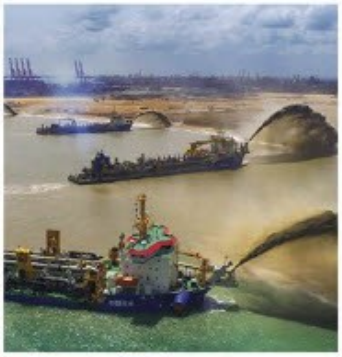
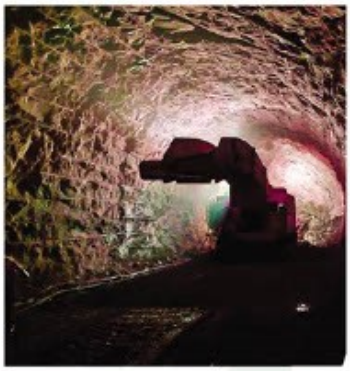
DEPARTMENT OF EARTH RESOURCES ENGINEERING

UNIVERSITY OF MORATUWA







2021

STUDENT HANDBOOK

(BATCH 20)

Welcome to the Department of Earth Resources Engineering (ERE)

We invite you to obtain the maximum use of the facilities available for you to achieve your academic goals.

We are sure that you will make the **Department of Earth Resources Engineering,** your **Home Away From Home**!

The handbook includes information on the undergraduate and postgraduate programs conducted by the Department of Earth Resources Engineering, University of Moratuwa. It also provides information on different areas of expertise, as well as resources and facilities available to the students. The handbook helps you to select course modules and projects to fulfill the requirements for your graduation.

We wish you a very much pleasant stay in our department throughout your undergraduate career!

- Head of Department and the staff of ERE

Contents

Message from Head of Department

It is my pleasure to welcome you all to our department, together with my staff.

The Department of Earth Resources Engineering was first established under the link-program between the University of Leeds [U.K] and Katubedda Campus in 1974, when the School of Applied Science at Katubedda was instituted. Since its establishment, the department's name was "Mining & Mineral Engineering" up until year 2000 in which a major curriculum revision was done to match the industrial expectations and to provide wider opportunities for our undergraduates to gain relevant knowledge and experience.

The major curriculum revision done in year 2000 enhanced the student intake up to fifty students per year, introducing three focus areas namely; Remote Sensing & Geographic Systems [RS & GIS], Ocean Resources Engineering, Gem & Jewellery, while the core of the curriculum remaining as Mining & Mineral Engineering. Petroleum Engineering was also added as a focus area into the curriculum later, and hence by now students has a choice of four focus areas in their degree program.

In year 2004, the department secured competitive "IRQUE" grant funded by the World Bank to Improve Relevancy and Quality of Undergraduate Education. Winning of this grant made the Department of Earth Resources Engineering much more resourceful. RS & GIS Laboratory, Ocean Resources Engineering Labs, Gem & Jewellery Lab, and Engineering Design Lab were established under this grant. The department could also purchase a twenty six seat bus which is dedicated to the departmental activities under this grant. In addition, the department also has a Geology Lab, Mine Ventilation Lab, Rock Mechanics Lab, Mineral Processing Lab, Analytical Lab, Atomic Absorption & ICP-MS Lab and also Workshop facilities. All these laboratories are comprised of modern

equipment necessary for practical classes, and also for research work in the relevant fields of specialization.

The Department of Earth Resources Engineering was granted full international accreditation in accordance with the Washington Accord, by the Institution of Engineers Sri Lanka [IESL] after a comprehensive review of the academic program in year 2016, which is a significant benchmark in the history of our department.

The department also has a strong network of industrial contacts, which has already strengthened the future of our undergraduates. The department annually organizes industrial training placements for third year undergraduates, together with the Industrial Training Division of the University of Moratuwa, which provides ample opportunities for our undergraduates to gain the relevant industrial training experience, before their graduation. This six months period of training will mostly help to secure their future employment opportunities as well.

The department also offers opportunities and facilities for graduating students from the department to read for their postgraduate qualifications by research, up to PhD level.

I wish you all the very best on your academic program, and also a very much pleasant stay in our department.

Dr. G.V.I. Samaradivakara

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Department of Earth Resources Engineering

The history of the Department of Earth Resources Engineering dates back to 1974, when Houldsworth-Katubedda link termed as "Leeds Link" was instituted for the establishment of graduate level education schemes in Sri Lanka. The department was established as a division of the School of Applied Science under the above link with the assistance of Overseas Development Ministry in London. From 1974 to 2000, the department was under the name of "Mining and Minerals Engineering" and offered the degree of Bachelor of the Science of Engineering in Mining and Minerals Engineering. Responding to the challenges created by the expansion of the industrial sector, economic growth and the government policies in the country, the department was restructured in year 2000 and, renamed as "Department of Earth Resources Engineering", enabling accommodating a wider range of disciplines. In keeping with this, the annual student intake was also increased up to fifty.

Currently, the department offers a four-year full-time B.Sc. Engineering Honours Degree Program in Earth Resources Engineering. M.Sc./PG Diploma in Mining and Mineral Exploration, M.Sc., M.Phil. and Ph.D. degree programs by research are also available in collaboration with relevant industries. The Department also offers a diploma course in Gemmology and two part-time courses in Gemmology and Geology at certificate level.

Vision

To achieve excellence in sustainable development of mineral industry in the country for the benefit of the national economy, through creation and dissemination of knowledge.

B.Sc. Engineering Honours Degree Program has been granted Full Accreditation (Washington Accord) by the Institute of Engineers Sri Lanka and it will be initially applicable for the intake years from 2011 to 2020.

Students of the department are exposed to the areas of mineral exploration, mining engineering and mineral processing. Mineral exploration involves the study of geology of ore deposits and exploration using geophysical and geochemical methods, geological mapping, groundwater studies and offshore exploration for minerals.

Mining involves, mine designing, rock drilling and blasting, shaft sinking, tunneling, hoisting, and quarrying in open-pit mining.

Mineral processing involves processing of minerals for metal extraction and refining of minerals for industries.

In year 2004, the department managed to secure a grant funded by the World Bank for the purpose of Improving the Relevance and Quality of Undergraduate Education (IRQUE) as an emerging field of study. Consequently, the department revised and expanded its undergraduate curriculum to offer three minors under the study stream of Earth Resources Engineering. These three minors are Remote Sensing and Geographic Information System (RS & GIS), Ocean Resources Engineering, and Gem & Jewellery.

In 2014, the Department was awarded a grant funded by the Government of Sri Lanka through year 2013 budget proposal for the purpose of introducing Petroleum Engineering into the undergraduate education system. As a result, the main degree program was restructured with Mining and Minerals Engineering stream having four focus areas in RS & GIS, Ocean Resources Engineering, Gem & Jewellery and Petroleum Engineering.

Introduction of modern software in a variety of disciplines such as rock blasting, mine planning and design was done with establishment of a new Computer Engineering Design Laboratory. This helps students in the department to gain more exposure to modern design software and develop skills in modeling. Students those who select the focus area of RS & GIS will be exposed to theory and application in this field, which is a

tool for planning, managing and policy development on natural resources as well as disaster mitigation.

Ocean Resources Engineering focus area exposes the students to exploitation of ocean resources. The Gem & Jewellery focus area covers jewellery design, jewellery production technology and jewellery production management.

The newly introduced Petroleum Engineering focus area covers the areas in petroleum exploration, drilling and production.

The senior academic staff of the Department of Earth Resources Engineering have had specialized training local and overseas in the fields of Extraction Metallurgy, Mineral Processing, Analytical Chemistry, Mining Engineering, Rock Mechanics, Electrochemistry, Geology, Geophysics, Geochemistry, Engineering Geology, Gemmology, Marine Geology, Remote Sensing and GIS, Environmental Engineering and Petroleum Engineering. They are also supported by qualified academic support staff and enthusiastic non-academic staff.

The department consists of a Geology Laboratory, Gemology Laboratory, Mineral Engineering Laboratory, Mine Ventilation Laboratory, Analytical and Environmental Engineering Laboratory, Remote Sensing and GIS Laboratory, Rock Mechanics Laboratory, Computer Laboratory, Ocean Resources Engineering Laboratory, Computer Design Laboratory, Jewellery Design Laboratory and the Workshop. The laboratories are equipped with modern instruments and equipment necessary to conduct undergraduate practical classes as well as research projects.

Mission

To produce competent graduates in the fields of Mineral Exploration, Mining and Mineral Processing to achieve sustainable development in the mineral industry.

To conduct high quality research and provide professional experience to become leaders in the field of Earth Resources Engineering.

The services offered by the department for the industry includes; mine planning and design for quarries and underground mines; designing of rock blasting operations; environmental impact assessments; site investigations; geological and engineering geological mapping; slope stability assessment; geophysical investigation for groundwater, minerals and foundations; resource management using RS and GIS; groundwater studies; natural disaster management; designing of mineral processing plants; heat treatment and processing of precious gem stones; gem identification and valuation; and industrial waste water treatment.

Taking another step forward, the department launched a postgraduate program in 2013, leading to Master of Science / Postgraduate Diploma in Mining & Mineral Exploration in response to the high demand from industry. Further, departmental relationships with local industries and overseas academic institutions are continuously being strengthened for the benefit of undergraduates of the department.

Why Study Earth Resources Engineering?

Earth's resources can be considered as an endowment or a gift to mankind. These resources are basic necessities for survival of mankind, limited, and therefore must be used with care. Earth's resources, a nation is endowed with, often determine its wealth and living conditions together with attitude of its people and, are essential elements in the achievement of economic prosperity and higher living standards. The sustainable development and economic extraction of these resources comprising valuable minerals and petroleum is a challenging endower requiring high professional standards.

With the gradual depletion of near surface mineral resources of the world, exploration and extraction of deeper lying resources is a daunting task requiring the intellectual input of high-caliber professionals in the fields of mineral prospecting, well trained with the adoption of modern RS & GIS techniques, environmental sciences and engineering, mining engineering and industrial management.

Therefore, the objectives of education and research in the department are to produce Earth Resource Engineers on par with international standards, committed to contribute to

the sustainable and environmentally adaptable development of global minerals and energy sources.

With this objective in mind, the department has committed itself for education and research in the sustainable development of mineral resources essential for industries through a multi-disciplinary approach. The degree program provides a holistic education and training in understanding, management and development of the mineral resources. In this context, the degree program provides a sound foundation in mathematics, sciences, and engineering. The undergraduates are exposed to onshore and offshore mineral exploration, mining and mineral processing.

The department prides itself in being the only department in Sri Lankan university system presenting an undergraduate engineering discipline in Mining which produces a large number of mining engineers making a great contribution to the industry locally and internationally.

Department Organization

ACADEMIC STAFF MEMBERS

HEAD OF THE DEPARTMENT

Dr. GVI Samaradivakara

B.Sc.Eng.(Hons.)(Moratuwa), M.Eng.(Moratuwa), M.Phil.(Moratuwa), Ph.D.(UQ), AMIE(SL)

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Professor PGR Dharmaratne

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SENIOR LECTURERS – GRADE I

Dr. DMDOK Dissanayake

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Dr. (Mrs.) ABN Dassanayake

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Eng. (Ms.) MADMG Wickrama

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LECTURERS (PROBATIONARY)

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ACADEMIC SUPPORT STAFF

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ANALYTICAL CHEMIST

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NON-ACADEMIC STAFF

TECHNICAL OFFICERS

Mr. WWS Perera

Geology and Gemmology Laboratories

Ms. AR Amarasinghe

Ocean Resources Engineering Laboratories

Mr. GP Priyasad

Mineral Processing,Rock Mechanics and Computer Laboratories

Mr. DMB Wikcramasinghe

Mine Ventilation, Analytical and RS & GIS Laboratories

Mr. LM Dushantha

Engineering Design Laboratory

SENIOR STAFF MANAGEMENT ASSISTANT

Ms. PL Jayadewa

LABORATORY ATTENDANTS/ OTHER ASSISTING STAFF

Mr. SD Sumith

Geology and Gemmology Laboratories

Mr. SSU Silva

Ocean Resources Engineering Laboratory

Mr. NMAB Nawarathne

Design and Computer Laboratories

Mr. PS Gulawita

Analytical and RS & GIS Laboratories

Mrs. HGC Shyamalie

Mine Ventilation Laboratory

Program Educational Objectives (PEOs)

The Department of Earth Resources Engineering expects to produce graduates, who are:

1. Technically competent in Mining and Mineral Process Engineering/Earth Resources Engineering to become professional engineers leading to successful career advancement.
2. Ethical and responsible to contribute to sustainable development.
3. Effective global citizens ensuring compliance to international standards and capable of fostering competitiveness in the sector adopting best practices.

What Earth Resources Engineers Do?

