Undergraduate Course Descriptions for a Degree of B. Sc. in Mining Exploration

1914101 Calculus I 4 Cr. Study of single variable calculus, numerical sequences, limits, continuity differentiation, extreme function values, The definite integrals, applications of the definite integrals, Inverse functions, logarithmic and exponential functions, inverse trigonometric and hyperbolic functions, techniques of integration, indeterminate forms, improper integrals, Taylor's formulae, infinite series. **Prerequisite : Precalculus**
2110103 General Chemistry (major in Eng.) 3 Cr. Stoichiometry, gases thermo chemistry, atomic structure, solutions of acids and bases, electrochemistry, chemical kinetics
2110104 General Chemistry Lab 1 Cr. Independent laboratory work under the supervision of a facility member of the chemistry department.
1212102 Field Excursion 1 Cr. Field study of important geological facies and Phenomena. **Prerequisite : General Geology 1212101**
1914102 Calculus II 4 Cr. Study of several variable calculus: Euclidean geometry matrices, linear transformation, elementary topology of Rn, limits, derivative as linear operator, directional and partial derivatives, extreme function values, Lagrange multiplier, multivariable and iterated integrals, change of variable theorem, parametric curves and surfaces, line integral, surface integral, vector analysis, green stokes and divergence theorem.
2010126 General Physic Lab. (Electricity) 1 Cr. Measurement of resistively, verification of Ohm's and Kirchhoff's laws, study of capacitors, hysteresis curves, R-C and R-L circuits, oscilloscope, Biot and Savart's law.
1914251 Elementary Differential Equations 3 Cr. Methods of solving especial classes of ordinary differential equation including linear, bernulli, separable and exact first order equation, reduction of order, variation of parameter, undetermined coefficients, power series methods, and Laplace transform methods in second order linear equation and autonomous system of linear differential equations. Systems of first order differential equations, exponential matrix.
1212204 Petrology II & Lab 2 Cr. Sedimentary and metamorphic classifications, Genesis, Processes, Chemical composition, Minerals, Environments, Relations with plate tectonics. **Prerequisite : Petrology I & Lab 1212202; Mineralogy I & Lab 1212123**
1212206 Structural Geology (Tectonics) 2 Cr. Introduction to tectonics, forces causing tectonic, anticlinal, synclinal, faults, types of foldings, files data analysis, diagrams, Schmitt net and Kluft rose diagram and its interpretations.
1514266 Fluid Mechanics 3 Cr. Definitions and general concepts. Fluid statics. Fluid kinematics. Conservation laws of mass, energy, and momentum and their applications. Incompressible flow in closed conduits.
1212205 Rock Mechanics 2 Cr. Stress, Strain and stress analysis. Mohr circle, Failure criteria. Earth stress. Induct stress, Concentration stress, stress around the underground opening measurements of in-situ stress, Rock mass classification, Stability of rock slope. **Prerequisites : Strength of Materials 1612212; Petrology II & Lab 1212204**
1914271 Numerical Methods 2 Cr. Errors and the sources, solving nonlinear equations solving systems of linear and nonlinear equations, interpolation, numerical differentiation and integrations, solving ordinary differential equations. **Prerequisite : Calculus II 1914102; Elementary Differential Equation 1914251**
1212305 Geotechnics 2 Cr. Classification and identification of soil, soil water, permeability and flow, shear strength of soils, stability slopes, element of stress analysis, site investigation. **Prerequisite : Rock Mechanics 1212205**
1212309 Exploration Geophysics I 2 Cr. Seismic prospecting, seismic recording instruments, Interpretation of seismic reflection data, gravity prospecting and field measurements and reduction, Interpretation of gravity data, magnetic prospecting, magnetic surveying techniques, interpretation of magnetic data.
