Islamic Azad University Science and Research Branch

Tehran

Faculty of Basic Sciences

Course Description

Computer Science

Bachelor's Degree

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Remarks:

According to the Academic Instruction of University, in the academic system, each theoretical credit is presented in 16 or 17 hours, each practical credit in 32 or 34 hours,each of the workshop credit in 48 or 51 (except Professional Certificates) and each internship or training credit in 64 or 68 hours.

There are some different type of the courses passing by a student at this university, as listed below:

1. Basic
2. Core / Major
3. Specialized
4. Elective / Optional
5. General
6. Internship / Workshop
7. Project / Thesis

Each one of these types contain some courses to be passed, according to the educational regulations passed by the Ministry of Science, Research and Technology or Ministry of Health & Medical Education of Iran.

The grading system in this university is from 0 to 20. The minimum passing grade for a course leading to an Associate's Degree or a Bachelor's Degree is 10, for a course leading to a Master's Degree and Medical Sciences is 12 and for a course leading to a PhD Degree is 14.

Note: This document has been prepared at **Shervin Iranaghideh's** request in the **Course Description** Platform. Scan the QR-code below to certify this document.

www.coursedescription.ir

Title of the Course: General Physics 1

Number of Credits: 3

Type of the Course: Basic | Theoretical

Training hours: 48h Theoretical

Course Objectives:

This course introduces fundamental principles of physics and their application in engineering. Students will learn concepts such as mechanics, thermodynamics, and wave theory.

Syllabus:

Vector algebra, kinematics, dynamics of a particle, work and energy, conservation of energy, systems of particles, center of mass, rotational kinematics, rotational dynamics, equilibrium of rigid bodies, elasticity, fluid mechanics, ideal gases, laws of thermodynamics, heat transfer, wave properties, wave equations, interference, diffraction, Doppler effect.

Title of the Course: Fundamentals of Entrepreneurship

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 48h Theoretical

Course Objectives:

The purpose of this course is to teach the basic concepts of entrepreneurship and creating new and knowledge-based businesses. In this course, students get to know the principles of business plan formulation, company launch, marketing and sales.

Syllabus:

Concepts and definitions of entrepreneurship, evolution of entrepreneurship in the world, importance and necessity of entrepreneurship. Definition of innovation and creativity, innovation process, levels and types of innovation, principles of invention and innovation, idea and opportunity. Organization and structure of a business, types of organizational structures, steps of business management, duties of a business manager, familiarity with types of companies, steps of setting up knowledge-based companies and leadership in business. Familiarity with company regulations, business rules, brand registration, trademark and licensing procedures. Management and timing of work and interests in business, financial management, definition of financial activities, capital estimation, capital sources, preparation of company's financial documents and documents, asset management, profit and loss account and expenses. Familiarity with marketing and sales, marketing tools, definition of advertising and the purpose of advertising, use of media and advertising tools, digital marketing in the future world, international business (trade and export) and entrepreneurial culture. Business model preparation, model difference and Business plan, how to set up and present a business plan, familiarity with growth and entrepreneurship centers and capital acquisition methods, familiarity with the concept of employability

TextBooks:

1- E. Ries, The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses, Crown Books, 2011.
2- S. Case, The third wave: An entrepreneur's vision of the future, Simon and Schuster, 2017.
3- A. Osterwalder, Y. Pigneur, M. A. Y. Oliveira, and J. J. P. Ferreira, Business Model Generation: A handbook for visionaries, game changers and challengers, African journal of business management, 2011.

Title of the Course: General Mathematics 1

Number of Credits: 3

Type of the Course: Basic | Theoretical

Training hours: 48h 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.

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, 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.

TextBooks:

R.L. Finney, G.B. Thomas, Calculus and Analytic Geometry, Geometry, 9th Edition, Addison Wesley, 1996

Title of the Course: Fundamentals of Computer and Programming

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 48h Theoretical

Course Objectives:

This course teaches students the basic concepts of programming using a high-level programming language such as Pascal. Techniques for developing and implementing algorithms in a high-level programming language are discussed.

Syllabus:

- Basic computer concepts. The role of computer in today's world and giving practical examples - Introduction of the main components of the computer and its environment (hardware - software) - Numerical systems in the computer - Display of numerical and non-numerical data - Familiarity with machine language (using a hypothetical language with About 10 instructions) - Algorithm concept - Principles of algorithm design (sequence, selection and iteration) and problem solving - Expression of algorithm to pseudocode - Familiarity with a structured programming language - Constants, variables, computational and logical expressions, types of instructions; Types of conditional operation loops, vectors. Matrices: sub-programs (functions and procedures), input and output instructions, common algorithms such as search and sorting methods. Familiarity with advanced program design principles.

