



ENAR12006 Rock Engineering

Term 2 - 2020

Profile information current as at 18/04/2024 12:17 pm

All details in this unit profile for ENAR12006 have been officially approved by CQUniversity and represent a learning partnership between the University and you (our student). The information will not be changed unless absolutely necessary and any change will be clearly indicated by an approved correction included in the profile.

General Information

Overview

You will be introduced to critical concepts in the application of geo-technical methods to mining operations. The methods and procedures you will learn will cover rock testing, design of underground openings, and pillar and ground support design. You will gain an understanding of how underground mining methods can impact on infrastructure and aquifers through subsidence. You will also learn how to analyse the stability of slopes generated by open pit mining operations. Throughout the unit you will be required to demonstrate professional levels of teamwork and communication. You will attend a Residential School where you will engage in activities designed to assist you to achieve the Learning Outcomes for the unit.

Details

Career Level: *Undergraduate*

Unit Level: *Level 2*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

Pre-requisites or Co-requisites

There are no requisites for this unit.

Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the [Assessment Policy and Procedure \(Higher Education Coursework\)](#).

Offerings For Term 2 - 2020

- Mixed Mode

Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Residential Schools

This unit has a Compulsory Residential School for distance mode students and the details are:

Click here to see your [Residential School Timetable](#).

Website

[This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.](#)

Class and Assessment Overview

Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

Class Timetable

[Regional Campuses](#)

Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

[Metropolitan Campuses](#)

Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Written Assessment**

Weighting: 20%

2. **Written Assessment**

Weighting: 35%

3. **Written Assessment**

Weighting: 45%

4. **Practical Assessment**

Weighting: Pass/Fail

5. **Portfolio**

Weighting: Pass/Fail

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the [University's Grades and Results Policy](#) for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the [CQUniversity Policy site](#).

You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the [CQUniversity Policy site](#).

Previous Student Feedback

Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

Feedback from Conversation with student.

Feedback

Content was useful and relevant.

Recommendation

Review content to ensure it is aligned with current mining practices.

Unit Learning Outcomes

On successful completion of this unit, you will be able to:

1. Apply various methods of rock testing to determine the relevant design properties of specific rock types.
2. Design openings, pillars and ground support for given situations in underground mining.
3. Describe subsidence associated with various mining methods and identify its potential impact on infrastructure and aquifers.
4. Analyse slope instabilities for given situations in surface mining operations.
5. Demonstrate professional levels of teamwork and communication to support collaborative peer group learning.

The Learning Outcomes for this unit are linked to the Engineers Australia Stage 1 competencies.

Alignment of Learning Outcomes, Assessment and Graduate Attributes



Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes				
	1	2	3	4	5
1 - Written Assessment - 20%	•				
2 - Written Assessment - 35%		•		•	
3 - Written Assessment - 45%		•	•	•	
4 - Practical Assessment - 0%	•				•
5 - Portfolio - 0%					•

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes				
	1	2	3	4	5
1 - Communication		•	•	•	•

Graduate Attributes	Learning Outcomes				
	1	2	3	4	5
2 - Problem Solving	•	•	•	•	•
3 - Critical Thinking	•	•	•	•	•
4 - Information Literacy	•	•	•	•	•
5 - Team Work	•				•
6 - Information Technology Competence		•		•	•
7 - Cross Cultural Competence					•
8 - Ethical practice	•	•	•		•
9 - Social Innovation					
10 - Aboriginal and Torres Strait Islander Cultures					

Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes									
	1	2	3	4	5	6	7	8	9	10
1 - Written Assessment - 20%	•	•	•	•		•		•		
2 - Written Assessment - 35%	•	•	•	•		•		•		
3 - Written Assessment - 45%	•	•	•	•		•		•		
4 - Practical Assessment - 0%	•	•	•	•	•	•	•	•		
5 - Portfolio - 0%	•		•					•		

Textbooks and Resources

Textbooks

ENAR12006

Prescribed

Engineered Rock Structures in Mining and Civil Construction (2006)

Authors: R. N. Singh and A. K. Ghose

Leiden, Netherlands : Taylor & Francis, c2006.

