Introduction to Information Technology

Course Title: Introduction to Information Technology
Course No: CSC109
Nature of the Course: Theory + Lab
Semester: I

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description: This course covers the basic concepts of computers and information technology including introduction, hardware, software, memory, input/output, data representation, database, networks and data communication, Internet, multimedia, and computer security.

Course Objectives: The main objective of this course is to provide students knowledge of fundamental concepts of computers and information technology.

Course Contents:

Unit 1: Introduction to Computer (3 Hrs.)
Introduction; Digital and Analog Computers; Characteristics of Computer; History of Computer; Generations of Computer; Classification of Computer; The Computer System; Application of Computers

Unit 2: The Computer System Hardware (3 Hrs.)
Introduction; Central Processing Unit; Memory Unit; Instruction Format; Instruction Set; Instruction Cycle; Microprocessor; Interconnecting the Units of a Computer; Inside a Computer Cabinet

Unit 3: Computer Memory (4 Hrs.)
Introduction; Memory Representation; Memory Hierarchy; CPU Registers; Cache Memory; Primary Memory; Secondary Memory; Access Types of Storage Devices; Magnetic Tape; Magnetic Disk; Optical Disk; Magneto-Optical Disk; How the Computer uses its memory

Unit 4: Input and Output Devices (4 Hrs.)
Introduction; Input-Output Unit; Input Devices; Human Data Entry Devices; Source Data Entry Devices; Output Devices; I/O Port; Working of I/O System

Unit 5: Data Representation (6 Hrs.)
Introduction; Number System; Conversion from Decimal to Binary, Octal, Hexadecimal; Conversion of Binary, Octal, Hexadecimal to Decimal; Conversion of Binary to Octal, Hexadecimal; Conversion of Octal, Hexadecimal to Binary; Binary Arithmetic; Signed and Unsigned Numbers; Binary Data Representation; Binary Coding Schemes; Logic Gates

Unit 6: Computer Software (6 Hrs.)
Introduction; Types of Software; System Software; Application Software; Software Acquisition; Operating System (Introduction, Objectives of Operating System, Types of OS, Functions of OS, Process Management, Memory Management, File Management, Device Management, Protection and Security, User Interface, Examples of Operating Systems)

Unit 7: Data Communication and Computer Network (5 Hrs.)
Introduction; Importance of Networking; Data Transmission Media; Data Transmission across Media; Data Transmission and Data Networking; Computer Network; Network Types; Network Topology; Communication Protocol; Network Devices; Wireless Networking

Unit 8: The Internet and Internet Services (4 Hrs.)
Introduction; History of Internet; Internetworking Protocol; The Internet Architecture; Managing the Internet; Connecting to Internet; Internet Connections; Internet Address; Internet Services; Uses of Internet; Introduction to Internet of Things (IoT), Wearable Computing, and Cloud Computing, Introduction to E-commerce, E-governance, and Smart City, and GIS

Unit 9: Fundamentals of Database (4 Hrs.)
Introduction; Database; Database System; Database Management System; Database System Architectures; Database Applications; Introduction to Data Warehousing, Data mining, and BigData

Unit 10: Multimedia (3 Hrs.)
Introduction; Multimedia - Definition; Characteristics of Multimedia; Elements of Multimedia; Multimedia Applications

Unit 11: Computer Security (3 Hrs.)
Introduction; Security Threat and Security Attack; Malicious Software; Security Services; Security Mechanisms (Cryptography, Digital Signature, Firewall, Users Identification and Authentication, Intrusion Detection Systems); Security Awareness; Security Policy

Laboratory Works:
After completing this course, students should have practical knowledge of different hardware components of computer, operating systems, Word Processors, Spreadsheets, Presentation Graphics, Database Management Systems, and Internet and its services.

Text Books:
1. Computer Fundamentals, Anita Goel, Pearson Education India

Reference Books:

1. Introduction to Computers, Peter Norton, 7th Edition, McGraw Hill Education
2. Computer Fundamental, Pradeep K. Sinha and Priti Sinha
3. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber and Jian Pei
4. Cloud Computing Bible, Barrie Sosinsky, Wiley

C Programming

Course Title: C Programming
Course No: CSC110
Nature of the course: Theory + Lab
Semester: I

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs.: 3

Course Description: This course covers the concepts of structured programming using C programming language.

