COURSE DESCRIPTION OF MATHEMATICS AND APPLICATIONS

COURSE TITLE	**CREDITS HOURS**
General Mathematics I /	4
General Mathematics II/	4
Advanced Mathematics	3
Differential Equations	3
General Physics	3
Fundamentals of Computer & Programming	3
Fundamental of economics	2
Fundamentals of entrepreneurship	2
COURSE TITLE	**CREDITS HOURS**
Foundations of Mathematics Science	3
Fundamentals of Matrix and Algebra line	3
Fundamentals of statistics	3
Fundamentals of Mathematical analysis	3
Fundamentals of numerical analysis	3
COURSE TITLE	**CREDITS HOURS**

Mathematics Analysis	3
Fundamentals of Discrete	3
Fundamentals of algebra	3
Liner optimization	3
statics 1	3
Probabilities Methods	3
Theory of differential equations	3
Partial differential equation	3
General topology	3
Fundamentals of geometry	3
COURSE TITLE	**CREDITS HOURS**
Algebra	3
Elementary Number Theory	3
Numerical methods of differential equation	3
Advanced programming	3
Topics in mathematics and applications	3

COURSE TITLE	**CREDITS HOURS**

Numerical analysis	3
Mathematical software	3
Bachelor Project	3
Topics in computer science	3
Specialized language (English)	3
History of mathematics	3
Discrete and applications	3
Philosophy of mathematics science	3
Techniques of language learning	2
Writing and editing skills	2
Earth in space	2
Fundamental of communication	2

Undergraduate Course Descriptions

General Mathematics I / 4 Cr.

Integration, Exponential and logarithmic functions And hyperbolic functions, Methods Integration, Integral applications, Sequences and series Numerical, Power series, complex numbers

General Mathematics II/ 4 Cr.

Vector and analytical geometry in three-dimensional space, Vector and bending functions, Partial derivation, Application of partial derivative, multiple integral, Vector field, Accounting, Ordinary differential equation, complex numbers, Complex functions, Continuous functions, Riemann integral, Applying Maple in Differential and Integral Calculus.

Prerequisite: General Mathematics I

Advanced Mathematics 3 Cr.

Cartesian coordinates, Polar coordinates, Complex numbers, addition and multiplication and roots and geometric representation of complex numbers, Polar representation of complex numbers, function, algebra of functions, limit and related theorems, infinite limit and limit in infinity, left and right limit, continuity, derivative, derivative statements, inverse function and its derivative, derivative of trigonometric functions and their inverse, Roll theorem, mean-value theorem, Tyler expansion, geometric and physical applications of the derivative, curves and acceleration in polar coordinates, Application of the derivative in approximating the roots of equations, A review on vector spaces, linear transformations, Matrix representation of linear transformtions, Dual spaces

Prerequisite: General Mathematics I / General Mathematics II/

Differential Equations 3 Cr.

- Basic concepts and definitions: Definition of differential equations and their classification in terms of ordinary, partial, Linear and nonlinear - Classification of differential equation solutions – Theorem Existence and uniqueness of the answer to the initial value problems
- Detachable or separable equations: Definition of separable equations - Definition of homogeneous function - Definition of homogeneous equation
- Complete equations Integrator factor: Defining the Complete Equation and Examining the Conditions of Perfection - Defining the Agent Integralizer - Finding the integral agent in several specific states
- First-order linear equations
- Important first-order nonlinear equations
- Special states in solving first-order equations
- Second and higher order equations
- Solve quadratic equations with constant coefficients and Variable
- Solve heterogeneous linear equations of the second order and above
- Solve the Cauchy-Euler equation and investigate several modes
- Specific in solving second-order and higher equations
- Solve differential equations with the help of series
- Legend's equation
- Forubenius series
- Bessel equation
- Laplace transform and its applications

Prerequisite: General Mathematics I

General physics 3 Cr.

measurement, Moving in one dimension, moving in the plane, particle dynamics, work and energy, particle system Collision (minus variable mass), rotational kinematics, rotational dynamics, equilibrium , Gravity (to the first Kepler's laws) , Oscillation

fundamentals of Computer & Programming 3 Cr.

