Curriculum 2015

Curriculum of B.Sc. Engineering Honours Degree Programme
Earth Resources Engineering
Mining & Minerals Engineering Stream

Module Code	Module Name	Category	Lec. hrs/ week	Lab / Assign/ hrs/weeks	Credits GPA	Credits NGPA	Norm GPA	Norm NGPA	Total
Semester 1									
CE1022	Fluid Mechanics	C	2.0	3/4	2.0				
CS1032	Programming Fundamentals	C	2.0	3/1	3.0				
EE1012	Electrical Engineering	C	2.0	3/4	2.0				
EL1012	Language Skill Enhancement I	C	-	3/1	1.0				
MA1013	Mathematics	C	3.0	1/1	3.0				
ME1032	Mechanics	C	2.0	3/4	2.0				
MT1022	Properties of Materials	C	2.0	3/4	2.0				
MN1012	Engineering in Context	C	1.0	-	-	1.0	15.0	1.0	16.0
				Total for Semester 1	15.0	1.0	**15.0**	**1.0**	**16.0**
Semester 2									
DE2XXX	Humanities Elective I *	C	2.0	-	2.0				
EL1022	Language Skill Enhancement II	C	-	3/1	1.0				
ER1013	Geology	C	2.0	3/1	3.0				
ER1023	Introduction to Oceanography	C	2.0	-	2.0				
MA1023	Methods of Mathematics	C	3.0	1/1	3.0				
ME1812	Basic Thermal Sciences	C	2.0	-	2.0				
ME1090	Engineering Drawing & Computer Aided Modeling	C	2.0	3/1	3.0				
ER1901	Introduction to Eng. Design & Workshop Technology	C	1.0	3/1	-	2.0	16.0	2.0	18.0
ER1703	Analytical Methods	O	1.5	3/2	2.0				
MN1030	Entrepreneurship Skill Development (continuing in Semester 3)	O	0.5	3/2	-	1.0			
				Total for Semester 2	18.0	3.0	**16.0**	**2.0**	**18.0**
Semester 3									
CE1812	Mechanics of Materials	C	2.0	-	2.0				
CE2062	Surveying I	C	2.0	3/1	3.0				
CS2812	Visual Programming	C	1.0	3/1	2.0				
ER2013	Principles of Gemmology	C	2.0	3/2	2.5				
ER2023	Principles of Environmental Engineering	C	1.5	-	1.5				
ER2033	Principles of RS and GIS	C	2.0	3/2	2.5				

ER2041	Industrial Rock Blasting	C	2.0	-	2.0				
MA2013	Differential Equations	C	2.0	-	2.0				
MA2023	Calculus	C	2.0	-	2.0				
EL2952	Language Skills Enhancement III	C	2.0	-	-	2.0	19.5	2.0	21.5
ER2703	Coastal Hydrodynamics	O	2.0	3/2	2.5				
MN1030	Entrepreneurship Skill Development (continued from Semester 2)	O	0.5	3/2	-	1.0			
				Total for Semester 3	22.0	3.0	**19.5**	**2.0**	**21.5**
Semester 4									
CE2142	Surveying II	C	2.0	3/1	3.0				
DE2XXX	Humanities Elective II *	C	2.0	-	2.0				
ER2053	Introduction to Petroleum Engineering	C	1.5	-	1.5				
ER2063	Geochemistry for Mineral Exploration	C	2.0	-	2.0				
ER2073	Optical Mineralogy and Petrology	C	2.0	3/2	2.5				
ER2083	Mineral Engineering I	C	2.0	3/2	2.5				
ER2093	Geophysics for Mineral Exploration	C	2.0	-	2.0				
ER2101	Mine Development	C	2.0	-	2.0				
MA2033	Linear Algebra	C	2.0	-	2.0				
MA3013	Applied Statistics	C	2.0	-	2.0		21.5	0.0	21.5
MN2010	Entrepreneurial Leadership	O	1.5	3/2	2.0				
				Total for Semester 4	23.5	0.0	**21.5**	**0.0**	**21.5**
Semester 5									
CE2812	Soil Mechanics	C	2.0	3/2	2.5				
ER3013	Extraction Metallurgy	C	2.0	-	2.0				
ER3033	Mining Methods	C	2.0	-	2.0				
ER3043	Mine Machinery & Des. of Mineral Transport Systems	C	3.0	-	3.0				
MA3023	Numerical Methods	C	2.0	-	2.0				
MN3042	Business Economics and Financial Accounting	C	3.0	-	3.0				
MN3052	Industrial Management and Marketing	C	2.5	3/2	3.0		17.5	0.0	17.5
ER3703	Digital Image Processing and Photogrammetry	O	2.0	3/1	3.0				
ER3713	Jewellery Products Development	O	2.0	3/1	3.0				
ER3700	Petroleum Exploration and Basin Analysis	O	2.0	3/2	2.5				
MN3010	Multidisciplinary Design, Innovation & Venture Creation	O	1.5	3/2	2.0				
				Total for Semester 5	28.0	0.0	**17.5**	**0.0**	**17.5**
Industrial Training									
ER3992	Industrial Training	C	-	-	-	6.0			
				Total for Industrial Training	0	6.0	**0.0**	**6.0**	**6.0**

Semester 6									
ER3022	Mine Surveying	C	1.5	3/2	2.0				
ER3063	Economic Geology	C	2.0	-	2.0				
ER3053	Structural & Field Geology	C	1.0	3/1	2.0				
ER3202	Design Project**(continued in Semester 7)	C	-	-	1.0				
ER3912	Geology Field Camp	C	-	-	-	1.0			
ER3922	Mine Surveying Field Camp	C	-	-	-	1.0			
ER3933	Mineral Exploration Field Camp	C	-	-	-	1.0	7.0	3.0	10.0
ER3903	Industrial Visits	O	-	-	-	1.0			
ER3942	Oceanography Field Studies	O	-	-	-	1.0			
				Total for Semester 6	7.0	5.0	7.0	3	10.0
Semester 7									
ER3202	Design Project (continued from Semester 6)	C	-	-	2.0				
ER4013	Rock Mechanics	C	2.0	3/2	2.5				
ER4023	Mine Ventilation	C	2.0	3/2	2.5				
ER4042	Mineral Engineering II	C	3.0	-	3.0				
ER3950	Scientific Writing and Presentation Skills	C	-	-	-	1.0			
ER4083	Mine Planning and Design	C	2.0	3/2	2.5				
ER4202	Research Project(continuing in Semester 8)	C	-	-	1.0				
MN4022	Engineering Economics	C	2.0	-	2.0		17.5	1.0	18.5
ER4210	Petroleum Drilling and Formation Evaluation	E	2.0	3/2	2.5				
ER4223	Hydrogeology and Groundwater Modeling	E	2.5	3/2	3.0				
ER4313	GIS and Spatial Statistics	E	2.0	3/2	2.5				
ER4433	Marine Surveying	E	2.0	-	2.0				
ER4512	Jewellery Production Technology	E	2.0	3/1	3.0				
ER4522	Fashioning of Gemstones	E	1.0	3/1	2.0		4.0	0.0	4.0
MN3020	Entrepreneurship Business Basics	O	2.0	3/1	3.0				
MN4800	Supply Chain Management	0	2.0	-	2.0				
MN4042	Technology Management	O	1.5	3/2	2.0				
				Total for Semester 7	37.5	1.0	19.5	1.0	20.5

Semester 8									
ER4033	Engineering Geology	C	2.0	3/2	2.5				
ER4073	Mineral Economics	C	2.0	-	2.0				
ER4093	Plant Performance	C	2.0	-	2.0				
ER4050	Mine Waste Management and Rehabilitation	C	2.0	3/2	2.5				
ER4103	Mine Safety and Legislation	C	2.0	-	2.0				
MN900	Professional Ethics	C	-	-		1.0			
ER4202	Research Project** (continued from Semester 7)	C	-	-	4.0		15.0	1.0	16.0
CH4350	Petroleum Refining and Petrochemical Industry	E	1.5	3/2	2.0				
ER4230	Petroleum Reservoir Engineering & Project Design	E	2.0	3/2	2.5				
ER4243	Natural Disaster Management	E	2.0	-	2.0				
ER4253	Offshore Mining & Project Design	E	2.0	3/1	3.0				
ER4260	Petroleum Production	E	2.0	-	2.0				
ER4271	Advanced Gemmology	E	2.0	3/2	2.5				
ER4322	Space Technology and Navigation Systems	E	1.5	3/2	2.0				
ER4532	Jewellery Production Management	E	2.0	3/1	3.0		4.0	0.0	4.0
ER4713	Construction Engineering Practice	O	2.0	-	2.0				
ER4720	Tunnel Engineering and Design	O	2.0	-	2.0				
MA4013	Linear Models and Multivariate Statistics	O	3.0	-	3.0				
MA4023	Operational Research	O	3.0	-	3.0				
MN4010	Business Plan Development	O	1.5	3/2	2.0				
MN4072	Small Business Management and Entrepreneurship	O	1.5	3/2	2.0				
MN4150	Project Management	O	2.0	-	2.0				
				Total for Semester 8	50.0	1.0	19.0	1.0	20.0
Total for the Programme					201.0	20.0	135.0	16.0	151.0

Course outline and syllabi of the Modules of the Curriculum

SEMESTER-1

Module Code	**CE1022**	**Title**	**FLUID MECHANICS**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**2.0**	**Pre–requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Assignments**	**3/4**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Identify important fluid properties and flow characteristics to assess their significance in the applications of Fluid Mechanics in engineering practice;

Determine hydrostatic forces and use them to assess the equilibrium and stability conditions of submerged and floating bodies;

Apply concepts on the conservation of mass, energy and momentum of fluids in the applications of Fluid Mechanics in engineering practice.

Outline Syllabus

Introduction: Applications of Fluid Mechanics in Engineering Practice, Historical development of Fluid Mechanics.

Fluids: Characteristics of fluids, Continuum concept, Fluid properties: Density, Specific Weight, Relative Density, Viscosity, Bulk Modulus, Vapour Pressure, Surface Tension, Significance of fluid properties in Engineering Applications.

Hydrostatic Pressure : Variation of hydrostatic pressure, Pressure and Piezometric head, Absolute and Gauge pressure, Pressure diagram, Measurement of pressure: Barometer, Piezometer, Manometer, Pressure gauges.

Hydrostatic Thrust : Hydrostatic thrust on plane and curved surfaces, Centre of pressure.

Buoyancy: Upthrust on submerged bodies, Archimedes principle, Centre of Buoyancy, Equilibrium and stability of fully submerged bodies, Metacentre, Equilibrium and stability of floating bodies, Time period of oscillation of floating bodies, Effect of liquid cargo.

Relative equilibrium: Relative equilibrium of fluids under linear acceleration, Forced vortex motion.

Fluids in Motion: Concepts of fluid flow, Fluid kinematics, Flow classification: Uniform/Non uniform flow, Steady/Unsteady flow, Incompressible/Compressible flow, Laminar/Turbulent flow, Irrotational/Rotational flow, Acceleration of a fluid particle, Techniques of fluid flow analysis.

Conservation of mass: Continuity equation and applications.

Conservation of energy: Bernoulli's equation, Datum, Pressure, Velocity, Piezometric and Total head, Head losses, Steady flow energy equation, Applications in pipe flow.

Conservation of momentum: Steady flow momentum equation and applications.

Hydraulic machinery: Centrifugal pumps, Performance and system characteristics, Operating point. Turbines.

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-1

Module Code	CS1032	Title	PROGRAMMING FUNDAMENTALS			
Credits	3.0	Hours/ Week	Lectures	2.0	Pre – requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain the theoretical concepts behind data and voice communication

Analyse the application of communication principles in data and voice communication systems

Explain the use of communication principles in network applications

Outline Syllabus

Principles of Communications (6 hrs)

Frequency, Spectrum and Bandwidth, Analog and Digital data, data encoding, Modulation, Transmission media, Transmission lines, Radio and microwave transmission, Satellite Transmission, Optical Fibre, Transmission impairments, Noise and transmission impairments

Transmission and Access networks (4 hrs)

Multiplexing and transmission hierarchies, DSL, Ethernet – media and topologies, standards, broadcast and switched, metro Ethernet, Wireless access networks – cellular, WLANs

Networking Principles (2 hrs)

Components of a Network, Circuit and packet switching, Convergence

Switching and routing (6 hrs)

Circuit switching, Packet switching and routing, The Internet Protocol (IP) – addressing and routing

Network applications (8 hrs)

Principles of network applications: client-server computing, e-mail, World wide web, web-2 applications, Telephony, SMS, MMS etc., Video, Radio and TV broadcasting

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-1

Module Code	EE1012	Title	ELECTRICAL ENGINEERING			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/4		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Use correct SI units
- Project an overall picture of Electrical Engineering
- Perform DC, AC and transient calculations
- Apply different types of meters for electrical measurements
- Draw up complete wiring circuit of a household and appreciate the importance of different protection

Course Outline

- SI Units, Overview of Electrical Engineering
- Basic DC circuit analysis: Circuit elements, circuit laws, circuit solutions
- Transient solution of simple RLC circuits
- AC Theory: Phasor representation, complex representation, impedance, admittance, complex power and energy, power factor, AC circuit calculations
- Electrical Measurement: Moving coil, moving iron and rectifier type meters, bridge methods, power and energy meters, working principles
- Electrical Installations: Fuses, MCBs, ELCBs, wires, complete household wiring circuit

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	EL1012	Title	LANGUAGE SKILLS ENHANCEMNT I			
Credits	1.0	Hours/ Week	Lectures	-	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Read and comprehend subject related texts
- Understand and write the gist of a subject related text
- Understand and express the content of a text in his/her own words
- Illustrate or develop an idea in writing coherently and logically
- Participate in a subject related discussion

Course Outline

- Subject related texts
- Précis
- Paraphrase
- writing paragraphs
- Group discussions

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-1

Module Code	MA1013	Title	MATHEMATICS			
Credits	3.0	Hours/ Week	Lectures	3.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	1/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Use discrete mathematical structures such as Logic and Set Theory in applications.

