



# ENEM13012 Maintenance Engineering

## Term 1 - 2024

Profile information current as at 19/05/2024 06:45 am

All details in this unit profile for ENEM13012 have been officially approved by CQUUniversity 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

This unit introduces you to the importance of effective maintenance management in the industry, the costs of maintenance, and the benefits of effective maintenance planning and strategies. Emphasis is placed on practical aspects of managing maintenance for plant and equipment. You are introduced to techniques and methods for monitoring the condition of plant and equipment, and to processes used to implement and manage condition monitoring. You will investigate maintenance problems and prepare plans to solve such problems. The unit delineates methods for assessing maintenance effectiveness and improving maintenance systems and provides a vehicle for developing skills for working and learning autonomously to solve problems, to document approaches used to solve problems, and to communicate professionally.

### Details

Career Level: *Undergraduate*

Unit Level: *Level 3*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

### Pre-requisites or Co-requisites

Pre-requisite: ENEG12007 Design and Project Management OR ENTA11014 OR Aircraft Structural Maintenance Practices. 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 1 - 2024

- Bundaberg
- Cairns
- Gladstone
- Mackay
- Online
- Rockhampton

### 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).

### 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: 15%

#### 2. **Written Assessment**

Weighting: 25%

#### 3. **Presentation and Written Assessment**

Weighting: 60%

### 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 Unit Evaluation data

**Feedback**

Enhance feedback on assignment.

**Recommendation**

Continue to add comments to students' submitted assignments but also explore grading sheets based on the marking rubric for students to see grade distribution/calculation.

#### Feedback from Unit Evaluation report

**Feedback**

Assignment marking in due time.

**Recommendation**

Recommend returning all assessments within two weeks of the due date or after students with extensions have submitted.

#### Feedback from Unit Evaluation report and UC reflection

**Feedback**

Source industry data for assessment items for real life skills development.

**Recommendation**

Recommended to continue sourcing individual industry projects for data collection and processing the collected data for their assessment items.

## Unit Learning Outcomes

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

1. Explain the impact of maintenance on the business of industrial organisations and the need for maintenance management
2. Describe processes for developing maintenance strategies and plans including explanations of costs and benefits of maintenance management
3. Analyse techniques and methods for monitoring the condition of plant and equipment
4. Describe processes used to implement and manage condition monitoring programs for specific applications of plant and equipment
5. Investigate and analyse maintenance problems and develop plans to solve these problems
6. Apply methods for assessing maintenance effectiveness and methods for improving maintenance systems and control of maintenance
7. Work and learn autonomously to solve problems and record and communicate clearly and professionally the approaches used to solve problems and the rationale for adopting such approaches to problems.

The Learning Outcomes for this unit are linked with the Engineers Australia Stage 1 Competency Standards for Professional Engineers in the areas of 1. Knowledge and Skill Base, 2. Engineering Application Ability and 3. Professional and Personal Attributes at the following levels:

**Introductory** 1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 1N 2N 4N 6N 7N ) 3.1 Ethical conduct and professional accountability. (LO: 1N 2N 7N )

**Intermediate** 1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. (LO: 1I 2I 3I 4I 5I 6I 7I ) 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 7I ) 1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 1I 2I 3I 4I 5I 6I 7I ) 1.6 Understanding of the scope, principles, norms, accountabilities, and bounds of sustainable engineering practice in the specific discipline. (LO: 1I 2I 3I 4I 5I 6I 7I ) 2.1 Application of established engineering methods to complex engineering problem solving. (LO: 1I 2I 3I 4I 5I 6I 7I ) 2.2 Fluent application of engineering techniques, tools, and resources. (LO: 1N 2N 3I 4I 5I 6I 7I ) 2.3 Application of systematic engineering synthesis and design processes. (LO: 1I 2I 3I 4I 5I 6I 7I ) 2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 7I ) 3.2 Effective oral and written communication in professional and lay domains. (LO: 1I 2I 4I 6I 7I ) 3.3 Creative, innovative, and pro-active demeanour. (LO: 1N 3I 4I 6I 7I ) 3.4 Professional use and management of information. (LO: 1I 3I 4I 6I 7I ) 3.5 Orderly management of self, and professional conduct. (LO: 3I 6I 7I ) 3.6 Effective team membership and team leadership. (LO: 7I )

**Advanced** 1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 1I 2A 3I 4I 5I 6A 7I )

*Note: LO refers to the Learning Outcome number(s) which link to the competency and the levels: N - Introductory, I - Intermediate and A - Advanced.*

