parallel load, shift registers – bidirectional shift register with parallel load. Binary Counters: 4-bit synchronous and asynchronous binary counter.	11
III	**Basic Computer Organization:** Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory-reference instructions, input-output interrupt, complete computer description, design of basic computer, design of accumulator logic. **Central Processing Unit**: Introduction, general register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, Reduced Instruction Set Computer (RISC), RISC vs CISC.	11
IV	**Pipeline and Vector Processing:** Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, RISC pipeline. **Input-Output Organization:** Peripheral devices, input-output interface,	12

	asynchronous data transfer, modes of transfer, priority interrupt, direct memory access (DMA), input-output processor (IOP). **Arithmetic Algorithms:** Integer multiplication using shift and add, Booth's algorithm, integer division, floating-point representations. **Memory Organization:** Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.	
Lab Programs	**Experiments** **1.** Verify the logic behaviour of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert, and Buffer gates. **2.** Study and verify NAND as a Universal Gate. **3.** Verify De Morgan's theorem for two variables. **4.** Design and test an S-R flip-flop using NAND/NOR gates. **5.** Convert BCD to Excess-3 code using NAND gates. **6.** Convert Binary to Gray Code. **7.** Verify the truth tables of J-K Flip-Flop using NAND/NOR gates. **8.** Realize Decoder and Encoder circuits using basic gates. **9.** Design and implement a 4:1 MUX using gates. **10.** Implement a 4-bit parallel adder using the 7483 IC. **11.** Design and verify the operation of a half adder and full adder. **12.** Design and verify the operation of a half subtractor. **13.** Design and implement a 4-bit shift register using flip-flops. **14.** Implement Boolean functions using logic gates in both SOP and POS forms. **15.** Design and implement a 4-bit synchronous counter. **16.** Design and verify a 4-bit asynchronous counter. **Hardware Experiments** **17.** Familiarize with the computer system layout: identifying SMPS, motherboard, FDD, HDD, CD, DVD, and add-on cards. **18.** Identify the computer name and hardware specifications (RAM capacity, processor type, HDD, 32-bit/64-bit architecture). **19.** Identify and troubleshoot issues related to RAM, SMPS, and the motherboard. **20.** Configure BIOS settings: enable/disable USB and LAN. **21.** Expand RAM size by adding additional RAM to the system. **22.** Study the motherboard layout of a computer system. **23.** Demonstrate the assembly of a PC. **24.** Demonstrate various ports: CPU, VGA port, PS/2 (keyboard, mouse), USB, LAN, Speaker, Audio. **25.** Install and configure the Windows Operating System. **26.** Study printer installation and troubleshooting.	

Text Books:

1. Leach, Donald P., Albert Paul Malvino, and Goutam Saha. *Digital Principles and Applications.* T McGraw Hill Education, 2011.
2. Mano, M. Morris. *Computer System Architecture.* 3rd ed., Pearson/PHI, 2006.
3. Digital Logic and Computer Design, Morris Mano, Pearson/PHI
4. Digital Fundamentals : Floyd L. Thomas, Pearson

Reference Books:

5. Stallings, William., *Computer Organization and Architecture.* 6th ed., Pearson/PHI, 2003.
6. Tanenbaum, Andrew S. *Structured Computer Organization.* 4th ed., PHI/Pearson, 1999.
7. Subramanyam, M. V. *Switching Theory and Logic Design.* Laxmi Publications, 2008.