Use algebraic structures such as Real Numbers, Vectors and Matrices in applications.

Apply the basic concepts of limits, differentiation and integration in engineering applications.

Course Outline

Logic and Set Theory

Propositions, truth tables, symbolic statements, conditional connectives, quantifiers;
Techniques of proof: Direct, contradiction, induction, pigeon-hole principle;
Sets, cardinality, Cartesian product, ordered pairs;
Relations, functions, Boolean algebra: Disjunctive and conjunctive normal forms, logic gates, Karnaugh maps, minimization and applications.

Real Analysis

Real number system, supremum and infimum, completeness axiom
Basic functions: Polynomial, exponential, trigonometric, hyperbolic and their inverses.
Limit of a function, continuity, differentiability, derivatives,
Rolle's theorem, mean value theorem, L' Hospital's rule;
Sequences and series of real numbers.
Tests for convergence of sequences and series.

Vectors, and Matrices

Vector algebra, vector product, scalar product, scalar triple product, vector triple product,
Equations of lines and planes;
Matrix operations, transpose, adjoint and inverse of a matrix, echelon forms, rank, determinants.
Systems of linear equations

Assessment scheme

Continuous assessments 30%
Final exam 70%

SEMESTER-1

Module Code	ME1032	Title	MECHANICS			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre – requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/4		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Calculate rigid body forces and motions
- Perform simple mechanics experiments
- Understanding of the basic concepts of dynamics
- Model and solve basic systems in dynamics

Course Outline

- Properties of plane areas
- Internal forces and principle of superposition
- Determination of forces in assemblies of rigid bodies
- Kinematics of particles and rigid bodies, 2D link mechanisms
- Kinetics of particles and rigid bodies, work and energy methods
- Mechanical vibrations (Free vibrations of single degree of freedom systems)

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	MT1022	Title	PROPERTIES OF MATERIALS			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/4		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Recognize the structure of metals, polymers and ceramics
- Identify the relationship between the structures of materials and their properties
- Assess the properties of engineering materials

Course Outline

- Structure of atoms, atomic theories, atomic bonding in materials
- Crystal structures and defects
- Structure-property relationships
- Mechanical properties of materials
- Electrical properties of materials
- Chemical properties of materials
- Radioactivity and nuclear properties

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-1

Module Code	MN1012	Title	ENGINEERING IN CONTEXT			
Credits	1.0	Hours/ Week	Lectures	1.0	Pre-requisites	-
GPA/NGPA	NGPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Recognize the scientific and social contexts in engineering profession.

Identify the basic ingredients of professionalism in engineering.

Explain the importance of economic, risk and safety issues for the engineering decisions.

Describe the basic professional skills, ethics and concepts required for an engineer in industrial society.

Course Outline

What is engineering and its relevance to society. Historical development of engineering and Sri Lankan engineering heritage (old and recent)

Economic, risk and safety issues in engineering. Roles and responsibilities of a professional engineer in society and industry.

Interaction of engineering with natural and built environment; Engineering solutions for environmental problems.

Sustainable engineering design, learning from failures

Skills of engineer in industrial environment (management, teamwork, communication)

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER - 2

Module Code	EL1022	Title	LANGUAGE SKILLS ENHANCEMNT II			
Credits	1.0	Hours/ Week	Lectures	-	Pre-requisites	EL1012
GPA/NGPA	GPA		Lab/Tutorials	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Contribute to a group project through discussion and other related work
Make a short presentation on a subject related topic
Describe a simple process

Course Outline

Group projects
Training in presentation skills
Reinforcing writing skills

Assessment scheme

Continuous assessments 30%
Final exam 70%

Module Code	ER1013	Title	GEOLOGY			
Credits	3.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain the basic concepts in geology

Course Outline

General geology – Origin of the Earth, interior structure of the Earth, rock cycle
Physical geology – Endogenic and exogenic processes of the earth
Deformational features of rocks – Foliation, fold, fault, joints and unconformities
Crystallography – External characteristics, symmetry, and crystallographic systems
Mineralogy – Classification and identification of minerals using physical properties

Assessment scheme

Continuous assessments 30%
Final exam 70%

SEMESTER - 2

Module Code	ER1023	Title	INTRODUCTION TO OCEANOGRAPHY			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student should be able to:

Apply the plate tectonics theory to the origin, evolution, and features of ocean basins.

Classify and analyze the stratigraphy of ocean floor rocks and sediment.

Demonstrate and explain the unique properties of water and their application to the oceans.

Evaluate the effects of temperature, pressure, and salinity on the density and the layering of the oceans.

Analyze and assess the origin and effects of waves.

Integrate and evaluate the general circulation of the atmosphere and oceans.

Analyze and evaluate the interactions and effects of the biological, physical, and chemical components of the oceans.

Course Outline

Origin of ocean basins.
The physiography of the ocean floor.
Marine sedimentation.
The Properties of Seawater --Composition of sea water, Salinity, principle of constant proportion, andsalinometers.
Structure of the Oceans--Sea surface temperature (SST), thermocline, halocline, density, pycnocline, gases in seawater, chemical techniques, Light penetration and the speed of sound in sea water.
The Ocean's Resources --Mineral Resources, Living Resources, and Mariculture.
The human presence in the ocean--pollution, hydrocarbons in the sea, municipal and industrial effluents, Introduction to ocean dredging and mining, Over fishing, Climate change and The ocean's future.
Marine Productivity--Global patterns of productivity, Biological productivity of upwelling water and El Niño.
Waves in the Ocean --Properties of ocean waves, progressive waves, Wave motions, Wave steepness, Tsunami and Storm surges. Wave property related equations.

Assessment scheme

Continuous assessments 30%
Final exam 70%

Module Code	**MA1023**	**Title**	**METHODS OF MATHEMATICS**			
Credits	**3.0**	**Hours/ Week**	**Lectures**	**3.0**	**Pre-requisites**	**MA1013**
GPA/NGPA	**GPA**		**Lab/Tutorial**	**1/1**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Understand the basic concepts of Numerical Methods.

Able to solve Ordinary Differential Equations.

Acquire the concepts of Multivariate Function and Calculus.

Acquire the concepts of Distributions for Statistical Applications.

Course Outline

Numerical Methods

Approximations by Taylor Series, Numerical Solution of System of Linear Equations: Non Iterative Methods: Gauss Elimination, LU Factorization; Iterative Methods: Gauss-Seidel and Jacobi Methods; Solution of Non-linear Equations: Bisection, Simple Iterative, Newton-Rapson; Polynomial Approximation of Functions: Lagrange Polynomials, Newton's Divided Differences, Least Square Polynomial and Functions, Finite Differences, Interpolation and Extrapolation, Numerical Differentiation, Numerical Integration: Trapezoidal, Simpson's Rules, Numerical Solution of Ordinary Differential Equations: Euler's Method, Taylor Series Method.

Ordinary Differential Equations

Orthogonal Trajectories, Isoclines, First Order Ordinary Differential Equations; Variable Separable, Homogeneous, Linear and Exact; Reducible Forms, Second Order Ordinary Differential Equations, Reducible Forms.

Multivariate Calculus

Multivariable Functions, Partial Differentiation, Chain Rule, Change of Variables and Jacobians, Directional Derivatives, Maxima and Minima, Lagrange Multipliers, Taylor Series Expansion, Double Integral, Triple Integral, Geodesics, Vector Functions, Introduction to Vector Calculus.

Statistics

Discrete and Continuous Random Variables, Joint Distribution Functions, Introduction of Common Distributions and their application: Binomial, Poisson, Normal and Exponential. Measures of Central Tendency. Measures of Dispersion. Moments. Skewness. Kurtosis. Association between random variables: Pearson Correlation Coefficient, Rank Correlation Coefficient, Introduction of Bi-Varaite and Multivariate Distributions:

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ME1812**	**Title**	**BASIC THERMAL SCIENCES**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**-**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Explain the basic thermodynamic principles.
- Use Thermodynamic Property Tables.
- Use the relevant properties to calculate the state of a substance/system.
- Apply the laws of thermodynamics to basic processes.
- Use the psychrometric property chart to do basic calculations.

Course Outline

Basic Principles
Review: Boyle's law, Charles's law etc.
Forms of energy and their transformations, Heat and Work as methods of Energy transfer, the statistical nature of thermodynamics, types of systems.

Properties of Substances
The importance of Thermodynamic properties, Intensive and Extensive properties, Concept of Thermodynamic state, Thermodynamic Equilibrium
The Difference between ideal and real substances, Thermodynamic Property tables.

Fundamental laws of thermodynamics
The First Law of Thermodynamics, The first law with reference to principle system types, Internal energy as a consequence of the first law.
The meaning of a reversible process, The second law of thermodynamics, entropy as a consequence of the second law

Processes
The basic types of processes, Processes as transition of Thermodynamic states, Property Diagrams, Reversible and Irreversible processes, Cyclic Processes

Heat Transfer
Methods of heat transfer, Effects in a closed space due to heat transfer.

Psychrometrics
Humidity and Relative Humidity, Calculations using psychrometric charts.

Assessment scheme

Continuous assessments 30%
Final exam 70%

Module Code	**ME1090**	**Title**	**ENGINEERING DRAWING & COMPUTER AIDED MODELING**			
Credits	**3.0**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**3/1**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Draw the orthographic projections of a given mechanical part or assembly
Memorize graphical construction techniques in engineering graphics
Draw orthographic projections on a CAD package
Develop 3D models using a CAD package so as to be able to carry out engineering graphics on the CAD system
Describe the principles of parametric solid modeling with CAD packages
Use a CAD package to generate orthographic views of a 3D model

Course Outline

The concepts in Engineering Drawing will be taught using both manual draughting techniques and computer aided draughting

Engineering Drawing

Orthographic projection methods:First angle projection, third angle projection
Orthographic views: Orthographic views of objects from given pictorial views, third view from two orthographic views, sectional views, orthographic views of an assembled object
Orthographic views of an assembly of a set of given components
Loci: Construction of Cycloids, Involutes, Helices

Lines and Planes: Graphical estimations of true lengths, inclinations, traces, auxiliary projection methods and true shapes of sections

Interpenetration Curves: Construction of interpenetration curves of cylinder, cone, sphere, pyramid, etc.

Developments: Construction of developments of prism, cylinder, cone, pyramid and developments by the method of triangulation

Isometric view: Drawing isometric views with an isometric scale

Computer-Aided Modeling

Draw orthographic projections using a CAD packages
Introduction to 3-dimentional modeling on a CAD packages
Carry out engineering graphics on the CAD system
Introduction to parametric 3-dimentional modeling using Pro-Engineer/SolidWorks
Generate orthographic projections from the solid model

Assessment scheme

Continuous assessments 30%
Final exam 70%

Module Code	**ER1901**	**Title**	**INTRODUCTION TO ENGINEERING DESIGN AND WORKSHOP TECHNOLOGY**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**1.0**	**Pre-requisites**	**-**
GPA/NGPA	**NGPA**		**Lab/Tutorials**	**3/1**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain basic engineering design concepts

Simulate the dynamics of a small design group

Apply the knowledge gained to a design project resulting in a working prototype

Course Outline

Introduction to Engineering Design

Design Principles

Introduction to Engineering Design, life cycles of engineering products and processes, design processes and design tools, concurrent engineering, creativity and reasoning, analysis and synthesis, simulation, evaluation and decision making

Case Studies

Several simple but comprehensive design case studies selected from different disciplines of engineering addressing the topics ;

Design for manufacturing ,Mechanical and material aspects in design, Electrical, Electronic and IT aspects in design

Design Assignments

Group based design projects will include;

gathering of data and information from various sources as a preliminary to the design preparing a work plan and delegating duties, working with others and to produce results by given deadlines and within given costs, learning the basic procedures required for conceptual, preliminary and detailed designs, learning the importance of the cost component in the manufacturing process, preparing a report and making a presentation of the design, demonstrating the working of the prototype

Workshop Practice

Carpentry Shop: 1. Study of tools & operations and carpentry joints. 2. Simple exercise using jack plane. 3. To prepare half-lap corner joint, mortise &tennon joints. 4. Simple exercise on woodworking lathe.

Fitting Bench Working Shop: 1. Study of tools & operations 2. Simple exercises involving fitting work. 3. Make perfect male-female joint. 4. Simple exercises involving drilling/tapping/dieing.

Black Smithy Shop: 1. Study of tools & operations 2. Simple exercises base on black smithy operations such as upsetting, drawing down, punching, bending, fullering& swaging.