Refer to the Engineering Undergraduate Course Moodle site for further information on the Engineers Australia's Stage 1 Competency Standard for Professional Engineers and course level mapping information <https://moodle.cqu.edu.au/course/view.php?id=1511>



## Alignment of Learning Outcomes, Assessment and Graduate Attributes



### Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Written Assessment - 15%	•	•					
2 - Written Assessment - 25%	•	•	•	•	•	•	
3 - Presentation and Written Assessment - 60%			•	•	•	•	•

### Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Communication	•	•	•	•	•	•	•
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							

## Textbooks and Resources

### Textbooks

**There are no required textbooks.**

### IT Resources

**You will need access to the following IT resources:**

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Online Study Guide Available on Unit Moodle website
- Zoom Lecture and Tutorial Sessions

## Referencing Style

All submissions for this unit must use the referencing style: [Harvard \(author-date\)](#)  
For further information, see the Assessment Tasks.

## Teaching Contacts

**Abdul Mazid** Unit Coordinator  
[a.mazid@cqu.edu.au](mailto:a.mazid@cqu.edu.au)

## Schedule

### Week 1: Introduction to maintenance - 04 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 1: Introduction to plant maintenance; Appendix 1: Terminology	Module 1: Study guide in unit Moodle website	Assessment 1 Task Part A: Project Topic Verification: prior to Friday of Week 1 Zoom lecture & Tutorial sessions

### Week 2: Maintenance Organisation Strategy - 11 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 1: Introduction to Maintenance Organisation Strategy	Module 1: Study guide (Access on Moodle Site)	Assessment 1 Task: Part A: Written verification of acceptance prior to the Monday of Week 2 from your lecturer. Zoom lecture & Tutorial sessions.

### Week 3: Theories of Management - 18 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 2: Theories of Maintenance Management	Module 2: Study guide (Access on Moodle Site)	Zoom lecture & Tutorial sessions. Check regular announcement on unit Moodle website.

### Week 4: Financial Analysis of Maintenance - 25 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 2: Financial Analysis of maintenance; Asset Life Cycle Cost Analysis	Module 2: Study guide (Access on Moodle Site)	Zoom lecture & Tutorial sessions. Check regular announcement on unit Moodle website.

### Week 5: Plant Condition Monitoring - 01 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
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Handout 1: Condition monitoring technology and Processes

Handout and lecture notes (Access on Moodle Site)

Zoom lecture & Tutorial sessions. Check regular announcement on unit Moodle website.

**Assessment Task 1 (Part B): Maintenance data collection** Due: Week 5 Friday (5 Apr 2024) 12:00 am AEST

#### Vacation Week - 08 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
VACATION		NO TEACHING THIS WEEK

#### Week 6: Method Study - 15 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 3: Method study technique in maintenance; Work measurement in maintenance	Module 3: Study guide (Access on Moodle Site)	Zoom lecture & tutorial sessions. Check regular announcement on unit Moodle website.

#### Week 7: Maintenance Activity Sampling and Queuing - 22 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 3: Maintenance activity sampling; Application of queuing theories	Module 3: Study guide (Access on Moodle Site)	Zoom lecture & tutorial sessions. Check regular announcement on unit Moodle website.

#### Week 8: Maintenance Management Technique - 29 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 4: Maintenance Management Techniques	Module 4: Study guide (Access on Moodle Site)	Zoom lecture & tutorial sessions. Check regular announcement on unit Moodle website.

#### Week 9: Plant Failure Analysis - 06 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 4: Statistical analysis of plant failure; Failure probability characteristics	Module 4: Study guide (Access on Moodle Site)	Zoom lecture & tutorial sessions. Check regular announcement on unit Moodle website.

#### Week 10: Failure Mode Analysis - 13 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
Appendix 2: Failure mode and criticality analysis (FMECA); Reliability of plant systems. Appendix 3: Weibull Analysis	Appendix 2 and 3 : Study guide (Access on Moodle Site)	Zoom lecture & tutorial sessions. Check regular announcement on unit Moodle website.  <b>Assessment Task 2: Statistical data analysis for maintenance</b> Due: Week 10 Friday (17 May 2024) 12:00 am AEST

#### Week 11: Reliability of Plant Systems - 20 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 5: Statistical process control; Pareto failure modelling	Module 5: Study guide (Access on Moodle Site)	Zoom lecture & tutorial sessions. Check regular announcement on unit Moodle website.