Leiden , Netherlands

ISBN: 9780415400138 (hbk.)

Binding: Hardcover

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Spreadsheet Software
- Zoom

Referencing Style

All submissions for this unit must use the referencing style: [Harvard \(author-date\)](#)

For further information, see the Assessment Tasks.

Teaching Contacts

Brendan Donnelly Unit Coordinator

b.donnelly@cqu.edu.au

Schedule

Week 1 - 13 Jul 2020

Module/Topic	Chapter	Events and Submissions/Topic
Unit Introduction Rock characterisation for rock mechanics design	Engineered Rock Structures in Mining and Civil and Construction. Chapter 1	Tutorial - How to develop a study plan. - Review chapter 1 quiz questions.

Week 2 - 20 Jul 2020

Module/Topic	Chapter	Events and Submissions/Topic
Compressive, tensile and shear strength of rocks	Textbook chapters 2 & 3	Tutorial - Work through a selection of chapter 2 & 3 review questions.

Week 3 - 27 Jul 2020

Module/Topic	Chapter	Events and Submissions/Topic
Time-dependent behaviour and index properties of rocks	Textbook chapters 4 & 5	Tutorial - Work through a selection of chapter 4 & 5 review questions - Work through assignment and learning portfolio questions

Week 4 - 03 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
Measurement and Analysis of stresses in rock	Textbook chapter 6 & 8	Tutorial - Work through a selection of chapter 6 & 8 review questions Assignment 1 Due: Week 4 Monday (3 Aug 2020) 8:00 am AEST

Week 5 - 10 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
Geomechanics instrumentation	Textbook chapter 7	Tutorial - Work through chapter 7 examples

Vacation Week - 17 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
		Due to COVID19 restrictions. An online lab session will be run in lieu of the residential school. Practical Assessment - On-Line Mining Lab Due: Vacation Week Friday (21 Aug 2020) 8:00 pm AEST

Week 6 - 24 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
Engineering classification of rock masses	Textbook chapter 13	Tutorial - Work through chapter 13 examples

Week 7 - 31 Aug 2020

Module/Topic	Chapter	Events and Submissions/Topic
Design of structures in rock	Textbook chapter 9	Tutorial - Work through chapter 9 examples

Week 8 - 07 Sep 2020

Module/Topic	Chapter	Events and Submissions/Topic
Stability of underground openings	Textbook chapter 10	Tutorial - Work through chapter 10 examples Assignment 2 Due: Week 8 Monday (7 Sept 2020) 8:00 am AEST

Week 9 - 14 Sep 2020

Module/Topic	Chapter	Events and Submissions/Topic
Design and stability of pillars and associated structures	Textbook chapter 11 & 12	Tutorial - Work through chapter 11 & 12 examples

Week 10 - 21 Sep 2020

Module/Topic	Chapter	Events and Submissions/Topic
Mine Support, mine subsidence and application of geomechanics	Textbook chapter 14 & 15	Tutorial - Work through chapter 14 & 15 examples

Week 11 - 28 Sep 2020

Module/Topic	Chapter	Events and Submissions/Topic
Slope stability	Textbook chapter 16	Tutorial - Work through chapter 16 examples

Week 12 - 05 Oct 2020

Module/Topic	Chapter	Events and Submissions/Topic

Unit review

Tutorial

- Work through assignment and learning portfolio questions

Review/Exam Week - 12 Oct 2020

Module/Topic

Chapter

Events and Submissions/Topic

Assignment 3 Due: Review/Exam Week Monday (12 Oct 2020) 8:00 am AEST

Exam Week - 19 Oct 2020

Module/Topic

Chapter

Events and Submissions/Topic

Term Specific Information

Due to COVID 19 restrictions a Residential School will not be conducted this term. It will be replaced by an on-line lab session.