Earth Resources Engineers are involved in the widest range of specialties and processes in extracting and processing minerals from the Earth economically and environmentally responsible manner. This process includes exploration of minerals, evaluation of the economics of mineral deposits, development of surface and underground mine, excavation processes of roadways and tunnels, designing ventilation systems, designing blast and excavation sequences, selecting equipment, optimizing productivity and profit, managing personnel, designing plant, ensuring safety and health, monitoring environmental characteristics, mine closure and rehabilitation, processing mineral and metallurgical extraction of material into the end product.

Program Outcomes (POs)

I. Apply knowledge of mathematics, basic sciences and engineering fundamentals to the analysis of complex engineering problems related to Mining and Mineral Processing Engineering/ Earth Resources Engineering.

II. Identify, formulate, research literature, conduct investigations, and solve complex engineering problems to provide valid conclusions for related areas.

III. Design systems, components, or process that meet specified needs.

IV. Conduct investigation of complex problems using research-based knowledge and research methods.

V. Create, select and apply appropriate techniques, resources, and modern engineering and IT tools to engineering activities.

VI. Assess societal, health, safety, legal, cultural and environmental issues related to professional engineering solutions.

VII. Demonstrate broad knowledge of sustainable development concepts and practices required for dealing with contemporary issues related to professional engineering practices.

VIII. Demonstrate broad knowledge of ethical responsibilities and professional standards.

IX. Demonstrate ability to function effectively as an individual and multidisciplinary and multi-cultural team, with the capacity to be a leader or manger as well as an effective team member.

X. Communicate effective on complex engineering activities with the engineering community and with the society at large, such as being able to

comprehend and write effective reports and designs, documentation, make effective preparations, and give and issue clear instructions.

XI. Demonstrate broad knowledge of management and business practices, including financial management, risk and change management.

XII. Engage in independent and lifelong learning in the broad context of technological change.

Academic Program

Degree Program

Degree program consists of eight semesters and spreads over a period of four academic years, including industrial training. The industrial training is intended to provide students with an exposure to apply the theoretical knowledge in practice.

The total number of 150 credits* are required to obtain the B.Sc. Engineering Honours Degree in Earth Resources Engineering, and the minimum credit requirement for each semester is given below. Faculty Electives beyond the specialization requirement is 15 credits.

	Credits for GPA**	Non GPA Credits	Total Credits
Semester*1	15	0	15
Semester 2	16	2	18
Semester 3	14	0	14
Semester 4	22	0	22
Semester 5	20	0	20
Industrial Training	0	6	06
Semester 6	8	4	12
Semester 7	16	0	16
Semester 8	12	0	12
Total	**123**	**12**	**135**

** A Semester generally consists of twenty-two weeks including sixteen weeks of academic work, three weeks for examinations and three weeks of vacation.*
*** GPA stands for Grade Point Average*

Focus Areas

Currently, the Earth Resources Engineering Degree programme offers Mining and Mineral Engineering stream, with four focus areas. The department is planning to develop the Petroleum Engineering focus area into a separate stream in the future.

Students have the option to follow the subjects which make them eligible to take one of the four focus areas. The four focus areas are: (1) Ocean Resources Engineering, (2) Gem & Jewellery, (3) Remote Sensing and Geographic Information System (RS & GIS) and (4) Petroleum Engineering. It is not compulsory to follow a focus area.

Gem and Jewellery

Gem and Jewellery focuses on gemmology, Jewellery products design and development, related production technology, fashioning of gemstone and Management of Jewellery production units.

Ocean Resources Engineering

Ocean Resources Engineering focuses on ocean/ocean floor where sampling, drilling, bathymetric/marine-geophysical surveying, hydrodynamic/sediment-dynamic modelling using marine instrumentation and related software are carried out to sustainably utilize marine mineral resources, resolve coastal engineering problems and mitigate coastal hazards.

Petroleum Engineering

Petroleum Engineering focuses on operations in the upstream petroleum sector where geological, geophysical, drilling, petrophysical, modelling and designing methods are practiced for petroleum exploration, formation evaluation, reservoir engineering and production engineering, etc.

Remote Sensing and Geographic Information System

Remote Sensing and GIS focuses on the collection, storage, management, processing, modelling, analysis and interpretation of spatially referenced data to utilize in natural resources management, environmental, hydrogeological analysis and hazard identification.

The compulsory subject modules to be completed by students who wish to follow a particular focus area.

Focus Area	Module Code	Module Name	Credits
Gem & Jewellery	ER2631	Elementary Gemmology	2.0
	ER2034	Principles of RS and GIS	2.0
	ER3714	Jewellery Products Development	3.0
	ER4301	Advanced Gemmology	3.0
	ER4513	Jewellery Production Technology	3.0
Ocean Resources Engineering	ER2420	Introduction to Ocean Resources Engineering	2.0
	ER2054	Introduction to Petroleum Engineering	2.0
	ER3520	Coastal Hydrodynamics	3.0
	ER4434	Marine Mineral Exploration and Hydrography	3.0
	ER4254	Offshore Mining and Project Design	3.0
Petroleum Engineering	ER2054	Introduction to Petroleum Engineering	2.0
	ER2420	Introduction to Ocean Resources Engineering	2.0
	ER3701	Petroleum Exploration and Drilling Engineering	3.0
	ER4351	Formation Evaluation and Reservoir Engineering	3.0
	ER4461	Petroleum Production and Down Stream Processes	3.0
Remote Sensing and Geographic Information System (RS & GIS)	ER2034	Principles of RS and GIS	2.0
	ER2054	Introduction to Petroleum Engineering	2.0
	ER3704	Digital Image Processing and Photogrammetry	3.0
	ER4323	GPS and Space Technology	3.0
	ER4314	GIS and Spatial Statistics	3.0

Curriculum

Curriculum of B.Sc. Engineering Honours Degree Programme

Field of Specialization: Earth Resources Engineering

Stream: Mining and Mineral Engineering

Reference- https://dms.uom.lk/s/F5FZ9sLziBjZBBg?

Module Code	Module Name	Category C/E/O	Time allocation [Hours/Week]		Credits offered		Norm		Evaluation %	
			Lecture	Lab / Tute	GPA	NGPA	GPA	NGPA	CA	WE
	Semester 1	**Specialization requirement**					**15.0**			
CE1023	Fluid Mechanics	C	2	2/4	2.0		15.0		20	80
CS1033	Programming Fundamentals	C	2	2	3.0				20	80
EE1040	Electrical Fundamemtals	C	2	2/4	2.0				20	80
EL1030	Language Skills Enhancement [S1 & S2]	C	0	2	1.0				100	0
MA1014	Mathematics	C	5/2	1	3.0				20	80
ME1033	Mechanics	C	2	2/4	2.0				20	80
MT1023	Properties of Materials	C	3	2/4	2.0				20	80
		Total			**15.0**	**0.0**	**15.0**	**0.0**		
	Semester 2	**Specialization requirement**					**18.0**			
HM-1	Humanities Elective I	C	2	0	2.0		16.0	2.0	100	0
EL1030	Language Skills Enhancement [S1 & S2]	C	0	2	1.0				100	0
ER1014	Geology	C	2	2	3.0				30	70
ER1040	Introduction to Mining & Mineral Engineering	C	2	0	2.0				30	70
MA1024	Methods of Mathematics	C	5/2	1	3.0				30	70

ER1050	Basic Mine Thermodynamics	C	2	0	2.0				30	70
ME1091	Engineering Drawing & Computer Aided Modeling	C	1	4	3.0				100	0
ER1902	Introduction to Engineering Design & Workshop Technology	C	1	2		2.0			60	40
		Total			**16.0**	**2.0**	**16.0**	**2.0**		
	Semester 3	**Specialization requirement**					**14.0**			
CE1813	Mechanics of Materials	C	2	0	2.0		14.0		30	70
CE2063	Surveying I	C	2	2	3.0				30	70
CS2813	Visual Programming	C	1	2	2.0				60	40
MA2014	Differential Equations	C	2	0	2.0				30	70
MA2024	Calculus	C	2	0	2.0				30	70
ER2110	Rock Blasting and Explosives Engineering	C	5/2	2/2	3.0				30	70
ER2420	Introduction to Ocean Resources Engineering	E	2	0	2.0				30	70
ER2631	Elementary Gemmology	E	3/2	2/2	2.0				30	70
ER2034	Principles of RS and GIS	E	3/2	2/2	2.0				30	70
ER2054	Introduction to Petroleum Engineering	E	2	0	2.0				30	70
		Total			**22.0**	**0.0**	**14.0**	**0.0**		
	Semester 4	**Specialization requirement**					**22.0**			
CE2143	Surveying II	C	2	2	3.0		22.0		30	70
HM-2	Humanities Elective II	C	2	0	2.0				100	0

ER2611	Petrology and Structural Geology	C	2	2	3.0				30	70
ER2643	Analytical Methods and Environmental Engineering Concepts	C	5/2	2/2	3.0				40	60
ER2084	Mineral Processing Engineering	C	7/2	2/2	4.0				30	70
ER2031	Mining Method & Mine Development	C	3	0	3.0				40	60
MA2034	Linear Algebra	C	2	0	2.0				30	70
MA3014	Applied Statistics	C	2	0	2.0				30	70
		Total			**22.0**	**0.0**	**22.0**	**0.0**		

	Semester 5	**Specialization requirement**					**20.0**			
CE2813	Soil Mechanics	C	5/2	2/2	3.0		20.0		30	70
ER3014	Extraction Metallurgy	C	5/2	2/2	3.0				30	70
ER3070	Economic Mineral and Mineral Exploration	C	5/2	2/2	3.0				30	70
ER4104	Mine Safety and Legislation	C	2	0	2.0				30	70
MA3024	Numerical Methods	C	2	0	2.0				30	70
MN3043	Business Economics and Financial Accounting	C	3	0	3.0				30	70
MN3053	Industrial Management and Marketing	C	3	0	3.0				30	70
ER3880	Engineer and Society [S5 & S6]	C	0	2	1.0				100	0
ER3320	Plant Design and Value Addition to Minerals	E	1	2	3.0				30	70
ER4714	Construction Engineering Practice	E	5/2	2/2	3.0				30	70

ER3704	Digital Image Processing and Photogrammetry	E	2	2	3.0				30	70
ER3714	Jewellery Products Development	E	2	2	3.0				50	50
ER3701	Petroleum Exploration and Drilling Engineering	E	5/2	2/2	3.0				30	70
ER3520	Coastal Hydrodynamics	E	2	2	3.0				30	70
		Total			**38.0**	**0.0**	**20.0**	**0.0**		
	Industrial Training	**Specialization requirement**					**6.0**			
ER3993	Industrial Training	C				6.0		6.0	100	0
		Total			**0.0**	**6.0**	**0.0**	**6.0**		
	Semester 6	**Specialization requirement**					**12.0**			
ER3203	Design Project [S6 & S7]	C	0	4	2.0		8.0	4.0	100	0
ER4084	Mine Surveying, Planning and Design [S6 & S7]	C	1/2	2/2	1.0				40	60
ER4024	Mine Ventilation	C	2	2	3.0				30	70
ER3880	Engineer and Society [S5 & S6]	C	1	2	2.0				100	0
ER3913	Geology Field Visits and Camp	C				2.0			100	0
ER3923	Mine Surveying and Ventilation Field Camp	C				2.0			100	0
		Total			**8.0**	**4.0**	**8.0**	**4.0**		
	Semester 7	**Specialization requirement**					**16.0**			
ER3203	Design Project [S6 & S7]	C	0	2	1.0		16.0		100	0
ER4014	Rock Mechanics	C	5/2	2/2	3.0				40	60

ER4034	Hydrogeology and Engineering Geology	C	3	0	3.0				30	70
ER4094	Plant Performance and Process Modelling	C	5/2	2/2	3.0				30	70
ER4084	Mine Surveying, Planning and Design [S6 & S7]	C	3/2	2/2	2.0				30	70
ER4203	Research Project [S7 & S8]	C	0	4	2.0				100	0
MN4023	Engineering Economics	C	2	0	2.0				30	70
ER4351	Formation Evaluation and Resevoir Engineering	E	5/2	2/2	3.0				40	60
ER4323	GPS and Space Technology	E	2	2	3.0				30	70
ER4434	Marine Mineral Exploration and Hydrography	E	2	2	3.0				30	70
ER4140	Mine Mechanization and Automation	E	3	0	3.0				30	70
ER4150	Advanced Electrochemistry	E	5/2	2/2	3.0				30	70
ER4301	Advanced Gemmology	E	2	2	3.0				40	60
		Total			**34.0**	**0.0**	**16.0**	**0.0**		
	Semester 8	**Specialization requirement**					**12.0**			
ER3044	Mine Machinery & Design of Mineral Transport Systems	C	3	0	3.0		12.0		30	70
ER4074	Mineral Economics & Ore Reserve Modelling	C	5/2	2/2	3.0				40	60
ER4131	Mine Waste Management and Rehabilitation	C	5/2	2/2	3.0				30	70

ER4203	Research Project [S7 & S8]	C	0	6	3.0				100	0
ER4721	Tunnel Design and Engineering	E	5/2	2/2	3.0				40	60
ER4470	Product Development and Nanotechnology	E	5/2	2/2	3.0				30	70
ER4314	GIS and Spatial Statistics	E	2	2	3.0				40	60
ER4461	Petroleum Production and Down Stream Processes	E	5/2	2/2	3.0				40	60
ER4513	Jewellery Production Technology	E	2	2	3.0				50	50
ER4254	Offshore Mining and Project Design	E	2	2	3.0				30	70
		Total			**30.0**	**0.0**	**12.0**	**0.0**		
		Grand Total			185.0	12.0	**123.0**	**12.0**		
Total Credit requirement for the specialization							**135**			
Faculty/Specialization Electives beyond the specialization requirements							**15**			
Total Credit Requirement for Graduation							**150**			

Semester 1

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
1	CE1023	Fluid Mechanics		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2/4	2.0	None	20	80

Learning Outcomes

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

1. Define the properties of fluids and describe the significance of such properties in applications in engineering practice,
2. Determine hydrostatic forces on submerged surfaces/ bodies and assess the conditions for equilibrium and stability such surfaces/ bodies in applications in engineering practice, and
3. Apply the concepts of conservation of mass, energy and momentum of fluids and determine the velocities, pressures, flow rates, forces, etc., in applications in engineering practice.