Title of the Course: General English Language

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 51h Theoretical

Course Objectives:

General English courses, offered at all levels of the Intensive English Program, seek to improve students' English skills in a great variety of discourse settings. Language skills addressed include: listening, fluency development, oral intelligibility, reading, grammar, writing, and vocabulary development.

Title of the Course: General Mathematics 2

Number of Credits: 3

Type of the Course: Basic | Theoretical

Training hours: 48h Theoretical

Course Objectives:

After completing the course, the student will find the appropriate mental background to understand and solve various engineering problems and acquire the ability to calculate the vectors, determinants, matrices, partial derivatives, complete differentials, and spherical and cylindrical coordinates.

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 R2; R3 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.

TextBooks:

R.L. Finney, G.B. Thomas, Calculus and Analytic Geometry, Geometry, 9thEdition, Addison Wesley, 1996

Title of the Course: Fundamentals of Mathematical Sciences

Number of Credits: 3

Type of the Course: Basic | Theoretical

Training hours: 48h Theoretical

Course Objectives:

In this lesson, we will get acquainted with the first principles of the subject on which the science of mathematics is based. We become acquainted with the logic of propositions and first-order logic and the correct methods of reasoning in mathematics, and we understand the basic concept of the set. We are also familiar with the exact definition of numbers, we understand the concept of infinity and in the following we examine the concepts of relation, its types and properties. We also get acquainted with basic mathematical concepts, including function and its concepts. In addition, we look at prime numbers and the principles of equivalence.

Title of the Course: Fundamentals of Probability

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 48h Theoretical

Course Objectives:

The course covers the basic principles of the theory of probability and its applications. Topics include combinatorial analysis used in computing probabilities, the axioms of probability, conditional probability and independence of events; discrete and continuous random variables; joint, marginal, and conditional densities, moment generating function; laws of large numbers; binomial, Poisson, gamma, univariate, and bivariate normal distributions.

Title of the Course: Advanced Programming

Number of Credits: 3

Type of the Course: Core | Theoretical | Practical

Training hours: 48h Theoretical

Course Objectives:

The purpose of this course is to study the principles and methods necessary to produce a computer program with good quality specifications. In this regard, after covering the top-down design method to solve the problem, students will be introduced to the concepts and techniques of object-oriented programming as a tool for managing complexity in medium and large-scale applications. Program performance, testing, and debugging are focused throughout the course. An object-oriented programming language (such as Java) is used to teach these principles and methods, and students are introduced to the concepts and techniques of object-oriented programming and module-based object design, advanced concepts such as graphical user interface design. , Multidisciplinary programming (parallel) and distributed programs on the network are also covered in this 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.

TextBooks:

1- Java : how to program / P.J. Deitel, H.M. Deitel. 9th ed, 2013.

Title of the Course: Thematic Interpretation of Nahj al-Balagha

Number of Credits: 2

Type of the Course: General | Theoretical

Training hours: 32h Theoretical

Course Objectives:

Getting to know Nahj al-Balagha and understanding its basic teachings with a topical approach.

Title of the Course: General Persian Language

Number of Credits: 3

Type of the Course: General | Theoretical

Training hours: 48h Theoretical

Course Objectives:

Familiarity with Persian language and reading literary texts, poetry and prose in Iranian Persian literature.

Title of the Course: Technical English Language

Number of Credits: 3

Type of the Course: Specialized | Theoretical

Training hours: 48h Theoretical

Course Objectives:

This course introduces students to technical texts and articles across a wide range of academic and professional disciplines. It develops their ability to read and understand specialized materials, expand their knowledge of field-specific vocabulary, and become familiar with common technical terminology. Students also practice summarizing, translating, and reporting technical content. By the end of the course, they will be able to effectively apply technical English in academic and professional contexts relevant to their field of study.

Title of the Course: General Mathematics 3

Number of Credits: 3

Type of the Course: Basic | Theoretical

Training hours: 48h Theoretical

Course Objectives:

After completing the course, students should be able to: Apply the fundamental concepts of Ordinary Differential Equations and Partial Differential Equations and the basic numerical methods for their resolution. Solve the problems choosing the most suitable method. Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution. Use computational tools to solve problems and applications of Ordinary Differential Equations and Partial Differential Equations. Formulate and solve differential equation problems in the field of Industrial Organization Engineering. Use an adequate scientific language to formulate the basic concepts of the course.

Syllabus:

Multivariate functions. Side and partial derivative. Tangent plane and perpendicular line on top. Gradient. Steepest slope method. Chain rule for the partial derivative. Complete differential. Extremum, extremum tests, bounded extremums. Lagrange multiplier method. Double and triple integrals in Cartesian, polar, cylindrical and spherical coordinates, their applications in geometric and physical problems. Integration methods. The theorem of switching the order of integration. Vector field and field flux. Integral on the bend. Integral of surfaces. Divergence.