Course Objective: This course is designed to familiarize students to the techniques of programming in C.

Course Contents:

Unit 1: Problem Solving with Computer (2 Hrs.)
Problem analysis, Algorithms and Flowchart, Coding, Compilation and Execution, History of C, Structure of C program, Debugging, Testing and Documentation

Unit 2: Elements of C (4 Hrs.)
C Standards(ANSI C and C99), C Character Set, C Tokens, Escape sequence, Delimiters, Variables, Data types (Basic, Derived, and User Defined), Structure of a C program, Executing a C program, Constants/ Literals, Expressions, Statements and Comments.

Unit 3: Input and Output (2 Hrs.)
Conversion specification, Reading a character, Writing a character, I/O operations, Formatted I/O

Unit 4: Operators and Expression (4 Hrs.)
Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment Operator, Ternary operator, Bitwise operator, Increment or Decrement operator, Conditional operator, Special Operators(sizeof and ,comma), Evaluation of Expression, Operator Precedence and Associativity.

Unit 5: Control Statement (4 Hrs.)
Conditional Statements, Decision Making and Branching, Decision Making and Looping, Exit function, Break and Continue.

Unit 6: Arrays (6 Hrs.)
Introduction to Array, Types of Array (Single Dimensional and Multidimensional), Declaration and Memory Representation of Array, Initialization of array, Character Array and Strings, Reading and Writing Strings, Null Character, String Library Functions(string length, string copy, string concatenation, string compare)

Unit 7: Functions (5 Hrs.)
Library Functions, User defined functions, Funciton prototype, Function call, and Function Definition, Nested and Recursive Function, Function Arguments and Return Types, Passing

Arrays to Function, Passing Strings to Function, Passing Arguments by Value, Passing Arguments by Address, Scope visibility and lifetime of a variable, Local and Global Variable,

Unit 8: Structure and Union (5 Hrs.)
Introduction, Array of structure, Passing structure to function, Passing array of structure to function, Structure within structure (Nested Structure), Union, Pointer to structure

Unit 9: Pointers (6 Hrs.)
Introduction, The & and * operator, Declaration of pointer, Chain of Pointers, Pointer Arithmetic, Pointers and Arrays, Pointers and Character Strings, Array of Pointers, Pointers as Function Arguments, Function Returning pointers, Pointers and Structures, Dynamic Memory Allocation

Unit 10: File Handling in C (4 Hrs.)
Concept of File, Opening and closing of File, Input Output Operations in File, Random access in File, Error Handling in Files

Unit 11: Introduction to Graphics (3 Hrs.)
Concepts of Graphics, Graphics Initialization and Modes, Graphics Function

Laboratory Works:
This course requires a lot of programming practices. Each topic must be followed by a practical session. Some practical sessions include programming to:

- Create, compile and run simple C programs, handle different data types available in C, perform arithmetic operations in C, perform formatted input and output operations, perform character input and output operations.
- Perform logical operations, create decision making programs, create loops to repeat task.
- Create user-defined functions, create recursive functions, work with automatic, global and static variables, create, manipulate arrays and matrices (single and multi-dimensional), work with pointes, dynamically allocate de-allocate storage space during runtime, manipulate strings (character arrays) using various string handling functions.
- Create and use structures and files to keep record of students, employees etc.

Text Books:

1. Byron Gottfried: "Programming with C," , Second Edition, McGraw Hill Education.
2. Herbert Schildt, C The Complete Reference, Fourth Edition, Osborne/McGraw-Hill Publication.

Reference Books:

1. Paul Deitel, Harvey Deitel, C: How to Program, Eighth Edition, Pearson Publication.
2. Al Kelley, Ira Pohl: "A Book on C", Fourth Edition, Pearson Education.
3. Brian W. Keringhan, Dennis M. Ritchiem, The C programming Language, Second Edition, PHI Publication.
4. Ajay Mittal, Programming in C: A Practical Approach, Pearson Publication

5. Stephen G. Kochan, Programming in C, CBS publishers & distributors.
6. E. Balagurusamy, Programming in ANSI C, Third Edition, TMH publishing

Digital Logic

Course Title: Digital Logic
Course No: CSC111
Nature of the Course: Theory + Lab
Semester: I

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description: This course covers the concepts of digital logic and switching networks. The course includes the fundamental concepts of boolean algebra and its application for circuit analysis, multilevel gates networks, flip-lops, counters logic devices and synchronous and asynchronous sequential logic and digital integrated circuits.