Syllabus Outline

Introduction: Applications of Fluid Mechanics in Engineering Practice, historical development of Fluid Mechanics.
Characteristic/ Properties of Fluids: Characteristics of fluids, Continuum concept, properties of fluids: Density, Specific Weight, Relative Density, Viscosity, Compressibility, Surface Tension, Vapour Pressure
Fluid Statics: Hydrostatic Pressure: governing equation, variation of pressure, piezometric pressure, absolute and gauge pressures, pressure head, measurement of pressure, pressure rating of pipes; Hydrostatic thrust: hydrostatic thrust on plane and curved surfaces, pressure diagram; Buoyancy: Up thrust on submerged bodies, Archimedes principle, Equilibrium and stability of fully submerged and floating bodies, effect of liquid cargo; Relative equilibrium: relative equilibrium of fluids under linear acceleration, forced vortex motion.
Fluids in Motion: Introduction to fluid flow: characteristics of fluid flow, flow classifications, flow visualization; Conservation of mass: continuity equation for incompressible flow, applications; Conservation of energy: Bernoulli's equation, steady flow energy equation, applications; Conservation of momentum: steady flow force-momentum equation, applications
Introduction to Hydraulic machinery: classification of hydraulic machinery, pumps and turbines, operating conditions of pumps.

Intake	2020 onwards	Specialisation	Earth Resources Engineering	
Semester	**Code**	**Module Title**	**C/E/O**	**GPA / NGPA**
1	CS1033	Programming Fundamentals	C	GPA

Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
2	2	3.0	None	20	80

Learning Outcomes

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

1. Device algorithms to solve simple computational problems
2. Develop programs from algorithms using a high level programming language (e.g., Python)
3. Develop programs for simple control applications using embedded hardware platforms

Syllabus Outline

Admin matters, Introduction to Computing
Python: Introduction, Operators, Expressions, Selection Control Structures, Loop Control Structures, Lists, Functions
Data Representation
Problem Solving
Computer System & Hardware

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	Code	Module Title		C/E/O	GPA / NGPA
1	EE1040	Electrical Fundamemtals		C	GPA

Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
2	2/4	2.0	None	20	80

Learning Outcomes

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

1. Use correct SI units
2. Project an overall picture of Electrical Engineering
3. Perform DC, AC and transient calculations
4. Analyse complex alternating current circuits and give solutions
5. Apply different types of meters for electrical measurements
6. Draw up complete wiring circuit of a household and appreciate the importance of different protection

Syllabus 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

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
1/2	EL1030	Language Skills Enhancement		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
0	2	2.0	None	100	0

Learning Outcomes

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

1. Demonstrate an understanding of information, opinions and arguments presented in written or oral forms and to engage critically with the ideas thus presented,
2. Adapt material prepared in one form for presentation in another — e.g. (from a reading text to a presentation/assignment),
3. Communicate technical (i.e. Engineering/IT/Architecture) information effectively in the academic setting in different modes: written, oral, audio-visual and graphic following internationally accepted conventions,
4. Communicate effectively with non-specialist audiences in tasks related to his/her area of specialisation.

Syllabus Outline

Communication - Preparation for academic study
- Get Acquainted
- Academic Writing
- Fact and Theory

Systems - Description and definition
- Description and Definition
- Static Descriptions
- Building Academic Vocabulary

Organisation - Classification
- Classification
- Flow Charts
- Sign-post Language

Change - Process writing
- Cause and Effect
- Different Types of Processes
- Linear Processes

Education - Comparison and contrast
- Language of Opinion
- Similarities and Differences
- Predicting

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
1	MA1014	Mathematics		C	GPA

Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
5/2	1	3.0	None	20	80

Learning Outcomes

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

1. Use discrete mathematical structures such as Logic and Set Theory in applications.
2. Use algebraic structures such as Real Numbers, Vectors and Matrices in applications.
3. Apply the basic concepts of limits, differentiation and integration in engineering applications.

Syllabus 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

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	Code	Module Title		C/E/O	GPA / NGPA
1	ME1033	Mechanics		C	GPA
Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
2	2/4	2.0	None	20	80

Learning Outcomes

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

1. Calculate sectional properties of plane areas,
2. Calculate internal forces in beams,
3. Identify statically determinate / indeterminate trusses, their stability and determine forces in truss members,
4. After completing this part (Dynamics) of the module, the students should be able to
5. Determine the geometry of planar motion of particles and rigid bodies,
6. Analyse geometry of motion of kinematic elements in 2D link mechanisms,
7. Analyse the forces in particles and rigid bodies in motion,

8. Estimate energy associated in particle and rigid body motion,
9. Analyse natural vibrations of damped, single degree of freedom systems,
10. Model systems and solve basic problems in dynamics.

Syllabus Outline

Statics

- ¶ Properties of Plane Areas
- ¶ Internal Forces (BMD & SFD)
- ¶ Principle of Superposition
- ¶ Determination of Forces in Assemblies of Rigid Bodies

Dynamics

Fundamentals of dynamics

- ¶ Kinematics of particles (rectilinear and curvilinear motion, relative motion, general motion in 2D) and rigid bodies (relative motion between two points in a rigid body, velocities in 2D link mechanisms, instantaneous centre of rotation method, introduction to acceleration)
- ¶ Kinetics of particles and rigid bodies (force, torque, work, energy and power, linear momentum, angular momentum)

Mechanical vibrations

- ¶ Free vibrations (undamped and damped) of single degree of freedom systems.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
1	MT1023	Properties of Materials		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
3	2/4	2.0	None	20	80

Learning Outcomes

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

1. Demonstrate knowledge of projection methods.
2. Draw the orthographic projections of a given component.
3. Use graphical construction techniques.
4. Use CAD software to draw orthographic projections.
5. Develop 3-dimensional models in a virtual environment.

Syllabus Outline

Projection Methods

Orthographic and isometric projections.

Orthographic Views

Orthographic views of objects from a given isometric view; 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.

Graphical Constructions

Lines and Planes: Graphical estimation of true lengths, inclinations, traces, auxiliary projection methods & true shapes of sections; Interpenetration Curves: Construction of Interpenetration curves of Cylinder, Cone, Sphere, Pyramid; Developments: Construction of Developments of Prism, Cylinder, Cone, Pyramid and Developments by the Method of triangulation.

Computer aided drafting and modelling
Software tools and techniques for drafting and modelling.

Semester 2

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
1/2	EL1030	Language Skills Enhancement		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
0	2	2.0	None	100	0

Learning Outcomes

At the completion of this module, students at elementary, intermediate, and advanced proficiency at entry in terms of language skills relevant for engineering undergraduates, will be able to:

1. Demonstrate having achieved the competencies for listening defined by UTEL bands 6, 7 and 8, respectively.
2. Demonstrate having achieved the competencies for speaking defined by UTEL bands 6, 7 and 8, respectively.
3. Demonstrate having achieved the competencies for reading defined by UTEL bands 6, 7 and 8, respectively.
4. Demonstrate having achieved the competencies for writing defined by UTEL bands 6, 7 and 8, respectively.

Syllabus Outline

Speaking on given topics.
Asking questions and responding to questions.
Reading comprehension.
Summarising and synthesising.
Describing objects, mechanisms, and processes.
Discussion/ writing activities.
Describing data and graphical information.
Functional grammar.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
2	ER1014	Geology		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	None	30	70

Learning Outcomes

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

1. Explain the basic concepts in geology.
2. Classification of minerals and identification of minerals using physical properties.
3. Explain and identification of optical properties of minerals using polarized microscope.

Syllabus Outline
Introduction to Geology for Earth Resources Engineers. 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. Mineralogy - Classification and identification of minerals using physical properties. Crystallography - External characteristics, symmetry, and crystallographic systems. Optical Mineralogy - Functions of Polarized Microscope, Optical properties under PPL and CPL arrangements, Double refraction, optic axes, and interference figures.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
2	ER1040	Introduction to Mining & Mineral Engineering		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	0	2.0	None	30	70

Learning Outcomes

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

1. Explain broader aspects of Mining and Mineral Engineering.
2. Evaluate the importance of earth resources and their usage.
3. Demonstrate the professional practices related to Mining and Mineral Engineering disciplines.

Syllabus Outline

Introduction to Mining and Mineral Processing practices
Minerals in Industry.
Introduction to Mining Engineering
Importance of Mining, Mining Terminology.
Life Cycle of a Mine: Surface and Underground.
Introduction to Mineral Processing
Introduction of Mineral Processing and its evolution.
Importance of Mineral Processing industry to the society.
Technologies involved in Mineral Processing.
Introduction to other associated disciplines
Professional practices of the discipline
Global Mining Industry.
Mining and Mineral Engineering prospects.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
2	ER1050	Basic Mine Thermodynamics		C	GPA
Hours/Week		**Credits**		**Evaluation %**	

Lecture	Lab/Tutes		Prerequisites / Corequisites	CA	WE
2	0	2.0	None	30	70

Learning Outcomes

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

1. Describe the basic concepts and fundamental laws of thermodynamics.
2. Classify, analyze and quantify various heat sources in mine.
3. Apply fundamental laws to solve simplified thermal systems related to Mining Engineering.

Syllabus Outline

Introduction to Thermodynamics.
Historical development, thermodynamics concepts and terminology, units, and conversions.
Basic principles of Thermodynamics.
Forms of energy and their transformations, heat, and work as a method of energy transfer, the statistical nature of thermodynamics, types of systems.
Fundamental laws of thermodynamics.
Heat Transfer.
Mine Ventilation Thermodynamics: Components of the Mine Cycle: elements of the system, the downcast shaft, level workings, upcast shaft, Natural ventilation, Combined fan and natural ventilation, and Case Studies.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	Code	Module Title		C/E/O	GPA / NGPA
2	ER1902	Introduction to Engineering Design and Workshop Technology		C	NGPA
Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
1	2	2.0	None	60	40

Learning Outcomes

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

1. Explain engineering design concepts.
2. Formulate design solutions considering concepts of sustainability.
3. Demonstrate skills related to engineering design.
4. Engage in team work to complete a design task.

Syllabus Outline

Introduction to Engineering Design
Design principles, design processes and design tools, life cycles of engineering products and processes, Design space exploration and motivation, Sustainable design strategies.
Managing design projects
Introduction to engineering design project management, Requirement analysis and scheduling, Concurrent engineering, Creativity and reasoning, Evaluation and decision making, Prototype development and simulation, Marketing and documentation, Product manufacturing.
Information sharing of engineering design projects
Report writing and presentation.
Simulations and audio visuals.
Professional communication.

Case studies
Design assessments and project work
Workshop practices
Carpentry Shop.
Fitting Bench Working Shop.
Blacksmith Shop.
Welding Shop.
Sheet Metal Shop.
Machine Shop.
Foundry Shop.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
2	MA1024	Methods of Mathematics		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	1	3.0	MA1014	30	70

Learning Outcomes

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

1. Use numerical techniques up to non-linear functions of single variable and linear functions of several variables.
2. Use basics on multivariate analysis up to bivariable analysis and double integrals on the plane and solve Exact ODE and PDE by characteristics as applications of the theory.
3. Describe the concepts of probability and statistics up to sampling distribution and apply the theory for real problems in engineering.