Title of the Course: Data Structure and Algorithm

Number of Credits: 4

Type of the Course: Basic | Theoretical

Training hours: 64h Theoretical

Course Objectives:

In this course, the student gets acquainted with the methods of analyzing algorithms, simple and slightly advanced but important data structures, and some preliminary algorithms. In the presentation of the contents of this lesson, the analysis and proof of the correctness of the algorithms are emphasized. The student must already be familiar with one of the C++ or Java programming languages as well as recursive methods in solving problems. Algorithms of the lesson are independent of the language and according to the instructions of the reference book.

TextBooks:

1- T. Cormen, C. Leiserson, R. Rivest, Introduction to Alghorithm, McGraw-Hill, 2001.

Title of the Course: Principles of Computer Systems

Number of Credits: 4

Type of the Course: Core | Theoretical

Training hours: 64h Theoretical

Course Objectives:

This course teaches students the design, implementation, and evaluation of computer systems, including operating systems, networking, and distributed systems. The course will teach students to evaluate the performance and study the design choices of existing systems. Students will also learn general systems concepts that support design goals of modularity, performance, and security. Students will apply materials learned in lectures and readings to design, build and evaluate new systems components.

Title of the Course: Mathematics Software

Number of Credits: 3

Type of the Course: Elective | Theoretical | Practical

Training hours: 48h Theoretical

Course Objectives:

Familiarity with mathematical software Familiarity with mathematical software that can solve algebraic equations and mathematical calculations in our world today is obvious. Therefore, this type of software is called engineering software. The most famous of these programs are MATLAB and Maple algebra software. These applications guide you through the final solution of a mathematical calculation and sometimes guide you descriptively to the solution of a problem. Despite the vastness of mathematical science, these softwares are developing and becoming more complete day by day. MATLAB software has more capabilities of solving mathematical problems that are used in accordance with different engineering disciplines.

TextBooks:

1- T.A. Davis, MATLAB Primer, 8th Edition, CRC Press, 2010.
2- B. Hahn, D. Hahn, Essential MATLAB for Scientists and engineers, 5th Edition, Academic Press, 2013.
3- C.F. Van Loan, Introduction to Scientific Computing: A Matrix-Vector Approach using MATLAB, Prentice Hall PTR, 1999.

Title of the Course: Sport I

Number of Credits: 1

Type of the Course: General | Practical

Training hours: 32h Practical

Course Objectives:

This course is designed for the prospective coach, physical education and/or recreation professional.

Title of the Course: Affiliation with the Holy Quran

Number of Credits: 1

Type of the Course: General | Theoretical

Training hours: 16h Theoretical

Course Objectives:

Teaching Quran Reading

Title of the Course: Linear Algebra

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 48h Theoretical

Course Objectives:

The purpose of this course is to familiarize students with the basic theoretical concepts of linear algebra as well as how to use and implement them in a suitable software platform. Familiarity with the concepts of this lesson provides the possibility of analyzing mappings and linear systems through matrices and actions, operators and defined concepts related to them. Similarly, the optimization problem is investigated as one of the most used applications of linear algebra.

Syllabus:

Systems of linear equations, Row reduction and echelon forms, Matrix operations, including inverses, Block matrices, Linear dependence and independence, Subspaces and bases and dimensions, Determinants and their properties Cramer's Rule, Symmetric matrices, Linear transformations

TextBooks:

1- Right Sheldon Axler. Linear Algebra. Springer, 2015.
2- Gilbert Strang. Linear Algebra and Its Application. 4th Edition, Cengage Learning, 2006.
3- David Clay. Linear Algebra and Its Application. 4th Edition, Pearson, 2011.

Title of the Course: Fundamentals of Mathematical Analysis

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 48h Theoretical

Course Objectives:

This course presents foundation concepts in analysis which lay the groundwork for further study in pure and applied mathematics, in particular real analysis courses. It is normally required material for mathematics majors. Topics studied include the nature of proof, set theory and cardinality, the real numbers, limits of sequences and functions, continuity, formal coverage of the derivative and the mean value theorem, Taylor's theorem, the Riemann integral, the fundamental theorem of calculus, and topics in infinite series.

Title of the Course: Fundamentals of Algebra

Number of Credits: 3

Type of the Course: Specialized | Theoretical

Training hours: 48h Theoretical

Course Objectives:

Foundations of Algebra will provide many opportunities to revisit and expand the understanding of foundational algebra concepts, will employ diagnostic means to offer focused interventions, and will incorporate varied instructional strategies to prepare students for required high school mathematics courses. The course will emphasize both algebra and numeracy in a variety of contexts including number sense, proportional reasoning, quantitative reasoning with functions, and solving equations and inequalities.

Title of the Course: Foundation of Combinatorics

Number of Credits: 3

Type of the Course: Specialized | Theoretical

Training hours: 48h Theoretical

Course Objectives:

Modeling natural events that occur discretely using graph and network tools.