Basic knowledge of computers, hardware and software, Internet and structured languages including C, Introduction to Algorithm, Variables, Input Output, Control structures (switch-else-if), Repetitive structures loops (while ،for ،while-do), Range of variables (local, global, static), Normal functions and recursive functions ,Arrays and its application along with the function, Pointers and their relationship to strings and arrays ,Files and processing on the file and performing exercises such as searching the file or sorting the contents of the file, Structures and how to use structures, functions and files, Characters and strings

- Familiarity with algorithms and flowcharts,
- Familiarity with computer hardware
- Familiarity with the basic concepts of networking
- General principles of working with the Internet, email, search and how to work on the web
- Familiarity with operating systems including Windows
- Familiarity with computer operating software including Microsoft Word, Microsoft Powerpoint, Microsoft Excel, (ICDL), XePersian, LATEX
- Familiarity with math software including Matlab
- Introduction to some programming and working languages
- Familiarity with the principles of reporting and doing the project

Advanced programing 3 Cr.

Familiarity with the principles of object-oriented programming and designing applications with one of the object-oriented languages such as C++, Matlab, python,

Software life cycle, programming position, program design methods, object-oriented ideas, Integrated development environments, Control and selection structures, return functions and functions, arrays and sending arrays as parameters, Exception management, Graphic interface, Sequential files ,Data flow, Interface Concepts, Work with strings and arrays, Search and sort algorithms,Dynamic memory, Link list and stack, Design an application

Prerequisite: Introduction to Computer & Programming

Foundations of mathematics science 3 Cr.

Logic of propositions, Value table, Collections and preliminary actions on them, Russell Paradox, Relationships and functions, Equivalence and separation relations Finite, innumerable and innumerable collections, Original numbers, Contour theorems, Schroeder Bernstein case, The principle of choice and not Zorn

Prerequisite: General Mathematics I

Fundamentals of Matrix and Linear Algebra 3 Cr.

System of linear equations and matrices, determinant, Vector space, Internal multiplication space, Linear transformation, Special vectors and special values, The case of Kelly Hamilton

Prerequisite: Foundations of mathematics

Fundamental of statistics 3 Cr.

Descriptive Statistics Basics of descriptive statistics, statistical tables, statistical charts, central criteria, dispersion criteria, torques, Skewness and elongation coefficients, Probability space, Incidence algebra, Counting, Permutation, Composition, Random experiment, Sample space, Probability rules, Distribution Co-occurrence probabilities, conditional probabilities, sample, space separation, Bayesian formula, Probability space, discrete and continuous random variables, probability function, probability distribution function, density pan, co-distribution and Conditional, hope and variance, covariance and correlation, function of distribution of random variables, Markov and Chebyshev inequalities. o Discrete distributions including (uniform, Bernoulli, binomial, geometric, negative binomial, Poisson, supersymmetric), Two-sentence approximation with Poisson, Continuous distributions include (uniform, exponential, gamma, chi-square, normal, beta, Cauchy, logistic, Weibull, Parato)

Prerequisite: General Mathematics I

Foundation of Mathematical analysis 3 Cr.

Real numbers, topology on R, limit and continuity on R, derivative, familiarity with metric spaces and its topological concepts, Set of real numbers, Principle of perfection, Archimedean property, Open and closed sets on R, compressed sets on R, Heine Borrell's theorem, bond sets on R, Continuity of functions, Intermediate theorem and extreme theorem, Uniform continuity, Derivative of functions, Mean value theorem, hospital rule, Metric spaces, Open and closed sets, compact sets, link sets, sequences and their convergence, limit and continuity of functions, conservation, Compression and bonding by continuous functions, uniform continuity

Prerequisite: General Mathematics II

Fundamentals of Numerical Analysis 3 Cr.

Error sources, number representation systems, Interpolation, Approximation of the least squares, Numerical derivation, Numerical integration, Solve linear devices, Rooting nonlinear functions and devices, round off error and its analysis

Prerequisite: General Mathematics II

Mathematical Analysis 3 Cr.