Welding Shop: 1.Study of tools & operations of Gas welding & Arc welding 2. Simple butt and Lap welded joints. 3. Oxy-acetylene flame cutting.

Sheet-metal Shop: 1. Study of tools & operations. 2. Making Funnel complete with ‘soldering’. 3. Fabrication of tool-box, tray, electric panel box etc.

Machine Shop: 1. Study of machine tools and operations. 2. Plane turning. 3. Step turning 4. Taper turning. 5. Threading 6. Single point cutting tool grinding.
Foundry Shop: 1. Study of tools & operations 2. Pattern making. 3. Mould making with the use of a core. 4. Casting

Assessment Scheme

Continuous assessments 60%
Final exam 40%

Module Code	**ER1703**	**Title**	**ANALYTICAL METHODS**			
Credits	**2.0**	**Hours/**	**Lectures**	**1.5**	**Pre-**	**-**
GPA/NGPA	**GPA**	**Week**	**Lab/Tutorials**	**3/2**	**requisites**	

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Prepare mineral/ore/rocks/sediments/water samples for analytical work
Perform mineral/ore dissolution techniques for preparing sample solutions
Perform instrumental analysis/ gravimetric and volumetric analysis
Perform basic statistical analysis for data received from chemical analysis

Course Outline

Introduction to analytical methods
General Laboratory techniques
Preparing mineral/ore/rocks/sediments/water samples for analytical work
Preparing samples powder/solutions for instrumental, gravimetric and volumetric analysis
Gravimetric and volumetric analysis
Instrumental analysis
Theory and use of Atomic Absorption Spectrophotometer (AAS) , Inductive Couple Plasma(ICP),
Micro probe, scanning Electron microscope, XRF and X-Ray diffraction, UV and IR spectrophotometers, Flame photometer, Gas chromatography and Mass Spectrometry.
Nuclear Techniques
Neutron Activation Analysis (NAA), Alpha, beta and gamma ray counters, Identification of radio isotopes

Assessment scheme

Continuous assessments 30%
Final exam 70%

Module Code	**MN1030**	**Title**	**ENTREPRENEURSHIP SKILL DEVELOPMENT**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**0.5**	**Pre-requisites**	**-**
GPA/NGPA	**NGPA**		**Lab/Tutorials**	**3/2**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Apply their business and entrepreneurial knowledge and skills to education, career and service pursuits

Recognize the significance of personal responsibility and financial literacy in making positive life decisions

Course Outline

Discuss leadership position, business idea, company name, vision and mission, establish company values, company capitalization process.

Working as a company, students conduct officer elections and learn about each department's specific responsibilities during the operation and liquidation phases.

Students use tools such as market surveys and cost-benefit analysis to determine potential products for their target market and develop initial business plan.

Students host Board of Directors meeting to approve the company's Business Plan, review implementation strategies and accept the company Charter, sell shares.

Materials needed for production are ordered and the company business plan is implemented.

Learn about specific sales techniques during selling of their product/service.

Students hold department meetings to share best practices and propose changes to current company operations.

Begin to finalize production, access excess inventory, and prepare for the Board of Directors liquidation meeting.

Students explore steps and learn how to apply what they have learned as a company to personal entrepreneurial pursuits.

Final Board of Directors liquidation meeting and approve the Annual Report.

Assessment scheme

Continuous assessments 70 %

Final exam 30 %

SEMESTER-3

Module Code	CE1812	Title	MECHANICS OF MATERIALS			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	ME1032
GPA/NGPA	GPA		Lab/Tutorials	-		
Learning Outcomes Upon successful completion of this module, the student will be able to: Compute the stresses, strains and deformations due to applied forces in beams						
Course Outline Bending stress in beams, Transverse shear stresses ,Analysis of stress and strain, Deflection of beams						
Assessment scheme Continuous assessments 30% Final exam 70%						

Module Code	CE2062	Title	SURVEYING I			
Credits	3.0	Hours/ Week	Lectures	2.0	Pre – requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/1		
Learning Outcomes Upon successful completion of this module, the student will be able to: Understand the use of survey measurements in civil engineering. Use chain, level and theodolite in the field for survey measurements. Produce hand-drawn survey plans and LS/CS drawings.						
Course Outline **Introduction to Land Surveying:** Classification of surveying; principles of surveying; methods of surveying; true bearing and magnetic bearing; linear and angular measurements; scale and maps; errors in measurements; coordinates on the Earth's surface. **Linear Measurements and Chain Surveying:** Chain, tape and accessory instruments; survey stations and lines; offsets, field procedure; booking procedure; plotting; errors and corrections. **Levelling and Contouring:** Levels; leveling staff; reduced level and level differences; rise and fall; height of collimation; booking procedures; fly-back; longitudinal and cross-sections; errors and corrections; curvature and refraction; contours and contouring. **Theodolite Surveying:**Vernier and Glass-circle Theodolites; measurement of horizontal and vertical angles; bearings; methods of traversing; angular and linear errors; correction of coordinates. **Tacheometry:** Principles of optical distance measurement; levels and distances using tacheometry.						
Assessment scheme Continuous assessments 30% Final exam 70%						

SEMESTER-3

Module Code	CS2812	Title	VISUAL PROGRAMMING			
Credits	2.0	Hours/ Week	Lectures	1.0	Pre – requisites	-
GPA/NGPA	GPA		Lab/Assignments	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

appreciate the difference between structured and visual programming approaches

develop simple software applications for engineering and other disciplines using a visual programming environment

Course Outline

Introduction to the VB.NET Framework , Objects, Properties, Events & Methods

Variables, Data Types & Controls , Use of Forms and Controls to create User Interfaces

Program Control Flow ,String and file manipulation, Arrays

Procedures & Functions ,Exception Handling, Basics of OOP

Database Programming, Further topic

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	ER2013	Title	PRINCIPLES OF GEMMOLOGY			
Credits	2.5	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Handle gemological equipment properly.

Identify gems using crystal formations and gemological properties

Course Outline

Introduction:

Essential qualities of gems, origin of gemstones, classification of gem materials, Crystal systems

Determination of Physical and optical properties using:

Hand lens, Polarisecope, Conoscope, Refractometer, Spectroscope, Dichroscope and Microscope

Properties and Methods of identification of following gem materials:

Beryl, Corundum, Crysoberyl, Diamond, Diopside, Feldspar, Jadeite and Nephrite, Natural glass, Opal, Peridot, Quartz, Topaz, Tourmaline, Zircon, Zoisite, and Synthetic gems

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER2023**	**Title**	**PRINCIPLES OF ENVIRONMENTAL ENGINEERING**			
Credits	**1.5**	**Hours/ Week**	**Lectures**	**1.5**	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**-**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Understand the nature and scope of environmental issues; air, water, land impacts; fundamentals and processes of pollution control. The role of engineers in society in solving new or emerging environmental problems, particularly complex and/or inter-disciplinary problems.

Apply knowledge of mathematics, science, and engineering; function on multi-disciplinary teams; identify, formulate, and solve engineering problems; communicate effectively on the impact of engineering solutions in a global, economic, environmental, and societal context; and awareness on contemporary issues.

Course Outline

Environmental measurements and units

Introduction to environmental engineering.

Introduction to various aspects of environmental problems: air pollution, water pollution, noise pollution, solid waste management, ionizing radiation, disease transmission, and food protection.

Introduction to water quality engineering, solid and hazardous waste management, air quality control, engineering issues associated with noise control, fate and transport of contaminants in the environment, and regulatory issues.

Environmental engineering ethics

Environmental legislation

Sustainable development

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER2033**	**Title**	**PRINCIPLES OF RS AND GIS**			
Credits	**2.5**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**3/2**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain concepts of Remote Sensing, GIS, GPS and their usage in Earth Resources Management.

Interpret satellite images and aerial photographs.

Scan, geo-reference and digitize features on hard copy of images.

Course Outline

Fundamentals of Remote Sensing ,Electromagnetic energy and remote sensing Sensors (Multispectral, hyperspectral and thermal sensors), platforms and remote sensing data acquisition systems , Introduction to: Aerial Photogrammetry, Satellite Remote Sensing, Microwave remote sensing, GIS and GPS

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER2041**	**Title**	**INDUSTRIAL ROCK BLASTING**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**-**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Design and implement rock blasting systems for surface and underground workings.

Conduct blasting in an environmental friendly manner.

Safe handling of explosives.

Course Outline

Explosives properties and selection: Chemistry of explosives, Explosive reaction, Mechanics of detonation, Mechanism of rock breakage

Explosive accessories: Detonators, Safety fuse, Detonating cord, NONEL tube.

Initiation systems: Safety fuse, Electric initiation, Detonating cord, NONEL tube, Other methods.

Blasting practice: Basics of blast design, Open-pit blasting, Underground blasting, Controlled blasting, Underwater blasting, Demolishing structures, and Fragmentation analysis.

Environmental impact of blasting: Mitigation of ground vibration, Fly rock and air-blast over pressure, Conducting pre-blast surveys, Blasting complaint handling.

Safe handling and storage of explosives

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-3

Module Code	MA2013	Title	DIFFERENTIAL EQUATIONS			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	MA 1023
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Approximate periodic function using Fourier series

Solve various categories of Partial differential equations appears in physical system modeling

Apply Lap lace Transform and Fourier Transform method to solve differential equation.

Apply series solution method to differential equation with variable coefficient

Course Outline

Fourier Series approximation

Fourier coefficients, Dirichlet's condition, odd and even function, half range series. Trigonometric approximation to discrete data.

Partial Differential Equations

Classification of second-order partial differential equations. Solutions by separation of variables. Fourier series application to boundary value problems.

Laplace Transform and applications

Laplace transform of elementary functions and some basic theorems on Laplace transform. Application of Laplace transforms to solution of differential equations and system of differential equations, transfer functions, convolution theorem, concepts of stability and controllabity.

Fourier Transform and applications

Non-periodic function, Fourier transform, properties of Fourier transform and applications.

Ordinary linear differential equations with variable coefficients

Solution in series, Special function (e.g. Bessel, Legendre) - singular points, Existence and uniqueness of the solution(elementary discussions without proof.

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-3

Module Code	MA2023	Title	CALCULUS			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	MA1023
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Perform vector differentiation and integration and evaluate vector and scalar quantities in various engineering applications.

Apply Divergence, Stokes' and Green's theorem in various situations.

Apply Cauchy's integral formula to solve engineering problems.

Perform contour integration techniques.

Apply conformal mapping in physical system modeling.

Course Outline

Vector Calculus

Double integral, triple integral, vector functions;

Introduction to vector calculus. Vector differentiation and differential operators.

Space curves and line integral, surface integrals;

Divergence theorem, Stokes' theorem and Green's theorem in a plane.

Some basic applications.

Complex Variables

Analytical function and Cauchy-Reimann equation.

Cauchy's integral formula and applications.

Taylor and Laurent's series.

Contour integration.

Introduction to conformal mapping.

Assessment scheme

Continuous assessments 30 %

Final exam 70%

Module Code	EL2952	Title	LANGUAGE SKILLS ENHANCEMNT III			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	EL1022
GPA/NGPA	NGPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Write a report on a subject related issue with reasonable grammatical accuracy

Course Outline

Describing mechanisms

Describing processes

Report Writing

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-3

Module Code	ER2703	Title	COASTAL HYDRODYNAMICS			
Credits	2.5	Hours/ Week	Lectures	2.0	Pre-requisites	ER1023
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Apply wave theory to derive wave equations
Evaluate the effects of temperature, pressure, and salinity on the dynamics of the ocean
Analyze and assess the origin and effects of tides, and ocean currents
Analyze and interpret basic beach processes, including variations in sediment size, coastal sediment erosion, transportation, and deposition processes.
Analyze and interpret the origin, dynamics of coastal estuaries and lagoons
Prepare coastal bathymetric maps and apply ocean hydrodynamic modeling on tsunami inundation forecasting

Course Outline

Physical and chemical structure of sea water

Waves in the Ocean : Wave theory, standing waves, wave refraction, reflection and deflection

Tides: Tidal characteristics, equilibrium theory of tides, tidal cycle, neap and spring times, dynamic theory of tides, tidal energy

Ocean Atmosphere Interactions: Wind circulation, surface ocean currents, deep ocean circulation

The Dynamic Shoreline and coastal protection: Coastal Water Movement, Beaches, sand budget,

coastal dunes, Barrier Islands, cliffed coast, deltas, impact of people on the coastline.

Estuarine process: Geomorphic classification, Energy classifications, Hydrodynamic classification, gravitational circulation, stratification and mixing, lagoons, salt marshes, mangrove swamps, coral reefs.