Syllabus:

Enumeration includes: main concepts, pigeon nest principle, transformations and combinations and coefficients of binomials, principle of inclusion and non-inclusion, recursive relations, generating functions. Relations and their types: relations and their representation, relations of harmony and separation, relations of partial order and complete order, the basis of a relation with respect to different properties. Matrices: Matrices from a combinatorial point of view, especially some important properties of zero and one matrices (preparation for the section of Eltyn squares and graphs), familiarity with Hadamard matrices and some results in this case. Graphs and models based on them: introducing the concept of graph with emphasis on applications It is in modeling, familiarity with the main concepts of graph theory such as distance, path, degree, sequence of insertions, main types of graphs such as complete graphs, trees, bipartite graphs, Eulerian and Hamiltonian graphs and directed graphs and tournaments (with emphasis on examples and applications). Complete and maximum correspondences (algorithm design and applications), coloring graphs and colored polynomials (with example and algorithm). Latin squares, designs and finite geometries: getting to know the definitions and main concepts with an emphasis on the connection of these concepts (with example) and also emphasizing the connection of these concepts with the previous concepts proposed in this lesson, such as graphs and also presenting several counting cases in this regard, presenting the concept of systems of differentiated representation (SDR) and also the design of Philipp's theorem (Hall.P) and providing examples and applications In Latin squares and some practical applications.

TextBooks:

1- I. Anderson, A First Course in Combinatorial Mathematics, 2nd Edition, Oxford Applied Mathematics and Computing Science, The Clarendon Press Oxford University Press, 1989.
2- J.A. Bondy, U.S.R. Murty, Graph Theory: Graduate Texts in Mathematics, Springer, 2008.
3- R.P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, 5th Edition, Addison-Wesley, 2003.

Title of the Course: Fundamentals of Matrices and Linear Algebra

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 48h Theoretical

Course Objectives:

The principal topics of the course include vectors, matrices, determinants, linear transformations, eigenvalues and eigenvectors, and selected applications.

Syllabus:

Solving and discussing linear equations and n unknowns on a field through line simplification, scaling the matrix of coefficients of the device, vector spaces on a field, multiplication of matrices, invertible matrices, vector spaces, subspace, base, dimension, coordinates, linear transformation , change of base, linear transformations, eigenvector, eigenvalue, eigenpolynomials and latent, similar matrices, form of Cayley-Hamilton theorem, a brief about diagonalization and triangulation of matrices, simultaneous diagonalization and triangulation. Introduction of determinants and their properties. Using suitable software such as Maple or MATLAB in solving and checking matrix problems.

TextBooks:

1- S. Lang, Linear Algebra, Springer, 1987.
2- G. Strong, Introduction to Linear Algebra, 4th Edition, Wellesly Cambridge Press, 2009.

Title of the Course: Human in Islam

Number of Credits: 2

Type of the Course: Core | Theoretical

Training hours: 32h Theoretical

Course Objectives:

Familiarity with Islam's view of man, his place in the system of existence, talents and responsibilities, and awareness of the true value of man.

Syllabus:

Generalities and basic concepts. Defining the importance and necessity of anthropology. Anthropology from different perspectives (experiential, mythological, philosophical, religious, etc.). Man in the opinion of Muslim mystics (Maulavi, Hafez, etc.). Constructions of human existence. Human nature and material needs. Spirituality and divine nature of man. Human intellect and consciousness. Human freedom and responsibility. Human perfection. Love and affection (true love, virtual love and false love). The course of human evolution (knowledge of God, divinity and responsibility). Levels of human perfection and ascension. Factors and barriers to perfection. alienation. The meaning of alienation and the existing views on this. Backgrounds, factors and consequences of human alienation. Modern man and man's alienation from himself. Treatment of alienation.

Title of the Course: Imam Khomeini Thoughts & Last Will

Number of Credits: 1

Type of the Course: Core | Theoretical

Training hours: 16h Theoretical

Course Objectives:

This course aims to explore the ideologies of the leaders of the Islamic Revolution in Iran and delve into the testament and guidance provided by Imam Khomeini.

Title of the Course: Differential Equations

Number of Credits: 3

Type of the Course: Basic | Theoretical

Training hours: 48h 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.

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, second order linear equation, homogeneous equation with fixed constants, method of indefinite constants, method of changing parameters, application of second 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.

TextBooks:

1. E. Kreyszig, Advanced Engineering Mathematics, 1999
2. P. Blanchard, R.L. Devaney, and Co. Hall, Differential Equations, 1st Edition, Brooks/ColePub, 1998

Title of the Course: Fundamentals of Numerical Analysis

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 48h Theoretical

Course Objectives:

This course is a presentation of the problems commonly arising in numerical analysis and scientific computing and the basic methods for their solutions. Topics include number systems and errors, solution of nonlinear equations, systems of linear equations, interpolation and approximation, differentiation and integration, and initial value problems. This course will involve the use of a numerical software package (such as MATLAB) and/or a high-level programming language (such as C/C++).