Sequence and series on R, Riemann integral, sequence and series on dependent functions and theorems Sequences, Sequence Limits, Uniform Sequences, Sub-Sequences, Superior and Lower Sequences, Riemann Integrality and Its Properties, Basic Theorem Calculus, Theorem of Mean Integral Value, Function Sequence, Point and Uniform Convergence, Relationship between uniform convergence and integral derivative, series of uniform convergence functions, Weierstrass tests, Abel and Dirichlet for Convergence of Function Series, Weierstrass Theorem, Introduction to Soft and Banach Spaces, Fourier Series

Prerequisite: Foundation of Mathematical analysis

Fundamentals of Discrete 3 Cr.

Familiarity with various discrete structures such as matrices, graphs, Latin squares and familiarity with algorithmic thinking and simple computational models, The main concepts of counting Bipolar coefficients, Generator functions, Recursive relationships, Graphs, Eulerian circuits, Trees, Hamilton routes and laps, Coloring graphs, Matrix, Altin squares, Finite geometries, Combined designs

Prerequisite: Foundations of mathematics science, General Mathematics I

Fundamentals of algebra 3 Cr.

Subgroup, group, homogeneity, subgroup and extracorporeal group, distance group theorems and alliance theorem, permutation groups and theorem Kelly, normal subgroups and derivative subgroups, homogeneity theorems, loops and preliminary operations on loops, loops and loop characteristics Ideals and the symmetry of rings, the first and maximum ideals, polynomial rings

Prerequisite: Foundations of mathematics science

Liner optimization 3 Cr.

Familiarity with modeling real problems with the help of linear relations, problem solving with the help of simplex algorithm, problems and Dual theorems, analysis of answers, and evaluation of shadow prices and the application of linear programming in transportation, Introduction of optimization concepts and linear programming problems, Modeling (Work Scheduling Problem, Mixing Problem, Cutting Problem, Project Selection Problem, Production Process Problem, Problem Multi-cycle decision-making, multi-cycle financial problem), Sensitivity analysis, parametric programming, Transportation problem, simplex transportation method, Vertex, basic answer, show theorem, relation between vertices and basic answers, Simplex Algorithm, Investigation of Specific Situations in the Simplex Algorithm Large M method, two-phase simplex method

Prerequisite: Fundamentals of Matrix and Algebra line

Statics I 3 Cr.

- Basic concepts of co-distribution of two or more random variables (continuous and discrete), marginal distribution, and conditional covariance Correlation, correlation, independence of two random variables, conditional mathematical hope, mathematical hope and variance of the sum of several variables Independent randomization, Functional distribution of one or more random variables, Sampling, Simple random sampling, Statistics, Statistics Sequential
- Estimation: Concept of estimation, estimation of sample mean and variance, sample distributions, central limit theorem, law of large numbers and
- Chebyshev, Markov, and Jensen inequality, types of confidence intervals for mean and variance of society
- Hypothesis test: Principles of statistical tests, types of errors, one-domain and two-domain tests, relationship between hypothesis test and distance Reliability, hypothesis test on mean and ratio,
- Regression: Simple linear, statistical inference about simple linear regression model parameters

Prerequisite: Foundations of mathematics science, General Mathematics II

Probabilities methods 3 Cr.

- Exponential and Gamma distribution
- Normal-Student distribution, the sample mean distribution, and Central Limit Theorem
- Chi-square distribution and Sample Variance distribution
- Student T probability distribution and corresponding theorem as the distribution of T statistics.
- Fisher probability distributions and corresponding theorem as the distribution of F statistics
- Point Estimation-Methods of Estimations (Moments-Maximum Likelihood)-Unbiased Estimator, Confidence Intervals (Mean-Ratio-mean difference-Proportion difference-Variance-Ratio of variances)

- Testing Hypothesis: Errors (Type one and Type two), Rejection area, Level of significance, p-value techniques, Power of the test.
- Testing Hypothesis (Mean, proportion, mean difference, Proportion difference-Variance, Ratio of Variances
- Linear Regression: estimation of the Regression parameters and correlation parameter R. Distribution of Corresponding estimators. Corresponding Confidence intervals and prediction interval. The corresponding testing hypothesis of the Regression parameters and R statistics.
- One-sided and two-sided Analysis of variance (ANOVA). Two-sided Analyse of variance with mutual effects. Testing the hypothesis for the equality of the mean of several populations.

