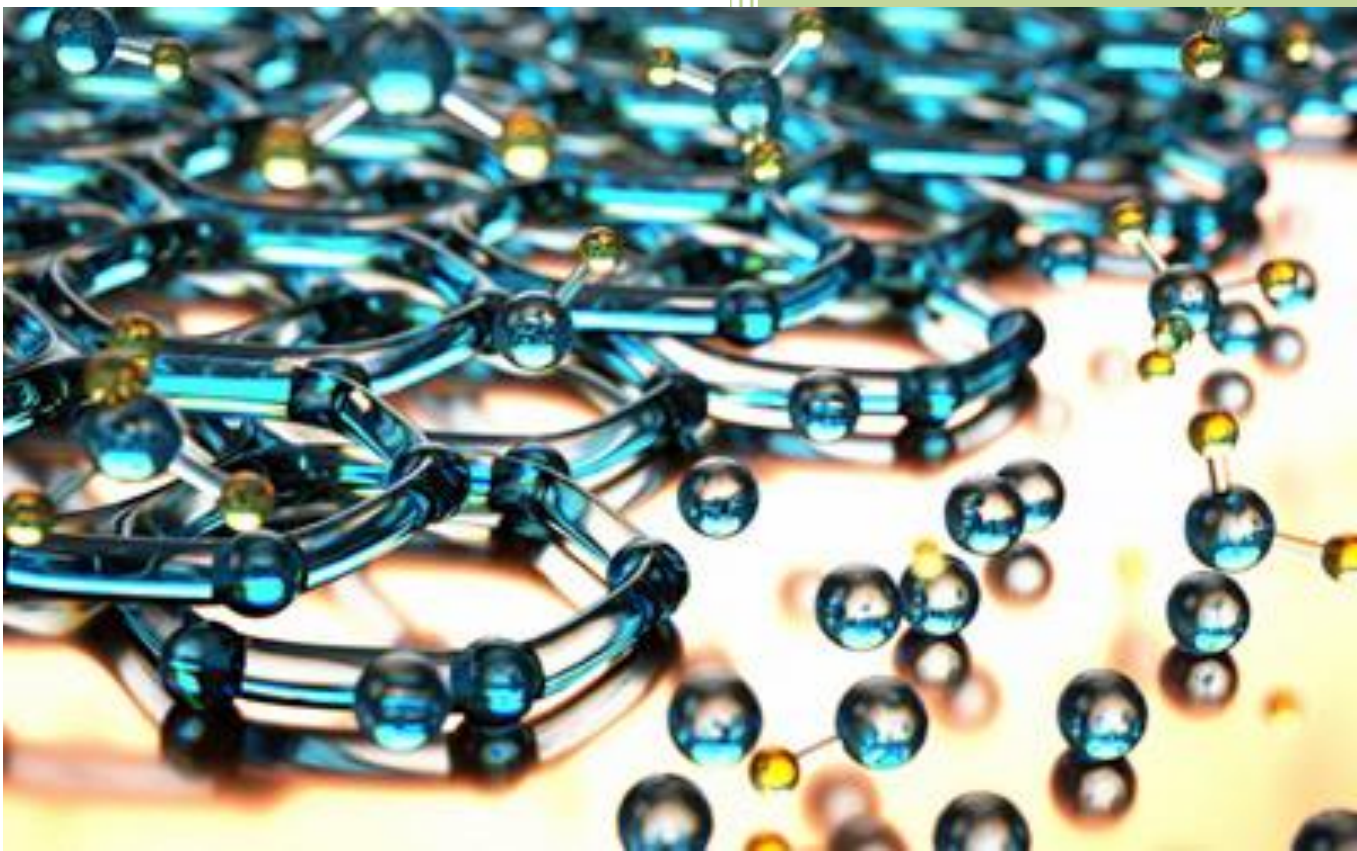




# Materials Engineering –B.S.



DANESHPAJOOHAN PISHRO HIGHER EDUCATION INSTITUTE

- **COURSE CHART**
- **SYLLABUS**
- **SEMESTER CHART**

## Mathematics-I

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-11-019	Mathematics-I	3	3	0	-----	-----

Calculus I, consisted principally of one-variable Calculus, Functions, Derivative, Integrals, Integration Methods, Complex Numbers and Infinite Series.