Ocean Hydrodynamic Modeling: Concepts of numerical modeling (Model types, Model forcing, Model validation), Preparation of bathymetric maps and Case Studies

Assessment scheme

Continuous assessments 30%

Final exam 70 %

SEMESTER-4

<table>
<tr><td>Module Code</td><td>CE2142</td><td>Title</td><td colspan="4">SURVEYING II</td></tr>
<tr><td>Credits</td><td>3.0</td><td rowspan="2">Hours/ Week</td><td>Lectures</td><td>2.0</td><td rowspan="2">Pre – requisites</td><td rowspan="2">CE2062</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3/1</td></tr>
<tr><td colspan="7">Learning Outcomes
Upon successful completion of this module, the student will be able to:
Use modern instruments for survey measurements in civil engineering applications;
Make computations for civil engineering works based on survey measurements;
Set out civil engineering works; and
Understand the use of field astronomy for survey and time measurements</td></tr>
<tr><td colspan="7">Course Outline

Modern techniques and instruments:
Electromagnetic Distance Measurement (EDM): Maximum non-ambiguous distance, principles of modulation and simulation, Total Station (TS) to measure inclined distances, tie distances, coordinates, levels and angles.
Global Positioning System (GPS): Satellite systems, principles of measurement, errors, uses, differential GPS.

Areas, Volumes and Earthwork: Areas using geometrical figures and formulae, areas using planimeter, volumes/ earthwork by end-areas and trapezoidal formulae, by spot levels, and by contours.

Field Astronomy and Time: Movement of Earth in space; celestial sphere; constellations; apparent motion of stars; determination of true north and coordinates; axial tilt of the Earth; seasons; apparent motion of sun in the celestial sphere; solar time and sidereal time; standard time.

Setting-out: Curves; curve ranging using chain/tape, theodolite, and TS; setting-out of buildings; horizontal and vertical alignment.

Introduction to surveying software (03 hours): AutoCAD for survey plans; other surveying software.</td></tr>
<tr><td colspan="7">Assessment scheme
Continuous assessments 30%
Final exam 70%</td></tr>
</table>

Module Code	**ER2053**	**Title**	**INTRODUCTION TO PETROLEUM ENGINEERING**			
Credits	**1.5**	**Hours/ Week**	**Lectures**	**1.5**	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**-**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Identify and analyze the formation and occurrences of petroleum
- Analyze the importance of geological fundamentals on exploration and drilling operation in the petroleum industry
- Analyze and evaluate various petroleum systems
- Describe the basic volumetric equation
- Explain the basics of formation evaluation, production stage of petroleum well, petroleum law and economics, health safety and environmental policy

Course Outline

- Nature of oil and gas
- Overview of petroleum industry
- Hydrocarbon formation
- Petroleum systems
- Structures and stratigraphy
- Basic concepts of petroleum exploration
- Heat flow analysis
- Basic volumetric calculation
- Basic concepts related to petroleum engineering
- Petroleum law
- Health, safety and environmental issues

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER2063**	**Title**	**GEOCHEMISTRY FOR MINERAL EXPLORATION**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	-
GPA/NGPA	**GPA**		**Lab/Tutorials**	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Properly collect field data/ samples related to mineral resources and groundwater
- Process and interpret data of different exploration techniques

Course Outline

Geochemistry:

- Introduction to geochemistry
- Geochemical environments
- Optimization and planning
- Geochemical mineral exploration techniques
- Geochemical surveys
- Data analysis (geostatistics, geothermatic maps, color contouring)

Geochemical techniques for mineral exploration:

- Stream sediment surveys, hydro-geochemical surveys, soil surveys, petrochemical surveys and geo-botanical surveys

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER2073**	**Title**	**OPTICAL MINEROLOGY AND PETROLOGY**			
Credits	**2.5**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	-
GPA/NGPA	**GPA**		**Lab/Tutorials**	**3/2**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Identify minerals using optical properties
- Classify and identify rocks

Course Outline

- Optical mineralogy
- Introduction to Petrology
- Igneous Petrology
- Sedimentary Petrology
- Metamorphic Petrology
- Petrographic analysis
- Geology of Sri Lanka

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-4

Module Code	ER2083	Title	MINERAL ENGINEERING I			
Credits	2.5	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain and compare basic physical separation methods as applied to value addition of minerals.

Design mineral processing and physical separation plants using run of mine raw material and control plant parameters for optimum value addition.

Course Outline

Comminution:

Crushers, Grinding mills, Theory of comminution , Kick's law, Rittinger's law, Calculation of Bond and Work index, Factors controlling comminution.

Sieving:

Types of screens, efficiency screening, factors affecting the efficiency, closed circuit crushing and grinding and simple flow charts using the above.

Flow properties of minerals through orifices:

Silos, Repose angle measurements

The movement of solids in fluids:

Stoke's law, Newton's correction, Rittinger's equation, Reynolds number, Ratios of concentration, Recovery,

Theory of hydrocyclones, hydro cyclone designs, performance curves, flow sheets and applications of hydrocyclone in specific mineral separations.

Industrial applications of Thickeners, Jigs, Tables, Sluices and Classifiers; all supported by industrial visits.

Magnetic Separation and High-Tension Separation:

Magnetic permeability, magnetic susceptibility, magnetic separators- wet and dry separation, high-tension separation, effect of variables and controls (particle size, moisture content, inclusions and their effect on the Recovery).

Filtration:

Darcy's equation ,Use of filter presses as a dewatering method, Disk & Drum filters the factors affecting filtration

Drying:

Types of dryers, dryer conveyors, types of kilns, firing techniques, Kiln lining materials (Refractories).

Micromeritics:

Characterization of particles, graphical representation of centre grain size and quartile ratio, particle size measurements- Andreason pipette method , Hydrometer method centrifugal method

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER2093**	**Title**	**GEOPHYSICS FOR MINERAL EXPLORATION**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain and compare the basics of geophysics and techniques

Course Outline

Introduction to geophysics , Geophysical methods: Gravity, Magnetic, Seismic, Electromagnetic, Electrical Resistivity, Self- Potential, Induced-Polarization, and Gamma-ray Spectrometry, Ground Penetrating Radar (GPR) ,Geophysical applications for mineral exploration

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER2101**	**Title**	**MINE DEVELOPMENT**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**2.0**	**Pre – requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Assignments**	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Plan and execute opening and development of a mine,

Design support systems

Organize and execute the mine opening and development plan with maximum safety and cost-effectively.

Course Outline

Drilling methods

Surface and underground drilling equipment and their application, Drill bits, basics of core drilling, wire-line/DTH drilling, selection of appropriate drilling method.

Underground Mine Infra-structure, Types of Openings, Dimensions, Location, Design criteria

Tunneling: Tunnel drilling, Designing the blasting pattern, Machine mucking, Mechanical excavation with Tunnel Boring Machines and Road Headers, Tunnel support design -Engineering rock mass classifications (RMR/Q-system)

Shaft sinking: Drilling, Cut-hole rounds, Blasting patterns, Methods of mucking, shaft support systems, Shaft support determination, Special methods of Shaft Sinking (shaft sinking in difficult ground)

Raise excavation: By drilling-and-blasting and with Alimak Raise Climber, Raise boring

Assessment scheme

Continuous assessments 30 %

Final exam 70%

SEMESTER-4

Module Code	MA2033	Title	LINEAR ALGEBRA			
Credits	2.0	Hours/Week	Lectures	2.0	Pre-requisites	MA 1023
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Familiarize with the concept of a vector space and its algebraic properties and the manipulative techniques necessary to use matrices and determinants in solving applied problems.

Bridge from the typical intuitive treatment of calculus to more rigorous courses.

Use the software Mathematica to reinforce concepts of matrix multiplication, inverse eigenvalues and eigenvectors

Learning Outcomes

Reduce a matrix using Gauss-Jordan reduction

Solve a system of n equations and m variables

Find the inverse of a matrix

Understand the dimension of a vector space, rank of a matrix and basis for a vector space.

Understand the concept of linear independence, linear transformation and determinants

Find eigenvalues and eigenvectors, and diagonalize quadratic forms.

Course Outline

Vectors spaces, subspaces, linear combinations, spanning sets, linear independence, and bases. Column space and row space and null space of a matrix and application. Linear transformation. Eigen values, eigen vectors and related topics. Diagonalisation of matrices. Quadratic forms. Applications. Numerical Linear Algebra.

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-4

Module Code	MA3013	Title	APPLIED STATISTICS			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	MA1023
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Identify the role of probability and statistics in their discipline area.
Perform a range of statistical procedures related to the manipulation and interpretation of data.
Distinguish between types of statistical tests that may me used to analyze data.
Demonstrate basic knowledge of assessing the appropriateness of statistical models.
Demonstrate practical expertise associated with the use of statistical package in performing basic statistical procedure.

Course Outline

Discrete and continuous random variables:

Bivariate distributions.
Moment generating function.
Introduction to ML estimators.
Basic properties of Geometric, Hyper geometric, Exponential and Gamma, distributions.
Student's t-distribution.
Fisher's distribution and Chi square distribution.

Statistical Inference:

Sampling distributions, central limit theorem, confidence intervals for mean and variance.
Hypothesis tests. Goodness-of-fit tests and contingency table.
Simple linear regression.
Least square estimation and hypothesis tests in simple linear regression.

Practical Work:

Use of MINITAB for statistical testing and regression analysis.

Assessment scheme

Continuous assessments 30%
Final exam 70 %

SEMESTER-4

<table>
<tr><td>Module Code</td><td>MN2010</td><td>Title</td><td colspan="4">ENTREPRENEURIAL LEADERSHIP</td></tr>
<tr><td>Credits</td><td>2.0</td><td rowspan="2">Hours/ Week</td><td>Lectures</td><td>1.5</td><td rowspan="2">Pre – requisites</td><td rowspan="2">-</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3/2</td></tr>
<tr><td colspan="7">Learning Outcomes
Upon successful completion of this module, the student will be able to:
Create a personal inventory of strengths and weaknesses
Create a vision for what a student wants to achieve
Develop a mindset to embrace and understand failure rather than fear it
Develop skills in terms of problem solving and decision making
Build and lead a team in a competitive environment
Make professional presentations
Understand how and why individuals become successful in the business world</td></tr>
<tr><td colspan="7">Course Outline
Introduction to entrepreneurial leadership
Leadership skills, abilities and qualities
Leader as a team builder
Leader as a motivator
Leader as an effective communicator and negotiator
How leaders play a critical role in shaping an organization's culture
Ethical behavior of a leader
Entrepreneur Presentation (by Entrepreneurs with good leadership skills)
Case Studies and Presentations</td></tr>
<tr><td colspan="7">Assessment scheme
Continuous assessments 50%
Final exam 50%</td></tr>
</table>

SEMESTER-5

<table>
<tr><td>Module Code</td><td>CE2812</td><td>Title</td><td colspan="4">SOIL MECHANICS</td></tr>
<tr><td>Credits</td><td>2.5</td><td rowspan="2">Hours/ Week</td><td>Lectures</td><td>2.0</td><td rowspan="2">Pre – requisites</td><td rowspan="2">-</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3/2</td></tr>
<tr><td colspan="7">Learning Outcomes
Upon successful completion of this module, the student will be able to:
Conduct basic soil classification and related tests
Understand the effect of water in soil with respect to stresses and flow
Understand the basic concepts of strength and consolidation of soils</td></tr>
<tr><td colspan="7">Course Outline
Formation and types of soils
Basic properties and classification of soils: Mass/volume relationships, particle size analysis, Atterberg limits, Classification of soils by the unified classification system
Compaction of soils: Factors affecting compaction, Standard and modified Proctor Compaction Tests, Control of compaction
Total and effective stresses in soils
Flow of water through soils: Concept of head, Coefficient of permeability, Darcy’s Law, Permeability measurements (laboratory and field)
Basic concepts of consolidation of saturated soils
Basic concepts of shear strength of soils</td></tr>
<tr><td colspan="7">Assessment scheme
Continuous assessments 30%
Final exam 70%</td></tr>
</table>

SEMESTER-5

Module Code	ER3013	Title	EXTRACTION METALLURGY			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Understand the fundamentals of extractive metallurgical processes for ferrous and non ferrous industries Assess material balance problems on the basis of physico-chemical and metallurgical principles

Apply the knowledge of basic chemistry and thermodynamics for problem identification and formulation of solutions

Explain the type of furnaces / kilns their design aspects, and the limitations

Understand the importance of energy and water footprints and zero waste flows in modern mineral processing and contribute towards environmental friendly and sustainable industry

Course Outline

Metallurgical unit processes: Minerals processing for metal extraction, Hydrometallurgy, Pyrometallurgy and Electrometallurgy.

Minerals concentration, leaching, precipitation, reduction of metal oxides, volatile metals, slags and refractories, matte smelting, refining processes.

Chemistry, thermodynamics and process kinetics with reference to the reactor design, operation and functionality.

Current technologies for production of common metals such as iron/steel/ferroalloys, light metals, base metals, and rare and reactive metals

Classification of metallurgical furnaces, review of various types of refractories used, High temperature measurement techniques. Principles of heat transfer in furnaces, Slag metal reactions. Simple binary phase diagrams, Slag attack on refractories and other refractory failures.

Energy and water footprints and zero waste for a environment friendly sustainable metallurgical industry

Professional and ethical responsibilities of the engineering profession to metallurgical industry

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-5

Module Code	ER3033	Title	MINING METHODS			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Select/Design a suitable mining method to mine a given mineral deposit.
Select appropriate machinery and equipment

Course Outline

Basic principles in the selection of mining methods.
Factors affecting the selection of mining methods.

Surface mining methods: Open-pit, placer, strip and quarry mining, Technological complexes – Machinery and equipment.

