

Preparing an assessment program for Engineering Studies

Technology Unit
Curriculum Support Directorate
Support for the NEW HSC

Preparing an assessment program – Engineering Studies

The following is a set of steps that will assist in developing an assessment program for your teaching and learning program. This process is suitable for use with the preliminary or HSC course.

Step 1: Map the course outcomes

All course outcomes are to be included in the assessment program. Teachers need to plan carefully to ensure they provide sufficient opportunities for students to achieve the outcomes and for the teacher to gather and record evidence so that they are able to provide feedback to each student about his or her achievement of the outcomes.

As part of the process of developing teaching programs and assessment programs, it is important to map the syllabus outcomes of the course against the course content.

The relationship between outcomes and content is different in each of the eight technology syllabuses.

The grids shown below map the Preliminary and HSC course outcomes of the Engineering Studies syllabus against the content.

Preliminary Outcome	Household appliances	Landscape products	Braking systems	Bio-engineering	School-based elective
P1.1		*	*	*	
P1.2	*			*	
P2.1	*	*	*		
P2.2				*	*
P3.1		*	*	*	
P3.2	*	*	*	*	
P3.3	*	*	*	*	
P4.1	*	*	*	*	
P4.2	*	*	*		
P4.3	*	*		*	
P5.1		*	*		
P5.2				*	*
P6.1				*	*
P6.2			*		

Engineering Studies Preliminary course outcomes mapped against content

HSC Outcome	Civil Structures	Personal & Public Transport	Lifting Devices	Aeronautical Engineering	Telecommunications Engineering
H1.1				*	*
H1.2	*	*	*	*	*
H2.1	*	*	*		
H2.2				*	*
H3.1	*	*	*		
H3.2	*	*	*	*	*
H3.3	*	*			
H4.1	*		*	*	*
H4.2		*	*		
H4.3	*	*	*	*	*
H5.1	*	*	*		
H5.2				*	*
H6.1	*	*			
H6.2	*	*	*	*	*

Engineering Studies HSC course outcomes mapped against content

Mapping of the outcomes and content is an important step in programming. In instances where an outcome is addressed once only in the teaching program, teachers will need to ensure they provide ample opportunity for students to work toward achieving, and demonstrating achievement of the outcome.

Where an outcome is included more than once, teachers will still need to ensure that the outcome is included at the relevant points in their teaching program. However they will have more opportunities to build student learning experiences and gather evidence for assessing student achievement of that outcome.

Step 2: Brainstorm possible tasks

For each outcome, brainstorm and research the range of appropriate tasks that could be used in Engineering Studies. This may assist you to identify which outcomes could be assessed together in one assessment task.

The table below can be used to brainstorm tasks most suited to particular outcomes.

Preliminary Outcome	Assessment tasks and strategies
P1.1 identifies the scope of engineering and recognises current innovations	
P1.2 describes the types of materials, components and processes and explains their implications for engineering development	
P2.1 explains the relationship between properties, uses and applications of materials in engineering	
P2.2 describes the nature of engineering in specific fields and its importance to society	
P3.1 uses mathematical, scientific and graphical methods to solve problems of engineering practice	
P3.2 develops written, oral and presentation skills and applies these to engineering reports	
P3.3 applies graphics as a communication tool	
P4.1 describes developments in technology and their impact on engineering products	
P4.2 describes the influence of technological change on engineering and its effect on people	
P4.3 identifies the social, environmental and cultural implications of technological change in engineering	
P5.1 demonstrates the ability to work both individually and in teams	
P5.2 applies management and planning skills related to engineering	
P6.1 applies knowledge and skills in research and problem-solving related to engineering	
P6.2 applies skills in analysis, synthesis and experimentation related to engineering	

An example of the assessment tasks suggested by one group of teachers for the preliminary course is shown below.

Preliminary Outcome	Assessment tasks and strategies
P1.1 identifies the scope of engineering and recognises current innovations	Engineering report, site visit report, interview report, research report, examination

P1.2 describes the types of materials, components and processes and explains their implications for engineering development	Engineering report, site visit report, interview report, practical applications, experimental work, class tests, examination
P2.1 explains the relationship between properties, uses and applications of materials in engineering	Engineering report, site visit report, interview report, practical applications, experimental work, class tests, examination
P2.2 describes the nature of engineering in specific fields and its importance to society	Engineering report, site visit report, interview report, practical applications, examination
P3.1 uses mathematical, scientific and graphical methods to solve problems of engineering practice	Engineering report, practical applications, experimental work, class tests, examination
P3.2 develops written, oral and presentation skills and applies these to engineering reports	Engineering reports, site visit report, interview report, research report
P3.3 applies graphics as a communication tool	Engineering report, site visit report, practical applications, class tests, examination
P4.1 describes developments in technology and their impact on engineering products	Engineering report, site visit report, interview report, examination
P4.2 describes the influence of technological change on engineering and its effect on people	Engineering report, site visit report, interview report, practical applications, examination
P4.3 identifies the social, environmental and cultural implications of technological change in engineering	Engineering report, site visit report, interview report, practical applications, class tests, examination
P5.1 demonstrates the ability to work both individually and in teams	Engineering report, site visit report, interview report, practical applications, experimental work
P5.2 applies management and planning skills related to engineering	Engineering report, practical applications, experimental work
P6.1 applies knowledge and skills in research and problem-solving related to engineering	Engineering report, site visit report, practical applications, experimental work
P6.2 applies skills in analysis, synthesis and experimentation related to engineering	Engineering report, site visit report, practical applications, experimental work

The table below can be used to brainstorm tasks most suited to particular outcomes.