## Mathematics-II

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-11-021	Mathematics-II	3	3	0	Mathematics-I	-----

The main scope of this course is to teach the students some topics in Introductory Linear Algebra including Matrix Algebra and Linear Transformations and Multivariable Calculus including Multivariable Functions, Directional and Partial Derivatives, Velocity and Acceleration, Tangent Plane and Normal Gradient Line, Cylindrical and Spherical Coordinates, Vector Field and Line Integrals, Surface Integral, Green's Theorem, Divergence Theorem and Stoke's Theorem.

## Differential Equations

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-11-022	Differential Equations	3	3	0	-----	Mathematics-II

The main reason for solving many differential equations is to try to learn something about an underlying physical process that the equation is believed to model. Gaining an understanding of a complex natural process is usually accomplished by combining or building upon simpler and more basic models. Thus a thorough knowledge of these models, the equations that describe them and their solutions, is the first and indispensable step toward the solution of more complex and realistic problems. Topics covered in this course:

Introduction to Differential Equations; First Order Differential Equations; Second Order Linear Equations; Higher Order Linear Equations; Series Solutions of Second Order Linear Equations; The Laplace Transform; Systems of First Order Linear Equations.

## Engineering Mathematics

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-11-046	Engineering Mathematics	3	3	0	Differential Equations	-----

Engineering mathematics is a branch of applied mathematics that concerns itself with mathematical methods and techniques that are typically used in engineering and industry. Engineering mathematics consists principally of Fourier analysis, Partial differential equations, Complex analysis, Integral transforms and Calculus of variations. Topics covered in this course:

Fourier series, Integrals and The Fourier Transform; Partial Differential Equations; Complex Analysis; Calculus of Variations.

## Materials Engineering Undergraduate Course Chart

General Courses						
Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
61-11-004	Islamic Thoughts-I	2	2	0	-----	-----
61-11-011	Islamic Thoughts-II	2	2	0	Islamic Thoughts-I	-----
61-11-003	Rite of Life (Applied Ethics)	2	2	0	-----	-----
61-11-012	Islamic Revolution of Iran	2	2	0	-----	-----
61-11-014	Analytical History of Islam	2	2	0	-----	-----
61-15-001	Persian Language	3	3	0	-----	-----
61-15-002	English Language	3	3	0	-----	-----
61-15-005	Physical Education	1	0.5	0.5	-----	-----
61-15-011	Exercise-I	1	0	1	Physical Education	-----
61-15-007	Family and Population Knowledge	2	2	0	-----	-----
61-11-008	Introduction to Constitution	2	2	0	-----	-----
61-11-013	The Holy Quran Exegesis	2	2	0	-----	-----
<b>Total Credits</b>		22	Note1: Only one course between 'Islamic Revolution of Iran' and 'Introduction to Constitution' shall be taken.			

Science Courses						
Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-11-019	Mathematics-I	3	3	0	-----	-----
51-11-021	Mathematics-II	3	3	0	Mathematics-I	-----
51-11-022	Differential Equations	3	3	0	-----	Mathematics-II
51-11-046	Engineering Mathematics	3	3	0	Differential Equations	-----
51-11-049	Computer Programming	3	3	0	Mathematics-I	-----
51-11-023	Numerical Methods	2	2	0	Computer Programming	-----
51-22-030	Physics-I	3	3	0	-----	-----
51-22-031	Physics-II	3	3	0	Physics-I	-----
51-22-032	Physics-I Lab	1	0	1	-----	Physics-I
51-22-033	Physics-II Lab	1	0	1	Physics-I Lab	Physics-II
51-22-008	General Chemistry	3	3	0	-----	-----
51-22-034	General Chemistry Lab	1	0	1	General Chemistry	-----
12-72-020	General Workshop	1	0	1	-----	-----
12-72-021	Industrial Drawing	2	1	1	-----	-----
<b>Total Credits</b>		32				