Assessment Tasks

1 Assignment 1

Assessment Type

Written Assessment

Task Description

This assessment is designed to strengthen your understanding of rock characterization and the measurement of strength for rocks. You will need to carefully review the material provided in the textbook and to answer the questions in the assignment. This assignment will cover work detailed in the first three weeks of the unit.

In order to achieve this you will need to:

- review the detailed assignment questions found in Moodle
- review relevant literature (textbooks, websites, etc) to gain a broad understanding of processes and procedures associated with sampling and testing rocks.
- research the primary literature to locate relevant current primary sources (scientific journal articles written in the last 10 years)
- complete the assignment questions in your own words making effective use of the sources of information

Your assignment should be produced in an electronic format using word processing and spreadsheet software. Submit your assignment through the assessment link on Moodle.

Note: All submissions are processed through the similarity detection software (called Turnitin). You must ensure that all of the work is your own, in line with University requirements. Correctly reference all sources of information using the CQU Harvard referencing style guide.

Assessment Due Date

Week 4 Monday (3 Aug 2020) 8:00 am AEST

Return Date to Students

Vacation Week Monday (17 Aug 2020)

Within 2 weeks of receipt of assignment.

Weighting

20%

Minimum mark or grade

40%

Assessment Criteria

Structure

Cover Page showing unit code and name, student name and number, date, assignment number, lecturer, and university. An interesting picture related to the assignment work (Cite source). Correctly formatted contents page. List of figures and tables. Include page headers and footers. State the assignment question at the beginning of each answer to give your answers context. Include a list of references at the end of the assignment.

Content

For calculation based questions ensure formulae and workings are shown in sufficient detail to clearly explain how the answer was derived. Include screenshots of spreadsheets as figures within the text of your answer, where required. Also include a spreadsheet as a separate submission. Ensure formulae are included in the spreadsheets so that different values can be entered to check the sensitivity of the answers. Formulae included in the spreadsheet need to be accessible for marking. Answers should show correct units of measurement eg. (m, MN, m², tonnes, m³, °C, etc). Where appropriate, include clearly labelled diagrams detailing such things as,

- the dimensions of equipment and excavations
- angles of slopes,
- coal thickness and overburden dimensions
- shapes of underground openings
- geometry of samples

For descriptive answers use clear, coherent sentences. Ensure photographs, pictures and diagrams are correctly labelled and introduced within the text of the answer. Use in-text citations and correctly reference all sources of information. Include at least one reference from a journal paper sourced from the CQU library (do not reference as a webpage). Use mining terminology correctly. A more detailed and specific marking criteria sheet will be available to download from within the assignment link on moodle.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

Assignments must be submitted using Moodle and Turnitin anti-plagiarism software.

Learning Outcomes Assessed

- Apply various methods of rock testing to determine the relevant design properties of specific rock types.

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Information Technology Competence
- Ethical practice

2 Assignment 2

Assessment Type

Written Assessment

Task Description

This assessment is designed to strengthen your understanding of the time dependent behaviour of rock, the measurement and analysis of stress in rock and the classification of a rock mass. You will need to carefully review the material provided in the textbook and to answer the questions in the assignment. This assignment will cover the material detailed in weeks 4 to 6 of the unit.

In order to achieve this you will need to:

- review the detailed assignment questions found in moodle
- review relevant literature (textbooks, websites, etc) to gain an understanding of the time dependent behaviour of rock, the measurement and analysis of stress and the classification of rock mass.
- research the primary literature to locate relevant current primary sources (scientific journal articles written in the last 10 years)
- complete the assignment questions in your own words making effective use of reliable sources of information

Your assignment should be produced in an electronic format using word processing and spreadsheet software. Submit your assignment through the assessment link on moodle.

Note: All submissions are processed through the similarity detection software (called Turnitin). You must ensure that all of the work is your own, in line with University requirements. Correctly reference all sources of information using the CQU Harvard referencing style guide.

Assessment Due Date

Week 8 Monday (7 Sept 2020) 8:00 am AEST

Return Date to Students

Week 10 Monday (21 Sept 2020)

Within 2 weeks of receipt of assignment.

