

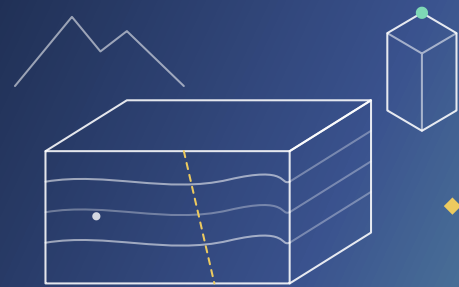
Module code

SPG-3411

Type of module

Undergraduate: Geosciences – Elective

Industrial Minerals and Sustainable Resource Management



Modular credits

4

Total student
engagement

56 hours

Prerequisite

SPG-1203 Introduction
to Geology

Anti-requisite

None

Aims

To provide a comprehensive understanding of industrial and critical minerals and their role in sustainable resource management. It covers exploration strategies, ESG considerations, circular economy principles, and responsible mining, integrating UNFC and UNRMS frameworks to promote sustainability and intergenerational equity.

Module learning outcomes (MLO)

On successful completion of this module, a student will be expected to be able to:

MLO 1

Apply and analyse how industrial minerals are located.

MLO 2

Classify industrial minerals based on their properties and applications.

MLO 3

Interpret simple data from exploration activities to understand the basic viability of mineral deposits.

MLO 4

Evaluate the environmental impact of mining industrial minerals and propose basic mitigation strategies.

MLO 5

Assess the sustainability of simple mining practices for industrial minerals.

MLO 6

Critique basic exploration strategies for their environmental implications.

MLO 7

Develop a basic plan for sustainable resource management of industrial minerals.

MLO 8

Propose simple improvements to current practices in industrial mineral extraction.

Module contents

Foundations of Industrial Minerals: Definitions and classifications, global production trends, geopolitical and economic drivers, Commodity categorisation, using USGS reports, global production trends and geological distribution, petrographic and mineralogical characterisation techniques

Deposit Types and Applications: Construction Minerals (aggregates, gypsum, dimension stone), ceramic and glass minerals (kaolin, feldspar, quartz), chemical and fertiliser minerals (phosphate, sulphur, potash), high-tech and aerospace minerals (boron, beryllium, zircon), energy transition minerals (lithium, graphite, REEs), lightweight and insulation minerals (pumice, vermiculite, perlite)

Sustainability and Resource Management: Cobweb model, supply chain vulnerabilities, green building, asbestos risks, conflict minerals, recycling challenges, quarry rehabilitation, circular economy and decarbonisation strategies, lifecycle assessment (LCA), waste valorisation, zero-waste quarry design

Governance and Policy: National mineral strategies vs. UN SDGs, artisanal vs. industrial mining regulations, deep-sea mining debates

Crisis Management and Resilience: War and pandemic-related mineral disruptions, simulation of resource allocation under crisis, strategic planning for supply chain resilience

Assessment

50% Examination
50% Coursework



■ Examination — 50% ■ Weekly practical reports — 5% ■ Class tests — 20%
■ Project report and presentation — 20% ■ Assignments and activities — 5%

Formative assessment

Weekly practicals, discussion and feedback

Summative assessment

COMPONENT	WEIGHTING
Examination	50%
Coursework	50%
Individual	25%
Weekly practical reports	5%
Class tests	20%
Group	25%
Project report and presentation	20%
Assignments and activities	5%

Graduate attributes and skills

Programme learning objectives (PLO) addressed

1

PLO 1 (Fundamental Theoretical Knowledge in Geosciences)

3

PLO 3 (Integrated Laboratory, Field, and Technical Skills)

7

PLO 7 (Independent Learning and Professional Development)

2

PLO 2 (Application of Scientific Methods and Data Analysis)

4

PLO 4 (Critical Thinking and Problem-Solving Skills)

Sustainability concept addressed

9

SDG 9 Industry, Innovation and Infrastructure

11

SDG 11 Sustainable Cities and Communities

12

SDG 12 Responsible Consumption and Production

Digital skills/software used (not limited to)

Application software (e.g. Microsoft Excel, Mineral and Rock Classification Apps, Image Analysis, ArcGIS, QGIS)

Organisational tools (e.g. Notion, Canvas)

Advanced digital tools (e.g. AI-assisted analysis tools)

Micro-credentialling option

Yes, 4 MCs

Stackable towards GenBESTARI Undergraduate Degree Programme or other relevant Lifelong Learning Programmes

Yes

Document details

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