Materials Engineering Courses						
Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272022	Fundamentals of Electrical Engineering	3	3	0	Physics-II	-----
1272001	Fundamentals of Electrical Engineering Lab	1	0	1	Fundamentals of Electrical Engineering	-----
1471028	Statics	2	2	0	Physics-I	-----
1272002	Mechanics of Materials	2	2	0	Statics	-----
1272003	Crystallography & Lab	3	2	1	General Chemistry	-----
1272004	Transport Phenomena	2	2	0	Differential Equations	-----
1272027	Physical Chemistry of Materials	3	3	0	Physics-I, Mathematics-II	-----
1272028	Thermodynamics-I	3	0	1	Physical Chemistry of Materials	-----
1272080	Physical Properties of Materials-I	3	3	0	Crystallography & Lab	-----
1272005	Metallography Lab	1	0	1	Physical Properties of Materials-I	-----
1272031	Mechanical Properties of Materials-I	3	0	0	Mechanics of Materials	-----
1272032	Mechanical Properties of Materials-I Lab	1	0	1	Mechanical Properties of Materials-I	-----
1272006	Introduction to Materials Engineering	2	2	0	-----	-----
1272007	Principles of Casting & Solidification	2	2	0	Physical Properties of Materials-I	-----
1272008	Casting & Solidification Lab	1	0	1	Principles of Casting & Solidification	-----
1272009	Physical Properties of Materials-II	2	2	0	Physical Properties of Materials-I	-----
1272010	Mechanical Properties of Materials-II	2	0	0	Mechanical Properties of Materials-I	-----
1272011	Principles of Polymer Eng.	3	3	0	(after passing 80 credits)	-----
1272012	Composite Materials	2	2	0	(after passing 80 credits)	-----
1272013	Principles of Surface Eng.	2	2	0	Corrosion and Conservation of Materials	-----
1272014	Materials Characterization and Analysis Tech.	2	2	0	(after passing 100 credits)	-----
1272064	English for Materials Engineering	2	2	0	English Language	-----
1272015	Principles of Ceramics Eng.	3	3	0	Physical Properties of Materials-II	-----
1272016	Selection of Engineering Materials	2	2	0	(after passing 100 credits)	-----
1272017	Corrosion and Conservation of Materials	2	2	0	Thermodynamics-I	-----
1272018	Principles of Materials Production	3	3	0	Thermodynamics-I	-----
1272019	Physics of Solid State	2	2	0	Physics-II	-----
1272053	Nano Materials	2	2	0	(after passing 100 credits)	-----
1272054	Bio Materials	2	2	0	(after passing 100 credits)	-----
1272050	Scientific Communication Techniques	1	1	0	(after passing 100 credits)	-----
1272052	Internship	1	0	1	(after passing 100 credits)	-----
1272051	Final Project	3	0	3	Scientific Communication Techniques	-----
<b>Total Credits</b>		68				

**Elective Courses (not complete)**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Theoretical</b>	<b>Practical</b>	<b>Pre-requisite</b>	<b>Simultaneous</b>
1272055	Design of Die Casting	2	2	0	Principles of Metals Forming	-----
1272056	Casting of Steel	2	2	0	Principles of Casting & Solidification	-----
1672056	Fluid Mechanics	2	2	0	Transport Phenomena	-----
1272046	Heat Treatments	2	2	0	Physical Properties of Materials-II	-----
1272062	Nondestructive Tests	2	2	0	(after passing 100 credits)	-----
1272065	Nonferrous Metal Alloys	2	2	0	Physical Properties of Materials-II	-----
1272059	Principles of Metals Forming	3	3	0	Mechanical Properties of Materials-I	-----
1272077	Powder Metallurgy	3	3	0	(after passing 100 credits)	-----
1272078	Manufacturing Processes of Materials	2	2	0	(after passing 100 credits)	-----
<b>Total Credits</b>		--				

**Total Credits (All Courses)**

142

## Computer Programming

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-11-049	Computer Programming	3	3	0	Mathematics-I	-----

Explanation of main computer parts, the concept of software and hardware, algorithms design and an introduction to a structured computer programming language.