Syllabus:

floating point display of real numbers and different types of errors, problem mode and stability of the algorithm, solution of linear equation devices, LU and LL analysis for positive definite matrices (and computational error analysis, axis selection and stability of LU T analysis and mode of linear devices) interpolation (Newton's methods and Lagrange, splines and smooth interpolation, the fixed point problem and its connection with rooting functions and minimization (Newton and pseudo-Newton), convergence and rate of convergence, iterative fixed point methods, Newton's method for solving nonlinear devices and minimizing multivariable functions, numerical derivation and order of error Shear, numerical integration (Newton-Kutz, Vaggi, Ramberg, Gaussian and Nasser integral methods). It is recommended to use at least one of the relevant mathematical software.

TextBooks:

1- A. Greenbaum, T.P. Chartier, Numerical Methods, Princeton University Press, 2012.
2- W. Cheney, D. Kincaid, Numerical Mathematics and Computing, Thomson, 2004.
3- R.L. Burden, J.D. Faires, Numerical Analysis, 10th Edition, 2015.

Title of the Course: Algorithm Design and Analysis

Number of Credits: 3

Type of the Course: Specialized | Theoretical

Training hours: 48h Theoretical

Course Objectives:

In this course students will learn algorithm definition; tools and methods for algorithm analysis and design; mathematical notations; choice of data structure, space and time efficiency, computational complexity, and algorithms for searching and sorting.

Syllabus:

Apply the mathematical notations used in the field of design & analysis of algorithms. Apply the design & analysis of algorithms with illustrations from different problem areas. Use the methods for analyzing and designing algorithms in the field of Computing Science. Use graph algorithms. Search and sort advanced data structures.

Title of the Course: Computer Networks

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 48h Theoretical

Course Objectives:

Basics and Principles of Computer Networks and Data Transition Systems will be introduced in this course. In this course the students will be introduced to different network security algorithms and they can learn about methods of implementation a secure network and a communication plan.

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.

TextBooks:

1. Computer Networking: a top-down approach / James F. Kurose, Keith W. Ross.6th ed, 2013. 2. Computer networks / Andrew S. Tanenbaum, David J. Wetherall. 5th ed, 2011.

Title of the Course: Fundamentals of Theory of Computation

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 48h Theoretical

Course Objectives:

The purpose of this course is to acquaint students with the basics of computational theory and the main concepts of computability models, solvable problems, mathematical logic and an introduction to automata theory on finite inputs of a string or tree. This course is in fact the necessary theoretical basis for students who in the graduate course tend to the theory of computation and algorithms with formal methods in software engineering and systems validation as well as mathematical logic necessary for artificial intelligence.

TextBooks:

1- M. Divis, R. Sigal, E. Weyuker, Computability, Complexity, and Languages. 2nd Edition, Academic Press, 1997.
2- M. Sipser, Introduction to the Theory of Computation. 2 nd Edition, Thompson co., 2006.

Title of the Course: Fundamentals of Logic and Set Theory

Number of Credits: 3

Type of the Course: Specialized | Theoretical

Training hours: 48h Theoretical

Course Objectives:

Examines the logical foundations of concepts used throughout mathematics, such as order and equivalence relations, number and continuity. The use of infinity in mathematical arguments is investigated and implicit assumptions about infinite sets are exposed. Notions of infinity are formulated precisely and it is shown how infinite sets may be counted and compared in size. It is seen that, even in something as basic as set theory, 'truth' is not absolute.

Title of the Course: Applied Ethics

Number of Credits: 2

Type of the Course: General | Theoretical

Training hours: 32h Theoretical

Course Objectives:

Familiarity of students with the moral standards of Islam about the most important aspects of daily life and creating a context for a greater tendency to accept the moral standards of Islam on individual and social issues.

Title of the Course: Numerical Linear Algebra

Number of Credits: 3

Type of the Course: Specialized | Theoretical

Training hours: 48h Theoretical

Course Objectives:

The course focuses on iterative techniques for solving large sparse linear systems of equations which typically stem from the discretisation of partial differential equations. In addition, computation of eigenvalues, least square problems and error analysis will be discussed.

