CLUSTER UNIVERSITY SRINAGAR

SYLLABUS (FYUP UNDER NEP 2020)

Offered By Department of Information Technology

Semester 4th (Major Course)

Course Title: Computer Organization and Architecture

Course Code: UGICT22J403 **Max. Marks 150**
Credits: 6 (Theory: 4, Practical: 2) **Theory External: 80; Min Marks: 32**
Contact Hrs: 120 (Theory: 60, Practical: 60) **Theory Internal (Continuous Assessment): 20 Marks, Min Marks: 08**
Practical Experimental Basis= 30, Min. Marks: 12
Practical Experimental (Continuous assessment) = 20, Min. Marks: 08

Course Objectives:

1. To introduce students to the fundamental concepts of computer architecture and organization.
2. To impart knowledge about various components of a computer system and their interrelationships.
3. To familiarize students with different types of data representation and instruction formats.
4. To teach students about the functioning of control units and their design.
5. To expose students to different types of processors and the concept of parallelism.

Learning Outcomes:

Upon completion of this course, students will be able to:

1. Understand and explain the basic components of a computer and their interconnections.
2. Analyze the performance of a computer system in terms of hardware.
3. Understand and explain different types of data representation and instruction formats.
4. Understand and explain the operations of a control unit and its impact on instruction execution.
5. Understand different types of processors and the concepts of parallelism, pipelining, and multiprocessor systems.

UNIT 1 **15 Hrs**

Introduction: Digital Signals, Basic Digital Circuits, Logic Gates, Number Systems, Binary Arithmetic, 2's Complement Arithmetic, Error Detection and correction codes,
Boolean Algebra and Logic Simplification, Laws of Boolean algebra, De-Morgan's theorem, Min term, Max term, POS, SOP, KMap, Simplification by Boolean theorems, don't care condition.

UNIT 2: **15 Hrs**

Combinational Logic: The Half adder, the full adder, subtractor circuit. Multiplexer demultiplexer, decoder, BCD to seven segment decoders, encoders.
Flip flop and Timing circuit: set-reset laches, D-flip flop, R-S flip-flop, J-K Flip-flop, Master slave Flip flop, edge triggered flip-flop, T flip-flop
Registers & Counters: Synchronous/Asynchronous counter operation, Up/down synchronous counter, application of counter.

UNIT 3: **15 Hrs**

Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit.
Functional units, Basic operational concepts, Von Neumann Architecture, Bus Structures,
BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction codes, Computer Registers, Computer Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt

UNIT 4: **15 Hrs**

Instruction set architecture of a CPU - registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC
REGISTER TRANSFER AND MICRO-OPERATIONS: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logic shift unit
Basics of MICRO-PROGRAMMED CONTROL.

UNIT: (Practical/Lab/Tutorials Course, Credits=2) **60 Hrs**

Tutorial 1: Introduction to Computer Architecture and Organization
Definition and Importance of Computer Architecture and Organization, Overview of the structure of a computer system, Von Neumann Architecture,

Tutorial 2: Basic Computer Organization
Components of a computer system: CPU, Memory, Input/Output devices, Bus Structures
Instructions and Instruction Sequencing

Tutorial 3: Processor Design
Register Organization, ALU design, Instruction Pipelining,

Tutorial 4: Control Unit Organization
Introduction to Control Units, Types of Control Units: Hardwired and Microprogrammed
Design of Control Units

Tutorial 5: Memory Organization
Types of Memory: RAM, ROM, Cache, Secondary Storage, Memory Hierarchy, Cache Memory and Memory Mapping Techniques

Tutorial 6: I/O Organization
Introduction to I/O Organization, Types of I/O Devices, I/O Techniques: Programmed I/O, Interrupt-Driven I/O, DMA

SUGGESTED READING:

1. Modern Digital Electronics, by R.P Jain.
2. Computer Organization and Architecture, By William Stallings.
3. Computer System Architecture, By Mano M Morris.