ECPC3003 COMPUTER ORGANISATION AND SYSTEM ARCHITECTURE (3-0-0)

Course Objectives:
This course introduces computer organization and system architecture, covering functional blocks (CPU, memory, I/O), instruction sets, and data representation. Students will learn computer arithmetic techniques, CPU control unit design (hardwired/microprogrammed), and memory hierarchy (cache, interleaving). Emphasis is placed on I/O subsystems, interrupts, DMA, and developing microcode for instruction execution.

Module-I(06 Hours)
Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Module-II (06 Hours)
Data representation: Signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift and add, Booth multiplier, carry save multiplier, etc. Division restoring and non restoring techniques, floating point arithmetic.

Module–III (06 Hours)
Introduction to x86 architecture. CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU. Memory system design: semiconductor memory technologies, memory organization.

Module–IV (06 Hours)
Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Module–V (06 Hours)
Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Course Outcome:
Upon completion of the course, the students will be able to:
CO1: Identify Basic Organization of Computers.
CO2: Identify the addressing modes used in macro instructions.
CO3: Apply algorithms for arithmetic operations and implementation for ALU design.
CO4: Identify Characteristics of Memory System.
CO5: Develop micro code for typical instructions in symbolic form.

Text Books:

1. Computer Organization and Architecture: Designing for Performance, 10th Edition by William Stallings, Pearson Education.
2. Computer System Architecture and Organization, Dr. M. Usha, T.S. Srikanth, Wiley.
3. Computer Organization and Embedded Systems, 6th Edition by CarlHamacher, McGraw Hill Higher Education

Supplementary Reading:

1. Computer Architecture and Organization, 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. Computer Organization and Design: The Hardware/Software Interface, 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
3. Computer System Design and Architecture, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.