Syllabus:

A student successfully meeting all the learning objectives of this course will be able to: (1) explain and fluently apply fundamental linear algebraic concepts such as matrix norms, eigen- and singular values and vectors; (2) estimate stability of the solutions to linear algebraic equations and eigenvalue problems; (3) recognize matrices of important special classes, such as normal, unitary, Hermitian, positive definite and select efficient computational algorithms based on this classification; (4) transform matrices into triangular, Hessenberg, tri-diagonal, or unitary form using elementary transformations; (5) utilize factorizations and canonical forms of matrices for efficiently solving systems of linear algebraic equations, least squares problems, and finding eigenvalues and singular values; (6) explain the underlying principles of several classic and modern iterative methods for linear algebraic systems, such as matrix-splitting, projection, and Krylov subspace methods, analyze their complexity and speed of convergence based on the structure and spectral properties of the matrices; (7) explain the underlying principles of iterative algorithms for computing eigenvalues of small and select eigenvalues of large eigenvalue problems; (8) explain the idea of preconditioning; (9) explain the fundamental ideas behind multigrid and/or domain decomposition methods; (10) estimate the speed of convergence and computational complexity of select numerical algorithms; (11) implement select algorithms on a computer.

TextBooks:

1- B. Nath Datta, Numerical Linear Algebra and Applications, 2nd Edition, 2010.
2- C.D. Mayer, Analysis and Applied Linear Algebra, Siam, 2000.

Title of the Course: Probability 1

Number of Credits: 3

Type of the Course: Elective | Theoretical

Training hours: 48h Theoretical

Course Objectives:

Understanding the fundamental concepts of probability theory, including sample spaces, events, random variables, and probability distributions. Learning to apply probability theory in solving real-world problems and analyzing data.

Syllabus:

Introduction to probability theory. Sample spaces and events. Definition and properties of probability. Conditional probability and independence. Discrete and continuous random variables. Probability distributions: uniform, binomial, Poisson, normal. Expected values and variance. Law of large numbers and central limit theorem. Applications of probability theory in computer science and data analysis.

Title of the Course: Theory of Computation

Number of Credits: 3

Type of the Course: Elective | Theoretical

Training hours: 48h Theoretical

Course Objectives:

This course introduces formal models of computation and the problems that they can solve. It presents Turing machines and equivalent models of computation. It also discusses the fundamental limitations of what can be computed. It covers finite state machines, regular expressions and regular grammars as well as context-free languages and grammars and non-context free grammars. It includes algorithms and decision procedures for regular and context-free languages, Turing machine, decidability and complexity analysis.

Title of the Course: Linear Optimization

Number of Credits: 3

Type of the Course: Specialized | Theoretical

Training hours: 48h Theoretical

Course Objectives:

Modeling real problems and solving them effectively and computerized.

Syllabus:

Familiarity with the fields of operations research, types of mathematical models, linear programming (modeling, drawing methods, basic and dual simplex, biphasic and large M methods, duality and its results, sensitivity analysis (networks and transport and allocation model, other similar models) Familiarity with the programming of correct variables (branch and limit and shear plane methods). Introduction and solution to a modeling language such as CPLEX, OPL (ILOG, GAMS, Juliapot, GUROBI and AMPL. It is recommended to use at least one related mathematical software.

TextBooks:

1- F.S. Hillier, G.J. Liberman, Introduction to Operation Research, 9th Edition, McGraw-Hill Science, 2009.
2- D. Luenberger, Linear and Nonlinear Programming, 4th Edition, Springer, 2016.
3- W.L. Winston, Operation Research: Applications and Algorithms, Duxbury Press, 2003.
4- H. Taha, Operations Research: An Introduction, 10th Edition, Pearson PRENTICE-Hall, 2016.

Title of the Course: Logic

Number of Credits: 3

Type of the Course: Specialized | Theoretical

Training hours: 48h Theoretical

Course Objectives:

The main objective of this course is to expose undergraduate and beginning graduate students to mathematical logic. Mathematical logic, used called symbolic logic, is a powerful tool for modeling and reasoning formally about computation and computational devices. It provides a unifying foundational framework for several areas of computer science such as databases, artificial intelligence, hardware design, programming languages, software engineering, and concurrent systems. This course introduces several logics (propositional, predicate or first-order, Hoare, temporal, ...), differing in their expressive power and focus, and discusses some of their uses in computer science. Main themes are how to represent knowledge in these logics, what represents a valid argument, and how to prove or disprove, possibly automatically, the validity of a logical statement. Since computer science is about problem solving using computers, the focus will be on how to use logic as problem-solving tools, and how the tools based on logic are created and used.

Title of the Course: Topics in Computer Science

Number of Credits: 3

Type of the Course: Elective | Theoretical

Training hours: 48h Theoretical

Course Objectives:

It is a course at the undergraduate level or higher with a variable subject in the field of computer science, which is offered for the first time in terms of facilities and needs. Relevant course materials must be approved by the Computer Science Department Council before submission.

Title of the Course: History of Imamate

Number of Credits: 2

Type of the Course: General | Theoretical

Training hours: 32h Theoretical

Course Objectives:

Familiarity with the issue of Imamate, its place in Islam and the manners and traditions of the leaders in different time requirements.