Underground mining methods:
Classification, Factors affecting the choice of mining methods,
Unsupported (open stoping), Supported (shrinkage stoping, cut and fill mining, vertical crater retreat) and Caving methods (sublevel caving, block caving and top slicing) and stope ventilation
Room-and-Pillar, Coal mining by conventional and Long-wall Advancing and Retreat mining

Environmental impacts and reclamation work.

Assessment scheme

Continuous assessments 30%
Final exam 70%

SEMESTER-5

Module Code	ER3043	Title	MINE MACHINERY AND DESIGN OF MINERAL TRANSPORT SYSTEMS			
Credits	3.0	Hours/ Week	Lectures	3.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Select suitable machinery and conveyor systems for mining and transport of minerals.

Course Outline

Underground machineries :

Machines used in development and extraction of hard mineral mines, Machines used in, development and extraction of Coal mines

Mine hoists

Mine communication

Remote controlled systems

Open pits:

Machines used in open cast mines and quarries for development and ore extraction

Machines used in exploitation of ore bodies below the water table

Machines used in hydraulicking

Offshore mining machines

Mineral transport:

Underground mines : Locomotive haulage and mine cars, dump trucks, loaders, LHDs and special transport machines, conveyors, rope haulage, hydraulic transport, wire ropes, mine hoists, non destructive testing of wire ropes and their applications, hoist and wire rope maintenance practices.

Open pits mines: Locomotive haulage, truck haulage, conveyors, rope haulage and hydraulic transport

Design ofConveyer transport systems and hoisting systems

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-5

Module Code	MA3023	Title	NUMERICAL METHODS			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	MA 1023
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Apply simple search and simple gradient methods in optimizing multivariable function.
Apply Taylor series to derive various implicit and explicit algorithm in solving ODE.
Compare different algorithm in terms of implementation in computers, and accuracy.
Apply different numerical scheme to find solution of different types of PDE.
Apply FEM in solving simple problems

Outline Syllabus

Numerical optimization problems (direct search and simple gradient methods) Solution of set of non-linear equations. Matrix eigenvalue determination including direct, inverse iteration and shift of origin, special methods for dealing with band type and sparse matrices. Simple error analysis, convergence properties. Simple finite difference technique for initial-value and boundary-value problems in ordinary and partial differential equations and systems. Phase plane and isoclinal curves. Taylor series, Runge-Kutta process. Explicit and implicit procedures, simple ideas on errors and stability. Introduction to method of characteristics. Finite Element Methods
Practical Work: Use of published algorithms and packages for solving numerical problems

Assessment scheme

Continuous assessments 30%
Final exam 70%

<table>
<tr><td>Module Code</td><td>MN3042</td><td>Title</td><td colspan="4">BUSINESS ECONOMICS AND FINANCIAL ACCOUNTING</td></tr>
<tr><td>Credits</td><td>3.0</td><td rowspan="2">Hours/ Week</td><td>Lectures</td><td>Credits</td><td rowspan="2">3.0 GPA</td><td rowspan="2">Hours/ Week</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>GPA/NGPA</td></tr>
<tr><td colspan="7">Learning Outcomes
Upon successful completion of this module, the student will be able to:
Define the basic micro and macro-economic concepts. Identify of the links between economy and technology.
Define basic concepts in financial, cost and management accounting.
Apply basic knowledge on these accounting concepts to business environment and to interpret main accounting statements.</td></tr>
<tr><td colspan="7">Outline Syllabus
Business Economics (12 hrs)
Economics and the economy; Elementary theory of Economics; Tools of economic analysis; Demand, supply and the market; Theory of the firm; Different types of firms; Motivation of firms; Theory of supply; Costs and production; Introduction to macroeconomics and national income accounting.
Financial and cost Accounting (24 hrs)
Basic accounting concepts; Trial balance; Profit & loss account, balance sheet; Cash flow statements; Interpretation of accounts; Cost concepts and terminology; Analysis and interpretation of cost; Allocation of overheads; Marginal costing, CPV analysis; Standard costing; Stock control.</td></tr>
<tr><td colspan="7">Assessment scheme
Continuous assessments 30%
Final exam 70%</td></tr>
</table>

SEMESTER-5

Module Code	MN3052	Title	INDUSTRIAL MANAGEMENT AND MARKETING			
Credits	3.0	Hours/ Week	Lectures	2.5	Pre – requisites	-
GPA/NGPA	GPA		Lab/Assignments	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Describe basic concepts and theories of organizational management. To explain the application of these theories for modern organizations.

Describe the fundamentals of technology management, human resource management and legal issues related to modern industrial relations.

Explain basic marketing concepts and theories and their applications.

Course Outline

Organization management (12 hrs)

Introduction to management & systems theory; Organizational theory; stakeholder analysis, organizational vision, mission & objectives. Types of organizations; organizational strategy, structures of modern organization and the concept of learning organization; Different roles of manager; manager & leader. Organizational culture & control; concepts of authority, power, responsibility & their applications and management of conflict. Management of change; importance of change management and conflict management. Modern management techniques; management styles: Japanese vs. Western Systems.

Technology management (6 hrs)

Technology and economic development; Key concepts of technology management and its relation to business management; Technology and competitive advantage; Evaluating technology;

Human Resource Management and Industrial Relations (6 hrs)

Introduction to human resource management, Employee selection, performance evaluation, rewards, Human resource development, Compensation and grievance handling, Labour - Management Relations in Sri Lanka and Business Ethics

Marketing: (12 hrs)

Marketing: overview; Marketing environment, marketing research and product life cycles; Buyer behavior: consumer and organizational; 4Ps of marketing including promotion and communication issues.

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-5

Module Code	ER3703	Title	DIGITAL IMAGE PROCESSING AND PHOTOGRAMMETRY			
Credits	3.0	Hours/ Week	Lectures	2.0	Pre – requisites	-
GPA/NGPA	GPA		Lab/Assignments	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Enhance and classify digital images.
- Develop digital elevation models.
- Interpret digital images with modern software.

Course Outline

- Digital image concepts
- Image rectification and restoration
- Image enhancement
- Image classification
- SAR image processing
- Hyperspectral image processing
- Digital Photogrammetry- fundamentals and processing techniques

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	ER3713	Title	JEWELLERY PRODUCTS DEVELOPMENT			
Credits	3.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Sketch Jewellery items, produce technical drawings and rendering.
- Conduct Jewellery designs using JewelCAD software.
- Carve a ring out of wax.

Course Outline

Jewellery Sketching, technical drawing, principles of Jewellery design, theory and practice of Jewellery designs, design and culture, Jewellery Design using JewelCAD

Proto-typing – Wax carving, master model making, CAM

Markets – Domestic market, international markets, market segments, supply chain, product distribution

Assessment scheme

Continuous assessments 50%

Final exam 50%

<table>
<tr><td>Module Code</td><td>ER3700</td><td>Title</td><td colspan="4">PETROLEUM EXPLORATION AND BASIN ANALYSIS</td></tr>
<tr><td>Credits</td><td>2.5</td><td rowspan="2">Hours/ Week</td><td>Lectures</td><td>2.0</td><td rowspan="2">Pre – requisites</td><td rowspan="2">ER2703</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3/2</td></tr>
<tr><td colspan="7">Learning Outcomes
Upon successful completion of this module, the student will be able to:
Evaluate problems related to the exploration by interpreting and integrating different types of geological, geophysical and engineering data.
Implement the use of new technology used in the exploration and production of hydrocarbons that will produce the best results.
Describe basin-forming processes and basin architecture
Review key analytical techniques with a focus on burial history analysis
Apply and integrate datasets to model basin evolution</td></tr>
<tr><td colspan="7">Course Outline
Petroleum Exploration
Geological mapping and geochemical exploration
Geophysical exploration methods for petroleum (Gravity, Magnetic, Resistivity, 2D and 3D seismic)
Seismic interpretation
Basin Analysis
Basin formation
Controls on basin stratigraphy
Classification of basins
Datasets
The concept of megasequences
Introduction to play fairway analysis techniques, burial history, petroleum systems
Analogue basin identification</td></tr>
<tr><td colspan="7">Assessment scheme
Continuous assessments 30%
Final exam 70%</td></tr>
</table>

SEMESTER-5

<table>
<tr><td>Module Code</td><td>MN3010</td><td>Title</td><td colspan="4">MULTIDISCIPLINARY DESIGN, INNOVATION AND VENTURE CREATION</td></tr>
<tr><td>Credits</td><td>02</td><td rowspan="2">Hours/ Week</td><td>Lectures</td><td>1.5</td><td rowspan="2">Pre – requisites</td><td rowspan="2">-</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>3/2</td></tr>
<tr><td colspan="7">Learning Outcomes
Upon successful completion of this module, the student will be able to:
Analyze a user need critically considering societal, environmental and economic aspects
Design and develop innovative products, processes and complex systems with a multidisciplinary perspective
Use state of the art digital technologies together with conventional technologies for rapid product, process and systems design and development
Develop a product, process, system to meet a client based multidisciplinary design</td></tr>
<tr><td colspan="7">Course Outline
Introduction to Creativity and Innovation
Role of Design under societal, environmental and economic trends
User Needs Assessment for user centered design
Multidisciplinary Design and creative problem solving
Product Analysis and Innovative Product Development
Analysis of Processes and Innovative Process Development
Complex Systems and Complex System Development
Conventional Technologies for transformation of ideas to new products
State of the Art technologies for rapid transformation of ideas to new products
Social Entrepreneurship and innovations
Sustainability, Green technologies, Cleaner production and Green products
Technological ventures based on design led innovation (Global, Local)
Commercialization strategies for new technologies</td></tr>
<tr><td colspan="7">Assessment scheme
Continuous assessments 50%
Final exam 50%</td></tr>
</table>

INDUSTRIAL TRAINING

Module Code	ER3992	Title	INDUSTRIAL TRAINING			
Credits	6.0	Hours/ Week	Lectures	-	Pre-requisites	-
GPA/NGPA	NGPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Demonstrate the nature of the industry and develop talent and attitude.
Recognize and demonstrate the responsibilities as a professional engineer in the future.
Analyze real life situations in the industrial organizations and their related environments.
Demonstrate the learning process of how the knowledge attained could be used in a realistic way.
Develop ability to make sound judgment.
Practice engineering activities in a feasible way with financial and economic limitations.
Analyze formal and informal relationships in an industrial organization so as to promote favorable human relations and team work.
Explain the problems encountered in the industry and select the optimal solution from the many alternatives available.
Perform basic laboratory tests.
Practice industry safety practices and explain such requirements and their appropriateness.

Course Outline

Study and gain experience in organizations involved in mining, mineral processing, mineral exploration, rock engineering, tunneling, ground water, oceanographic work, RS & GIS and gem and Jewellery
Study and gain experience in the worksite procedures, equipment and plants used and procedures adopted to get maximum benefits.
Study the environmental impacts associated with such activities.
Study and gain experience in activities related to research in such activities.
Study and gain experience in legal aspects involved in such activities.

Assessment scheme

Report on Industrial Training; Daily Diary; Attendance and conduct during the period of training and the observation of the supervisors. Oral examination

SEMESTER-6

Module Code	ER3022	Title	MINE SURVEYING			
Credits	2.0	Hours/ Week	Lectures	1.5	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Utilize 3-D view of underground and open pit mining

Transfer coordinates in an underground and open pit mining.

Create plan/elevation views of an underground mine and an open pit mine.

Course Outline

Introduction to mine surveying

Introduction to Mining Geometry: Projection with numerical point heights.

Surface reference nets, mine surveying maps, plans and profiles: Surface control for underground surveys, Miner's plans, Field books and notes used in mine surveying.

Surveys of underground workings: Underground mining reference and survey nets, Measuring vertical and horizontal angles in underground workings, Measuring underground Theodolite traverse lines.

Vertical surveys in underground workings: Direct leveling, Indirect leveling.

Connection Surveys.

Mine surveying in open pits.

Using AUTOCAD software to draw Plan ,Elevation and 3-D views

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-6

Module Code	ER3063	Title	ECONOMIC GEOLOGY			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre – requisites	-
GPA/NGPA	GPA		Lab/Assignments	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Explain the formation and occurrence of mineral deposits
- Explain the structural features of mineral deposits
- Identify the Industrial uses of minerals
- Describe the Sri Lankan mineral deposits

Course Outline

Introduction to economic mineral deposits

- Mineral deposits ,ore minerals, industrial minerals and gangue minerals
- Economic, political and environment factors influencing to convert a mineral deposit to a mine

Structural features of mineral deposits

- Disseminated type, veins, lodes, lenses, beds, dykes and sills, solution cavity fillings, breccia and pore- space filling

Classification of mineral deposits

Formation of economic mineral deposits

Industrial uses of minerals

Economic mineral deposits of Sri Lanka

Assessment scheme

Continuous assessments 30 %

Final exam 70 %

Module Code	ER3053	Title	STRUCTURAL & FIELD GEOLOGY			
Credits	2.0	Hours/ Week	Lectures	1.0	Pre – requisites	-
GPA/NGPA	GPA		Lab/Assignments	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Identify and explain various geological structures and rock types

Course Outline

- Interpretation of geological structures: Stereonets, Aerial photographs, maps
- Principles of geological mapping
- Field mapping programme
- Deformational features and history of Sri Lankan rocks

Assessment scheme

Continuous assessments 50 %

Final exam 50 %

SEMESTER-6

Module Code	ER3202	Title	DESIGN PROJECT			
Credits	3.0	Hours/ Week	Lectures	-	Pre-requisites	-
GPA/NGPA	GPA		Design work	3.0		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Plan and carry out an engineering design according to the client's requirement, available resources, and other limitations

Present the design performed

Demonstrate the methodology adopted in an engineering design

Course Outline

Identification of the problem (objectives)

Rapid assessment of the client requirements, available resources and limitations

Writing Terms of Reference (TOR)

Carrying out an EIA

Brain storming for alternative solutions

Detail investigation of the design

Planning and Preliminary design

Detail design

Negotiation with the stakeholders to comply with the objectives

Preparation of tender documents

Implementation of the project with project management aspects

Note-

Students will be working in small groups (8 – 10 per group). Students are responsible to conduct the design work under the guidance of the assigned academic staff member (supervisor) and submit the project deliverables as a complete document. Guest lecturers presenting related case studies etc will be organized as necessarily to provide additional insights.