1212308 Exploration Geochemistry I 2 Cr. Geochemical dispersion and migration of elements, geochemical index (pathfinder and indicator elements), geochemical mapping, analytical methods, statistical analysis of geochemical data (monovariable and multivariable). **Prerequisites : Engineering Statistics and Probability 1912291; Engineering Mathematics 1914252, Structural Geology (Tectonics) 1212206, General Physics l 2010115**

1212313 Mineralography 1 Cr. The preparation of samples, physical and optical properties of opaque minerals , reflectance theory. Micro chemical methods, paragenesis, textures, characteristics of common ore minerals.
1212312 Principles of Mine Exploitation 3 Cr. Explosives, blasting, tunneling, shaft sinking, mining methods (surface & underground), mine support, ventilation, safety transportation in mines, mine lighting, drainage.
1212403 Well-logging 2 Cr. Field operation, permeability, saturation, reservoir geometry, temperature and pressure, Log interpretation, resistivity formation factor and porosity, water saturation, resistivity logging, S.P logging, gamma ray logging. Sonic, density, and nextron logs, induction logging, electromagnetic propagation logs, well bore seismic. **Prerequisite : Drilling 1212304**
1212405 Exploration Project 3 Cr. The basic purpose of exploration project is to be familiar with analysis of geological and mining field techniques.
1212311 Evaluation of Mineral Deposits 2 Cr. Exploratory tunnels, bore holes and bore hole grid plans, estimation and evaluation, sampling and evaluation extracting. **Prerequisite : Analysis and interpretation of Exploration Data 1212432**
1212408 Mineral Economics 2 Cr. Introduction to general economics, energy resources, gross National Product, mineral production of Iran and its role in the national economy, exploration and mining Costs, financing mining projects, feasibility Study. **Prerequisite : Engineering Statistics and Probability 1212291**
1214103 Excursion to Mines 1 Cr. Visiting different mines in the first year
1214104 Mineralogy & Lab 4 Cr. Crystallography, Structure and chemistry of minerals, calculation of chemical formula, physical and chemical properties. Different classes of silicates and non-silicates, Laboratory.
2010116 Gen. Physics Lab. l (Heat) 1 Cr. Thermal expansion, heat conduction, specific heat, calorimetry, the mechanical equivalent of heat, surface tension.
1214201 Blast Hole Drilling & Blasting Technique 2 Cr. Rock drills, jumbo drills, drilling pattern, composition of explosives, fuses, detonation instruments and facilities, blasting, compressed air consumption, safety regulations according to the blasting. **Prerequisite : Excursion to Mines 1214103**
1214202 Petrology & Lab 3 Cr. Igneous, sedimentary and metamorphic petrology including classifications, genesis, processes, chemical, composition and minerals. Experimental petrology, environment relation with plate tectonic and laboratory. **Prerequisite : General Geology 1212101; Mineralogy and Lab 1214104**
1512213 Strength of Materials (Non-ME students) 2 Cr. Stress. Stress tensor. Equilibrium equation. Strain. Stress-strain relation. Hook's law. Torsion problem. Bending of beams. Transformation of stress. Deflection of beams.
1214203 Shaft Sinking and Tunneling 2 Cr. Types of tunnels, tunneling methods, tunnel supporting, shaft sinking in hard rocks and strata, shaft lining, shaft sinking in water tables, special methods for shaft sinking, a short description to explosives and borehole drilling as well as blasting technique.
1214206 Cartography and Photogeology 1 Cr. Topographic and geological maps and cross sections, application of aerial photographs in drawing geological maps.
1214204 Rock Mechanics & Lab 3 Cr. Stress, strain and stress analysis, Mohr circle, failure criteria, earth stress, induct stress, concentration stress, stress around the underground opening measurements of in situ stress, rock mass classification, stability of rock slope.