Syllabus:

Will and succession in the history of previous prophets. Terminology of Imamate, Wilayat, Ahl al-Bayt, Sahaba, Tabi'in, etc. The death of the Prophet and the chain of succession. The story of Saqifa, its contexts and consequences. Life periods of Imam Ali (a.s.) (together with the Prophet, the Caliphate era, the reign period). The biography of Imam Ali (a.s.) and the principles of Alawite government. Imam Hasan (a.s.) during the period of the Prophet and Imam Ali (a.s.). Peace of Imam Hassan (AS), motivations and consequences. Imam Hussein (a.s.) during the period of the Prophet and Imam Ali (a.s.). Ashura uprising, its contexts and effects. Personality and actions of Imam Sajjad (AS). Political, social and cultural characteristics of Imam Baqir (a.s.) and Imam Sadiq (a.s.). The scientific and spiritual personality of Imam Baqir (a.s.) and Imam Sadiq (a.s.) from the point of view of Shiites and Sunnis. The role of Imam Baqir (a.s.) and Imam Sadiq (a.s.) in strengthening and flourishing Islamic and Shiite culture and education. The political and social situation during the time of Imam Kazem (a.s.). The character of Imam Kazem (a.s.) and his influence in the Islamic and Shiite society. The political, social and cultural situation during the era of Imam Reza (a.s.). The personality of Imam Reza (a.s.) and his cultural and political influences in the Islamic society. The issue of Imam Reza's (a.s.) guardianship, motivations, causes and consequences. Social, cultural and political conditions of the era of Imams. The personality of imams and their influence in Islamic and Shiite society. Creating a network of scientific, social and political communication between imams and the Shia community (lawyers, narrators and jurists). Absence contexts and social and political conditions of that period. Imam Mahdi (AS) in Sunni and Shia sources. Shi'ism in the era of Ghaibt Soghari and Nawab Arbaah. The philosophy of expectation and conditions of emergence.

Title of the Course: Introduction to Holy Defense

Number of Credits: 2

Type of the Course: General | Theoretical

Training hours: 32h Theoretical

Course Objectives:

The history of the Iran-Iraq war.

Title of the Course: Numerical Analysis

Number of Credits: 3

Type of the Course: Basic | Theoretical

Training hours: 48h Theoretical

Course Objectives:

This course analyzed the basic techniques for the efficient numerical solution of problems in science and engineering. Topics spanned root finding, interpolation, approximation of functions, integration, differential equations, direct and iterative methods in linear algebra.

Syllabus:

Series expansions: from calculus to computation. Integrals as sums and derivatives as differences. Interpolation, splines, and a second look at numerical calculus. Numerical methods for ODE, initial-value problems. Root finding, Newton’s method, boundary-value problems. Fourier transform, Fourier series, Shannon sampling theory. Bandlimited interpolation, spectral methods. Least-squares approximation. Principal component analysis.

Title of the Course: Principles of Operating Systems

Number of Credits: 4

Type of the Course: Core | Theoretical

Training hours: 64h Theoretical

Course Objectives:

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

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.

TextBooks:

1. W. Stallings, Operating Systems, 4th Edition, Prentice Hall, 2001 2. Silberschatz, J.L. Peterson, Operating Systems Concepts, Addison Wesley, 2000 Course

Title of the Course: Bachelor's Degree Project

Number of Credits: 3

Type of the Course: Specialized | Practical

Training hours: 48h Theoretical

Course Objectives:

With the consent of the research committee of the public relations department and under the supervision of one of the professors appointed by the department, the student selects a topic with the consent of his / her supervisor and compiles his / her dissertation in one of the research methods or practical project. Graduation of the student will depend on the successful defense of the dissertation. The evaluation of the dissertation and the project is the responsibility of the supervisor and the representative of the department (consulting professor) and if necessary, the student will defend his dissertation orally.

Title of the Course: Artificial Intelligence

Number of Credits: 3

Type of the Course: Elective | Theoretical

Training hours: 48h Theoretical

Course Objectives:

AI is an introductory course in Artificial Intelligence. The goal is to acquire knowledge on intelligent systems and agents, formalization of knowledge, reasoning with and without uncertainty, machine learning and applications at a basic level.

Syllabus:

Problem solving, reasoning, planning, natural language understanding, computer vision, automatic programming, machine learning, and so on. Of course, these topics are closely related with each other. For example, the knowledge acquired through learning can be used both for problem solving and for reasoning. In fact, the skill for problem solving itself should be acquired through learning. Also, methods for problem solving are useful both for reasoning and planning. Further, both natural language understanding and computer vision can be solved using methods developed in the field of pattern recognition.

TextBooks:

1- Qiangfu ZHAO and Tatsuo Higuchi, Artificial Intelligence: from fundamentals to intelligent searches, Kyoritsu, 2017.
2- Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Prentice Hall.