Assessment scheme

Continuous assessments 100%

Module Code	**ER3912**	**Title**	**GEOLOGY FIELD CAMP**			
Credits	**1.0**	**Hours/ Week**	**Lectures**	**-**	**Pre-requisites**	**-**
GPA/NGPA	**NGPA**		**Lab/Tutorials**	-		
Learning Outcomes Upon successful completion of this module, the student will be able to: Use various geological field techniques. Identification of rocks and their structures in the field and map the structures.						
Course Outline Preparation for field programmes Geological mapping in the field. Structural mapping in the field. Identification of rocks in the field area. Identification of minerals in the field area. Preparation of geological maps, reports and presentation						
Assessment scheme Continuous assessments 100%						

Module Code	**ER3922**	**Title**	**MINE SURVEYING FIELD CAMP**			
Credits	**1.0**	**Hours/ Week**	**Lectures**	**-**	**Pre-requisites**	**-**
GPA/NGPA	**NGPA**		**Lab/Tutorials**	-		
Learning Outcomes Upon successful completion of this module, the student will be able to: Carry out surveying and leveling in a mine, and prepare the report.						
Course Outline Familiarization with surveying techniques and instrument used by the Mining enterprise. Conducting of level survey underground. Transferring of co-ordinates from one level to another sub level. Preparation of report and presentation.						
Assessment scheme Continuous assessments 100%						

SEMESTER-6

Module Code	ER3933	Title	MINERAL EXPLORATION FIELD CAMP			
Credits	1.0	Hours/ Week	Lectures	-	Pre-requisites	-
GPA/NGPA	NGPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Handle geophysical equipment and identify sub-surface geological features using geophysical techniques in the field.

Use geochemical sampling techniques and identify different geochemical features of mineral deposits in the field.

Course Outline

Geophysical exploration:

Selection of the suitable geophysical techniques for the area

Conduction of the following geophysical surveys:

Resistivity survey

Magnetic survey

Interpretation of data

Preparation of reports and presentation

Geochemical exploration:

Planning for Geochemical surveys

Geochemical sampling

Preparation of samples for analytical work

Preparation of reports and presentation

Assessment scheme

Continuous assessments 100%

Module Code	**ER3903**	**Title**	**INDUSTRIAL VISITS**			
Credits	**1.0**	**Hors/ Week**	**Lectures**	-	**Pre-requisites**	-
GPA/NGPA	**NGPA**		**Lab/Tutorials**	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain the operational steps and safety measures in underground and open cast mines.
Draw and explain the process flow diagrams in mineral processing plants.
Identify mineral deposits through inspection.

Course Outline

Field visits to locations from among the following:
Underground mines
Open-cast mines
Quarries
Processing plants
Open deposits

Assessment scheme

Continuous assessments 100%

Module Code	**ER3942**	**Title**	**OCEANOGRAPHY FIELD STUDIES**			
Credits	**1.0**	**Hours/ Week**	**Lectures**	**-**	**Pre-requisites**	**ER2703**
GPA/NGPA	**NGPA**		**Lab/Tutorials**	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Organize a field work program
Manage safety issues
Perform and explain sampling techniques
Explain operation and maintenance of ocean equipments

Course Outline

Usage and data interpretation of marine instruments
Usage of Side Scan sonar
Eco sounder
Tide and wave gauges
Navigation GPS
Current Meters
Gravity corer
Grab Sampler
CTD (Conductivity, Temperature, Depth)

Assessment scheme

Continuous assessments 100%

SEMESTER-7

Module Code	ER4013	Title	ROCK MECHANICS			
Credits	2.5	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Determine properties of rocks for engineering applications.

Estimate stability of rock slopes.

Analyze stress around underground openings and estimate support requirements.

Course Outline

Rock mass classification, Physical and mechanical properties of rocks and their testing methods, Elastic and time dependent behavior of rocks, In-situ stress measurements

Theories of rock failure, Geometric and stress analysis of rocks, Rock slope stabilization and methods of reinforcement

Stress around underground excavations, Underground structural failures and methods of reinforcement

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	ER4023	Title	MINE VENTILATION			
Credits	2.5	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain concepts of mine ventilation, Conduct measurements related to mine gas regime, Conduct flow calculations, Airflow requirement calculations, Design underground ventilation networks, Selection and location fans, Conduct ventilation surveys

Course Outline

Introduction to sub-surface ventilation**,**

Underground atmosphere: Gases in subsurface, Dust, Heat and Psychrometry,

Air flow: Introduction to fluid mechanics and fundamentals of steady –flow thermodynamics. Natural ventilation.

Fan engineering: Centrifugal and axial flow fans, Fan and system characteristics, Fan laws. Drawing –up fan specifications, Fan output control, Main, booster and auxiliary fans.

Mine Refrigeration:

Ventilation surveying: Quantity and Pressure surveys, Measurements with instrumentation

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	ER4042	Title	MINERAL ENGINEERING II			
Credits	3.0	Hours/ Week	Lectures	3.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain chemical separation techniques in the recovery of minerals of higher grade from as-mine materials.

Explain the various complications arising from handling of mineral suspensions.

Design suitable processing plants using chemical processing techniques and apply modifications wherever necessary, fulfilling conditions for environmentally sound processing technique/s.

Course Outline

Chemical Processing :

Sintering and pelletizing of iron ores, pellet testing, flow sheets relevant to iron ore preparation

Stability of mineral suspensions, Rheology, zeta-potential, flocculation, selective flocculation

and applications in mineral separation.

Theory of flotation, type of flotation cells, activation, depression, modification of mineral

surface characteristics, and calculations.

Leaching of minerals:

Treatment of sulphide minerals, Arbeiter process, Sherritt Gordon process, Toth process, Bayer

process and its economics.

Gold extraction using Activated Carbon , Gold Recovery methods ; Flow sheets .

Theory of Solvent Extraction , Solvent extraction with special reference to Copper and

Uranium ores

Tailings and tailings disposal (Radioactive and Hazardous)

Ion exchange process as applied to rare earth separations. Types of iron exchangers (Cat ionic, Anionic)

Air pollution, water pollution and pollution control methods, design of an electrostatic

separator.mElectroplate separator: theory, Applications in industry.

Physico-Chemical :

In-stream analysis with special reference to radio isotopes. Such as Californium-252 (gamma

emitters), sample geometry.(Prior knowledge of Nuclear techniques is essential)

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-7

Module Code	ER3950	Title	SCIENTIFIC WRITING AND PRESENTATION SKILLS			
Credits	1.0	Hours/ Week	Lectures	-	Pre-requisites	-
GPA/NGPA	NGPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Write technical reports, thesis, dissertation, sceinatific conference /journal papers

Deliver effective presentation

Course Outline

Scientific Writing

Planning and structuring technical reports, thesis, dissertation, sceinatific conference /journal papers

Writing introduction, materials & methods, results & discussion

Preparing the title, abstract & keywords, Presentation of statistical results, Effective tables and illustrations, Preparing references (referencing software), Submitting your manuscript

Authorship and acknowledgements, How the manuscript is processed

What the reviewer and editor look for in a manuscript, Dealing with Editor's & Reviewer's Comments, Proof Reading and Final Submission

Plagiarism and copyrights

Presentation Skills

Planning and Preparation

Criteria for an effective presentation, Establishing your objective, Presentation structure, Tips for effective Power Point presentations

Interactive presentations

Involving and relating to your audience, Presenting your message,

Handling questions, Motivating commitment

Presenting with Impact

Speaking without notes, Vocal Variation, gestures, eye contact

Assessment scheme

Continuous assessments 100%

SEMESTER-7

Module Code	ER4083	Title	MINE PLANNING AND DESIGN			
Credits	2.5	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Conduct cost analysis on mine planning,

Accomplish mine optimization, Selecting a suitable mining method

Course Outline

Introduction to mine planning and design.

Principals of project management.

Mine capital investment: Fixed capital, Working capital, Capital costs and production costs

Time value of money: Net present value, Pay-back period, Rate of Return on Investment.

Capital recovery and sinking fund, cost-benefit ratio, Basics of mine ventilation, Depletion.

Mine optimization,Equipment fleet selection

Regulatory environment, Mine Closure

Computer-aided mine design

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER4202**	**Title**	**RESEARCH PROJECT**			
Credits	**5**	**Hours/ Week**	**Lectures**	-	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**-**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain the concepts on conducting a scientific research project.
Demonstrate writing skills on research proposals and final reports.
Demonstrate the concepts on publication of research (abstract, full paper and conference presentation).

Course Outline

Literature review/ Individual Presentation
Planning of project work/ Preparation of work program
Research proposal and group presentation
Field work (if necessary)
Laboratory testing programs (if necessary)
Analysis of data
Interpretation of data
Writing the research project report
Writing the abstract/ Full paper for publications
Individual viva
Draft research project report/ Presentation
Publications on research project/ Full Paper and Conference presentation
Final report

Assessment scheme

Continuous assessments 100%

SEMESTER-7

<table>
<tr><td>Module Code</td><td>MN4022</td><td>Title</td><td colspan="4">ENGINEERING ECONOMICS</td></tr>
<tr><td>Credits</td><td>2.0</td><td rowspan="2">Hours/ Week</td><td>Lectures</td><td>2.0</td><td rowspan="2">Pre – requisites</td><td rowspan="2">-</td></tr>
<tr><td>GPA/NGPA</td><td>GPA</td><td>Lab/Assignments</td><td>-</td></tr>
<tr><td colspan="7">Learning Outcomes
Upon successful completion of this module, the student will be able to:
Identify the most relevant economic concepts for the engineering decisions
Apply these concepts to practical engineering projects and decisions</td></tr>
<tr><td colspan="7">Outline Syllabus
Fundamentals; time value of money, equivalence and cash flow diagrams; (2 hrs)
Discounted cash flow; time value equivalence, single payment and annuity factors and numerical examples. Cash flows and compounding; (4 hrs)
Comparison methods; assumptions, net present value, annual worth, equivalent annual cost with/without salvage value, equivalent annual worth of fixed asset lives and perpetual lives, internal rate of return (IRR) and minimum acceptable rate of return and IRR irregularities, numerical examples; (6 hrs)
Analysis of alternatives; classification, mutually exclusive alternatives, incremental analysis and preferred method for decision making; (3 hrs)
Project feasibility analysis; financial feasibility, market price analysis, cost of capital and weighted average, economy feasibility, shadow pricing, benefit cost (B/C) analysis, irregularities of B/C analysis and preferred method for decision making; (4 hrs)
Sensitivity analysis and decision trees; What if?, sensitivity graph and interpretation of the analysis, discounted decision trees and application of decision trees; (2 hrs)
Risk management; Risk identification, risk analysis and risk response; (2 hrs)</td></tr>
<tr><td colspan="7">Assessment scheme
Continuous assessments 30%
Final exam 70%</td></tr>
</table>

Module Code	**ER4210**	**Title**	**PETROLEUM DRILLING AND FORMATION EVALUATION**			
Credits	**2.5**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	**ER3700**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**3/2**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Identify machinery and methods of petroleum drilling of onshore and offshore wells, for recovery of oil and gas from a petroleum reservoir
- Identify the basic physical principles of the common hole logging measurements in order to evaluate formation properties
- Interpret open hole logging measurements for lithology, porosity, and water saturation estimates
- Calculate basic wire-line log evaluations on a representative, commercial software package

Course Outline

Drilling wells

- Petroleum drilling systems
- Drilling rig components
- Drilling fluids
- Casing design
- Well cementing
- Directional drilling
- Pressure control

Formation Evaluation

- Logging Principles
- Passive logs
- Acoustic logs
- Density / Neutron logs
- Porosity , Lithology Determination
- Resistivity logging
- Capillary pressure and saturation
- Shally – sand Analysis
- Core –log interpretation

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-7

Module Code	ER4223	Title	HYDROGEOLOGY AND GROUND WATER MODELING			
Credits	3.0	Hours/ Week	Lectures	2.5	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain the basic concepts of hydrogeology and groundwater exploration.
Carry out design of tube-wells and pumping tests.
Explain the concepts on chemical characteristics in groundwater and treatments.
Understand basic concepts of groundwater modeling
Select and formulate groundwater models using computer programs

Course Outline

Introduction to hydrogeology
Aquifers, aquifer properties, aquifer types and groundwater environments
Groundwater exploration – geological, geomorphological and geophysical methods
Design of shallow and deep tube-wells
Well drilling
Water pumps
Pumping tests (well and aquifer)
Chemical characteristics of groundwater
Groundwater treatments
Mining and groundwater
Basics of groundwater modeling
Introduction to groundwater modeling software
Designing conceptual models, calibrating and forecasting groundwater conditions

Assessment scheme

Continuous assessments 30%
Final exam 70%

SEMESTER-7

Module Code	ER4313	Title	GIS AND SPATIAL STATISTICS			
Credits	2.5	Hours/ Week	Lectures	2.0	Pre-requisites	ER 3703
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Explain the analytical techniques to treat spatial data.
- Manipulate and analyze spatial data and make final output maps using GIS techniques.