1214304 Support in Mining 2 Cr. RMR, Q System, RSR, Underground stress analysis, Support equipment, Rock boiling, Shotcrete and steel rips in mining stress and strain criteria. **Prerequisite : Drilling and Blasting 1214201; Rock Mechanics & Lab 1214204**
1214305 Economic Geology 2 Cr. Modern theories of ore-bearing fluids, migration of ore, deposition, alteration, gangue, paragenesis, zoning, geo-thermometry, isotopic studies, classification of ore deposits, magmatic, pegmatitic, metamorphic, hydrothermal, volcanogenic and sedimentary deposits, metamorphism of ores. Metallogenic provinces and epochs.
1214306 Surface Mining Methods 2 Cr. Mine development, stripping, open Pit, quarries, drilling, blasting, excavation and loading, haulage and transportation, economics aspects, stripping ratio, cut off Grade.

1214307 Field Geology 1 Cr. Field geology, preparing geological maps and sections in an area with topographical maps and aerial photographs. Applying some instruments such as compass.
1214309 Transportation in Mines 2 Cr. Railway, Conveyor, Chain conveyors, Chutes, Construction of railroads in mines, Rope Ways, Shaft hauledge, Vertical transportation by pipes in both directions, Hydraulic transportation, Man riding and material transportation. **Prerequisite : Drilling and Blasting 1214201**
1212314 Machine Elements 1 Cr. Welding, screws, keys, springs, shafts, ball bearings, roller bearings, clutches, gears, belts, friction, solid couplings, flexible coupling, brakes.
1214404 Mineral Processing & Lab 3 Cr. Crushing, grinding, classification, screening, gravity concentration, electrostatic and magnetic separation, floatation, thickening, filtering, drying, storage.
1214402 Underground Mining Methods 3 Cr. Definition and naming of methods, long wall mining, cut and fill, shrinkage, sublevel, block caving methods, open stopes. Stopes with supporting roof, combined mining methods, methods for mine steep seams and veins.
1214403 Technical Services in Mine 2 Cr. Mine lighting (personal and general), water supply and drainage, workshops, compressed air, compressors, mine electrical power circuit safety.
1214405 Principal of Exploration & Evaluation of Mineral Deposits 2 Cr. Criteria and guidelines for prospecting, exploratory tunnels, bore holes and bore hole grid plans. Estimation and evaluation, sampling and evaluation extracting.
1214406 Excavation Project 3 Cr. A research on a subject of excavation.
1212407 Mine Surveying 2 Cr. Introduction, differences between mine and general surveying, underground surveying, marking of points orientation, transfer of points and directions. **Prerequisite : General Surveying Practice 1212306**
1214408 Principles of Mine Planning 2 Cr. Calculation of production. Opening a mine, planning of mine network, considering the laws, regulation and instruction for mine planning, using the diagrams, graphs and tables for mine planning.
1212408 Mineral Economics 2 Cr. Introduction to general economics, energy resources, gross National Product, mineral production of Iran and its role in the national economy, exploration and mining Costs, financing mining projects, feasibility Study. **Prerequisite : Engineering Statistics and Probability 1912291**
1214301 Mine Draining 2 Cr. Specifications of Confine and Unconfined aquifer, Darcy's low, Determination of permeability coefficient in Laboratory and field, equivalent permeability in layer medium, prevent of waterpollution in mining, dewatering in canals, Design storage and pipe line, pump Types, specification curve of centrifugal pumps, application of pumps, cavitations, NPSH, Similarity in pumps **Prerequisite : Fluid Mechanics 1514266, Shaft Sinking and Tunneling 1214203**
1214401 Mine Ventilation 2 Cr. Review some elementary thermodynamic, Gases in subsurface, Methane and coal dust, The hazardous nature of dusts, Airflow through Roadways and ducts, Ventilation network analysis, Auxiliary ventilations, Fans, Ventilation layout, Subsurface fires and explosions, Safety **Prerequisite : Fluid Mechanics 1514266, Shaft Sinking and Tunneling 1214203**
1212101 General Geology 2 Cr. Introduction, Mineralogy, Igneous rocks, weathering and ground water, clacier, Time and dating in geology, Deformation of the crust, Internal Structure of the earth, volcanism and magmatism activities, Sea-Floor Spreading, Plate tectonic, earthquake.