## Numerical Methods

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-11-023	Numerical Methods	2	2	0	Computer Programming	-----

This course is an introduction to Numerical Methods for solving mathematical problems that arise in Science and Engineering. The goal is to provide a basic understanding of the derivation, analysis and use of these numerical methods. The course includes:

Error Analysis; Numerical solution of Nonlinear Equations; Interpolation, Polynomial Approximation, Curve Fitting; Numerical Differentiation and Integration; Numerical Solution of Ordinary Differential Equations; Solutions of Systems of Equations.

## Physics-I

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-22-030	Physics-I	3	3	0	-----	-----

To provide tools by which students can learn how to effectively read scientific material, identify fundamental concepts, reason through scientific questions, and solve quantitative problems. Physics-I is the first course of this set. This course covers the fundamental concepts in Classical Mechanics and Thermodynamics.

## Physics-II

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-22-031	Physics-II	3	3	0	Physics-I	-----

The main goal of fundamental courses in physics is to provide tools by which students can learn how to effectively read scientific material, identify fundamental concepts, reason through scientific questions, and solve quantitative problems. Physics-II is the second course of this set. This course covers the fundamental concepts in Electromagnetism and includes:

Electric Charge and Electric Field; Gauss's Law; Electric Potential; Capacitance and Dielectrics; Current, Resistance, and Electromotive Force; Direct-Current Circuits; Magnetic Field and Magnetic Forces; Sources of Magnetic Field; Electromagnetic Induction; Inductance; Alternating Current; Electromagnetic Waves.

## Physics-I Lab

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-22-032	Physics-I Lab	1	0	1	-----	Physics-I

The main goal of this course is to introduce students to practical topics of Physics-I. Topics covered in this course:

Inclined planes experiments; Thermal conductivity of materials testing; Pendulum and Spring tests; Calculating the friction of different surfaces.

## Physics-II Lab

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-22-033	Physics-II Lab	1	0	1	Physics-I Lab	Physics-II

Examination of various materials thermal resistance; Examination of Gauss's Law; Magnetic force testing; Electrical currents testing.

## General Chemistry

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-22-008	General Chemistry	3	3	0	-----	-----

To teach students to think about the properties and behavior of the macroscopic world in terms of the structure and arrangement of the constituent molecules and atoms.

## General Chemistry Lab

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
51-22-034	General Chemistry Lab	1	0	1	General Chemistry	-----

Chemistry is an experimental science. This means that, in general, chemical theories have followed observations made in the lab. contents covered in this course:

Measuring Density of Liquids and Solids; Predict the Salt Content of a Solution from Its Density; Separation and Identification of Food Dyes by Paper Chromatography; Qualitative Analysis Naming Inorganic Compounds; Transition Metal Complexes; Titrations of Acids and Bases; Buffered Solutions; Designing Solutions to Resist Changes in PH.

## General Workshop

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
12-72-020	General Workshop	1	0	1	-----	-----

The main goal of this course is to introduce students to various machinery processes, including: Lathing, Milling, Drilling and ...

## Industrial Drawing

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
12-72-021	Industrial Drawing	2	1	1	-----	-----

Introduction to graphic language and design — means and techniques. The third and the first angle projections. Orthographic projection of points, lines, planes and solids. Principal and



auxiliary views. Views in a given direction. Sectional views. Intersection of lines, planes and solids. Development of surfaces. Drafting practices. Dimensioning, fits and tolerance.