Prerequisite: Statics I

Theory of differential equations 3Cr.

- Introduction to Ordinary Differential Equations
- Solve first-order differential equations
- Solve differential equations of rank two and higher
- Solving a system of linear differential equations with constant coefficients
- Solve differential equations by series method
- Laplace Converts

Prerequisite: Differential Equations, Foundation of Mathematical analysis

Partial Differrential Equations 3Cr.

- Fourier analysis
- Classification of PDEs, Boundary Value Problems
- Solutions of elliptic equations Laplace, Heat and wave equation
- principles Maximum, problems Parabolic
- wave equations, Hyperbolic equations
- Green function and Dirichlet and Neumann problems
- Sturm-Liouville Differential Equation

Prerequisite: Differential Equations, Mathematical Analysis

General Topolpgy 3Cr.

- Topological spaces
- Basic topology
- Construction of new topological spaces
- Continuous functions
- Localization and localization

- Compression and local compression
- Compression in metric spaces
- The case of Tikhonov
- Regular and normal spaces
- Thesis of the expansion of Titus

Prerequisite: Foundations of mathematics science

Fundamentals of geometry 3Cr.

- Isometries of Euclidean Plane and Euclidean Space
- Mappings Conformal and Inversion, Similarities
- Affine and Projective Transformations
- Conic Sections
- Hilbert Axioms and Hyperbolic Plane

Prerequisite: Foundations of mathematics science

Algebra 3Cr.

- Reminders of the basic definitions of circles
- Symbolic and ideal
- The first and maximum ideals
- Nutri and Artini rings
- First and non-deliverable elements
- The original ideal rings
- Unique domains of UFD decomposition
- Euclidean spheres
- Ring of polynomials
- Solvable groups
- Silo cases and its application

Prerequisite: Fundamentals of algebra

Elementary Number Theory 3Cr.

- divisibility and G.C.D
- Congruence Ring
- Diophantine Equation
- Arithmetic function
- Quadratic Reciprocity
- Application of number theory in cryptography

Prerequisite: Foundations of mathematics science

Numerical Methods of Differential Equation 3Cr.

- Introduction to the theory of differential equations
- Euler method
- Differential equation system
- Retro Euler method and trapezoidal method
- Ronge-Kota and Taylor methods
- Multi-step methods
- Hard differential equations
- Implicit runge-quota methods for rigid differential equations
- Algebraic Differential Equations
- Two-point boundary value problems
- Voltra integral equations
- Introduction to Solving Partial Differential Equations Numerically

Prerequisite: Fundamentals of Numerical Analysis, partial differential equation

Numerical Analysis 3Cr.

- Numerical solution of normal differential equations with initial conditions
- Numerical solution of boundary differential equations
- Numerical solution of partial differential equations using finite difference method, stiff differential equations
- Repetitive methods for solving linear devices
- decomposition
- Matrix analysis(SVD و QR ،LR)
- Solve the least linear squares problem
- Vertical decomposition of matrices
- The problem of eigenvalue and methods of solving it

Prerequisite: Fundamentals of Numerical Analysis

Mathematical Software 3Cr.

- Familiarity with word processing and typewriter software for writing mathematical texts (Latex and word)
- Adequate familiarity with Matlab software

- Introduction to Python and its libraries, especially NumPy and Scipy.
- Use Excel software analytics tools such as Solver to optimize and analyze data

Prerequisite: Fundamentals of Numerical Analysis

Topics in computer science 3Cr.

- Familiarity with the basics of network security
- Familiarity with different types of Attack
- Attack Services
- Security policies
- Network protocols
- Functions of different layers of Protocol OSI
- Firewall
- Risk management
- IDS

Specialized language 3 Cr.

Some Writing Tips, Essential Dictionary, Mathematical Sentences, Describing Functions, Writing Well, Forms of Argument, Induction, Existence and Definitions, Writing a Thesis, Writing Mathematical Papers

History of mathematics 3 Cr.