Course Objectives: The main objective of this course is to introduce the basic tools for the design of digital circuits and introducing methods and procedures suitable for a variety of digital design applications.

Course Contents:

Unit 1: Binary Systems (6 Hrs.)
Digital Systems, Binary numbers, Number base conversion, Octal and hexadecimal numbers, compliments, Signed Binary numbers, Decimal codes (BCD, 2 4 2 1,8 4 -2 -1,Excess 3, Gray Code), Binary Storage and Registers, Binary logic

Unit 2: Boolean algebra and Logic Gates (5 Hrs.)
Basic and Axiomatic definitions of Boolean algebra, Basic Theorems and properties of Boolean Algebra, Boolean Functions, Logic Operations, Logic Gates, Integrated Circuits

Unit 3: Simplification of Boolean Functions (5 Hrs.)
K-map, Two and Three variable maps, Four variable maps, product of sum simplification, NAND and NOR implementation, Don't Care conditions, Determinant and selection of Prime Implicants

Unit 4: Combinational Logic (5 Hrs.)
Design Procedure, Adders, Subtractors, Code Conversions, Analysis Procedure, Multilevel NAND and NOR Circuits, Exclusive-OR Circuits

Unit 5: Combinational Logic with MSI and LSI (8 Hrs.)
Binary Parallel Adder and Subtractor, Decimal Adder, Magnitude Comparator, Decoders and Encoders, Multiplexers, Read-only-Memory (ROM), Programmable Logic Array (PLA), Programmable Array Logic (PAL)

Unit 6: Synchronous and Asynchronous Sequential Logic (10 Hrs.)
Flip-Flops, Triggering of flip-flops, Analysis of clocked sequential circuits, Design with state equations and state reduction table, Introduction to Asynchronous circuits, Circuits with latches.

Unit 7: Registers and Counters (6 Hrs.)
Registers, Shift registers, Ripple Counters, Synchronous Counters, Timing Sequences, The memory

Laboratory Works:
Students should be able to realize following digital logic circuits as a part of laboratory work.

- Familiarizations with logic gates
- Combinatorial Circuits
- Code Converters
- Design with Multiplexers
- Adders and Subtractors
- Flip-Flops
- Sequential Circuits
- Counters
- Clock Pulse Generator

Text Books:

1. M. Morris Mano, "Digital Logic & Computer Design"

Reference Books:

1. Brain Holdsworth, "Digital Logic Design", Elsevier Science.
2. John Patrick Hayes, "Introduction to Digital Logic Design", Addison-Wesley.
3. M. Morris Mano and Charles Kime, "Logic and Computer Design Fundamentals", Pearson New International.

Mathematics I

Course Title: Mathematics I
Course No: MTH112
Nature of the Course: Theory
Semester: I

Full Marks: 80 + 20
Pass Marks: 32 + 8
Credit Hrs: 3

Course Description: The course covers the concepts of functions, limits, continuity, differentiation, integration of function of one variable; logarithmic, exponential, applications of derivative and antiderivatives, differential equations, vectors and applications, partial derivatives and Multiple Integrals.

Course Objectives: The objective of this course is to make students able to

- understand and formulate real world problems into mathematical statements.
- develop solutions to mathematical problems at the level appropriate to the course.
- describe or demonstrate mathematical solutions either numerically or graphically.

Course Contents:

Unit 1: Function of One Variable (5 Hrs.)
Four ways of representing a function, Linear mathematical model, Polynomial, Rational, Trigonometric, Exponential and Logarithmic functions, Combination of functions, Range and domain of functions and their Graphs

Unit 2: Limits and Continuity (4 Hrs.)
Precise definition of Limit, Limits at infinity, Continuity, Horizontal asymptotes, Vertical and Slant asymptotes

Unit 3: Derivatives (4 Hrs.)
Tangents and velocity, Rate of change, Review of derivative, Differentiability of a function, Mean value theorem, Indeterminate forms and L'Hospital rule

Unit 4: Applications of Derivatives (4 Hrs.)
Curve sketching, Review of maxima and minima of one variable, Optimization problems, Newton's method