Syllabus Outline

Numerical Methods
Numerical solution of non-linear equations: Bisection, Fixed point, Newton's methods.
Numerical differentiation and integration: Trapezoidal and Simpson's rules.
Interpolation: Lagrange polynomial, Newton's Divided Difference and Least Square method.
Numerical solution to systems of equations: Gauss-Jacobi Gauss-Seidel methods.
Numerical solution to ODEs-Euler' s method.
Numerical Optimization-Golden section search, method of finding roots of the derivative Multivariate Calculus and Introductions to PDEs.
Limits, Continuity, Partial Derivatives, Mean Value Theorem, Differentiability.
Chain rule-Bivariate.
Gradient, Tangent plain, Directional derivatives.
Jacobian, Hessian.
Inverse Function Theorem, Implicit Function Theorem.
Maxima, minima and Saddle points, Lagrange multipliers.
Taylor series expansion for two variable, quadratic forms.
Double integrals: Fubini's theorem, Change of variables, polar coordinates.
Solution of the exact ODE.
Introduction and solve first order PDE, Solution by the method of Characteristics.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
2	ME1091	Engineering Drawing & Computer Aided Modelling		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
1	4	3.0	None	100	0

Learning Outcomes

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

1. Demonstrate knowledge of projection methods.
2. Draw the orthographic projections of a given component.
3. Use graphical construction techniques.
4. Use CAD software to draw orthographic projections.
5. Develop 3-dimensional models in a virtual environment.

Syllabus Outline

Projection Methods

Orthographic and isometric projections.

Orthographic Views

Orthographic views of objects from a given isometric view; 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.

Graphical Constructions

Lines and Planes: Graphical estimation of true lengths, inclinations, traces, auxiliary projection methods & true shapes of sections; Interpenetration Curves: Construction of Interpenetration curves of Cylinder, Cone, Sphere, Pyramid; Developments: Construction of Developments of Prism, Cylinder, Cone, Pyramid and Developments by the Method of triangulation.

Computer aided drafting and modelling

Software tools and techniques for drafting and modelling.

Semester 3

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
3	CE1813	Mechanics of Materials		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	0	2.0	None	30	70

Learning Outcomes

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

1. Recognize and report on the structural and material behaviour under flexural loading.
2. Compute stresses and deformations in determinate structures under flexural loading.
3. Compute elastic stress and strain at a point.
4. Apply the knowledge to solve practical problems involving structural behaviour.

Syllabus Outline

Recognize and report on the structural and material behaviour under flexural loading.
Compute stresses and deformations in determinate structures under flexural loading.
Compute elastic stress and strain at a point.
Apply the knowledge to solve practical problems involving structural behaviour.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
3	CE2063	Surveying I		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	None	30	70

Learning Outcomes

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

1. Demonstrate an understanding of the use of survey measurements in Civil Engineering.
2. Use survey instruments to make measurements in the vertical and horizontal planes.
3. Produce hand-drawn survey plans and longitudinal section/cross section drawings.

Syllabus Outline

Introduction to Land Surveying.
Linear measurements and Chain Surveying.
Levelling and Contouring.
Theodolite Surveying.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
3	CS2813	Visual Programming		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
1	2	2.0	None	60	40

Learning Outcomes

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

1. Develop a working program for specified programming problem using a visual programming environment.

Syllabus Outline

Introduction to the concept of visual programming.
Introduction to visual programming environments.
Practice of visual programming using .NET Framework.
Objects, Properties, Events and Methods; Variables, Data Types and Controls; Use of Forms and Controls to create User Interfaces; Program Control Flow; String and file manipulation; Arrays; Procedures and Functions; Exception Handling; Database Programming.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
3	ER2034	Principles of RS and GIS		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
3/2	2/2	2.0	None	30	70

Learning Outcomes

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

1. Describe remote sensing history and its applications.
2. Describe basics of electromagnetic spectrum, satellite, sensors, and image acquisition methods.
3. Interpret satellite images and aerial photographs.
4. Identify different components, functions and applications of GIS.

Syllabus Outline

Introduction to Remote Sensing (RS).
Physical principles of electromagnetic radiation and interaction with matters.
Remote sensing platforms and sensor characteristics.
Basics of pre-processing of Satellite Images.
Introduction to Geographical Information System (GIS).
Global Positioning System (GPS).
Areas of application in RS and GIS, and their significance.
Future of RS and GIS.

Intake	2020 onwards	Specialisation	Earth Resources Engineering

Semester	Code	Module Title		C/E/O	GPA / NGPA
3	ER2054	Introduction to Petroleum Engineering		E	GPA
Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
2	0	2.0	None	30	70

Learning Outcomes

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

1. Explain the scopes of the upstream, midstream and downstream sectors.
2. Explain fundamental concepts of hydrocarbon formation, exploration, reservoir modelling and volumetric calculations.
3. Work collaboratively in groups to present basic concepts related to Petroleum Engineering.
4. Analyse Petroleum Fiscal Systems with given data.

Syllabus Outline

Overview of petroleum industry.
Nature of oil and gas.
Hydrocarbon formation.
Petroleum system.
Basic concepts of petroleum exploration.
Heat flow analysis.
Basic volumetric calculation.
Basic concepts related to Petroleum Engineering.
Petroleum Law.
Health, safety, and environmental issues.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	Code	Module Title		C/E/O	GPA / NGPA
3	ER2110	Rock Blasting and Explosives Engineering		C	GPA
Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
5/2	2/2	3.0	None	30	70

Learning Outcomes

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

1. Categorize explosives for site specific requirements.
2. Identify relevant requirements for the security, storage, and safe handling of explosives.
3. Design and implement rock blasting systems for surface and underground workings.
4. Conduct blasting in an environmentally friendly manner.

Syllabus Outline

Explosives

Types of Explosives; Explosives properties; Chemistry of explosives; Explosive reaction; Mechanisms of rock breakage and fragmentation; Selection, Safe handling, and Storage of explosives.

Initiation systems
Mechanics of detonation, Safety Fuse, Electric Detonator, Detonating Cord, NONEL Tube, Electronic Detonator, Other methods.
Blasting practices
Basics of blast design, Open-pit blasting, Underground blasting, Pre-split blasting, Trench blasting, Controlled blasting, Underwater blasting, Demolition blasting, Chemical and silent Rock breakage, and Fragmentation analysis.
Blasting and monitoring accessories
Exploders, Tampers, Electronic firing system, Ohm metre, NONEL Starter, Vibration, and Air-blast monitoring systems.
Environmental impact of blasting
Regulatory and safety considerations, Mitigation of ground vibration, Flyrocks and air blast over pressure, conducting pre-blast surveys, Blasting complaints handling.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
3	ER2420	Introduction to Ocean Resources Engineering		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	0	2.0	None	30	70

Learning Outcomes

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

1. Recognize physiography of the ocean floor and stratigraphy of the ocean floor rocks, sediments and minerals.
2. Explain the unique properties of water, physical and chemical structure, and their application to the oceans.
3. Recognize the interactions and effects of the biological, physical, and chemical components including rocks, sediments, and minerals through understanding dynamics of the oceans.

Syllabus Outline

Origin of ocean basins.
The physiography of the ocean floor.
Marine sedimentation.
Properties of Seawater - Composition, salinity, principle of constant proportion, and salinometers.
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 seawater.
Ocean Resources - Mineral Resources and Living Resources.

Human Presence in the Ocean - Pollution, hydrocarbons in the sea, municipal and industrial effluents, Introduction to ocean dredging and mining, overfishing, climate change, and ocean's future.
Marine Productivity - Global patterns of productivity, Biological productivity of upwelling water and El Niño.
Ocean Wave Dynamics - Properties of ocean waves, Progressive Waves, Wave motions, Wave steepness, Tsunami and Storm surges, Wave property related equations.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
3	ER2631	Elementary Gemmology		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
3/2	2/2	2.0	None	30	70

Learning Outcomes

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

1. Explain the origin of gemstones, their qualities, crystal formations and gemmological properties.
2. Operate gemmological equipment to examine and identify gems.
3. Operate gem cutting machines, cut and polish gemstones to enhance the appearance.

Syllabus 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, Chrysoberyl, Diamond, Diopside, Feldspar, Jadeite and Nephrite, Natural Glass, Opal, Peridot, Quartz, Topaz, Tourmaline, Zircon, Zoisite.

Coloured Gemstone Fashioning

Gem cutting methods - Traditional (hanaporuwa), jam peg, universal faceter, robotic, tumbling, carving, and 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.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
3	MA2014	Differential Equations		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	0	2.0	MA1024	30	70

Learning Outcomes
Upon successful completion of this module, the student will be able to: 1. Solve linear ODEs with variable coefficients using power series. 2. Identify special functions associated with ODEs. 3. Solve ODEs with Laplace Transform. 4. Classify PDEs. 5. Reduce PDEs to canonical form. 6. Solve PDEs using Laplace Transform, Fourier Series and Fourier Transform.
Syllabus Outline
Ordinary Linear Differential Equations with Variable Coefficients Solutions in series form, Frobenius method. Special functions: Introduction of Legendre Polynomials and Bessel's functions. **Laplace Transform and Application to DE** Laplace transforms of elementary functions and some basic theorems on Laplace transform. Inverse Laplace transform, methods to find inverse transform, Convolution theorem. Application of Laplace transforms to find solutions to ODEs and systems of ODEs. Transfer functions, concepts of stability and controllability. Complex Inversion formula. **Fourier Series** Fourier coefficients, Dirichlet's condition, odd and even functions. Half rawe series. Parseval's Theorem. **Complex Fourier Series** Fourier series as the norm minimizer. **Partial Differential Equations** Canonical Forms.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
3	MA2024	Calculus		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	0	2.0	MA1024	30	70

Learning Outcomes
Upon successful completion of this module, the student will be able to: 1. Perform vector differentiation and integration and evaluate vector and scalar quantities. 2. Apply Divergence, Stokes' and Green's theorem. 3. Apply Cauchy's integral formula. 4. Perform contour integration techniques. 5. Apply conformal mapping.
Syllabus Outline
Vector Calculus Vector Functions. Vector differentiation and differential operators. Space curves and curvature, line integrals. Greens' Theorem.

Surfaces and curvature, surface integrals Curvilinear coordinate systems: spherical and cylindrical coordinates.
Stokes' theorem.
Triple integrals.
Divergence theorem.
Complex Variables
Complex valued functions and branch cuts.
Analytical function and Cauchy-Reimann equation.
Complex Integration.
Cauchy' s integral formula.
Singularities, zeros, and poles.
Taylor and Laurent series.
Residue theorem and applications of residue theorem for real integrals.

Semester 4

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
4	CE2143	Surveying II		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	None	30	70

Learning Outcomes

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

1. Use modern instruments for survey measurements in civil engineering.
2. Make computations and prepare drawings for civil engineering works based on survey measurements using manual methods and software.
3. Set out civil engineering works and use field astronomy for location and time measurements.

Syllabus Outline

Modern surveying techniques and instruments.
Global Positioning Systems (GPS).
Areas, volumes, and earth work calculations.
Introduction to surveying software.
Tacheometry.
Setting out.
Field Astronomy and time.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
4	ER2031	Mining Methods & Mine Development		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
3	0	3.0	None	40	60

Learning Outcome/s

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

1. Select a suitable mining method for a particular ore body.
2. Design and develop mine infrastructures.
3. Design and develop surface and underground excavations.

Syllabus Outline

Mining Methods
Introduction to mining methods and selections principle.
Surface mining methods: Open-pit, placer, strip and quarry mining, technological complexes - machinery and equipment.
Underground 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).
Room-and-pillar, coal mining by conventional and long-wall advancing and retreat mining.
Mine Development
Drilling methods: Surface and underground drilling equipment and their application, drill bits, basics of core drilling, wireline/ DTH drilling, selection of appropriate drilling method.
Mine Infrastructure, openings, dimensions, location, and design criteria.
Horizontal mine openings (crosscuts, drives, tunnels, and adits): Conventional excavations (drilling, blasting, and mucking); Mechanical excavations (TBM and road headers) and Support systems.
Vertical mine openings (shafts, raises and winzes): Conventional excavations (drilling, blasting, mucking); Mechanical excavations (boring machines, and raise climbers) and Support systems.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
4	ER2084	Mineral Processing Engineering		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
7/2	2/2	4.0	None	30	70

Learning Outcome/s

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

1. Compare basic principles of physical and chemical separation methods.
2. Distinguish the chemical separation methods in the context of high-grade mineral recovery.
3. Discuss inherent obstacles in mineral suspension systems.

Syllabus Outline

Comminution
Models, breakage characterization, energy efficiency, crushers, grinding mills and industrial screening, micromeritics.
Physical Separation
Classification: Hydro cyclones, sedimentation classifiers, hydraulic classifiers, classifier performance.
Gravity Concentration: Gravitational and centrifugal devices, fluidized bed separators, sluices and cones, gravity recoverable minerals, dry processing.
Magnetic Separation and High-Tension Separation: Magnetic permeability, magnetic susceptibility, magnetic separators- wet and dry separation, effect of variables and controls.
Dewatering: Thickening, gravity and centrifugal sedimentation, coagulation and flocculation, filtration, vacuum, and pressure filtration, drying.

Movement of solids in fluid

Chemical Processing

Flotation: Surface phenomena, flotation reagents, chemistry of flotation, flotation machines, flotation circuits.

Sintering and pelletizing of iron ores, pellet testing.

Stability of mineral suspensions.

Leaching of Minerals.

Physicochemical Methods

In-stream analysis with special reference to radio isotopes.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
4	ER2611	Petrology and Structural Geology		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	None	30	70

Learning Outcomes

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

1. Classify and identify rocks.
2. Explain brittle and ductile structures of rocks.
3. Explain Geology of Sri Lanka.

Syllabus Outline

Introduction to Petrology.

Igneous Petrology.

Sedimentary Petrology.

Metamorphic Petrology.

Petrographic analysis.

Geological structures of rocks (Brittle and ductile).

Interpretation of geological structures: stereo nets, aerial photographs, maps.

Deformational features and history of Sri Lankan rocks.

Geology of Sri Lanka.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering	
Semester	**Code**	**Module Title**	**C/E/O**	**GPA / NGPA**
4	ER2643	Analytical Methods and Environment Engineering Concepts	C	GPA

Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
5/2	2/2	3.0	None	40	60

Learning Outcomes

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

1. Recognize Environmental Engineering concepts.
2. Evaluate analytical data in terms of statistics.
3. Compare usability of conventional and instrumental analysis of rock samples.
4. Analyse rocks, minerals, and water.

Syllabus Outline

Analytical Methods
Introduction to analytical methods.
Collecting and preparing samples for mineral and water analysis.
Gravimetric and volumetric analysis.
Instrumental analysis.
Evaluating analytical data.
Environmental Engineering Concepts
Introduction to Environmental Engineering.
Environmental problems and solutions.
Water and air quality measurements.
Solid and hazardous waste management.
Ventilation and air quality control.
Fate and Transport of contaminants in the environment.
Environmental Engineering ethics, legislation, and sustainable development.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	Code	Module Title		C/E/O	GPA / NGPA
4	MA2034	Linear Algebra		C	GPA

Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
2	0	2.0	MA1014	30	70

Learning Outcome/s

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

1. Reduce a matrix using Gauss-Jordan reduction.
2. Solve a system of n equations in m variables.
3. Find the inverse of a matrix and eigen values and eigenvectors of a matrix.
4. Understand the dimension of a vector space, rank of a matrix and basis for a vector space.
5. Understand the concept of linear independence, linear transformation, and determinants.

Syllabus Outline
Groups and Fields. Vector Spaces, Subspaces, linear combinations, span of a set, linear independence, bases, dimension. Inner product spaces, orthogonal complements, Gram-Schmidt orthonormalization. Linear transformations, nullity, kernel, matrix form of a linear transformation, column space and row space of a matrix. Special Linear Transformations. Dual space. Eigen values and eigenvectors, characteristic polynomial, Cayley-Hamilton theorem, minimal polynomial, diagonalization of matrices, QR factorization, quadratic forms. Norms, spectral radius, functions of matrices. Positive/negative definiteness.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
4	MA3014	Applied Statistics		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	0	2.0	MA1024	30	70

Learning Outcome/s

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

1. Apply statistics distributions for different applications in their discipline area.
2. Define a range of hypothesis tests and derive inferences for statistical reasoning in engineering.
3. Demonstrate basic knowledge of using appropriate statistical models.
4. Use basic experimental design and sample techniques for various applications.
5. Use of statistical packages in performing statistical procedures.

Syllabus Outline

Discrete distributions (Negative Binomial, Geometric, Hypergeometric).
Continuous distributions (Exponential, Gamma, Chi-Square, Fisher's F-distribution).
Confidence intervals for proportion and variance.
Hypothesis testing on means, proportions, and variances.
Contingency tables, Chi-square test of association and Goodness-of-fit test of distributions.
Linear regression: Simple linear regression and multiple linear regression.
Basic experimental designs.
Introduction to sampling techniques.
Note: Statistical software is used to demonstrate the data analysis.

Semester 5

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	CE2813	Soil Mechanics		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	None	30	70

Learning Outcomes

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

1. Explain the formation of soils and classify soils.
2. Evaluate the vertical stresses and pore water pressures in soils under static water conditions.
3. Identify the fundamental properties of soils and determine the basic engineering properties through appropriate laboratory testing.
4. Classify soils and assess the suitability of a soil for different civil engineering constructions, and to plan and conduct necessary quality control tests.
5. Estimate the permeability characteristics of soils.

Syllabus Outline

Identify the fundamental properties of soils and rocks, and determine the basic engineering properties through appropriate laboratory testing.
Classify soils and assess the suitability of a soil for different civil engineering constructions, and to plan and conduct necessary quality control tests.
Evaluate the vertical stresses and pore water pressures in soils under static water conditions.
Estimate the permeability characteristics of soils.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	ER3014	Extraction Metallurgy		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	None	30	70

Learning Outcomes

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

1. Understand the fundamentals of extractive metallurgical processes for ferrous and non- ferrous industries.
2. Assess material balance problems based on physicochemical and metallurgical principles.
3. Apply the knowledge of basic chemistry and thermodynamics for problem identification and formulation of solutions.
4. Explain the type of furnaces, kilns, their design aspects, and the limitations.

5. Understand the importance of energy and water footprints and zero waste flows in modern mineral processing, and contribute towards an environmentally friendly and sustainable industry.

Syllabus 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 an environment friendly sustainable metallurgical industry.
Professional and ethical responsibilities of the Engineering Profession to metallurgical industry.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	ER3070	Economic Minerals and Mineral Exploration		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	None	30	70

Learning Outcomes

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

1. Explain the formation and mode of occurrence of mineral deposits.
2. Describe Sri Lankan minerals and identify the industrial uses of minerals.
3. Explain field data collection techniques and interpretation of data in geochemical and geophysical exploration.

Syllabus Outline

Introduction to economic mineral deposits
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.
Introduction to Geochemistry.
Geochemical mineral exploration techniques.
Geochemical surveys.
Data analysis (geo-statistics, geochemical maps, contouring).

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.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	ER3320	Plant Design and Value Addition to Minerals		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
1	2	3.0	None	30	70

Learning Outcome/s

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

1. Apply value addition techniques.
2. Design and simulate mineral processing plants.
3. Analyse financial feasibility and socio-environment aspects.

Syllabus Outline

Value Addition to Minerals
Introduction to value addition to minerals.
Value addition methods and technologies.
Market climate for the value-added minerals.
Mineral Processing Plant Design
Theory and concepts.
Mass and energy balance.
Develop flowsheet, model, and simulate mineral processing plants.
Financial feasibility
Environment and sociological aspects and mitigation methods.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	ER3520	Coastal Hydrodynamics		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	ER2420	30	70

Learning Outcome/s

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

1. Evaluate the effects of gravitational forces, temperature, pressure, and salinity on the dynamics of the ocean.

2. Analyse and interpret basic beach processes, including variations in sediment size, coastal sediment erosion, transportation, and depositional processes.
3. Apply ocean hydrodynamic modelling.
4. Organize offshore fieldwork program, manage safety issues, operate and maintain ocean equipment and perform offshore sampling.

Syllabus Outline

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 Modelling
Concepts of numerical modelling (Model types, model forcing, model validation), preparation of bathymetric maps and case studies.
Field Instrumentation
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, and CTD (Conductivity, Temperature, Depth).

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	ER3701	Petroleum Exploration and Drilling Engineering		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	ER 2054	30	70

Learning Outcome/s

Upon successful completion of this module, the student will be able to:
1. Interpret seismic data.
2. Describe basin forming processes and basin architecture.
3. Recognize and describe the elements and processes of a petroleum system.
4. Identify machinery and methods of petroleum drilling and well completion.

Syllabus Outline

Petroleum Exploration
Seismic acquisition, processing, and interpretation.
Basin Analysis
Petroleum system.
Basin formation.
Classification of basins.
The concept of mega sequences.
Fairway analysis techniques, burial history, and petroleum systems.
Drilling wells
Petroleum drilling systems.
Drilling rig components.
Drilling fluids.
Casing design, cementing and well completion.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	ER3704	Digital Image Processing and Photogrammetry		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	ER2034	30	70

Learning Outcome/s

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

1. Classify different remote sensing image formats and their use.
2. Apply image rectification, restoration, and enhancement methods in image processing.
3. Apply image classification and transformations techniques.
4. Describe digital photogrammetric techniques.

Syllabus Outline

Remote sensing data and image formats.
Image rectification and restoration.
Image enhancement.
Image transformation.
Image classification and time series analysis.
Classifiers, Accuracy Assessments, Advanced methods for Change detection.
SAR Image Processing.
Hyperspectral Image Processing.
Digital Photogrammetry-fundamentals and processing techniques.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	ER3714	Jewellery Products Development		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	ER2631	50	50

Learning Outcome/s

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

1. Explain the main components of the jewellery products development process.
2. Design Jewellery products by manually, and using computer software.
3. Evaluate the demand for jewellery products in the local and international markets.
4. Create master models and cater for the social trends.

Syllabus Outline

Introduction to theory and practice of Jewellery Design: Jewellery sketching, technical drawing, principles of Jewellery design.
Evolution of jewellery products design and development with respect to the cultural inheritance.
Use of computer software to design Jewellery products.
Development of the jewellery product prototypes: Wax carving, master model making, CAM.
Quality control and quality assurance of jewellery products.
Demand for jewellery products: Domestic market, international markets, market segments, supply chain, product distribution.
Modern trends in jewellery product development: Reuse and recycling of jewellery products.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5/6	ER3880	Engineer and Society		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
1	4	3.0	None	100	0

Learning Outcome/s

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

1. Begin to practise in the social context of the engineering profession with an understanding of ethical issues.
2. Demonstrate an understanding of the impact of the engineering profession on society and environment.
3. Demonstrate an understanding of the health, safety, and environmental requirements of the society.
4. Interpret the engineer's role in ethically assuring healthy, safe, and excellent environmental conditions, targeting the overall development of the society.
5. Apply knowledge of building character as a socially responsible professional engineer.

6. Identify and apply appropriate tools/ techniques for the identification of health, safety and environmental hazards/ consequences and risk assessment.

Syllabus Outline

Introduction to Engineering Ethics - Historical context, moral responsibility, IESL code of ethics, community standards and personal responsibility.
Ethics in Society - Respect for social and cultural values, respect for other professions, ethical decisions as individuals, workplace ethics, identifying ethical issues, conflicting scenarios, and problems in the field of engineering, leading organizations towards ethical behaviour, inclusive engineering.
Legal requirements related to engineering practice - acts and ordinances.
Health & Safety - Definitions, areas and hazard identification, risk assessment, evaluation, and management.
Health & Safety Management – Management practices, local regulations, global standard, and best practices, designing of health & safety management systems, special topics.
Environment - waste generation in industry, overview of controlling and treatment technologies, local standards and EPL (Environmental Protection License) procedure, EIA (Environmental Impact Assessment).
Case studies (industry specific).

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	ER4104	Mine Safety and Legislation		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	0	2.0	None	30	70

Learning Outcome/s

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

1. Explain occupational health and safety requirements.
2. Conduct risk assessments to evaluate hazardous situations and take preventive measures.
3. Conduct accident investigations and reporting.
4. Explain legislative background of Mining And Mineral Engineering.

Syllabus Outline

Introduction to Occupational Health and Safety, and safe environment in mine operations.
Classification of mining accidents, causes and consequence of mining accidents, types of hazards, accident theories.
Risk management process.
Investigations into accidents and accident reports.
Accident prevention and optimization of safety culture.
Mine Rescue and Recovery.
Personal Protective Equipment: selections and training.
Safety Audit and Controls.

Mines and Minerals Act, Explosives Act, National Environment Act (Mining and Mineral related). Environment Assessment and review framework for licensing procedure in Mining and Mineral related activities.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	ER4714	Construction Engineering Practice		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	None	30	70

Learning Outcome/s

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

1. Explain the uses of construction materials.
2. Analyse the behaviour of structural elements using bending moment and shear force diagrams (steel and reinforced concrete).
3. Interpret the specifications and structural drawings.

Syllabus Outline

Construction materials (steel, timber, sand, brick, metal, cement).
Manufacturing process, selection, testing and properties of building materials (such as bricks, rubble, sand, coarse aggregates, timber, roof cover material, cement blocks, cement, lime, concrete, asphalt, steel), and 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, pile testing.
Typical construction practices (steel construction, pad footings, piling, brick work, R/C slabs, beams, and columns), Reading and understanding of technical specifications and structural drawings.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	MA3024	Numerical Methods		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	0	2.0	MA1024	30	70

Learning Outcome/s

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

1. Solve systems of linear and non-linear equations numerically.
2. Numerically approximate data using cubic Splines.
3. Optimize one dimensional and basic multidimensional functions.
4. Numerically solve initial value problems.
5. Numerically solve boundary value problems.

Syllabus Outline

Solving Systems of Linear Equations
Condition of a linear system.
Direct methods.
LU decomposition.
Symmetric, Positive definite Matrix decomposition.
Tri diagonal Matrix decomposition.
Numerical Solutions of System of Non-Linear Equations
Fixed Point iteration.
Newton's Method.
Curve Fitting
Splines.
Numerical Optimization
Multi-dimensional.
Steepest decent.
Numerical Solutions of Initial Value Problems for of ODEs
Single step methods.
Euler's Method & Modified Euler Method.
Runge-Kutta methods.
Numerical Solutions of a System of IVPs.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	MN3043	Business Economics and Financial Accounting		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
3	0	3.0	None	30	70

Learning Outcome/s

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

1. Define the basic micro and macroeconomic concepts.
2. Identify of the links between economy and technology.
3. Apply basic knowledge on these accounting concepts to business environment and to interpret main accounting statements.

Syllabus Outline

Business Economics
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
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, CVP analysis.
Standard costing.
Stock control.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
5	MN3053	Industrial Management and Marketing		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
3	0	3.0	None	30	70

Learning Outcome/s

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

1. Describe basic concepts and theories of organizational management.
2. Explain the application of these theories for modern organizations.
3. Describe the fundamentals of technology management, human resource management and legal issues related to modern industrial relations.
4. Explain basic marketing concepts and theories and their applications.

Syllabus Outline

Organization management
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

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

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.
Teamwork; developing teams and teamwork, advantages of teams and stages of team development.

Marketing

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

Industrial Training

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
Ind. Tr.	ER3993	Industrial Training		C	NGPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
-	-	6.0	None	100	0

Learning Outcome/s

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

1. Apply engineering knowledge and skills in a responsible manner.
2. Demonstrate deep understanding of industrial health, safety and environmental aspects and practices.
3. Perform teamwork in dynamic work environments, maintaining high ethical standards with good human relationships.
4. Create optimized engineering applications and enhancing productivity.

Syllabus Outline

Understanding how to apply technical knowledge and engineering methods in industry.
Induction on organizational health, safety and environmental practices and standards.
Signing of the training contract with training provider and familiarization with organizational structure.
Organizational induction by the immediate training supervisor/ training department of the training provider.
Identification of relevant sections to undergo hands-on training by the trainee and updating with the immediate supervisor/ training division of the organization.
Familiarisation with work procedures and work teams of relevant sections.
Gain hands-on experience in all relevant sections.
Updating of the daily records with important things learnt/ hands-on experience.
Environmental aspect of site/ organizational operations and legal framework.
Engineering Professional Ethics.
Networking with management and other employees, by attending common organizational functions.
Sharing of constructive suggestions with the management of training provider to enhance the efficiency and productivity of organizational functions.
Identification of potential collaborative research opportunities with the training provider, based on the training experience.

Semester 6

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
6/7	ER3203	Design Project		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Design Work**			**CA**	**WE**
0	6	3.0	None	100	0

Learning Outcomes

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

1. Plan and carry out an engineering design according to the client's requirement, available resources, and other limitations.
2. Present the design performed.
3. Demonstrate the methodology adopted in an engineering design.

Syllabus Outline

Identification of the problem (objectives).
Rapid assessment of the client requirements, available resources, and limitations.
Writing Terms of Reference (TOR).
Environmental Impact Assessment (EIA) process.
Brainstorming for alternative solutions.
Detail investigation of the design.
Planning and Preliminary design.
Detailed 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 (4-5 students 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.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
6	ER3913	Geology Field Visits and Camp		C	NGPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
-	-	2.0	None	100	0

Learning Outcome/s

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

1. Use various geological field techniques and geological mapping.
2. Explain geological surveying technics for both geochemical and geophysical investigations.
3. Interpret geological field data, and reporting.

Syllabus 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.
Geophysical Exploration
Selection of the suitable geophysical techniques for the area.
Conduct of geophysical surveys: Resistivity survey, Magnetic survey, and GPR 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.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
6	ER3923	Mine Surveying and Ventilation Field Camp		C	NGPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
-	-	2.0	None	100	0

Learning Outcome/s

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

1. Compare different survey applications and understand their accuracies.
2. Organize surveying and leveling in both surface and underground mines.
3. Organize a mine ventilation survey in an underground mine.

Syllabus Outline

Mine Surveying Field Camp
Familiarization with surveying techniques and instruments.
Conducting of level survey in a mine.
Transferring of co-ordinates from one level to another sub level.
Preparation of survey map, report, and presentation.
Mine Ventilation Field Camp
Familiarization with ventilation surveying techniques and instruments for precise observations.
Conducting of a ventilation survey in an underground mine.
Preparation of a professional report containing ventilation survey data, computations, analysis, and results.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
6	ER4024	Mine Ventilation		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	None	30	70

Learning Outcomes

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

1. Explain concepts of mine environment and ventilation.
2. Conduct ventilation surveys.
3. Design and optimize sub-surface ventilation networks.

Syllabus Outline

Introduction to mine environment and sub-surface ventilation.
Underground atmosphere: Gases in subsurface, dust, heat and psychrometry.
Incompressible flow relationships: Introduction, Atkinson's equation, the square law, determination of friction factor, airway resistance, airpower, shock loss factors.
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.
Ventilation network analysis and design.
Ventilation surveying: Quantity and pressure surveys, measurements with instrumentation.
Mine Refrigeration.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
6/7	ER4084	Mine Surveying, Planning and Design		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	None	40	60

Learning Outcomes
Upon successful completion of this module, the student will be able to: 1. Conduct a mine surveying using survey equipment. 2. Evaluate the most appropriate design for a mine site. 3. Plan and design mining operations. 4. Analyze financial aspects and optimize mine operations.
Syllabus Outline
Mine Surveying Introduction to Mine Surveying: Importance and applications of mine surveying, difference between surface survey and underground survey, mine plans, basic principles applied in mine surveying. Open-Cast Survey: General terms in open-cast mine survey, Design of horizontal control networks in open-cast mines, Volumetric survey, Slope monitoring in opencast mines. Underground Survey: Development surveys, Shaft survey methods. Application of Photogrammetry to Mine Survey **Mine Planning and Design** Introduction to mine planning and design. Stripping ratio: Concept of stripping ratio; Types of stripping ratios and their significance; Choice between surface and underground mining. Principals of project management. Surface mine planning and Design: Geometrical considerations; pit planning and design; equipment, systems selection and optimization; production scheduling and measuring. Underground mine planning and Design: Geometrical considerations; mine openings and stope planning and design; equipment, systems selection and optimization; production scheduling and measuring. Design of drainage system in surface and underground mines. Regulatory environment, Mine Closure.

Semester 7

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7	ER4014	Rock Mechanics		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	None	40	60

Learning Outcomes

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

1. Define the characteristics and the mechanical properties of rock mass, rock matrix and discontinuities.
2. Use rock mass classification systems.
3. Determine likely rock mass behaviours under different excavation and loading stress conditions, and proposed mitigation measures.

Syllabus Outline

Introduction to rock mechanics.
Physical and mechanical properties of rocks and their testing methods.
Elastic and time dependent behaviour of rocks.
Characterization of rock discontinuities and their fundamental properties.
Rock mass classification.
In-situ stress measurements.
Geometric and stress analysis of rocks.
Stress around underground excavations.
Theories of rock failure.
Rock slope stabilization and methods of reinforcement.
Underground structural failures and methods of reinforcement.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7	ER4034	Hydrogeology and Engineering Geology		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
3	0	3.0	None	30	70

Learning Outcomes

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

1. Explain subsurface behaviour of groundwater and carry out design of tube-wells and pumping tests.
2. Explain engineering geological concept and methodology in site investigations and utilize concepts in geology for engineering applications and reporting.

3. Explain the basic concepts of geological disaster, prevention, mitigation, and preparedness.

Syllabus Outline

Hydrogeology
Aquifers, aquifer properties, aquifer types and groundwater environments.
Groundwater exploration - Geological, geomorphological, and geophysical methods.
Design of shallow and deep tubewells.
Well drilling, well completion, well development.
Pumping equipment for shallow and deep wells.
Pumping tests (well and aquifer).
Engineering Geology
Site investigation for engineering projects.
Drilling, borehole logging for site investigation.
Preparation of site investigation proposal and reports.
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.
Geological disaster management: Landslides, earthquakes and tsunami, volcanic eruption.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7	ER4094	Plant Performance and Process Modelling		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	None	30	70

Learning Outcomes

Upon successful completion of this module, the student will be able to:
1. Assess the ability to operate, maintain and optimize throughput of processing plants and simulate their processes.
2. Evaluate productivity and quality at the workplace.

Syllabus Outline

Introduction to plant performance.
Importance of crystal structures and physical properties of minerals for process modelling.
Sampling techniques.
Pulp stream analysis.
Effect of specific gravity of media in heavy media separation.
Usage of washability curves to design washery.
Pulp formulation and recycling of media.
Industrial screening and classification.
Process control and control charts.
Mass and ingredient balance optimization.
Recovery calculations and process modelling.
Determination of the efficiency of processes.
Waste minimization and cleaner production.
Application of "5S" workplace organization method for processing plants.

Application of ISO 9001 system for product and services quality management.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7	ER4140	Mine Mechanization and Automation		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
3	0	3.0	None	30	70

Learning Outcome/s

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

1. Describe the basic concepts of mine mechanization and automation.
2. Analyse the current state of the art and future trends in mine mechanization and mine automation systems.
3. Analyse the infrastructure required to support mine automation.

Syllabus Outline

Introduction to mine mechanization and automation concepts.
Mine power distribution and applications.
Compressed air systems in mines.
Mine dewatering systems.
Underground mine communication systems.
Industrial control systems for mining.
Condition monitoring of machines, equipment and support systems deployed in mines.
Simulation of mining processes and equipment using mining software (with case studies).
Drone technology for mining.
Applications of mine automation and mechanization: Drilling operations, loading and transportation, inspections, fixing/supporting and ventilation.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7	ER4150	Advanced Electrochemistry		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	ER3014	30	70

Learning Outcome/s

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

1. Explain fundamental aspects of electrochemical reaction in terms of thermodynamics, kinetics, and mass transport.

2. Explain the structure of electric double layer at the interface and its role on electrode reactions.
3. Explain measuring principle of fundamental electrochemical methods such as cyclic voltammetry.
4. Promote practical usage of electrochemical technology.

Syllabus Outline

Introduction to advanced electrochemistry.
Electrochemical cells.
Electrochemical synthesis.
Electrochemical power generation.
Electrochemical reactions: Thermodynamics, electrode kinetics, mass transport.
Electrochemical interface.
Electrochemical measurements: Apparatus and cell, potential step, and potential sweep techniques.
Impedance spectroscopy and pulse voltammetry.
Corrosion and electroplating.
Green electrochemistry.
Fuel cells.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7/8	ER4203	Research Project		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
0	10	5.0	None	100	0

Learning Outcome/s

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

1. Explain the concepts on conducting a scientific research project.
2. Demonstrate writing skills on research proposals and final reports.
3. Demonstrate the concepts on publications of research findings.

Syllabus Outline

Research methodology, scientific writing, and presentation skill enhancement.
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 and interpretation of data.
Writing the research project report and compiling of a research paper.
Individual viva-voce.
Submission of research project report and presentation.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7	ER4301	Advanced Gemmology		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	ER2631	40	60

Learning Outcome/s

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

1. Operate advanced gemmological equipment to identify gemstones.
2. Differentiate synthetic and organic gemstones based on the gemmological properties.
3. Execute gemstone enhancement methods for value addition.

Syllabus Outline

Production Techniques and Identification of Synthetic Gemstones

Flame fusion (Vernueil) process, Czochralski method, flux melt growth, skull melting, zone melting & hydrothermal method, diamond synthesis.

Identification of Organic Gem Materials

Pearl, coral, amber, ivory, tortoiseshell, shell, jet.

Gemstone Enhancement Methods and the Identification of Enhanced Gemstones

Surface treatment, colourless and coloured impregnations, heat treatment, diffusion treatment, irradiation, laser drilling, HPHT treatment for diamond.

Advanced Gem Identification Techniques

Electron microprobe, scanning electron microscope, ultraviolet-visible and near infrared 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.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7	ER4323	GPS and Space Technology		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	ER2034	30	70

Learning Outcome/s

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

1. Use satellite-based navigation system and improving position accuracy.
2. Explain characteristics of spacecrafts and orbits.

Syllabus Outline

GPS
Introduction and describing position using coordinate systems.
Technological development of positioning.
Conventional instrument use for angle, distance, and position measurements.
Space based positioning and navigation system.
Map coordinate systems.
GPS signal characteristics.
Determining position using GPS.
Sources of errors and improving of accuracy.
GPS positioning methods.
GPS data processing methods.
Other satellite positioning methods.
Applications of GPS technology.
Space Technology
Historical development of space activities.
Elements of space mission.
Rocket propulsion fundamentals.
Orbital mechanics.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7	ER4351	Formation Evaluation and Reservoir Engineering		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	ER3701	40	60

Learning Outcome/s

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

1. Interpret open hole logging measurements for lithology, porosity, and water saturation estimates.
2. Estimate reservoir parameters and reservoir volume with given well data.
3. Analyse the reservoir behaviour with time.
4. Apply fundamental mechanics of well stimulation and enhanced oil recovery.

Syllabus Outline

Formation Evaluation
Logging principles.
Passive logs.
Acoustic logs.
Density / neutron logs.
Porosity, lithology determination.
Resistivity logging.
Capillary pressure and saturation.
Shally – and analysis.
Core –log interpretation.
Reservoir Engineering

Rock and fluid properties. Volumetric calculation. Material balance. Reservoir types and drive mechanisms. Darcy's law and applications. Well stimulation. Well testing.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7	ER4434	Marine Mineral Exploration and Hydrography		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	ER3520	30	70

Learning Outcome/s

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

1. Recognize and evaluate the offshore mineral potential.
2. Apply direct and indirect methods of mineral exploration in the field.
3. Apply SONAR (Sound Navigation and Ranging) techniques and preparation of hydrographic maps.

Syllabus Outline

Types of ocean minerals found from continental shelf and deep seabed.
Seawater as a resource - Fresh water from desalination of seawater, sodium chloride, bromine, magnesium, and uranium.
Introduction to marine exploration geophysics.
Offshore navigation and positioning techniques.
Offshore sampling techniques.
Hydrography – SONAR techniques, bathymetric maps, and relevant software applications.
Tidal variations and measurements.
Side scan sonar imaging.
Beach profiling.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
7	MN4023	Engineering Economics		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	0	2.0	None	30	70

Learning Outcome/s
Upon successful completion of this module, the student will be able to: 1. Identify the most relevant economic concepts for the engineering decisions. 2. Apply these concepts to practical engineering projects and decisions.
Syllabus Outline
Fundamentals: time value of money, equivalence, and cash flow diagrams. Discounted cash flow; time value equivalence, single payment and annuity factors and numerical examples. Cash flows and compounding. **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. **Analysis of alternatives:** classification, mutually exclusive alternatives, incremental analysis, and preferred method for decision making. **Project feasibility analysis:** financial feasibility, market price analysis, cost of capital and weighted average, economic feasibility, shadow pricing, benefit cost (B/C) analysis, irregularities of B/C analysis and preferred method for decision making. **Sensitivity analysis and decision trees:** What If, Sensitivity Graph, and interpretation of the analysis, discounted decision trees, and application of decision trees. **Risk management:** Risk identification, risk analysis and risk response.

Semester 8

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
8	ER3044	Mine Machinery and Design of Mineral Transport Systems		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
3	0	3.0	None	30	70

Learning Outcomes

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

1. Classify mine machinery and equipment.
2. Select suitable machinery and conveyor systems to design mineral transport systems.
3. Perform routine maintenance and safe operations of the equipment.

Syllabus Outline

Introduction to Mine Machinery

Surface Mine Machinery: Machines used in open cast mines and quarries for development and ore extraction.

Subsurface Mine Machinery: Machines used in development and extraction of mineral and coal, mine hoists; mine communication, remote controlled systems.

Other Mining Machinery: Machines used in exploitation of ore bodies below water table, offshore mining machines, water pumps, scaling machines, shotcrete machines, mine fans.

Mineral Transport

Underground Mines: Machinery used for haulage and hoisting.

Open Pit Mines: Locomotives, trucks, conveyors, rope, and hydraulic transport.

Monitoring, Testing and Machine Maintenance

Machine Fleet Design

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
8	ER4074	Mineral Economics and Ore Reserve Modelling		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	None	40	60

Learning Outcomes

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

1. Analyse the market of minerals in dynamic economic conditions.
2. Conduct sensitivity analysis to analyse the effects of uncertainty in mineral projects.
3. Perform ore reserve modelling and estimation from exploration data, and reporting.

Syllabus Outline

Mineral Economics
Introduction to mineral economics.
Mineral demand and supply.
Mineral markets and pricing.
Mineral finance and investment.
Financial modelling and discounted cashflow for mineral projects.
Uncertainties and risk with mineral projects.
Ore Reserve Modelling
Sampling.
International reporting codes for exploration results, mineral resources, and reserves definitions.
Principal factors in the conversion of the in-situ to a recoverable reserve.
Reserve modelling and estimation.
Loss of mineral in mining.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
8	ER4131	Mine Waste Management and Rehabilitation		C	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	None	30	70

Learning Outcomes

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

1. Conduct environmental assessment in mine sites.
2. Evaluate and execute waste treatment technologies.
3. Apply sustainability concepts in mining industry.
4. Implement mine rehabilitation and waste management procedures.

Syllabus Outline

Environmental Aspects of Mining
A general introduction to mine wastes including their sources, environmental impacts, global extent, and impacts.
Impacts on Water Resources
Surface and underground mine water management.
Siltation and erosion control.
Types of Mine Wastes (Solid, liquid, and gaseous)
Characterization of mine wastes.
Metal and metalloid-bearing minerals in mine wastes: Types and processes of formation.
Sulfide mine wastes.
Radioactive mine wastes.
Waste reduction technologies
Containment.
Mine waste storage facilities/ impoundment structures long-term geotechnical and environmental stability considerations of storage facilities.
Treatment.
Sampling and analysis of mine wastes.
Risk assessments.

Mine waste treatment technologies.
Case studies.
Sustainable Mining
Evolution of the principles and theories of sustainability, and sustainable development.
Application of sustainability concept in mining industry.
The Mining Industry in Sri Lanka, mitigation of social, cultural, and environmental issues.
Mine rehabilitation
Principles of mine closure, mine closure planning, stakeholders of mine closure, environmental and social impacts, financial aspects of reclamation planning and management, site preparation, restoration, monitoring and maintenance, regulatory authorities.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
8	ER4254	Offshore Mining and Project Design		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	ER4434	30	70

Learning Outcome/s

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

1. Understand legal framework for exploration and mining of offshore minerals.
2. Select appropriate mining methods and relevant machinery to exploit offshore mineral deposits.
3. Design of offshore mining projects.

Syllabus Outline

Law of the Sea
Appraisal of Subsea Conditions
Offshore site investigations (Geotechnical aspects for project implementation).
Offshore Mining
Offshore mining techniques, mining machinery and underwater rock blasting.
Environmental Aspects of Offshore Mining
Offshore Mining Project Design

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering	
Semester	**Code**	**Module Title**	**C/E/O**	**GPA / NGPA**
8	ER4314	GIS and Spatial Statistics	E	GPA

Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
2	2	3.0	ER2034	40	60

Learning Outcome/s

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

1. Explain the analytical techniques to treat spatial data.
2. Manipulate and analyse spatial data and make final output: maps using GIS techniques.

Syllabus 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.
Spatial Statistics.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	Code	Module Title		C/E/O	GPA / NGPA
8	ER4461	Petroleum Production and Downstream Processes		E	GPA
Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
5/2	2/2	3.0	ER4351	40	60

Learning Outcome/s

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

1. Evaluate inflow and outflow performance between reservoir and wellbore.
2. Select artificial lift equipment and equipment for surface facilities.
3. Select and describe required refining processes for specified fuel specification.
4. Select suitable fuels for specific applications.

Syllabus Outline

Production Engineering
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.

Downstream Process

Processes to transform crude 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.

Intake	2020 onwards	**Specialisation**	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
8	ER4470	Product Development and Nanotechnology		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
5/2	2/2	3.0	None	30	70

Learning Outcome/s

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

1. Explain nanoparticles and behaviour of nanoparticles.
2. Compare and contrast nanoparticle production technique/s.
3. Apply nanotechnology for associated product development.

Syllabus Outline

Nanoparticles: Evolution and prospects.

Characterisation of nanoparticles (SEM, TEM, particle size analysis, XRD).

Synthesis of nanomaterials (Top-down process: High energy ball milling, physical vapour deposition, gas phase synthesis, bottom-up process: Chemical reduction of transitional metal, thermal, photochemical, sono chemical decomposition, ligand reduction and displacement from organometallics, electro chemical reduction).

Nanoparticle in the colloidal state (Introduction to colloidal systems, optical properties of colloidal systems, molecular kinetic properties of colloidal systems, science of adsorption, adsorption at the solid gas interface, adsorption at the solution gas interface, adsorption at the solid solution interface, electrical properties of colloidal systems, preparation and purification of colloidal systems and the structure of colloidal miscellas, stability and coagulation of colloidal systems, structural -mechanical properties of dispersed systems, systems having a gaseous dispersion medium, systems having liquid and solid dispersed phases, colloidal surfactants).

Application of nanotechnology in mineral industry (Graphene, Expanded Graphite, nano-clay/synthetic rutile/rutile particle).

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
8	ER4513	Jewellery Production Technology		E	GPA
Hours/Week		**Credits**	**Prerequisites / Corequisites**	**Evaluation %**	
Lecture	**Lab/Tutes**			**CA**	**WE**
2	2	3.0	ER3714	50	50

Learning Outcome/s

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

1. Explain the technology of metal melting and development of alloys in jewellery production.
2. Perform wire drawing, soldering, welding, sawing, filing, and polishing.
3. Produce handmade jewellery to a given design.
4. Develop rubber moulds, inject wax patterns, conduct the investment procedure, burn-out procedure, and casting.

Syllabus 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, matt 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, hand working, rolling, wiredrawing, 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.
Quality Assurance - Laws and regulations, stamping, assaying, hallmarking, quality attributes, statistical methods, inspection methods, laboratory reports and certificates, hazardous materials.

Intake	2020 onwards	Specialisation	Earth Resources Engineering		
Semester	**Code**	**Module Title**		**C/E/O**	**GPA / NGPA**
8	ER4721	Tunnel Design and Engineering		E	GPA

Hours/Week		Credits	Prerequisites / Corequisites	Evaluation %	
Lecture	Lab/Tutes			CA	WE
5/2	2/2	3.0	None	40	60

Learning Outcome/s

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

1. Identify the characteristics of ground behaviour.
2. Select and design appropriate method of tunnel excavation, supporting system, work organization, with safe practices.
3. Predict ground movements resulting from underground excavations.

Syllabus Outline

Introduction to Tunnelling

Rock Tunnelling

Stresses and displacements around underground excavations.
Tunnel responses and relation to ground properties and geology.
Tunnel ground responses: Rock burst, loosening, squeezing, etc.

Methods of Excavation and Support

Conventional method (drill-and-blast excavation).
Mechanized tunnelling and tunnel boring machines (TBM's).
Rock supports (initial & final supports): Steel ribs, rock bolts, and shotcrete.
Ground treatments and supports for difficult ground conditions.

Determination of Rock Loads for Tunnel Support Design

Empirical methods.
Analytical methods.
Numerical methods.

Design and Construction According to the New Austrian Tunnelling Method (NATM)

Geotechnical investigations for design and construction (with case studies).
Instrumentations: Purposes, types of measurements and interpretation.

Soft Ground Tunnelling

Cut and cover method.
Shield tunnelling.
Micro-tunnelling.

Case Studies in Tunnelling

Floor Plan of the Department

The office, laboratory, lecture theaters and other spaces allocated to the Department of Earth Resources Engineering are located in the Applied Science Building as illustrated below in Fig.1, Fig.2 and Fig.3 (not to scale).

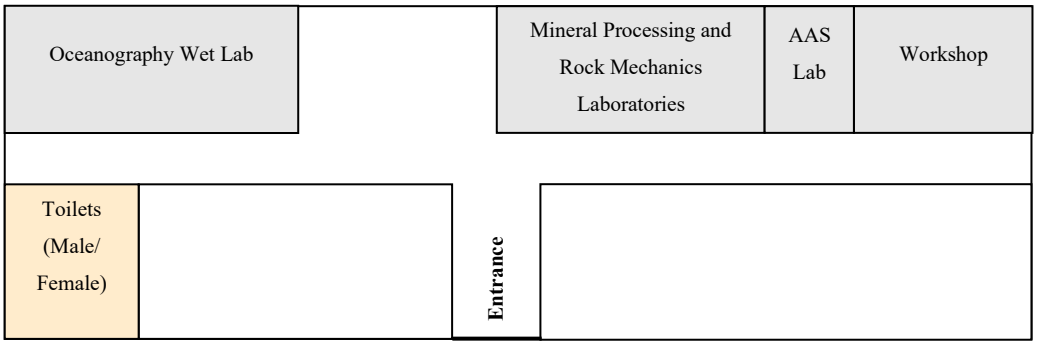

FIG.1 – GROUND FLOOR

FIG.2 – FIRST FLOOR

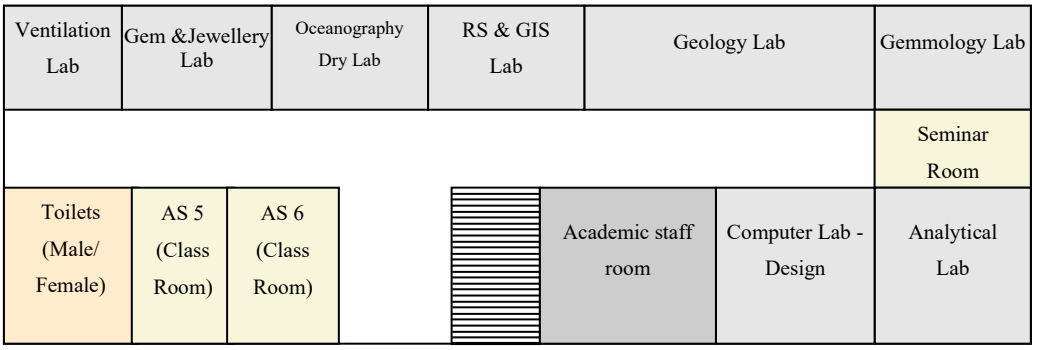

FIG.3 – SECOND FLOOR

Equipment and Facilities

The Department of Earth Resources Engineering is open for general academic works from 8.15 am to 4.15 pm. Laboratory facilities in the department are available for students during the scheduled practical sessions. Students are advised not to use any equipment without permission from the lecturer in-charge or under the guidance of the technical officer-in-charge. Laboratories are kept open during afterhours for project/design /research work with special permission from the Head of the Department and supervisors. The computer laboratory is open from 8.30 am to 9.30 pm on weekdays and from 8.30 am to 6.30 pm on Saturdays.

Laboratories and Equipment

Analytical and Geo-Environmental Engineering Laboratory

Inductively Coupled Plasma –MS, Atomic absorption spectrometer, UV-Visible spectrometer, COD apparatus, BOD apparatus, BOD incubator, Drying oven, Water quality parameter meters (Conductivity meter, pH meter, Dissolved-oxygen meter, Turbidity meter, Chlorine meter), Magnetic stirrer, Laminar Flow cabinet, Fume hood, Analytical balance and micro balance, Muffle furnace.

Computer Laboratory-Design

Twenty Five Hi-End computers with appropriate modern design software to facilitate the modeling capabilities of different subject components.

Gemmology Laboratory

Gemological microscopes (Horizontal and Vertical), Refractrometers, Polariscopes, Spectroscopes, Dichroscope, Ultra violet unit, Gas furnace for heat treatment of gemstones.

Geology Laboratory

GPR, Hydraulic earth drill, Magnetometer, Petrological microscope, Rock cutting and thing section machine, Stereoscope and field survey equipment, Rock and mineral samples on display.

Jewellery Design Laboratory

PCs equipped with, Jewel CAD software and Laser color printers.

Mineral Processing Laboratory

High tension separator, Wilfley table, Humphry spiral, Magnetic separator, Hydro cyclone, Mineral jig, Sieve shaker, Electric furnace, Electric oven, Electronic balance, Froth flotation cell, Tema mill

Mine Ventilation Laboratory

Airflow demonstration equipment with wind tunnel, Airflow testing set (MK4 apparatus), Gravimetric dust sampler, Personal air sampling pump, Open jet wind tunnel, Anemometers, Hygrometers, Kata thermometer, Aneroid barometer and mine surveying equipment, ground vibration monitoring equipment (Blastmate) is also available in the lab.

Oceanography Wet & Dry Laboratory

Sub bottom profiler, Seismograph, Reflection – refraction polarizing microscope, Particle size analyzer, Echo sounder, Grab sampler, Sieves & Sieve Shaker, Niskin bottles, Gravity corer, Gamma ray spectrometer, Tide gauge, Wave gauge, Current meters, Side scan sonar, CTD, Spectrophotometer, Navigational GPS, Research Boat & Life Jackets, Softwares-'Global Mapper, Surfer,Techlog, Petrel, Eclipse, Sonarwiz, Mat Lab'.

Rock Mechanics Laboratory

Rock crushers (Jaw crusher, Cone crusher), Triaxial testing machine, Point load tester, UCS testing machine, Ball mill, Rock coring machine, Rock cutter, Rock grinder, Lapping machine.

RS & GIS Laboratory

PCs with RS and GIS software, Scanner, Printer, Stereoscopes, Aerial and Satellite images, Topographical maps, Global Positioning Systems.

Computer Laboratory

PCs with Internet access. Provides facilities for students' project work, assignments and general internet access.

Workshop

Boxford lathe machine, Pedestal electric drilling machine, Pedestal grinder, Power saw for metal cutting, Electric arc welding plant, Gas welding plant, basic tools for wood and metal work. This is a common facility for all students of the department, especially to conduct project work.

Code of Conducts for Laboratories

- Read the SOPs/instruction manuals of instruments/devices prior to use.
- Handle equipment, specimens and chemicals with extreme care for personal and equipment safety.
- Strictly follow the instructions given when using laboratories.

Expertise Services Offered by Dept. of ERE

- Borehole logging
- Designing and planning of underground and surface mines/quarries.
- Designing and planning of drilling and blasting for road construction and civil works.
- Designing of mineral processing plants.
- Economic viability reports (EVR) for mining and mineral industry.
- Environmental assessment report for mining and quarry projects.
- Flood hazards assessment.
- Gem identification and valuation.
- Geochemical analysis.
- Geological and engineering geological mapping.
- Heat treatment of semi-precious gem stones.
- Minerals and rock analysis.
- Minerals exploration inland and offshore.
- Mine waste management and treatment.
- Resource management using RS and GIS.
- Rock/ aggregate testing and petrographic analysis.
- Site investigations for engineering geological projects.
- Geophysical investigation.
- Slope stability assessment/landslide investigation.
- Tunneling and shaft sinking.
- Water quality analysis (including sample collection for testing).

Academic Awards

Annual academic award is offered to the most outstanding grandaunt fulfilling the following criteria of the Department of Earth Resources Engineering.

- **Gold Medal donated by Geological Survey and Mines Bureau**

Awarded to the Earth Resources Engineering graduand who obtains the highest overall Grade Point Average of 3.8 or above at the B.Sc. Engineering Degree examinations.

OR

- **National Gem and Jewellery Authority Award**

Awarded to the Earth Resources Engineering graduand who obtains the highest overall Grade Point Average of 3.7 or above at the B.Sc. Engineering Degree examinations.

Special Events

Mentoring Programme

The mentoring programme at the Department of Earth Resources Engineering is conducted with the intention of improving the undergraduates with soft skills such as leadership, communication, team work, positive attitudes, etiquette, personal grooming, etc. The young graduate's employability and chances of success need to be addressed in competitive environment. The Program is conducted on two parallel lines during 6th and 7th semesters, as a series of guided activities conducted by senior professionals in industry and as a series of in-house lectures delivered by specialists on topics related to key skills developed.

Department Mentoring Coordinator: Professor NP Ratnayake

International Symposium on Earth Resources Management and Environment (ISERME)

This is the annual conference organized by the department to bring together mining engineers and related professionals to present their research findings for constructive discussion and paving the way for applications of those findings for betterment of the trade, industry and standards of public life.

In 2017, Department organized the first-ever International Symposium jointly with Hokkaido University, Japan and in future this annual symposium will be held as an international event.

Earth Resources Engineering Society (ERES)

Earth Resources Engineering Society was established in 2002, to enhance peer interaction among the students of Earth Resources Engineering. The Society organizes annual fund raising programs, which contribute to student activities such as student get together, guest lectures and community projects (Guru Gedarata Arunellak).

In the past ERES have organized 'Shramadana' campaigns as well as tutorial classes for A/L students in remote areas. The annual "Sports and Cultural Festival" is the biggest venture organized by the ERES.The ERES is also continuing to offer a financial assistance for few students in the Department of Earth Resources Engineering since 2014. The students registered in the Department are eligible to apply. ERES financial assistance program provides a monthly stipend to each successful applicant for a period of two academic semesters with the support of Mr. Chirantha Weerawardana, Mr. Sagara Kelaniya and ERE Society Fund.

As an undergraduate student of the Department of Earth Resources Engineering, you are welcome to extend fullest support and take active participation for all activities.

Annual Sports and Cultural Festival

An annual sports and cultural festival is organized by the Earth Resources Engineering Society (ERES), under the guidance of the Department of Earth Resources Engineering. The objective of this annual event is to enhance the social, cultural and religious harmony among the undergraduates, through engagement in extracurricular activities.

The sports festival consists of badminton, table tennis, volley ball, netball and cricket tournaments with a musical show and a colorful award ceremony concluding the grand event. The sports festival attracts students, academics as well as non-academic staff from all faculties of University of Moratuwa.

Postgraduate Prospects

Postgraduate Research

The research areas of interest of the department includes; quarrying and bulk material handling, drilling and blasting, environmental studies on mining activities, mineral and petroleum exploration, geological and engineering geological studies, landslide and slope stability, groundwater studies, coastal hydrodynamics and sediment dynamics, RS & GIS, geological disaster, mineral processing, heat treatment of gem stones, tunnel support economics, ventilation, mine waste treatment, etc.

The department has qualified academic staff with postgraduate qualifications. They are actively involved in research and development activities which have been well recognized locally as well as internationally. Graduate students are encouraged to join the postgraduate programs of the department to broad base the knowledge while gaining industrial experience to widen the horizons.

Postgraduate Degree Programs Offered by the Department

- MSc/Postgraduate Diploma in Mining and Mineral Exploration
- MSc/Postgraduate Diploma in RS and GIS
- MSc (by research)
- MPhil (by research)
- PhD (by research)

Other Courses Offered by the Department

- Diploma in Gemmology
- Certificate Course on Gemmology
- Certificate Course on Geology
- Short Course on Tunneling

At the beginning of each semester, the students must:

- Enroll in appropriate subjects through LearnOrg for each semester, according to the credit requirement stipulated in the ERE curriculum. The students have to check;
    - Pre-requisites.
    - Departmental GPA credit requirement of the subject stream.
    - Non-Departmental GPA credit requirement.
    - Non-GPA credit requirement.
- Verify the accuracy of initial student registration details published on the departmental notice board.
- Add/drop subjects within 2 weeks from the commencement of each semester and finalize the subject selection for a particular semester.
- Make sure to sign on final student registration list provided by the level coordinator.
- Collect previous semester result sheets from the examinations division.

During the stay at the department, students are advised to contact academic advisers, level coordinators and university student counsellors for advice regarding streams/subject selections and in any other matters that requires assistance.

Students may contact Industrial training coordinator at the department to search available training opportunities. Industrial training division will assist the students on monthly training report submission, updating training diary, regular inspections, final training report submission and oral examinations.

Details of all academic criteria and bylaws refer performance criteria for the Honors Degree of the Bachelor of the Science of Engineering in Faculty of Engineering. Details of student counsellors and procedure for submission of medical certificates by students refer the first year handbook, Faculty of Engineering.

Conduct Yourself

- **Follow, 'Student code of conduct'**
- **Refer: By-law for the conduct at the examinations (By-law No 15:2013)**

Industrial Training Placements Offering Organizations for Our Undergraduates

1. Access Engineering
2. Ananda Miners Pvt. Ltd.
3. Bogala Graphite Lanka PLC
4. Central Engineering Consultancy Bureau
5. Centre for Urban Water, Ministry of Megapolis and Western Development
6. Ceylon Petroleum Storage Terminals
7. CML Edwrads Pvt. Ltd.
8. Disaster Management Centre
9. Engineering and Laboratory Services (Pvt) Ltd
10. Foundation & Waterwells Eng.Pvt. Ltd.
11. Geo Informatics Centre - Thailand
12. Geotech Pvt. Ltd.
13. Greater Colombo Waste Water Mgt. Project
14. Geological Survey and Mines Bureau
15. Hayles Energy Pvt. Ltd.
16. Illuka Resources Pvt. Ltd. -Australia
17. Irata Holding Pvt. Ltd.
18. Irrigation Department
19. Lanka Mineral Sands Ltd.
20. Lanka Hydraulic Institute
21. MAGA Engineering Pvt. Ltd.
22. Master Divers Pvt. Ltd.
23. Metal Mix Pvt. Ltd.
24. National Gem & Jewellery Authority
25. Nawaloka Costruction Pvt Ltd.
26. National Building Research Organization
27. Petroleum Resources Development Secretariat
28. ROCELL Pvt. Ltd.
29. Sanken Construction Pvt. Ltd. | San Piling
30. Senarath Group of Companies

31. Siam City Cement [Lanka] Ltd. [Formerly HOLCIM Lanka Pvt. Ltd.]
32. Sierra Piling
33. Sri Lanka Ports Authority
34. Urban Development Authority
35. Water Board- Ratmalana

Contact

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