Weighting

35%

Minimum mark or grade

40%

Assessment Criteria**Structure**

Cover Page showing unit code and name, student name and number, date, assignment number, lecturer, and university. An interesting picture related to the assignment work (Cite source). Correctly formatted contents page. List of figures and tables. Include page headers and footers. State the assignment question at the beginning of each answer to give your answers context. Include a list of references at the end of the assignment.

Content

For calculation based questions ensure formulae and workings are shown in sufficient detail to clearly explain how the answer was derived. Include screenshots of spreadsheets as figures within the text of your answer, where required. Also include a spreadsheet as a separate submission. Ensure formulae are included in the spreadsheets so that different values can be entered to check the sensitivity of the answers. Formulae included in the spreadsheet need to be accessible for marking. Answers should show correct units of measurement eg. (m, MN, m², tonnes, m³, °C, etc). Where appropriate, include clearly labelled diagrams detailing such things as,

- the dimensions of equipment and excavations
- angles of slopes,
- coal thickness and overburden dimensions
- shapes of underground openings
- geometry of samples

For descriptive answers use clear, coherent sentences. Ensure photographs, pictures and diagrams are correctly labelled and introduced within the text of the answer. Use in-text citations and correctly reference all sources of information. Include at least one reference from a journal paper sourced from the CQU library (do not reference as a webpage). Use mining terminology correctly. A more detailed and specific marking criteria sheet will be available to download from within the assignment link on moodle.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

Assignments will be submitted using Moodle and Turnitin anti-plagiarism software.

Learning Outcomes Assessed

- Design openings, pillars and ground support for given situations in underground mining.
- Analyse slope instabilities for given situations in surface mining operations.

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Information Technology Competence
- Ethical practice

3 Assignment 3

Assessment Type

Written Assessment

Task Description

This assessment is designed to deepen your knowledge of the application of ground support, monitoring and excavation design to mitigate the risk of rock mechanics related failures in a range of mining situations. You will need to carefully

review the material provided in the textbook and to answer the questions in the assignment. This assignment will cover material detailed in weeks 7 to 12 of the unit.

In order to achieve this you will need to:

- review the detailed assignment questions found in moodle
- review relevant literature (textbooks, websites, etc) to gain a deeper understanding of the risks of ground failure associated with mine excavations.
- research the primary literature to locate relevant current primary sources (scientific journal articles written in the last 10 years)
- complete the assignment questions in your own words that make effective use of the sources of information

Your assignment should be produced in an electronic format using word and excel documents. Submit your assignment through the assessment link on moodle.

Note: All submissions are processed through the similarity detection software (called Turnitin). You must ensure that all of the work is your own, in line with University requirements. Correctly reference all sources of information using the CQU Harvard referencing style guide.

Assessment Due Date

Review/Exam Week Monday (12 Oct 2020) 8:00 am AEST

Return Date to Students

Exam Week Monday (19 Oct 2020)

Within 2 weeks of receipt of assignment.

Weighting

45%

Minimum mark or grade

45%

Assessment Criteria

Structure

Cover Page showing unit code and name, student name and number, date, assignment number, lecturer, and university. An interesting picture related to the assignment work (Cite source). Correctly formatted contents page. List of figures and tables. Include page headers and footers. State the assignment question at the beginning of each answer to give your answers context. Include a list of references at the end of the assignment.

Content

For calculation based questions ensure formulae and workings are shown in sufficient detail to clearly explain how the answer was derived. Include screenshots of spreadsheets as figures within the text of your answer, where required. Also include a spreadsheet as a separate submission. Ensure formulae are included in the spreadsheets so that different values can be entered to check the sensitivity of the answers. Formulae included in the spreadsheet need to be accessible for marking. Answers should show correct units of measurement eg. (m, MN, m², tonnes, m³, °C, etc). Where appropriate, include clearly labelled diagrams detailing such things as,

- the dimensions of equipment and excavations
- angles of slopes,
- coal thickness and overburden dimensions
- shapes of underground openings
- geometry of samples

For descriptive answers use clear, coherent sentences. Ensure photographs, pictures and diagrams are correctly labelled and introduced within the text of the answer. Use in-text citations and correctly reference all sources of information. Include at least one reference from a journal paper sourced from the CQU library (do not reference as a webpage). Use mining terminology correctly. A more detailed and specific marking criteria sheet will be available to download from within the assignment link on moodle.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

Assignments will be submitted using Moodle and Turnitin anti-plagiarism software.

