CS-203  Object Oriented Programming  (3-1)

Difference Between Conventional and Object Oriented Programming; Data Abstraction; Objects; Classes and Methods; Inheritance; Multiple Inheritance; Polymorphism; Defining Objects in C++; Structure of C++; Programming in C++; Graphic Objects; Handling Messages; Constructors and Destructors; Overloaded Function Names; Inline and Friend Functions; Data Declarations in C++.

CS-211  Discrete Structures  (3-0)

History and Overview - Contributors to the subject, purpose and role of discrete structures in computer engineering, contrasts between discrete-time models and continuous-time models. Functions, Relations and Sets - one-to-one, onto, inverses, composition functions; Reflexivity, symmetry, transitivity, equivalence relations; Discrete versus continuous functions and relations; Venn diagrams, complements, Cartesian products, power sets; Cardinality and countability; Application of functions in coding theory. Applications of set theory in grammar and languages. Basic Logic - Propositional logic, logical connectives, truth tables, conjunctive and disjunctive normal forms, predicate logic, universal and existential quantification, Boolean algebra, application of logic to computer engineering. Proof Techniques - Notions of implication, converse, inverse, negation and contradiction; structures of formal proofs; Direct Proofs; Proof by counterexample, contraposition and contradiction; Mathematical induction and strong induction. Introduction to Group Theory - groups and semi-groups. Basics of counting - Permutations and combinations; Discrete probability; Counting arguments rule of products; rules of sums; The pigeonhole principle; Generating functions; recurrence relation; Applications to algorithm analysis. Graphs and Tree - Basics of trees and graphs; Directed and Undirected graphs; Spanning Trees

CS-214  Digital Logic Design  (3-1)

Truth Functions; Logic Families; Speed and Delays in Logic Circuits; Review of Boolean Algebra; NAND and NOR Implementation; Duality; Negative Logic; Switches and Relays; Gate-Level Minimization of Boolean Functions using Karnaugh Map and Tabular Method; Storage Devices and Sequential Logic; Latches and Flip Flops; Shift Registers; Synchronous and Asynchronous Counters; Synthesis of Sequential Networks; State Minimization techniques (pair chart) for completely specified sequential circuits; Design of Combinational Logic Circuits; Analysis and Design of Adders, Decoders, Encoders, Multiplexers, Demultiplexers, Magnitude Comparators and Code Converters; Programmable Logic Devices: ROMs, PLA, PALs and FPGAs
EE-217  Circuit Theory  (2-0)


MT-222  Linear Algebra & Ordinary Differential Equations  (3-0)

Linear Algebra - Linearity and Linear Dependence of Vectors; Basis; Dimension of a Vector Space; Field Matrix and Type of Matrices (Singular, Non-Singular, Symmetric, Non-Symmetric, Upper, Lower, Diagonal); Rank of a Matrix using Row Operations and Special Method; Echelon and Reduced Echelon Forms of a Matrix; Determination of Consistency of a System of Linear Equation using Rank; Matrix of Linear Transformations; Eigen Value and Eigen Vectors of a Matrix; Diagonalization; Applications of Linear Algebra (Scaling, Translation, Rotation and Projection) with Graphical Representation. Introduction to Ordinary Differential Equations (ODEs) - The Concept and Terminologies; Order and Degree; Linearity and Non-Linearity; A Brief Classification of ODEs; Formulation of ODEs; Concrete Examples; Solutions: General and Particular; Concrete Examples and Applications; Initial Value Problems (IVP) and Boundary Value Problems (BVP); A Brief Introduction to Issues Related to Existence and Uniqueness of Solutions. The First Order ODEs: Linear and Non-Linear - Variable Separable Cases and Applications; Growth and Decay Problems; Newton’s Law of Cooling; Torricelli’s Law; Simple Kinematical and Dynamical Applications; Exact and No-Exact Odes; Solution Procedures and Integrating Factors; The Standard Linear Differential Equation of First Order: Solution Procedures and Applications to RL Circuits and RC Circuits; Bernoulli’s Equation and Logistic Growth Models; Direction Fields and Euler’s and Picard’s Iterative Schemes for the First Order ODEs. The Linear Second Order ODEs: Homogeneous and Non-Homogeneous Cases - Linear Second Order Homogeneous ODE with Constant Coefficients: Solution Procedures and the Principle of Linear Superposition and Application; Mechanical Systems and Electrical Systems;
Undamped and Damped Harmonic Oscillators; Linear Second Order Non-Homogeneous ODEs with Constant Coefficients: Solution Procedures and the Principle of General Linear Superposition; Complementary Functions and Particular Solutions; The Method of Undetermined Coefficients and Variations of Parameters; Applications; Spring Mass Systems; Damped and Undamped Harmonic Oscillators with Forcing Terms and their Odes and Solutions; RCL Circuits and their Odes and Solutions; The Physics and Mathematics of Phenomenon of Resonance in Mechanical and Electrical Systems; Cauchy-Euler Odes and their Solution Procedures. Partial Differential Equation - Formation of Partial Differential Equations; Solutions of First Order Linear and Special Types of Second and Higher Order Differential Equations; Homogeneous Partial Differential Equations of Order One; Lagrange’s Multiplier. Advance Calculus and Vector Calculus - Double and Triple Integral with Application (Area, Centeroid, Moment of Inertia); Vector Differentiation and Vector Integral with Applications; Green and Stokes Theorem with Applications.

**HS-205 Islamic Studies**


**HS-209 Ethical Behaviour**

Nature, Scope and Methods of Ethics; Ethics and Religion; Ethical Teachings of World Religions; Basic Moral Concepts, Rights and Wrong, Good and Evil; An Outline of Ethical Systems in Philosophy; Hedonism, Utilitarianism, Rationalism and Kant; Self Realization Theories, Intuitionism; Islamic Moral Theory: Ethics of Quran and its Philosophical Basis;
Ethical. Precepts from Quran and Hadith and Promotion of Moral Values in Society.

CS-210 Data Structures & Algorithms (3-1)


CS-212 Computer Organization & Design (3-1)

Introduction & Motivation: Instruction Set Architecture (ISA) as an interface between hardware and software; ISA: Instruction Formats, Addressing Modes, Translation of High Level Language Program into Machine Language; Classes and Comparative Study of ISAs: Accumulator-based, Stack-based, Register-Memory & Register-Register Architectures; Instruction Encoding Techniques; Measuring and Reporting Computer Performance: Common Pitfalls, Amdahl’s Law; Computer Arithmetic: Integer and Floating-Point; Basic Processor Design: Single-Cycle and Multi-Cycle datapath & control; Hardwired and Microprogrammed Control; Memory System Design: Memory Hierarchy, Cache Memory, Virtual Memory; Input/Output: Bus Standards, Arbitration Schemes, Programmed I/O; Interrupt-Driven I/O. Interrupt Processing, Direct Memory Access (DMA); Emerging Architectures.

CS-215 Signals and Systems (2-1)

Routh-Hurwitz Stability Test; Application to Control: Root Locus, Compositions – Cascade, Parallel, Feedback, PID controllers; State Representation.

EE-222  Instrumentation & Measurement  (3-1)

Functional description and performance characteristics of instruments; Analog and Digital mode of operations, Static and Dynamic characteristics, Resolution, Sensitivity, Accuracy, Hysteresis, Uncertainty, Range, Repeatability, Reproducibility, Engineering Units and Standards; Data Conversion: Sampling, DAC, ADC, V/f and f/V converters. Measuring Instruments: Principle, construction and working of DC and AC AVO meters, power meters, power factor meters, DC & AC Bridges; Electronic Instruments: Working principle of analog, digital and sampling oscilloscope, frequency generator, frequency counter and logic analyzer. Transducer Principles and Types: Variable Resistance and inductance transducers, Hall effect, Linear variable differential transformer (LVDT), Capacitive, Photoconductive, Piezo-Electric Transducers, Thermo electric transducers, optical transducers.

MT-224  Complex Variable & Fourier Analysis  (3-0)

Infinite Series - Application Convergence Tests such as Comparisons; Root; Ratio; Raabe’s and Gauss’ Tests on the Behavior of Series. Complex Variable - Limit, Continuity, Zeros and Poles of a Complex Function; Cauchy Reimann Equations; Conformal Transformation; Contour Integration. Laplace Integral and Transformation - Definition; Laplace Transforms of Some Elementary Functions; First Translation or Shifting Theorem; Second Translation or Shifting Theorem; Change of Scale Property; Laplace Transform of the nth Order Derivative; Initial and Final Value Theorem; Laplace Transform of Integrals; Laplace Transform of Functions Tn F(T) and F(T)/T; Laplace Transform of Periodic Function; Evaluation of Integrals; Definition of Inverse Laplace Transform and Inverse Transforms; Convolution Theorem; Solutions of Ordinary Differential and Partial Differential Equations using Laplace Transform (Ivps and Bvps); / and Inverse / Transformations; Properties of / - Transformations and Applications. Fourier Series - Introduction to Fourier Series; Euler Fourier Formulae; Even and Odd Functions; Application of Fourier Series; Fourier Transform and Fast Fourier Transform and Properties with Applications.