## Fundamentals of Electrical Engineering

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272001	Fundamentals of Electrical Engineering Lab	1	0	1	Fundamentals of Electrical Engineering	-----

Dependent sources; Voltage and current dividers; voltage and current sources; superposition; Linear and nonlinear circuit analysis.

## Fundamentals of Electrical Eng. Lab

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272022	Fundamentals of Electrical Engineering	3	3	0	Physics-II	-----

The main purpose of this course is to train the relevant works in Electronics Laboratory.

Teaching Single-Phase and Three-Phase Transformers and Their Shunt Connection, Relays, Fuses, High-Voltage and Low-Voltage Cables.

## Statics

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1471028	Statics	2	2	0	Physics-I	-----

This course presents analytical mechanics of particles, rigid bodies and mechanical structures when the system is in static equilibrium and includes:

Statics of Particles, Rigid Bodies: Equivalent Systems of Forces, Equilibrium of Rigid Bodies, Distributed Forces: Centroids and Centers of Gravity, Analysis of Structures, Forces in Beams and Cables, Friction, Distributed Forces: Moments of Inertia, Method of Virtual Work.

## Mechanics of Materials

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272002	Mechanics of Materials	2	2	0	Statics	-----

Calculation of the deformation of various bodies under a variety of loads. Topics covered in this course: Stress; Torsion; Bending; Deflection; General stress-strain relations.

## Crystallography and Lab

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272003	Crystallography & Lab	3	2	1	General Chemistry	-----

Bonding; Crystal Systems; Bravais Lattice; Elements of Crystal Symmetry; Reciprocal Lattice; Stereographic Projection; Elements of X-Ray Crystallography.

## Transport Phenomena

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272004	Transport Phenomena	2	2	0	Differential Equations	-----

Transport Phenomena is the subject which deals with the movement of different physical quantities such as momentum, energy and mass in any chemical or mechanical process and combines the basic principles (conservation laws) and laws of various types of transport. Transport Phenomena can be classified into three types: Momentum transport, Energy transport, Mass transport.

## Physical Chemistry of Materials

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272027	Physical Chemistry of Materials	3	3	0	Physics-I, Mathematics-II	-----

Behavior of gases: equation of state of ideal and real gases, heat capacity of an ideal gas, mixtures of ideal gases. The first law of thermodynamics: intensive and extensive properties, internal energy and the first law of thermodynamics, chemical equilibrium, enthalpy of formation and the Hess law, heat of reactions. The second law of thermodynamics and statistical interpretation of entropy.

## Thermodynamics-I

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272028	Thermodynamics-I	3	0	1	Physical Chemistry of Materials	-----

Review of Thermodynamics laws and functions; Reactions involving pure condensed phases and gaseous phase; Phase equilibria in a one-component system; Solution thermodynamics; Free energy-composition and phase diagrams of binary systems; Electrochemical systems.

## Physical Properties of Materials-I

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272080	Physical Properties of Materials-I	3	3	0	Crystallography & Lab	-----

Atomic structure of metals; Atomic binding; Metal structure; Crystal defects; Classification of alloys; Phase diagrams; Solid solution, eutectic, peritectic, monotectic, eutectoid, ...; iron-carbon diagram; TTT diagrams; precipitation hardening, ternary diagrams.

## Metallography Lab

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272005	Metallography Lab	1	0	1	Physical Properties of Materials-I	-----

This course covers the experimental methods necessary to perform mechanical testing and metallographic analysis, and the relationships between the microstructure, processing and mechanical properties of materials.



## Mechanical Properties of Materials-I & II

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272031	Mechanical Properties of Materials-I	3	0	0	Mechanics of Materials	-----
1272010	Mechanical Properties of Materials-II	2	0	0	Mechanical Properties of Materials-I	-----

Behavior of metals under simple and combined stress systems, Elements of theory of elasticity; Plastic deformation; Elements of theory of dislocations; strengthening mechanisms.