#### Week 12: Revision - 27 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
Revision on Module 5	Module 5: Study guide (Access on Moodle Site)	Zoom lecture & assignment 3 drop-in sessions.

#### Review/Exam Week - 03 Jun 2024

Module/Topic	Chapter	Events and Submissions/Topic
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**Exam Week - 10 Jun 2024**

Module/Topic

Chapter

Events and Submissions/Topic

## Assessment Tasks

### 1 Assessment Task 1 (Part B): Maintenance data collection

#### **Assessment Type**

Written Assessment

#### **Task Description**

Refer to the Moodle site for **complete details** of the assessment items. This is only a basic outline of the features relating to the assessment task. This assessment has two parts.

#### **Part A:**

**Project Topic Verification - Identification of an appropriate Maintenance Problem currently exists in your organisation.**

**Prior** to Friday of Week 1 you need to discuss and submit the 'Identification of Maintenance Problem: Proposal Form" to your lecturer's CQU email address and then receive **written verification** of acceptance **prior** to the Monday of Week 2 from your lecturer regarding the appropriateness and viability of your chosen organisation and the identified maintenance problem as a focus for all assessment tasks in this unit.

#### **Part B:**

Outline Organisational Description including Organisational Structure existing in the organisation and Define Maintenance Problem

The aim of Assessment 1 is to select **one** problem or opportunity within the maintenance function within your chosen organisation that could be solved using basic concepts of maintenance, management theories, maintenance principle and maintenance management techniques and principles presented in your Study Guide.

Remember your study approach should not be limited to unit Study Guide only. You are encouraged to study and investigate further beyond the unit materials.

You will need to complete and submit through the Assessment submission link in the unit Moodle website, an appropriately referenced, written investigative report, including appropriate descriptions, analysis, documentation with appropriate figures, charts and tables support relevant to your assessment task.

Study Module 1 and Module 2 in your Unit Study Guide should be supportive to complete your Assessment 1.

#### **Assessment Due Date**

Week 5 Friday (5 Apr 2024) 12:00 am AEST

Title page essential. Please submit only Microsoft Word document. No PDF file Submission will be accepted for any task.

#### **Return Date to Students**

Week 7 Friday (26 Apr 2024)



Expected return 2 weeks after submission due date.

**Weighting**

15%

**Minimum mark or grade**

50% of the weighting

**Assessment Criteria**

Refer to the Moodle site for complete details of the Assessment Criteria sheet for Assessment 1. This is only a basic outline of the features relating to the assessment task. Each submission will be assessed for presentation and layout, correct procedure, analysis and accuracy and appropriate referencing. The major assessment criteria relate to Analysis and Interpretation, Communication and Information Literacy. Please read carefully the details outlined in the Assessment 1 Assessment Criteria sheet **before** commencing the assessment item.

**As you undertake** the Assessment 1 ensure you address all assessment criteria outlined.

**Referencing Style**

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

**Submission**

Online

**Submission Instructions**

Title page is essential. Check in the Moodle for appropriate file name protocol for different files.

**Learning Outcomes Assessed**

- Explain the impact of maintenance on the business of industrial organisations and the need for maintenance management
- Describe processes for developing maintenance strategies and plans including explanations of costs and benefits of maintenance management

## 2 Assessment Task 2: Statistical data analysis for maintenance

**Assessment Type**

Written Assessment

**Task Description**

Develop an investigative report on the Maintenance Problem you have chosen as a project in your Assessment 1. This report should cover In-depth problem Analysis, conduct relevant literature review and develop solutions as strategies to solve the maintenance problem.

Refer to the Moodle site for **complete details** of the assessment item. This is only a basic outline of the features relating to the Assessment 2.

The aim of Assessment Task 2 is to discuss in detail upon your chosen maintenance problem, defined in Assessment 1, and to provide detailed insights into the technique you will adopt to address this problem. Your solution needs to focus upon using concept of maintenance, theories of management, maintenance management techniques and principles presented in Unit Study Guide available in the unit Moodle website. You need to Study Module 3, Module 4 and Module 5 in your Unit Study Guide. As you have already studied Module 1 and Module 2 to define your project for Assessment 1, it should be supportive in your report writing for this Assessment. should be supportive to complete your Assessment 1.

Remember your study approach should not be limited to unit Study Guide only. You are encouraged to study and investigate further beyond the unit materials.

You will need to complete and submit through the Assessment submission link in the unit Moodle website,

an appropriately referenced, written investigative report, including appropriate descriptions, analysis, documentation with appropriate figures, charts and tables support relevant to your assessment task.