Title of the Course: Physical Education

Number of Credits: 1

Type of the Course: General | Practical

Training hours: 8h Theoretical & **16h Practical**

Course Objectives:

Physical Education classes are designed to practice and develop skills in activities that will help you maintain fitness throughout your life. During the year, you will set and monitor personal fitness goals that will aid in the development of a personal fitness plan.

Title of the Course: Family and Population Knowledge

Number of Credits: 2

Type of the Course: General | Theoretical

Training hours: 32h Theoretical

Course Objectives:

Familiarity of students with the basics of family knowledge and how to form, consolidate, and excel it and demographic characteristics and their role in improving the quality of life

Title of the Course: Islamic Ideology I (Genesis & Resurrection)

Number of Credits: 2

Type of the Course: General | Theoretical

Training hours: 32h Theoretical

Course Objectives:

Explaining the need for Muslim students to deal with religion and religious categories, deepening and expanding information and strengthening the belief in God and faith of students in the field of theology and resurrection.

Syllabus:

Man and faith: spiritual needs of man, the role of religious faith in human life, reason and faith. The concept of God: different perceptions about God, God in Abrahamic religions (Judaism, Christianity, Islam). Finding God: heart and intuition, intellect and reason. Monotheism and polytheism: monotheism of nature and attributes, monotheism of verbs, monotheism of worship (invocation and intercession). Other attributes of God: divine justice, wisdom and judgment, the problem of evil. Predestination and discretion (Qada and Qadr). Resurrection and immortality of man: death and purgatory, resurrection.

Title of the Course: History of Islamic & Iranian Culture and Civilization

Number of Credits: 2

Type of the Course: General | Theoretical

Training hours: 32h Theoretical

Course Objectives:

Familiarity of students with the history of culture and civilization of Islam and Iran.

Title of the Course: Compiler

Number of Credits: 3

Type of the Course: Core | Theoretical

Training hours: 48h Theoretical

Course Objectives:

Designing and building compilers is one of the basic concepts of computer science. Although there is little variety in the way compilers are made, a wide variety of languages and machines can be used to make interpreters and translators. In this lesson, the subject of building compilers is introduced by describing the main components of a compiler, their tasks and their relationship. After an introductory introduction to the components of a compiler and the types of grammars, the various stages of translation, such as lexical, syntactic and semantic analysis, and code generation and payment, are described. Students who successfully pass this course will have a good insight into the following: Familiarity with compiler components and various techniques for their implementation, understanding the implementation of programming language commands, gaining skills in producing optimal programs and fixing programming errors, familiarity And the use of automated tools in compiler production.

Syllabus:

An introduction to the design and implementation of programming language translators. Theoretical aspects of language design and translation is discussed and practically demonstrated by developing a working compiler.

TextBooks:

A. Aho, M. Lam, R. Sethi, and J. Ullman, Compilers: Principles, Techniques, and Tools (2nd Edition), Prentice Hall, 2006.

Title of the Course: Graph Theory and Applications

Number of Credits: 3

Type of the Course: Elective | Theoretical

Training hours: 48h Theoretical

Course Objectives:

The course treats grapph theoretical notions and problems, and the use of algorithms, both in the mathematical theory of graphs and its applications. In the course, the basic theory of graphs of different kinds is developed in detail, especially trees and bipartite graphs. In the course some of the algorithms that totally or partly solve graph theoretical problems are presented. An example of such a problem is to find a matching of maximum weight, and another is to find a maximum flow in a network. The theory for matchings and Hall's theorem are treated, as well as spanning trees and Menger's theorem. Further, the theory of vertex and edge colouring, including Brooks' theorem and Vizing's theorem, are presented. Finally, an introduction to matroid theory is included.

TextBooks:

1- J.A. Bondy, U.S.R. Murty, Graph Theory with Applications, Springer, 2008.
2- G. Chartrand, L. Lesnika, Graphs and Digraphs, 5th Edition, Chapman & Hall, 2010.

Title of the Course: Dynamic Optimization

Number of Credits: 3

Type of the Course: Elective | Theoretical

Training hours: 48h Theoretical

Course Objectives:

The aim of this course is to provide students with some the mathematical and practical tools to set up, analyze and simulate discrete time dynamic optimization problems. Identify and analyse an issue using the relevant analytical tools and methods. Adopt a scientific approach to data collection, research and analysis and communicate results with clear, structured, and sophisticated arguments. Apply quantitative and qualitative techniques to support data analysis using standard office and statistical software.

Title of the Course: Islamic Revolution of Iran

Number of Credits: 2

Type of the Course: General | Theoretical

Training hours: 32h Theoretical

Course Objectives:

Theoretical acquaintance with the causes and factors of the emergence of the Islamic Revolution and the study of the cultural, social and political developments of the Islamic Revolution and the issues after it.