Unit 5: Antiderivatives (5 Hrs.)
Review of antiderivatives, Rectilinear motion, Indefinite integrals and Net change, Definite integral, The Fundamental theorem of calculus, Improper integrals

Unit 6: Applications of Antiderivatives (5 Hrs.)
Areas between the curves, Volumes of cylindrical cells, Approximate Integrations, Arc length, Area of surface of revolution

Unit 7: Ordinary Differential Equations (6 Hrs.)
Introduction, Introduction to first order equations Separable equations, Linear equations, Second order linear differential equations, Non homogeneous linear equations, Method of undetermined coefficients

Unit 8: Infinite Sequence and Series (5 Hrs.)
Infinite sequence and series, Convergence tests and power series, Taylor's and Maclaurin's series

Unit 9: Plane and Space Vectors (4 Hrs.)
Introduction, Applications, Dot product and cross Product, Equations of lines and Planes, Derivative and integrals of vector functions, Arc length and curvature, Normal and binormal vectors, Motion in space

Unit 10: Partial Derivatives and Multiple Integrals (3 Hrs.)
Limit and continuity, Partial derivatives, Tangent planes, Maximum and minimum values, Multiple integrals

Text Book

1. Calculus Early Transcendentals, James Stewart, 7E, CENGAGE Learning.

Reference Book

1. Calculus Early Transcendentals, Thomas, 12th Editions, Addision Wesley.

Physics

Course Title: Physics
Course No.: PHY113
Nature of the Course: Theory + Lab
Semester: I

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hour: 3

Course Description: This course covers the fundamentals of physics including oscillations, electromagnetic theory, and basics of quantum mechanics, band theory, semiconductors and universal logic gates and finally physics of manufacturing integrated circuits.

Course Objectives: The main objective of this course is to provide knowledge in physics and apply this knowledge for computer science and information technology.

Course Contents:

Unit 1: Rotational Dynamics and Oscillatory Motion (5 Hrs.)
Moment of inertia and torque, Rotational kinetic energy, Conservation of angular momentum, Oscillation of spring: frequency, period, amplitude, phase angle and energy

Unit 2: Electric and Magnetic Field (5 Hrs.)
Electric and magnetic field and potential, Force on current carrying wire, magnetic dipole moment, Force on a moving charge, Hall effect, Electromagnetic waves

Unit 3: Fundamentals of Atomic Theory (8 Hrs.)
Blackbody radiation, Bohr atom, Spectrum of Hydrogen, Franck-Hertz experiment, de Broglie's hypothesis and its experimental verification, Uncertainty principle and its origin, matter waves and the uncertainty principle, group velocity.

Unit 4: Methods of Quantum Mechanics (5 Hrs.)
Schrodinger theory of quantum mechanics and its application, Outline of the solution of Schrodinger equation for H-atom, space quantization and spin, Atomic wave functions

Unit 5: Fundamentals of Solid State Physics (6 Hrs.)
Crystal structure, Crystal bonding, Classical and quantum mechanical free electron model, Bloch theorem, Kronig-Penny model, Tight-binding approximation, conductors, insulators and semiconductors, effective mass and holes.

Unit 6: Semiconductor and Semiconductor devices (8 Hrs.)
Intrinsic and extrinsic semiconductors, Electrical conductivity of semiconductors, Photoconductivity, Metal-metal junction: The contact potential, The semiconductor diode, Bipolar junction transistor (BJT), Field effect transistor (FET).

Unit 7: Universal Gates and Physics of Integrated Circuits (8 Hrs.)
Universal gates, RTL and TTL gates, Memory circuits, Clock circuits, Semiconductor purification: Zone refining, Single crystal growth, Processes of IC production, Electronic component fabrication on a chip.

Laboratory Works:
Students should able to perform at least one experiment from units 1, 2 and 5, 6, 7. The details of the experiment will be provided in the manual.

Text Books:

1. Garcia Narciso, Damask Arthur, Physics for Computer Science Students, Springer-Verlag

Reference Books:

1. Heliday David, Resnick Robert and Walker Gearl, Fundamentals of Physics, 9th ed., John-Wiley and Sons, Inc.
2. Francis W. Sears, Hugh D. Young, Roger Freedman, Mark Zemansky, University Physics, Volume 1 & 2, 14th ed., Pearson Publication
3. Knight Randall D., Physics for Scientists and Engineers: A Strategic Approach, 3rd ed., Pearson Publication