**Assessment Due Date**

Week 10 Friday (17 May 2024) 12:00 am AEST

Title page is essential. Please submit only Microsoft Word document No PDF file Submission will be accepted for any task

**Return Date to Students**

Week 12 Friday (31 May 2024)

Assessment feedback should be available 2 weeks after submission.

**Weighting**

25%

**Minimum mark or grade**

50% of the weighting

**Assessment Criteria**

Refer to the Moodle site for complete details of the Assessment Criteria sheet for Assessment 2. This is only a basic outline of the features relating to the assessment task. Each submission will be assessed for presentation and layout, correct procedure, analysis and accuracy and appropriate referencing. The major assessment criteria relate to Analysis & Interpretation, Communication and Information Literacy. Please read carefully the details outlined in the Assessment 2 Assessment Criteria sheet **before** commencing the assessment item.

**As you undertake** the Assessment 2 ensure you address all assessment criteria outlined.

**Referencing Style**

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

**Submission**

Online

**Submission Instructions**

Check in the Moodle for appropriate file name protocol for different files. No PDF file Submission for any task

**Learning Outcomes Assessed**

- Explain the impact of maintenance on the business of industrial organisations and the need for maintenance management
- Describe processes for developing maintenance strategies and plans including explanations of costs and benefits of maintenance management
- Analyse techniques and methods for monitoring the condition of plant and equipment
- Describe processes used to implement and manage condition monitoring programs for specific applications of plant and equipment
- Investigate and analyse maintenance problems and develop plans to solve these problems
- Apply methods for assessing maintenance effectiveness and methods for improving maintenance systems and control of maintenance

### 3 Assessment Task 3: Modelling for maintenance

**Assessment Type**

Presentation and Written Assessment

**Task Description**

To complete Assessment 3 you will develop and submit two items:

- Your Video Presentation file for the project, and
- Your PowerPoint Presentation Slides

Refer to the Moodle site for **complete details** of the Assessment 3. This is only a basic outline of the

features relating to the assessment task. You must provide detailed and appropriately referenced descriptions, diagrams, discussions and analysis in order to demonstrate your knowledge and understanding of concepts and processes.

The aim of Assessment 3 is to present complete solution for your project undertaken, in a cohesive and holistic form. In investigating, analysing and finding an appropriate solution to the maintenance problem you have chosen in Assessment 1, you need to use maintenance management techniques, theories, principles and modelling extensively (e.g. Financial Analysis/Modeling, Life Cycle Management and Cost Modelling, Work Study, Queuing Theory, Statistical Failure Analysis, Reliability/RAMS Modelling FMECA, Planned Maintenance Optimisation, Pareto Analysis, Control Charts, etc.).

**Assessment Due Date**

Review/Exam Week Friday (7 June 2024) 12:00 am AEST

Please submit PowerPoint document and Presentation video.

**Return Date to Students**

Exam Week Friday (14 June 2024)

Assessment feedback and final grade will be available after unit moderation.

**Weighting**

60%

**Minimum mark or grade**

50% of the weighting

**Assessment Criteria**

Refer to the Moodle site for complete details of the Assessment Criteria sheet for Assessment 3. This is only a basic outline of the features relating to the assessment task. Each submission will be assessed for presentation and layout, correct procedure, analysis and accuracy and appropriate referencing. The major assessment criteria relate to Analysis and Interpretation, Communication and Information Literacy. Please read carefully the details outlined in the Assessment 3 Assessment Criteria sheet **before** commencing the assessment item.

**As you undertake** the Assessment 3 ensure you address all assessment criteria outlined in the assignment document. Accurate reflection of your knowledge on Statistical Failure Analysis, Reliability/RAMS Modelling FMECA, Planned Maintenance Optimisation, Pareto Analysis, Control Charts must be demonstrated.

**Referencing Style**

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

**Submission**

Online

**Submission Instructions**

Check in the Moodle for appropriate file name protocol for different files.

**Learning Outcomes Assessed**

- Analyse techniques and methods for monitoring the condition of plant and equipment
- Describe processes used to implement and manage condition monitoring programs for specific applications of plant and equipment
- Investigate and analyse maintenance problems and develop plans to solve these problems
- Apply methods for assessing maintenance effectiveness and methods for improving maintenance systems and control of maintenance
- Work and learn autonomously to solve problems and record and communicate clearly and professionally the

approaches used to solve problems and the rationale for adopting such approaches to problems.

## 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