Learning Outcomes Assessed

- Design openings, pillars and ground support for given situations in underground mining.
- Describe subsidence associated with various mining methods and identify its potential impact on infrastructure

- and aquifers.
- Analyse slope instabilities for given situations in surface mining operations.

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Information Technology Competence
- Ethical practice

4 Practical Assessment - On-Line Mining Lab

Assessment Type

Practical Assessment

Task Description

The practical assessment will consist of an on-line laboratory session.

Part 1. Students will complete an on-line laboratory session using a point load rock testing machine. A worksheet will be forwarded to the students instructing them on suitable preparation for the laboratory session.

Part 2. Students will present their findings from their laboratory session to other students and available staff.

Alternative Part 2. Students based on mine sites will present a rock engineering related issue from their mine site.

Assessment Due Date

Vacation Week Friday (21 Aug 2020) 8:00 pm AEST

Return Date to Students

Week 7 Friday (4 Sept 2020)

Within 2 weeks of the assessment submission.

Weighting

Pass/Fail

Assessment Criteria

Students will be assessed on their ability to,

- work as part of a team
- comply with instructions from mine site or laboratory personnel
- demonstrate an understanding of rock mechanics
- participate in risk assessment discussions
- present their findings

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Learning Outcomes Assessed

- Apply various methods of rock testing to determine the relevant design properties of specific rock types.
- Demonstrate professional levels of teamwork and communication to support collaborative peer group learning.

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Team Work
- Information Technology Competence
- Cross Cultural Competence
- Ethical practice

5 Portfolio

Assessment Type

Portfolio

Task Description

The objectives of developing a learning portfolio include,

1. Provide the student with an opportunity to reflect on what they are learning.
2. Record work and reading that is not presented or assessed as part of the submitted assignments.
3. Provide students with an opportunity to discuss their learning experiences online.
4. Provide students with an opportunity to record and demonstrate evidence of all of the learning outcomes detailed for this unit, but particularly teamwork, cultural sensitivity and ethical values, as appropriate.

The learning portfolio will consist of two components,

- i) a study diary, including reflections on learning
- ii) evidence of learning outcomes.

Templates will be provided for the learning portfolio. Detailed examples explaining what is required to be recorded in each element of the learning portfolio will also be available on moodle.

Assessment Due Date

Submit updates with each of the three assignments

Return Date to Students

Within 2 weeks of assessment submission.

Weighting

Pass/Fail

Assessment Criteria

The assessment criteria for your learning portfolio will require you to make regular weekly entries in the study diary. Collect and record evidence of how the learning outcomes for this unit have been met. Write up reflections on what has been learnt from each assignment. Record interactions that seem relevant to this unit. Interactions may be with the lecturer, other students and work colleagues. Interactions may be zoom sessions, telephone conversations, emails, postings on blogs or, face to face meetings. Submit updates of the learning portfolio with each assignment submission. To achieve a Pass for this assessment requires some evidence recorded against each learning outcome.

Referencing Style

- [Harvard \(author-date\)](#)

Submission

Online

Submission Instructions

Submit the updated learning portfolio with each of the three assignments.

Learning Outcomes Assessed

- Demonstrate professional levels of teamwork and communication to support collaborative peer group learning.

Graduate Attributes

- Communication
- Critical Thinking
- Ethical practice

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the [Student Academic Integrity Policy and Procedure](#). This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?

A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?

A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?

For academic advice and guidance, the [Academic Learning Centre \(ALC\)](#) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?



Be Honest

If your assessment task is done by someone else, it would be dishonest of you to claim it as your own



Seek Help

If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)



Produce Original Work

Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem