GENERAL MATHEMATICS I

Number of Credits: **4**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

Basic concepts of Calculus and Geometry will be taught to the students in this course which provides necessary background for technical courses.

COURSE SYLLABUS

Cartesian coordinates; polar coordinates; complex numbers; addition, product, root & geometrical representation of complex numbers; polar representation of complex numbers; function; functions algebra; limit and relevant theorems; infinite limit and limit in infinite; left-hand and right-hand limit; connectivity; derivative; derivation formula; inverse function and its derivative; trigonometric functions derivative and their inverse functions; Rolle's theorem; mean theorem; Taylor expansion; geometrical and physical applications of derivative; curves and acceleration in polar coordinates; application of derivative in approximation of equations roots; definition of integral of continuous functions and piecewise continuous; basic theorems of differential & integral arithmetic; primitive function; approximate methods of integral estimate; application of integral in computation of area, volume, length of curve, moment, center of gravity and labor ….(in Cartesian and polar coordinates); logarithm and exponential function and their derivative; hyperbolic functions; integration methods such as change of variable, component and decomposition of fractions; transform of special variables of sequence and numerical series and relevant theorems; power series and Taylor theorem with remainder.

GENERAL MATHEMATICS. II

Number of Credits: **4**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

Basic concepts of Calculus and Geometry will be taught to the students in this course which provides necessary background for technical courses, continuing "General Math. I "discussions.

COURSE SYLLABUS

Parametric equations; space coordinates; vector and space; numerical product; matrix 3x3 of three-indeterminate linear equations system; operation on lines; matrix reverse; solving equations system; linear independence; base in R^2; R^3 linear transform and its matrix; determinate 3x3 and characteristic value and vector; vector product; second order line and plane equations; two vector functions and its derivative; speed and acceleration; bending; normal vector to a curve; multivariable function; directional and partial derivative; tangent plane and normal line to a curve; multivariable function; directional and partial derivative; tangent plane and projecting line of gradient; chain of rule for partial derivative; exact differential; second kind and third kind integrals and their application in geometrical and physical problems; transform of integration arrangement (without accurate affirmation); cylindrical and spherical coordinates; vector field; curvilinear integral; surface integral; divergence; curl; Laplacian; potential of green space and divergence and stochastic.

DIFFERENTIAL EQUATIONS

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

In this course, first and second levels of linear differential equations and some nonlinear differential equations will be introduced, in addition, students will learn about some numerical and analytical ways to solve Mathematical Problems.

COURSE SYLLABUS

Nature of differential equations and their solution, family of graphs and vertical routes, physical patterns, separable equation, first order linear differential equation, homogeneous equation, 2nd order linear equation, homogenous equation with fixed constants, method of indefinite constants, method of changing parameters, application of 2nd order equations in physics and mechanics, solution of differential equation with series, Bessel and Gamma functions, Legendre polynomial, an introduction to differential equations set, Laplace transform and its application in solving differential equations

PRINCIPLES OF COMPUTER I

Number of Credits: **4**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

This course will teach students the main concepts of Programming using a Programming Language such as C++. Techniques of Developing and Implementing Algorithms in a programming language will be taught in this course.

COURSE SYLLABUS

Introducing organization and main parts of computer, machine language and assembly, numeric and non-numeric data representation, algorithms and sub-algorithms and flowchart, basic concepts such as frequency, selection, repetition and branching, familiarity with a structured language and programming including: constants and variables, computational and logical phrases, different types of instructions, different types of conditional operations loops, vectors and matrices, subprograms, input and output instructions, common algorithms such as methods of search and arrangement, practical examples of programming in C++ Programming.

BASIC PHYSICS. I (GENERAL PHYSICS)

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

Principals and applications of mechanics, wave motion, sound, and heat with emphasis on fundamental concepts, problem solving, notation, and units.

PHYSISCS, LAB.

Number of Credits: **1**
Type of the Course: **Practical**

COURSE OBJECTIVES

Applying the knowledge acquired in the physics course in the real-world scenarios.

STATISTICS AND PROBABILITIES, I, II

Number of Credits: **4**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

By learning this course, students will be able to use basic rules of Probability Theory for real modeling of information problems

COURSE SYLLABUS

An introduction to theory of sets, samples and their table display together with average, exponent, middle and variance of conversion and composition, probabilities and the relevant theorems, random variables, intermediate and average and variance of distributions, Poison's two-phrase distributions, geometric difference, normal distribution, distribution of several random variable, random sampling and random numbers, sampling from small society, estimation of statistical parameters, assurance intervals, test 2 presumptive test of decision-making, analysis and variance, regression, correlation, nonparametric methods test, fitting straight line on data.

LINEAR ALGEBRA
Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVE

This course covers matrix theory and linear algebra, emphasizing topics useful in other disciplines. Linear algebra is a branch of mathematics that studies systems of linear equations and the properties of matrices. The concepts of linear algebra are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics (and increasingly in high school). After successfully completing the course students will have a good understanding of the following topics and their applications: Systems of linear equations, Row reduction and echelon forms, Matrix operations, including inverses, Block matrices, Linear dependence and independence, Subspaces and bases and dimensions, Orthogonal bases and orthogonal projections, Gram-Schmidt process, Linear models and least-squares problems, Determinants and their properties, Cramer's Rule, Eigenvalues and eigenvectors, Diagonalization of a matrix, Symmetric matrices, Positive definite matrices, Similar matrices, Linear transformations, Singular Value Decomposition.

NUMERICAL ANALYSIS

Number of Credits: **4**
Type of the Course: **Theoretical**

COURSE OBJECTIVE

The course will introduce basic numerical methods used for solving problems that arise in different scientific fields. Properties such as accuracy of methods, their stability and efficiency will be studied. Students will gain practical programming experience in implementing the methods using MATLAB or Scilab. We will cover the following topics (not necessarily in the order listed): Finite Precision Arithmetic and Error Propagation, Linear Systems of Equations, Root Finding, Interpolation, least squares, Numerical Integration.

DESCRETE MATHEMATICS

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVE

A basic introduction to combinatorics and graph theory for advanced students in computer science, mathematics, and related fields. Topics include elements of graph theory, Euler and Hamiltonian circuits, graph coloring, matching, basic counting methods; generating functions; recurrences; inclusion-exclusion; Polya's theory of counting, combinatorial game theory.

PRINCIPLES OF COMPUTER II

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

Students will learn the advanced concepts and techniques such as OOP in Programming using *Java* language.

COURSE SYLLABUS

In depth Java programming, Introduction of UI design QT. Complementary issues of Java programming, Memory management, in depth understanding of Java codes, Coding relation with operating system, file management, IO streams, clear implementing basic data structures like link lists, Generic programming, Implementation of inheritance and its related issues in Java. Multithreading essentials, exception handling, object oriented programming principles, Debugging and testing of programs, Function calling conventions, Dynamic memory coding.

DATA STRUCTURES AND ALGORITHMS

Number of Credits: **4**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

Familiarity with Information Structures, Effects of Structures in Produced Applications, Selecting Optimized Inside-Memory Structures, Organizing Memory based on requirements.

COURSE SYLLABUS

Arrays, vectors, matrices, private matrices, arrays display, stacks, queues and rows, bond lists: graphic, cyclical, double bond, multi-bond, method of display and application of bond lists, trees and their menstruation, method of representation and application of trees: decision making trees, search trees, tree of the game and etc., graphs and their representation, dynamic memory allocation and the relevant issues, searching and sorting and combining algorithms

NUMERICAL LINEAR ALGEBRA

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

The course discuses Numerical linear algebra (NLA) with emphasis on applications in engineered systems; matrix factorizations; perturbation and rounding error analyses of fundamental NLA algorithms. Offered in alternate years.
To give students an in-depth introduction to the graduate-level numerical linear algebra (NLA) that lies at the heart of all modern computational science and engineering. Throughout the course there is an emphasis on the interplay between the underlying mathematical descriptions of algorithms and their implementation on specific computing machines with specific software. Students should gain from the course an ability to be an intelligent, discriminating user of current algorithms and software in NLA and related disciplines.

PRINCIPLES OF COMPUTER SYSTEMS I

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

In this course, students will learn how Computers work and become familiar with their organization. Also they could gain some practical experiences in designing, utilizing and developing computer sections and joining them to Microprocessors.

COURSE SYLLABUS

An introduction to computer configuration, introducing different generations of computer, register transfer and micro-operations, register transfer language, inter-register transfer, computational micro-operations, sliding micro-operations, control functions. Basic computer organization and its design, instruction codes, computer instructions, scheduling and controlling, designing a sample computer such as PDP/8 and its micro-operations, methods of numbers representation, representation by fixed point, representation by floating point, other binary codes, errors revealing codes, organization of central processor including systems with several processor registers and bass system and systems using stack, study of several computers such as PDP/11, IBM 370. Designing computational processors, comparison and subtraction of binary numbers without sign, algorithm of multiplication and division with fixed and floating point. Input and output organization, memory organization, auxiliary memories, memory of microcomputer, hierarchy of memory, associative memory, dummy memory, cache memory, memory management hardware.

AUTOMATA THEORY AND LANGUAGES

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

Some subjects of this course are Finite Automata, Push down Automata, Turing Machine, Machine Grammars and Languages, and so on.

COURSE SYLLABUS

Finite automata, PUSHDOWN automata, touring machine, different types of grammars and languages, Chomsky classification, relation between languages and machines and the relevant theorems.

PRINCIPLES OF OPERATING SYSTEMS

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

This course relates to the most of the Operating Systems' fundamental structures, their specification and usages.

COURSE SYLLABUS

Definition, existence philosophy, basic functions, different types of operating systems, operating systems hierarchy, operating system in view of user, Program Status Word (PSW), concept of interrupts, different types of interrupts and their processing, interrupts priority and next coming, I/O programming and the relevant facilities, concurrency in I/O, memory management, introducing multiprogramming environments, static memory allocation, dynamic memory allocation, commutative memory allocation, paging according to demand, partitioning, paging part, memory hierarchy. Processor management, works scheduling, scheduling policies, processes scheduling, processes scheduling policies, multiprocessor systems, weak communication, stable communication, allocation of sources to processes, competition mode, blocked mode and methods of releasing, mutual exclusion, processes concurrency by use of semaphore and problems resulting from which. Systems management, basic functions, exclusive, common and dummy instruments, I/O instruments and subsidiary memories, conversion of exclusive instruments to dummy instruments, extra linear processing, direct communication, auxiliary processor of spooling system.

COMPUTER NETWORKS

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

Basics and Principles of Computer Networks and Data Transition Systems will be introduced in this course.

COURSE SYLLABUS

Structure of networks, network architectures, reference model of ISO, networks of ARPA, SNA, DECNET and general. Network topology, connectivity analysis, delay analysis, design of network with local access. Design of physical layer, fundamentals of theory for data transfer, transfer telephone systems and multiplexing, survey on terminal, transfer errors. Data relation layer, primary protocols for data relation, sliding window protocol, protocols analysis. Primary layer of network, point-point networks, routing algorithms, density. Secondary layer, satellite and radio networks, broadcasting satellite packages, radio packages.

ENGLISH LANGUAGE FOR COMPUTER SCIENCE

Number of Credits: **2**
Type of the Course: **Theoretical**

COURSE DESCRIPTION

This subject aims at raising students' specific language ability in reading and writing academic texts of their own major disciplines. The subject will use reading texts from chapters of books or journal articles recommended by teachers of different majors for reading comprehension. These texts will also be used for analysis to enable students to develop an awareness of the genre in that discipline.

DATABASE + LAB

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

In this course, theoretical and practical concepts of Relational Databases are introduced, and Concurrency, Security, and Completeness aspects of Database Systems are discussed.

COURSE SYLLABUS

Survey of change and evolution of data storage and retrieval technology, reminding storage and retrieval in non-bank policy, definition of database, data, existence, relation between existences, Operating medium, different types of communications, data engineering, data abstraction, Difference of bank policy with non-bank policy, bank medium components including application of data, software and hardware, database system architecture including: external, conceptual, internal and physical levels, database management system, method of achieving database in different levels, data models including relational, hierarchical and network models mentioning to the other models, detailed study of model, relational computations, study of a specified sample of relational model, normalization in relational model, safety, confidentiality, protection, non-defectiveness and comprehensiveness of database, very large database and special machines of database. The student should perform a theoretical project and a practical project in appropriate to the objective of design and implementation of a base.

ALGORITHMS DESIGN AND ANALYSIS

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE OBJECTIVES

IN this course students will learn to design Efficient and Optimized Algorithms for Computer Programs.

COURSE SYLLABUS

Review of essential points of Data Structures, problem solving methods (for each methods some problems and special algorithm for the problem shall be represented and being analyzed), introducing to complexity, divide & conquer method (problems to be analyzed: max and min of an array, multiplication of two n-bit number, Strassen method about matrix multiplication, round robin algorithm, sorting with Quicksort algorithm), dynamic programming method (matrix multiplication, traveling sales man problem, polygon triangulation),greedy algorithms(scheduling problem, Huffman Code, making change),methods based one exhaustive search, alpha-beta pruning (puzzle, tic-tac-tac), revelation of methods for problems, graph algorithms(searching methods of graph, Dijkstra algorithms, minimum spanning tree, Floyd algorithm, topological sorting and…), maximum flow networks and other problems.

PROGRAMMING LANGUAGES

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE DESCRIPTION

The projects focus either on various aspects of programming languages (for example, simple parsers, translators, symbolic computation, and implementation of abstract data types) or on exercising the particular strengths of a given language. Students work individually or in small groups on several programming projects. Students design, implement, and test their solutions. Each project typically uses a different language, such as: Ada, C++, Java, Smalltalk, Python, LISP, Scheme, Standard ML, Haskell, and Prolog. At least one project language will support object-oriented programming and at least one will be a non-imperative language. Students will: (1) learn the fundamental principles of modern computer programming languages; (2) learn the commonalities and differences among the different languages; (3) learn about a variety of different programming languages and about their relative strengths and weaknesses; and (4) gain experience designing and writing programs in a selected set of languages.

COMPILERS

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE DESCRIPTION

This course introduces the students to the principles of compiler writing. It focuses on lexical analysis, parsing, and simple code generation. The students are expected to write a complete compiler for a very simple high-level programming language.

PRINCIPLES OF COMPUTER SYSTEMS II

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE DESCRIPTION

This course introduces the concepts of Computer architecture by going through multiple levels of abstraction, and the numbering Systems and their basic computations. It focuses on the instruction-set architecture of the MIPS Machine, including MIPS assembly programming, translation between MIPS and C, and between MIPS and machine code. General topics include performance calculation, processor data path, Pipelining, and memory hierarchy.

PRE-REQUISITE ENGLISH LANGUAGE

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE DESCRIPTION

The aim of this course is that students learn about the General English language.

PERSIAN LANGUAGE

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE DESCRIPTION

Familiarizing to Persian literature and Persian poets.

PHYSICAL EDUCATION. I, II

Number of Credits: **1**
Type of the Course: **Practical**

COURSE DESCRIPTION

Teaching sports.

PRINCIPLE OF SOFTWARE DESIGN

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE DESCRIPTION

Modeling, Design, and Testing. An introduction to object-oriented software development process and design. Topics include: iterative development, interpretation of requirements and use case documents into code; application of design notation in UML; and use of commonly-used design patterns. Introduction to second object-oriented programming language. Laboratory experiments and examples will be used to illustrate and reinforce concepts taught in the lectures.

COMPUTER SIMULALTION

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE DESCRIPTION

Introduction to simulation and comparison with other techniques. Simulation methodology including generation of random numbers, design of simulation experiments for optimization, analysis of data generated by simulation experiments, and validation of simulation models and results.

SYSTEMS ANALYSIS AND DESIGN

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE DESCRIPTION

This course introduces established and evolving methodologies for the analysis, design, and development of an information system. Emphasis is placed on system characteristics, managing projects, prototyping, CASE/OOM tools, and systems development life cycle phases. Upon completion, students should be able to analyze a problem and design an appropriate solution using a combination of tools and techniques.

PROJECT CONTROL MANAGEMENT

Number of Credits: **3**
Type of the Course: **Theoretical**

COURSE DESCRIPTION

This course develops a foundation of concepts and solutions that supports the planning, scheduling, controlling, resource allocation, and performance measurement activities required for successful completion of a project.

LOGIC

Number of Credits: **3**

Type of the Course: **Theoretical**

COURSE DESCRIPTION

Boolean algebra and truth tables; combinational logics: AND, OR, NOT, XOR gates; sequential circuits: flip-flops, counters, memory circuits; logic circuit analysis, synthesis, and optimization; A/D and D/A interfaces; ROM and RAM; Field Programmable Gate Array (FPGA) and Application Specific Integrated Circuits (ASIC).

ARTIFICIAL INTELLIGENCE

Number of Credits: **3**

Type of the Course: **Theoretical**

COURSE DESCRIPTION

The goal of Artificial Intelligence is to build software systems that behave "intelligently". By this, we mean that the computer systems "do the right thing" in complex environments--that they act optimally given the limited information and computational resources available. This course introduces artificial intelligence. We will first study the core topics of knowledge representation, reasoning, and learning, all from the perspective of probabilistic methods. Then we will cover several of the "subject areas" of artificial intelligence where these probabilistic methods are applied including Natural Language Processing, Perception (primarily vision), and Robotics.

CRYPTOGRAPHY

Number of Credits: **3**

Type of the Course: **Theoretical**

COURSE DESCRIPTION

Cryptography provides important tools for ensuring the privacy, authenticity, and integrity of the increasingly sensitive information involved in modern digital systems. Nowadays, core cryptographic tools, including encryption, message authentication codes, digital signature, key agreement protocols, etc., are used behind millions of daily on-line transactions. In this course, we will unveil some of the "magic" of cryptography. Modern Cryptography uses mathematical language to precisely pin down elusive security goals, design primitives and protocols to achieve these goals, and validate the security of designed primitives and protocols using mathematical proofs based on clearly stated hardness assumptions. Therefore, to learn cryptography, it is essential to understand its mathematical underpinning. In this class, we will see the inner-working of cryptography for several core cryptographic tools, from encryption, to message authentication codes, to hash functions, to digital signatures, etc.

ENGINEERING MATHEMATICS

Number of Credits: **3**

Type of the Course: **Theoretical**

COURSE DESCRIPTION

Mathematical models are used to understand, predict and optimize engineering systems. Many of these systems are deterministic and are modelled using differential equations. Others are random in nature and are analyzed using probability theory and statistics. This course introduces differential equations and their solutions and to probability and statistics, and relates the theory to physical systems and simple real-world applications. Topics covered are: Ordinary differential equations, including first and second order equations and series solutions; Fourier series; partial differential equations, including the heat equation, the wave equation, Laplace's equation and separation of variables; probability and statistical methods, including sampling and probability, descriptive statistics, random variables and probability distributions, mean and variance, linear combinations of random variables, statistical inference for means and proportions and linear regression.

PRINCIPLES OF ECONOMICS

Number of Credits: **3**

Type of the Course: **Theoretical**

COURSE DESCRIPTION

This course provides a comprehensive introduction to the Principles of Macroeconomics that includes (i) Scarcity, Choice and opportunity Cost; (ii) Demand & Supply, Market Systems and Circular Flow Analysis; (iii) GDP, Growth and Instability; (iv) Macroeconomic Model and Fiscal Policy; (v) Money, Banking and Monetary Policy; (vi) International Economics and Current Economic Problem Analysis.

EXPERT SYSTEMS

Number of Credits: **3**

Type of the Course: **Theoretical**

COURSE DESCRIPTION

Techniques for the construction of expert systems including computer inference and knowledge acquisition; knowledge representation schemes; conceptual date analysis; plausible reasoning techniques; validation and measurement methods; production-rule programming.

LINEAR AND NETWORK PLANNING

Number of Credits: **3**

Type of the Course: **Theoretical**

COURSE DESCRIPTION

This is an introductory course on formulating mathematical models and developing solution methods for real–life optimal decision problems. We will study how to obtain the best decisions (according to a well–defined objective) in allocating scarce resources such as capital, materials, equipment, manpower, energy, etc. among competing activities that produce goods and services. Rather than developing a specific solution method for each optimization problem, we will build abstractions of these problems in the form of mathematical models and study a general method to solve these models.