Course Outline

- GIS technology
- Spatial information
- Database concept
- Data quality
- Errors and map projections
- Spatial data analysis (vector and raster based)
- Multi-criteria analysis
- Network analysis
- Decision support system

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	ER4433	Title	MARINE SURVEYING			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	ER2703 &ER3942
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Apply onshore and offshore surveying methods in the field
- Understand and prepare bathymetric maps, navigation charts and related software

Course Outline

- Hydrography; simple bathymetric maps; software related to hydrography.
- Offshore navigational positioning (GPS and DGPS).
- Dassictechniques and sampling techniques.
- Tidal variations and measurements.
- Sources of error; instrument calibration and error budgets.
- Side scan sonar imaging
- Beach profiling.

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-7

Module Code	ER4512	Title	JEWELLERY PRODUCTION TECHNOLOGY			
Credits	3.0	Hours/ Week	Lectures	2.0	Pre-requisites	ER3713
GPA/NGPA	GPA		Lab/Tutorials	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Melt metal and produce alloys

Perform wire drawing, soldering, welding, sawing, filing, and polishing

Prepare a rubber mould, inject wax patterns, carry out the investment procedure and burn-out procedure, and cast.

Course Outline

Alloying & Melting – Karatage& fineness, colour, physical and mechanical properties, alloy making, ingot casting, assaying, hallmarking;

Investment Casting - Rubber moulding, wax and tree assembly, investment, casting, defects and
their control;

Joining Technology - Soldering, fusion welding, spot welding, tack welding, laser-welding, pressure welding;

Finishing Technology - Techniques, sawing, filing, abrasive grading systems, polishing process,
mass production methods, matte and mirror finishing, indentation and beaded type textures,
etching and electro finishing, setting gemstones;

Annealing and heat treatment - Principals and practice of annealing, metallurgy of precious
metals, heat treatment of carat gold alloys;

Metal working technology - Metal working technology, handworking, rolling, wire-drawing,
chain making, Jewellery making, Investment casting, electroforming, EDM (electrical discharge machining), die striking (stamping), Fabrication, CAM;

Electrolytic Processes - Electrolytic processes, techniques & materials, electroforming, electroplating, electro polishing;

Metal refining - Equipment, chemicals, processes, aqua regia process, formic acid method, precipitation methods, electrolytic methods, silver refining, gold refining, platinum refining,
hazards, laws and regulations

Assessment scheme

Continuous assessments 50%

Final exam 50%

SEMESTER-7

Module Code	ER4522	Title	FASHIONING OF GEMSTONES			
Credits	2.0	Hours/ Week	Lectures	1.0	Pre-requisites	ER3713
GPA/NGPA	GPA		Lab/Tutorials	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Develop capability to manage Jewellery production units involving handmade Jewellery, casting, electroforming, EDM

Course Outline

Coloured Gemstone Fashioning : Gem cutting methods - Traditional (hanaporuwa), jam peg, universal faceter, robotic, tumbling, carving, laser.Cutting styles - Cabochon, bead, facetted, shapes (standard shapes and fancy shapes), cuts (step, brilliant, rose etc), invisible.

Manufacturing Processes - Sawing, drilling, forming, shaping, calibrating, faceting, polishing, orientation, machinery.

Diamond Fashioning: Manufacturing process - Cleaving, sawing, bruting, cutting, polishing, brilliant cut, girdling machinery.

Management aspects : Supply chain - Local and international supply chain, of gem cutting: Management and control - Production systems, mass production systems, factory and workshop organizing, productivity. management, information systems

Quality Assurance: Attributes, standards, international conventions, inspection and reports.

Assessment scheme

Continuous assessments 50%

Final exam 50%

SEMESTER-7

Module Code	MN3020	Title	ENTREPRENEURSHIP BUSINESS BASICS			
Credits	3.0	Hours/ Week	Lectures	2.0	Pre – requisites	-
GPA/NGPA	GPA		Lab/Assignments	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Demonstrate understanding of fundamentals ideas of financial management for entrepreneurs, concepts such as cash flow, financial statements, financial ratios, time value for money, capital budgeting and net present value.

Go through the process of securing entrepreneur's intellectual property, including patents, trademarks, copy rights and trade secrets.

Analyze an industry and identify opportunities for new products/services along with marketing tactics and strategies.

Identify human resource needs for an organization and acquire and maintain required people.

Course Outline

Overview of Corporate Finance: Introduction to corporate finance; Financial statements/taxes/cash flow.

Financial statements and long-term financial planning: Working with financial statements and real world applications; Long-term financial planning and growth

Valuation of cash flows: Time value for money; Net present value

Risk management; Risk identification, risk analysis and risk response;

Patents, trade secrets and copy rights: Introduction to business law; Patents and procedure for obtaining patents; Trade secrets, copy rights and trade marks

Marketing: Introduction to marketing; Consumer behavior; Business and organizational consumers; Production development and management; Pricing objectives and policies; Business ethics; Advertising and sales promotion; Integrated marketing communications

Managing Human Resources; Introduction to Human Resource Management; Manpower planning; Job Analysis and designing; Recruiting and selecting appropriate human capital; Staffing and training people; Reward management; Grievance handling; Transfers promotions and retirements

Managing Operations; Designing new products and processes, Demand forecasting, Planning for production facilities, Production planning, Managing inventories, Managing productivity and quality

Assessment scheme

Continuous assessments 50%

Final exam 50%

SEMESTER-7

Module Code	**MN 4800**	**Title**	**SUPPLY CHAIN MANAGEMENT**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**2.0**	**Pre – requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Assignments**	**N/A**		

Learning Outcomes

After completing this module, the students should be able to:

- Understand fundamental supply chain management concepts
- Understand how to manage supply chain performance drivers to support the supply chain strategy

Develop supply chain strategy in line with the corporate strategy

Course Outline

- Introduction to supply chain management
- Managing drivers of supply chain such as Information, Inventory, Transportation, Sourcing, Facilities and Technology
- Coordination of stakeholders to maximize supply chain performance
- Supply chain strategy development

Assessment scheme

Continuous assessments 50%

Final exam 50%

SEMESTER-7

Module Code	MN4042	Title	TECHNOLOGY MANAGEMENT			
Credits	02	Hours/ Week	Lectures	1.5	Pre – requisites	-
GPA/NGPA	GPA		Lab/Assignments	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Recognize basic concepts and theories of management of technology.

Identify the use of MOT concepts and theories in modern organizations and economy.

Course Outline

Concept of technology Management

Strategic management of technology:

Technology-strategy relationship; Elements of technology strategy and formulation of a technology strategy; Integration of technology strategy and business strategy for competitive success; Technology, the environment and sustainable development

Organizational Aspects of technology management:

Human dimension of technology and concepts of the entrepreneur and entrepreneur; Organizational cultures and structures for promotion of creativity and innovation; The learning organization; The imperative of knowledge management

Acquiring technology through technology transfer:

Motivations for acquiring technology through technology transfer;Elements of technology transfer process; Success and failure factors in technology transfer

Acquiring technology through research and development:

The concepts of invention and innovation: Definition and classifications of research and development; New product development; Challenges in commercializing research results

National innovation systems for facilitating technology-based development:

Concepts of the national innovation system (NIS) and science and technology infrastructure; Comparison of NISs of developed, developing and first and second tier NIC countries; State involvement and growth of science and technology parks in developed and developing countries

Practical : 4 industry case studies, 2 plant/lab visit

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-8

Module Code	**ER4033**	**Title**	**ENGINEERING GEOLOGY**			
Credits	**2.5**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**3/2**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain the methodology in site investigations and preparation of proposal and reports.
Utilize concepts in geology for engineering applications.
Explain the basic concepts on geological disaster prevention, mitigation and preparedness.

Course Outline

Site investigation for engineering projects.
Drilling, core logging for site investigation
Mass movements: Landslides, Mudflows, Rock–flows and slides, Creep
Engineering application of geology in planning and construction of dams and reservoirs
Importance of geology in planning and construction of tunnels
Geological considerations involved in construction of roads, railways, bridges and buildings
Preparation of site investigation proposal and reports

Assessment scheme

Continuous assessments 30%
Final exam 70%

SEMESTER-8

Module Code	ER4073	Title	MINERAL ECONOMICS			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Estimate ore reserves from field data

Assess the market conditions for mineral products

Course outline

Introduction to mineral economics

Ore reserve estimation

- Analytical results, Errors in sampling
- Proven and probable ore reserves
- Krigging
- Methods of squares, polygons and triangles
- Cross sectional methods
- Principal factors in the conversion of the in-situ to a recoverable reserve

Mine and mill cut-off grades:

- Aspects of market value and costs
- Mineable widths/depths

Marketability of mineral products

- Form of sale

Market analysis for mineral products

- Forms of contract sales and features of them
- Market forecasting and schedule of tariffs

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-8

Module Code	ER4093	Title	PLANT PERFORMANCE			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Operate and maintain processing plant
- Competency in mineral sampling techniques.
- Implement the 5S system of the plant and waste minimization
- Implement an ISO certification system in processing plant.

Course Outline

- Introduction to plant performance.
- Application of mineralogy for mineral processing industry.
- Evaluation of a concentrate by mineral percentage.
- Sampling techniques, devices and systems.
- Pulp stream analysis.
- Process control and control charts.
- Mass and ingredient balance optimization.
- Effect of specific gravity of media in heavy media separation and washability curves.
- Pulp formulation and recycling of media.
- Recovery calculations.
- Industrial screening and classification.
- Determination of the efficiency of processes.
- Waste minimization and cleaner production.
- Application of 5S for processing plants.
- Quality assurance of ISO certification.
- Introduction to plant performance and stimulation software

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-8

Module Code	ER4050	Title	MINE WASTE MANAGEMENT AND REHABILITATION			
Credits	2.5	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Apply of sustainability principles in mining industry
- Understand mine reclamation planning and management
- Implement mine waste treatment technologies
- Conduct environmental management of mine sites

Course Outline

Mining and Sustainability

Evolution of the principles and theories of sustainability and sustainable development.
Applied sustainability and their applications in the mining industry.
The mining industry and society; the nature of the mining industry in Sri Lanka and around the world, social and cultural issues in mining, mitigation of environmental and social impacts of mining
Environmental management in mining and environmental audits
Cleaner production technologies

Mine rehabilitation

Principles of Mine Closure -Mine closure planning, Stakeholders of mine closure, Environmental and social impacts, Financial aspects
Reclamation planning and management-Site preparation, Restoration, Monitoring and Maintenance, Regulatory authorities

Waste management

Waste reduction technologies -dust suppression in mining and in mineral transport facilities, material recovery and recycling
-Containment
The principles of designing, constructing and operating mine waste storage facilities/impoundment structures
Long-term geotechnical and environmental stability considerations of storage facilities
Case studies of failures of storage facilities
-Treatment
Types of mine waste; waste rock and tailings. Tailings deposition methods.
Wastes, effluents and their point sources in mining and metallurgical processes such as mineral concentration, value extraction and process metallurgy.
Characteristics of wastes and effluents.
Sampling and analysis of tailings,

Fundamentals of unit operations and unit processes

Final disposal and materials recycling, Risk assessment & remedial measures.

Assessment scheme

Continuous assessments 30%
Final exam 70%

SEMESTER-8

Module Code	ER4103	Title	MINE SAFETY AND LEGISLATION			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Identify hazardous situations and take appropriate measures in hazard control and accident prevention,

Conduct accident investigations,

Implement legislation related to mining and explosives.

Course Outline

Introduction to Mine safety, Health and safety environment in mining operations.

Hazards, Accidents and Disasters,

Hazard control approaches: Health and Safety regulations, Medical examinations, Engineering control, Human factors engineering, Systems safety analysis,

Accident investigation and prevention: General principles and means of accident prevention, Risk assessment, Hazard control, Personal protection

Management role in accident prevention: Management philosophy, Safety orientation, Mine safety program, Accident costs, Statistics in accident prevention, Miner training. Underground communication

Causes of Industrial traumatism and their elimination

Personnel protective equipment.

Mine rescue,

Mines and Minerals Act, Explosives Act

Case studies:

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-8

Module Code	**CH4350**	**Title**	**PETROLEUM REFINING AND PETROCHEMICAL INDUSTRY**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**1.5**	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**3/2**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Select and describe required refining processes for specified fuel specifications
Select suitable fuels for specific applications
Describe production processes for petrochemicals

Course Outline

Processes to transformcrude oil into useful products: Distillation processes (atmospheric and vacuum distillations), conversion processes (cracking, and reforming), treating processes (desalting, hydro treating, solvent extraction, amine plants, desulfurization and sweetening)

Properties and qualities of major petroleum refinery products: liquefied petroleum gas (LPG), gasoline, kerosene,aviation fuel, diesel oil, fuel oils, lubricating oils, and asphalt.