## Mechanical Properties of Materials-I Lab

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272032	Mechanical Properties of Materials-I Lab	1	0	1	Mechanical Properties of Materials-I	-----

Practical introduction to methods of calculating materials strengths; Tension, Pressure, Bending, Metals Impact, Identantion Hardness, Fracture, Fatigue tests.

## Introduction to History of Materials Eng.

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272006	Introduction to History of Materials Eng.	2	2	0	-----	-----

Introduction to Metallurgy and Materials Engineering history in Iran and around the world, and surveying the related engineering techniques; Ancient humans knowledge of minerals and also metals such as Gold, Copper and Silver; A brief summary describing Iron Age and tools and parts making, thus eventually resulting in industrial advances and development of Materials Engineering, as well as metals and industrial materials production techniques.

## Principles of Casting & Solidification

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272007	Principles of Casting & Solidification	2	2	0	Physical Properties of Materials-I	-----

Introduction to scientific fundamentals of solidification and its application in metals casting, and surveying the casting principles both scientifically and technically; Solidification applications in various scientific fields and an introduction to solidification of pure metals, mold and melt flow; Surveying the effective factors of Casting Fluidity and Risering Systems Design.

## Casting & Solidification Lab

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272008	Casting & Solidification Lab	1	0	1	Principles of Casting & Solidification	-----

Experimental tests related to Casting and Solidification for practical introductory purposes; Testing the mold type effect on Aluminum alloys micro-structures; Testing the Nucleation factors effects on Aluminum alloys micro-structures.

## Physical Properties of Materials-II

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272009	Physical Properties of Materials-II	2	2	0	Physical Properties of Materials-I	-----

Kinetics of phase transformation in the solid state; Diffusion; Nucleation; Annealing; Recrystallization grain growth; Diffusional transformation in steels; Martensitic transformation.

## Principles of Polymer Engineering

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272011	Principles of Polymer Eng.	3	3	0	(after passing 80 credits)	-----

Basic concepts of polymer science; Polymer melt rheology; Polymer processing; Rubber elasticity; Viscoelasticity; Yield and fracture; Additives; Polymers and their properties; Environmental considerations.

## Composite Materials

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272012	Composite Materials	2	2	0	(after passing 80 credits)	-----

Introduction, definition, and classifications of composite materials. Introduction to processing methods, physical properties, and mechanical behavior of composite materials.

## Principles of Surface Engineering

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272013	Principles of Surface Eng.	2	2	0	Corrosion and Conservation of Materials	-----

To develop expertise in advanced coating technologies with an emphasis on thermal spray, weld overlay and physical vapor deposition. Characterization methods are also included. Present models for the formation processes of coatings and how their physical properties evolve.

## Materials Characterization and Analysis Tech

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272014	Materials Characterization and Analysis Tech.	2	2	0	(after passing 100 credits)	-----

Surveying modern methods of identifying metal and non-metal materials properties and structures, and introduction to the related devices and tests; A review over SEM and TEM optic, and linear and point analysis.

## English for Materials Engineering

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272064	English for Materials Engineering	2	2	0	English Language	-----

Introduction to technical words and expressions within the field of Materials Engineering

## Principles of Ceramics Engineering

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272015	Principles of Ceramics Eng.	3	3	0	Physical Properties of Materials-II	-----

This course provides an overview of the properties, manufacturing and design of ceramics, nanostructured ceramics, films and coatings. Three main topics are covered: Properties, manufacturing processes (bottom-up and top-down approaches) with emphasis on achieving the desired properties as well as the basis for design.

## Selection of Engineering Materials

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272016	Selection of Engineering Materials	2	2	0	(after passing 100 credits)	-----

Structure and properties of engineering materials and their applications; Effect of strain, strain rate and temperature on mechanical properties of metals and alloys; Heat treatment of metals and alloys, and its influence on mechanical properties.