1212202 Petrology I & Lab 2 Cr. Introduction, Geological Shape of the plutonic and volcanic body, Structures and texture, Minerals, Classification of the Igneous rocks, Descriptive of the major of the Igneous rocks, Petrology and origin of the Igneous rocks, Experimental of petrology. **Prerequisite : Optical Mineralogy 1212108, Mineralogy & Lab 1212123**
1212123 Mineralogy & Lab 3 Cr. Crystallography: Definition of crystals, primitive cell, Laws in crystallography miller's Indices, The Law zone, crystallography systems and thirty-two crystal classes, crystal growth and Twining. Mineralogy: Physical properties of mineral (crystal habits, aggregate…), Physical and chemical of the Non-Silicates, Physical and chemical of the Silicates. **Prerequisite : General Geology 1212101, General Chemistry 2110103**
1212108 Optical Mineralogy 1 Cr. Theories of Light-Indices of refraction-The polarizing microscope-study of the minerals by orthoscopic by using of microscope: Olivine, Pyroxene, Amphiboles, Biotite, Muscovite, Quartz, Feldspar, Calcite….**Prerequisite : General Geology 1212101, General Chemistry 2110103**
1212402 Exploration Geochemistry II 2 Cr. Litho-geochemical Exploration (Rock and Soil), Hydro-geochemical Exploration, Atmo-Geochemical Exploration, Bio-geochemical Exploration, Isotope Geochemistry, Hydrocarbon Exploration **Prerequisite : Exploration Geochemistry I 1212308**

1612212 Strength of Material 3 Cr. Definition of stress, loading, stress tensor, safety factor, strain; stress-strain relationship; Hoek's law; elastic modulus; creep; thermal deformation; Poison's ratio; torque definition, stress concentration during torque; bending, stress concentration during bending; stress in a beam; principal stresses, drawing and application of Mohr's circle; residual stresses; strain analysis and measuring in 3D. **Prerequisite : Static 1610104**
1610104 Static 3 Cr. Definition of force, torque, couple process; force projection and analysis; force analysis in 2D and 3D; combination of force and torque; force equilibrium; application of static in engineering works; internal and external forces; force and torque analysis in beams; stress analysis, torque and bending in beams; analysis in complex beams. **Prerequisite : Calculus I 1914101**
1212347 Geology of Ore Deposit in Iran 2 Cr. Introduction to basic of stratigraphy, Stratigraphic Units (Lithostratigraphy, Biostratigraghy, Chronostratigrphy), Lithostratigraph Units in Iran (Albroz/Zagros, Central Iran. Koped Dagh), Precainbrian in Iran (Sedimentation Metamorphism Magmatism and tectonic phase), Paleozoic, Mesozoic, Tertiary and Quaternary in Iran, Ore deposits Forming in Iran. **Prerequisite : Pertology II 1212204**
1212229 Remote Sensing & Photogeology 1 Cr. Field Geology Theoretical & practical Structural Geology Goal: How to prepare the Geological Maps & Sections, How to use the Maps & Applications in Mining exploitation Syllabus: Topographic Maps & preparing cross sections, Interpretation of Geological Maps (Especially Iran's geological Maps) & preparing Crosse sections, Preparing Geological Maps on the base of Aerial photos and satellite imges, Measuring of deposit thickness & depth, Drawing of Structural Contour Lines & Isopach line, Using of Stereographic projection in Structural interpretation, Drawing Methods in Measurement of Faults displacement. Remote Sensing: Mapping lithological, alteration and structural controls of ore deposits. **Prerequisite : Petrology II 1212204, Economic Geology (Metallic Ore Deposits) 1212346**