Introduction to the history of old and new mathematics, History of Euclidean and non-Euclidean geometries, History of algebraic arithmetic devices, History of Mathematical Logic, History of Topology, The great contribution of Euclid, Archimedes, Descartes, Cantor, Hilbert, Russell, and Islamic scholars.

Discrete & Applications 3Cr.

- Cryptographic theor**y**
- Collection systems
- Compositions of ordered sets of parts
- Networks and Altis
- Critical compounds
- Shared systems
- Full graphs
- Advanced counting techniques

- Issues in error correction designs and codes

Prerequisite: Fundamentals of Discrete

Philosophy of mathematics science 3 Cr.

- Introducing basics questions in philosophy of science and historical reviewing
- Review of some important topics in philosophy such as observational data, outer world, realism,) idealism, ration & sense
- An introduction to Math- Philosophy, objects, in Mathematics and existence of sets
- Logic and formal languages and interpretations and formal deduction and semantic deduction
- Limits of formal languages, mathematical intuition, applicability of mathematics
- Logic and natural languages, forms and meanings of sentences
- Roots of meanings and limits and nature of language
- Science and non-science, the role of deduction, induction
- Scientific theories and their validates
- Paradime and Cognitive structure
- Science and real world, knowledge and its bases
- Science in role its and Causality
- determinism and free will and unrecognizability
- Emotional comprehension & morality & social rules, and justice
- Theories of Ethics
- Meaning and identity and cognition-emotion structure

Fundamentals of Entrepreneurship 2 Cr.

Familiarity with the history of entrepreneurship, entrepreneurial concepts and its types, Familiarity with the types of business and the basics and principles of business (home business, rural business, business in technology

Information, Business in the Service Sector (with Study Case), Familiarity with market basics and market management, Feasibility study and selection of entrepreneurial ideas, Familiarity with the business plan framework along with reviewing real examples (Study Case), Designing tables and calculations of business plan (practical exercise), Familiarity with the stages of registration and establishment of the company and familiarity with different types of companies, Entrepreneurship applications in the field of artificial intelligence, machine learning, network technology and cloud computing, electronic health,

Electronic banking, insurance, banking services and e-commerce, etc. in order to educate students intellectually and practically to create business and new work and motivation of the student to create value from the mentioned topics and technologies

Earth in space 2Cr.

- Basic definitions and concepts about space, cosmos, galaxies, etc .;
- How the world is born;
- Study and familiarity with the solar system (the star of the sun and the types of planets orbiting it);
- Study and familiarity with constellations, asteroids, comets, meteors, rocks and stars;
- Study and explain the characteristics of the earth and the moon (description of positional and transitional movements);
- Laws of motion and eclipses (solar and lunar eclipses);
- Time and calendar;
- Sovereignty and human use of space.
- Introduce students to the principles and topics of astronomy related to mathematical geography

Fundamental of economics 2Cr.

- Investigating micro and macro economics
- Ten important concepts in economics
- Key concepts in economics
- Exchange and its benefits
- Demand
- Factors influencing demand
- Demand curve
- Production
- Economic enterprise
- Resource allocation
- Market efficiency
- Government
- Measuring national income
- GDP
- Measuring the cost of living
- Economic Growth
- The relationship between growth and economics
- Money
- Money growth and inflation
- Market economy

Topics in Mathematics & Applications 3Cr.

- Mathematical application in architecture
- Application of mathematics in biology
- Computer models and theory of automata
- Application of group theory in cryptography
- Application of group theory in chemistry
- Application of mathematics in economics
- Optimization applications
- Applications of linear algebra
- Finsler Geometry
- Coding theory and its applications
- Applications of numerical analysis
- Fuzzy mathematics and its applications
- Reminders of general math topics
- Manifold accounts
- Metric Riemann
- Differentiation

GENERAL COURSES:

COURSE TITLE	**CREDITS HOURS**
Physical Education I	1
Physical Education II	1
English Language	3
Persian Language	3
Population and Family knowledge	2
Islamic Thought I	2
Islamic Thought II	2
Life style	2
History of the Imamate	2
political thoughts of Imam Komeine	2
Thematic interpretation of Nahj-al Balaghe	2