Liquefied Natural gas (LNG)

Petrochemicals and their derivatives; Polymers, Solvents, Surfactants and Fertilizers

Practical/Assignments

Flash Point and Fire Point
Aniline Point
Viscosity Index
A.S.T.M. Distillation

***Note: Offered to ERE students following Petroleum Engineering focus area in semester 8

Assessment scheme

Continuous assessments 30%
Final exam 70%

SEMESTER-8

Module Code	**ER4230**	**Title**	**PETROLEUM RESERVOIR ENGINEERING AND PROJECT DESIGN**			
Credits	**2.5**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	**ER4210**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**3/2**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Calculate the reservoir volume with given data
- Estimate reservoir parameters with given well data
- Analyze the reservoir behavior with time

Course Outline

- Rock and Fluid Properties
- Volumetric Calculation
- Reservoir Types and Drive Mechanisms
- Material Balance
- Decline Curve Analysis
- Fluid Flow in Porous Media
- Well Testing
- Immisicible Displacement

Offshore Mining Project Design: Student has to carry out a design project on offshore mining

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-8

Module Code	ER4243	Title	NATURAL DISASTER MANAGEMENT			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain the basic concepts on natural hazards.
Discuss the methods in hazard and risk assessments.
Explain the concepts on disaster prevention, mitigation and preparedness.

Course Outline

Natural and Man-made Hazards and Disasters
Introduction to plate tectonics
Geological Disasters
- Landslides
- Earthquakes and tsunami generation
- Volcanic eruptions

Meteorological Disasters
- Storm Surges
- Lightening

Hydrological Disasters
- Droughts
- Floods

Hazard Assessment, Risk Assessment, and Risk Management
Sensor Systems for monitoring, forecasting and warning dissemination
Prevention, Mitigation and Preparedness

Assessment scheme

Continuous assessments 30%
Final exam 70%

Module Code	ER4253	Title	OFFSHORE MINING AND PROJECT DESIGN			
Credits	3.0	Hours/ Week	Lectures	2.0	Pre-requisites	ER4433
GPA/NGPA	GPA		Lab/Tutorials	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

DescribeLaw of the Sea

Evaluate the offshore mineral potential

Recognize various offshore minerals

Familiarize with various advanced offshore mining/dredging techniques and relevant mining/dredging machinery.

Familiarize with underwater blasting methods

Course Outline

Law of the sea

Types of ocean minerals

Minerals of the deep seabed: Ferromanganese nodules, cobalt crusts and pollymetallic sulfides, etc.

Minerals of the continental shelf: Placers, seabed metals,industrial chemicals, etc.

Offshore Mining

Offshore mining/dredging machinery, coastal, shallow water and deep sea mining methods and underwater blasting

Seawater as a resource

Fresh water distillation, sodium chloride, bromine, magnesium, uranium, etc

Offshore Mining Project Design

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-8

Module Code	ER4260	Title	PETROLEUM PRODUCTION			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	ER4210
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Handle the process of petroleum production from a geological formation

Course Outline

Production platforms.

Evaluating inflow and outflow performance between the reservoir and the wellbore.

Designing completion systems, including tubing selection, perforating, sand control, matrix stimulation, and hydraulic fracturing.

Selecting artificial lift equipment, including sucker-rod lift (typically beam pumping), gas lift, electrical submersible pumps, subsurface hydraulic pumps, progressing-cavity pumps, and plunger lift.

Selecting equipment for surface facilities that separate and measure the produced fluids (oil, natural gas, water, and impurities), prepare the oil and gas for transportation to market, and handle disposal of any water and impurities

Aspects of petroleum production law

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER4271**	**Title**	**ADVANCED GEMMOLOGY**			
Credits	**2.5**	**Hour**	**Lectures**	**2.0**	**Pre-**	**ER4512&E**
GPA/NGPA	**GPA**	**Week**	**Lab/Tutorials**	**3/2**	**requisites**	**R4522**

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Handle advance gemological equipment.

Identify natural gems, synthetics and organic gems using advanced gemmological instruments

Course Outline

Man made gems : Synthetics, Artificial products and composites

Synthetic gemstones: Flame fusion (Vernueil) process,Czochralski method, flux melt growth, skull melting, zone melting &Hydrothermal method, Diamond synthesis.

Organic gem materials: Pearl, coral, amber, ivory, tortoiseshell, shell, jet.

Gemstone Enhancement: Surface treatment, Colourless&Coluored impregnations, heat treatment, Diffusion treatment, Irradiation, laser drilling, HPHT treatment for diamond.

Advanced techniques of gem and inclusion identification:

Electron microprobe, Scanning electron microscope, Ultraviolet-visible and near infra red spectrometry (UV-vis-NIR), Secondary ion mass spectrometry (SIMS), Fourier-transform infrared (FTIR) spectrometer, Raman spectrometer, Energy Dispersive X-ray fluorescence (EDXRF), Laser Ablation-Inductively Coupled Plasma-mass spectrometry**.**

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER4323**	**Title**	**SPACE TECHNOLOGY AND NAVIGATION SYSTEMS**			
Credits	**2.0**	**Hours/**	**Lectures**	**1.5**	**Pre-**	**ER4313**
GPA/NGPA	**GPA**	**Week**	**Lab/Tutorials**	**3/2**	**requisites**	

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain characteristics of space crafts and orbits.

Use satellite based navigation system.

Course Outline

Spacecrafts and orbits, GPS systems

Navigations systems, Satellite GDOP

Receivers, GPS errors

DGPS, Analysis of GPS data

GPS data processing

GLONASS, EGNOS, MSAS, and GALELIO SYSTEMS

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-8

Module Code	ER4532	Title	JEWELLERY PRODUCTION MANAGEMENT			
Credits	3.0	Hours/ Week	Lectures	2.0	Pre-requisites	ER4512&ER4522
GPA/NGPA	GPA		Lab/Tutorials	3/1		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Manage Jewellery production units involving handmade Jewellery, casting, electroforming, and EDM.

Course Outline

Production - Investment casting, electroforming, EDM (electrical discharge machining), die striking (stamping), Fabrication, CAM, hand crafting, organization, management of metal loss.

Quality Assurance - Laws and regulations, stamping, assaying, hallmarking, quality attributes, statistical methods, inspection methods, laboratory reports and certificates, hazardous materials.

Assessment scheme

Continuous assessments 50%

Final exam 50%

Module Code	ER4713	Title	CONSTRUCTION ENGINEERING PRACTICE			
Credits	2.0	Hours/ Week	Lectures	2.0	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Explain the uses of various constructions materials.

Draw bending moment and shear force diagrams to analyze the behavior of structural elements (steel and reinforced concrete).

Read and interpret the specifications and structural drawings.

Course Outline

Construction materials (steel, timber, masonry, concrete).

Manufacturing process, selection, testing and properties of building material

Bricks, Rubble , Sand,Coarse aggregates, Timber, Roof cover material, Cement blocks, Cement, Lime, Concrete, Steel, New building Materials

Testing:

Bending moment and shear force diagrams (simply supported and continuous beams, cantilevers, typical columns, and arches). Bending stresses and shear stresses in a steel member and a reinforced concrete member.

Typical construction practices (steel construction, pad footings, brick work, R/C slabs, beams and columns) ,Reading and understanding specifications and structural drawings

Assessment scheme

Continuous assessments 30%

Final exam 70%

Module Code	**ER4720**	**Title**	**TUNNEL ENGINEERING AND DESIGN**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**2.0**	**Pre-requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Tutorials**	**-**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Evaluate ground conditions and existing structures in specifying support requirements.

Select the appropriate method of tunnel excavation, supporting system, work organization, with safe practices in execution.

Predict ground movements resulting from underground excavations or ground treatments

Course Outline

Introduction:Tunnel shapes and dimensions, Evaluation of tunneling methods; Conventional methods and mechanical methods of excavation in different ground conditions.

Drilling-and-Blasting method: Full-face and by benching, Drilling round design, Drilling patterns, charging, ventilation, mucking, types of support -Timber, Steel, Shot-crete, Rock-bolting, auxiliary services, work organization.

Tunnel support determination: Support design, Geo-technical factors influencing support design, Support erection.

New Australian Mining Method (NATM)

Tunneling under shields

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-8

Module Code	MA4013	Title	LINEAR MODELS AND MULTIVARIATE STATISTICS			
Credits	3.0	Hours/ Week	Lectures	3.0	Pre-requisites	MA1023/ MA 3013
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Develop statistical models to identify influential factors in a given process.
Understand the concepts of statistical data mining methods.
Use MINITAB and SPSS for data analysis.
Select the appropriate multivariate statistical methods to analyze data.

Course Outline

Linear Models

Types of measurement scale, multiple regressions, one-way analysis of variance. Model
partial F-Test, forward selection, Backward elimination and Stepwise techniques.

Multivariate Statistics

Geometric concept of multivariate data.
Introduction to data mining and warehousing.
Multivariate normal distributions.
Principal component analysis, explanatory factor analysis, discriminant analysis, clusters
Multivariate analysis of variance.
Use of MINITAB and SPSS.

Assessment scheme

Continuous assessments 30%
Final exam 70%

SEMESTER-8

Module Code	MA4023	Title	OPERATIONAL RESEARCH			
Credits	3.0	Hours/ Week	Lectures	3.0	Pre-requisites	MA1013
GPA/NGPA	GPA		Lab/Tutorials	-		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

Identify appropriate OR techniques in a given real world problem.
Perform sensitivity analysis in the chosen OR model.
Choose an appropriate algorithm for the given the OR technique.
Use the TORA software for engineering problems.

Course Outline

Modeling with linear programming, geometrical solution to problems with two decision variables, simplex method including Big M-method and two phase method of a solution of problems with mixed constraints.

Duality in linear programming, Transportation and assignment problems, trans-shipment problems. Theory of zero sum, two person matrix games.

Revised simplex algorithm. Dual simplex algorithm, sensitivity analysis, and parametric programming.

Integer programming, Gomory's cutting plane, branch and bound, the knapsack problem. Dynamic programming, the inventory model. Non-linear optimization.

Introduction to network algorithm including minimum connector problems: Shortest and longest path algorithms and critical path analysis.

Assessment scheme

Continuous assessments 30%
Final exam 70%

SEMESTER-8

Module Code	MN4010	Title	BUSINESS PLAN DEVELOPMENT			
Credits	2.0	Hours/ Week	Lectures	1.5	Pre-requisites	-
GPA/NGPA	GPA		Lab/Tutorials	3/2		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Exploit business opportunities
- Prepare marketing, production, human resource and finance plans
- Write and present a business plan attractively

Course Outline

- Introduction to the Business Plan
- Marketing Planning
- Production Planning
- Planning for HR
- Planning for Finance
- Writing a Business Plans
- Presenting a Business Plan for donors and other related institutions

Assessment scheme

Continuous assessments 70 %

Final exam 30%

SEMESTER-8

Module Code	**MN4072**	**Title**	**SMALL BUSINESS MANAGEMENT AND ENTREPRENEURSHIP**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**1.5**	**Pre – requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Assignments**	**3/2**		

Learning Outcomes

Upon successful completion of this module, the student will be able to:

- Describe the theoretical and empirical framework of small business management.
- Explain the applications of these concepts & theories for own business.
- Identify the necessary skills to become a successful entrepreneur.

Outline Syllabus

Small Business Management

- Scale, nature & role of small business in a developing country;
  - Characteristics of small businesses;
  - Role of small businesses;
  - Reasons for failure of small businesses & barriers in establishing and managing small businesses.
- Business environment and industrial supporting system in Sri Lanka.
- Relevant concepts to understand business creation and growth such as;
  - Identification of market opportunities;
  - Developing a business plan;
  - Managing small business operations
  - Marketing in small businesses

Entrepreneurship

- Identifying who the entrepreneur is;
  - Definition;
  - Relevant economic, psychological and sociological theories of entrepreneurship;
  - Characteristics and functions of the entrepreneur;
- Entrepreneurship development;

Practical: 6 industrial case studies, guest lectures and assignments

Assessment scheme

Continuous assessments 30%

Final exam 70%

SEMESTER-8

Module Code	**MN4150**	**Title**	**PROJECT MANAGEMNET**			
Credits	**2.0**	**Hours/ Week**	**Lectures**	**2.0**	**Pre – requisites**	**-**
GPA/NGPA	**GPA**		**Lab/Assignments**	**-**		

Learning Outcomes

Understand the basic concepts and theories of Project Management.

Acquire and develop capabilities in Project Management concepts and applications

Outline Syllabus

Definition of project management and relationship to other management disciplines

Project management context

Project planning

Key management skills

Project management process

Management of the project scope, time, cost, quality, risk and communications

Project integration management

Project procurement management

Project assessment and stakeholder marketing

Text Book

Greene J. and Stellman A., (2013) Head First PMP, O'Reily Media

Assessment scheme

Continuous assessments 50%

Final exam 50%