Session: Jan-June 2020

Title: Introduction to Computer Science - 1

Course outline (10 topics):

Critical Thinking

- Computational thinking and Logic building
- Language independent Algorithm development process
- Analysis of complex decision structures
- Language features and coding
- Testing & Quality Assurance
  - Testing by tracing | dry run |
  - Test Case Development
  - Trace Tables
  - Decision Tables
- Debugging process and techniques
- Some Frequently used Algorithms

Python Programming

- Installing Python and setting up the development environment, Screen reader software and operating system.
- From algorithm to Python program
  - Input, Output, variables, Mathematical Operators, Comparison operators, if-statement, while-statement
  - Converting mathematical to Python expressions
  - Mathematical and string functions
- List, tuple, set, dictionary
- Iterateables, Range function, for and while statements, break, continue and pass
- Defining functions, parameters, arguments, default parameters,
- Standard and user developed modules and packages
- Reading and writing to text and binary files

Testing and debugging features of the development environment

Digital Electronics and Computer Architecture and OPENSOURCE Hardware

- Logic Gates
- Combination of logic gates
- Truth tables of circuits
- Circuit designing using SOP method
- Adder --> Subtrator --> Adder/Subtractor -->
    - Mathematical operations (+ - / * power, factorial, sin, cos, tan, log, …)
    - Logical operations
- Machine Language (of SAP)
    - Hand coding
- SAP architecture
- Storage formats (inside the machines)
    - Numbers (unsigned integer, signed integer, floating point numbers)
    - Characters and Strings

Operating Systems

- Memory Management
- Process Management
- Storage Management
- Development environment
    - Text Editor, Compiler, Linker, Loader
- Spool Management
- Virtual Memory
- Advanced User Guide
    - Advanced features of Windows + Linux as OS
        - Redirection
        - Piping
        - Shell Programming
            - Shell commands (internal + external)
            - Environment variables
            - Control Structures

- Input and output
- Output replacement - `backquote`
- Sharing
- Backup & Restore
- Restore point
- Virtual Machines
- Security
  - Types of Malware
  - Effective protection from malwares through Softwares
  - Effective protection from malwares through understanding them

Data Communication and Networks

- Protocol (point to point) Physical layer +
- Communication Media
  - Twisted pair cables, Fiber optics, Wireless (infrared, bluetooth), satellites communication, Mobile communications
  - Introduction to Android, iOS, Windows, Blackberry
- OSI Layers
  - Protocols (Networking) Application layer
- Error Detection
  - Parity (odd and even)
  - RLE
- Error Correction

Software Engineering

- Why and What of SE
- SE Models
- A simple business application - POS software (From idea to finished project)

Numerical Computing

- Basic concept of finding a solution (what does it mean symbolically, algebraically and graphically)
- Solution of Equations
  - Bisection Method

- Differentiation
  - Forward, Backward, Central difference formula
- Integration
  - Trapezoidal, Simpson's 1/3 algorithm

- Secant
- Newton Raphson
- Simultaneous linear equations
  - Jacobi method of iteration
- Linear Algebra
  - Applications of linear algebra - Graphics, Vector Space
- Mathematical Modelling

Sorting

- Selection

Searching

- Linear
- Binary

Information Management & Retrieval

- DB Concepts (definition, Evolution, Terms)
- Designing
  - ERD
  - List of Data items to DB Schema (Normalization)
- DBMS Softwares
  - SQL
- Connectivity and programming using C#.VB
- Non-Relational Databases
- IR systems and Text databases