## Corrosion and Conservation of Materials

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272017	Corrosion and Conservation of Materials	2	2	0	Thermodynamics-I	-----

Definition; Classification; Anodic and cathodic reactions; Various types of corrosion; Corrosion tests; Materials selection; Cathodic and anodic protections; Inhibitors; Polarization; Electrochemical techniques.

## Principles of Materials Production

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272018	Principles of Materials Production	3	3	0	Thermodynamics-I	-----

Introduction to processes such as Casting, Machining and Hot Work Processes; Introduction to Powder Metallurgy in order to make materials; Introduction to types of Presses and Hammers

## Physics of Solid State

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272019	Physics of Solid State	2	2	0	Physics-II	-----

This course aims at providing an introduction to some basic concepts in Solid State Physics. These include: Crystal structure; Lattice vibrations; Sommerfeld free-electron models; Electron energy bands; Fermi surface; Semi-classical model of electron dynamics; Electron transport in semiconductors; Superconductivity.

## Nano Materials

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272053	Nano Materials	2	2	0	(after passing 100 credits)	-----

Fundamentals of bonding in solids: ionic, covalent and metallic bonding. Physical structure of matter: crystalline and non-crystalline solids, and the fundamentals of diffraction theory and practice. Crystal defects. Amorphous materials, including polymers and glasses. Electronic structure of solids. Optical, electronic, magnetic and dielectric properties of materials.

Introduction to inorganic nanostructured materials and Nano scale crystalline materials. Inorganic nanocomposites. Effects of scale on interfaces and properties. Natural and synthetic nanostructured materials. Theoretical and experimental interpretation of structure-properties relationship in nanostructured materials.

## Bio Materials

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272054	Bio Materials	2	2	0	(after passing 100 credits)	-----

Basic concepts in material science; Biological response to biomaterials; Biomaterial applications; Biomaterials in Engineering Design.

## Scientific Communication Skills

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272050	Scientific Communication Techniques	1	1	0	(after passing 100 credits)	-----

Developing the students' ability to clearly and effectively present scientific and technical contents in various fields; Gathering, Categorizing and Storing contents, and editing reports.

## Internship

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272052	Internship	1	0	1	(after passing 100 credits)	-----

Practical introduction of studied courses through the university, in entirely industrial environments.

## Final Project

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272051	Final Project	3	0	3	Scientific Communication Techniques	-----

Teaching students how to do researches, gather information, categorize data and present results based on data.

## Design of Die Casting

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272055	Design of Die Casting	2	2	0	Principles of Metals Forming	-----

Practical and theoretical introduction to design methods for various types of molds to shape materials; Introducing molds and cutting process; Identifying components of a mold, and common materials used for producing various components of molds in general.

## Casting of Steel

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272056	Casting of Steel	2	2	0	Principles of Casting & Solidification	-----

Casting processes – types and applications; Patterns – types and materials; Allowances; Molds and cores – materials, making, and testing; Casting techniques of cast iron, steels and nonferrous metals and alloys; Solidification; Design of casting, gating and risering; Casting inspection, defects and remedies.

## Heat Treatment

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272046	Heat Treatments	2	2	0	Physical Properties of Materials-II	-----

Iron-Carbon equilibrium diagram; Effects of alloying elements and cooling rate on microstructure; Pearlite, Bainite and Martensite transformations; TTT and CCT diagrams; homogenizing, annealing, normalizing, partial annealing, hardening and tempering; hardenability; case hardening; industrial problems.

## Nondestructive Testing

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272062	Nondestructive Tests	2	2	0	(after passing 100 credits)	-----

Discussion of various inspection techniques, e.g. Liquid-penetrant, magnetic-particles, Eddy-current, radiographic (X-and Gama Ray), electron and neutron radiographic, ultrasonic, thermal, optical and acoustical holography.

## Non-Ferrous Metal Alloys

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272065	Nonferrous Metal Alloys	2	2	0	Physical Properties of Materials-II	-----

Review of failure mechanisms and strengthening mechanisms; structure, properties, metallurgical processing and applications of non-ferrous alloys including light metals, copper, zinc and their alloys, low-melting, solders and bearing metals, precious metals, refractory metals and super alloys.

## Principles of Metals Forming

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272059	Principles of Metals Forming	3	3	0	Mechanical Properties of Materials-I	-----

Stress and strain, principal stresses and yielding criteria, metalworking theory, effect of temperature and strain rate on workability, metalworking, processes: cold and hot rolling, drawing, extrusion, forging, sheet metal working.

## Powder Metallurgy

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272077	Powder Metallurgy	3	3	0	(after passing 100 credits)	-----

The course is a specialized course of the metallic materials area. The scope is to provide the necessary knowledge on the metallic part production by metal powders. It covers subjects such as metal powder characterization, metal powder production methods, powder metallurgy processing steps, post processing treatments.

## Manufacturing Processes of Materials

Course Code	Course Title	Credits	Theoretical	Practical	Pre-requisite	Simultaneous
1272078	Manufacturing Processes of Materials	2	2	0	(after passing 100 credits)	-----

Introduction to processes such as Casting, Machining and Hot Work Processes; Introduction to Powder Metallurgy in order to make materials; Introduction to types of Presses and Hammers



Total	Guide				Course title		Materials Engineering-B.S. Semester Chart										Semester
	ME Materials Eng.		G General Course														
	S Science		E Elective Course		Credits	Course type according to the guide											
20	Physics Lab-I		Persian Language		English Language		Computer Programming		General Chemistry		Physics-I		Mathematics-I		General Workshop		1
	1	S	3	G	3	G	3	S	3	S	3	S	3	S	1	ME	
18	General Chemistry Lab		Islamic Thoughts-I		Introduction to Materials Engineering		Crystallography & Lab		Statics		Numerical Methods		Physics-II		Mathematics-II		2
	1	S	2	G	2	ME	3	ME	2	ME	2	S	3	S	3	S	
18	Physics Lab-II		Islamic Thoughts-II		Physical Education		Mechanics of Materials		Physical Chemistry of Materials		Physical Properties of Materials-I		Differential Equations		Fundamentals of Electrical Eng.		3
	1	S	2	G	1	G	2	ME	3	ME	3	ME	3	S	3	ME	
18	Mechanical Properties of Materials-I		Principles of Casting & Solidification		Fundamentals of Electrical Eng. Lab		Analytical History of Islam		Metallography Lab		Engineering Mathematics		Physical Properties of Materials-II		Thermodynamics-I		4
	3	ME	2	ME	1	S	2	G	1	ME	3	S	3	ME	3	ME	
16	English for Materials Eng.		Islamic Revolution of Iran		Corrosion and Conservation of Materials		Principles of Materials Production		Casting & Solidification Lab		Mechanical Properties of Materials-I Lab		Heat Treatments		Mechanical Properties of Materials-II		5
	2	ME	2	G	2	ME	3	ME	1	ME	1	ME	2	E	3	ME	
18	Industrial Drawing		Rite of Life (Applied Ethics)		Physics of Solid State		Selection of Engineering Materials		Principles of Surface Eng.		Principles of Polymer Eng.		Principles of Ceramics Eng.		Composite Materials		6
	2	ME	2	G	2	ME	2	ME	2	ME	3	ME	3	ME	2	ME	
18	Transport Phenomena		Principles of Metals Forming		The Holy Quran Exegesis		Powder Metallurgy		Nondestructive Tests		Bio Materials		Nano Materials		Materials Characterization and Analysis Tech.		7
	2	ME	3	E	2	G	3	E	2	ME	2	ME	2	ME	2	ME	
16	Final Project		Exercise-I		Family and Population Knowledge		Internship		Casting of Steel		Manufacturing Processes of Materials		Nonferrous Metal Alloys		Design of Die Casting		8
	3	ME	1	G	2	G	2	ME	2	E	2	E	2	E	2	E	