HSC Outcome	Assessment tasks and strategies
H1.1 describes the scope of engineering and critically analyses current innovations	
H1.2 differentiates between properties of materials and justifies the selection of materials, components and processes in engineering	
H2.1 determines suitable properties, uses and applications of materials in engineering	
H2.2 analyses and synthesises engineering applications in specific fields and reports on the importance of these to society	

H3.1	demonstrates proficiency in the use of mathematical, scientific and graphical methods to analyse and solve problems of engineering practice	
H3.2	uses appropriate written, oral and presentation skills in the preparation of detailed engineering reports	
H3.3	develops and uses specialised techniques in the application of graphics as a communication tool	
H4.1	investigates the extent of technological change in engineering	
H4.2	applies knowledge of history and technological change to engineering- based problems	
H4.3	appreciates social, environmental and cultural implications of technological change in engineering and applies them to the analysis of specific problems	
H5.1	works individually and in teams to solve specific engineering problems and in the preparation of engineering reports	
H5.2	selects and uses appropriate management and planning skills related to engineering	
H6.1	demonstrates skills in research and problem-solving related to engineering	
H6.2	demonstrates skills in analysis, synthesis and experimentation related to engineering.	

Step 3: Review assessment requirements in Board syllabuses

Refer to *Assessment components, weightings and tasks* in section 12, *Assessment and Reporting*, of the syllabus.

Draw up a table which allows the teacher to map how each assessment task addresses the syllabus outcomes, content, and assessment components and weightings. Below are shown sample tables for each course. Steps 4-8 will assist you to complete the assessment table.

Preliminary course Syllabus components, weightings and related outcomes	Task 1:	Task 2:	Task 3:	Task 4:	Task 5:
	Module:	Module:	Module:	Module:	Module:
	Outcomes:	Outcomes:	Outcomes:	Outcomes:	Outcomes:
	Date:	Date	Date:	Date:	Date:
Scope of the profession: 10%					
Knowledge of engineering principles: 40%					
Communication skills: 20%					
Understanding the impacts of engineering: 10%					
Management and problem solving: 10%					
The application of engineering methodology: 10%					
Total: 100%					

Engineering Studies Preliminary course sample assessment table

HSC Course	Task 1:	Task 2:	Task 3:	Task 4:	Task 5:
Syllabus components, weightings and related outcomes	Module:	Module:	Module:	Module:	Module:
	Outcomes:	Outcomes:	Outcomes:	Outcomes:	Outcomes:
	Date:	Date	Date:	Date:	Date:
Scope of the profession: 20%					
Knowledge of engineering principles: 40%					
Communication skills: 10%					
Understanding the impacts of engineering: 10%					
Management and problem solving: 10%					
The application of engineering methodology: 10%					
Total: 100%					

Engineering Studies HSC course sample assessment table

In the top line of each table:

- *Task* refers to the name of the task
- *Date* refers to the scheduled date the task is due
- *Outcomes* refers to the syllabus outcomes addressed by the task and should have the number of each outcome listed
- *Content area* refers to the syllabus content area addressed by the task.

Step 4: Cluster or group the course outcomes

Engineering Studies has 14 outcomes for each of the preliminary and HSC course. If all outcomes are to be addressed in an assessment task, then most, if not all tasks will need to assess a number of outcomes. This is best achieved by clustering or grouping the outcomes.

Steps 1 and 2 assist in this process. Outcomes may be clustered together because they are best assessed by a similar type of task. For example, some outcomes lend themselves better to research and analysis tasks whilst others may be more suited to demonstrations, experimentations or other forms of practical work.

Each clustered group of outcomes will form the basis of one task.

- Is the number of tasks manageable(3-5)?
- Are all course outcomes being addressed?

Step 5: Select the task type.

Decide on the most appropriate task type to use for each cluster of outcomes.

Ask the following questions when completing this step.

- What type of task will best assess student achievement of these outcomes?
- Does the task type give your students the best chance to demonstrate achievement of the outcome?
- Is a range of task types being used across the course to allow students to demonstrate achievement of outcomes in a variety of ways?
- Do the task types fit within the overall teaching and learning program?

Step 6: Outline each of the assessment tasks

At this stage in the development of an assessment program, it is important to develop an outline of the task. The detailed task description and marking scheme do not need to be completed. In your task outline you will need to ensure that:

- a manageable number of outcomes is being assessed
- the task chosen will enable the outcomes to be assessed effectively
- the task will measure what you want it to assess
- students will have the best opportunity to demonstrate what they know and can do.

Insert the information regarding each of the tasks into an assessment grid such as that shown under step 3.

Step 7 Allocate the weighting for each task

Insert the weighting information regarding each task into the assessment program.

- Does each task weighting follow the weightings required by the syllabus and the relative importance of the task?
- Is each task weighted at between ten and forty per cent?

Add each column across and down to ensure that the total value of the task is 100% and the value of each component is appropriate.

Step 8: Schedule each task

Decide on the timing of each task. Consider:

- the school calendar of events
- the amount of teaching time needed to ensure that students have had the opportunity to achieve the outcomes before being assessed
- the capacity of all classes in the school that are undertaking the same course to be assessed with the same or equivalent tasks.

Insert the date for each task into the assessment program.

Step 9: Check that your assessment program meets all requirements

Does your internal assessment program for the HSC Engineering Studies course:

- include 3-5 tasks?
- include a range and balance of task types?
- address all course outcomes?
- focus on a manageable number of specified outcomes in each task?
- adequately reflect the practical intent of the syllabus, especially those outcomes (H3.1, H3.2, H3.3, H5.1, H5.2, H6.1, H6.2) which are not readily assessed by the external examination?
- reflect syllabus assessment components and weightings of:
 - scope of the profession – 20%?
 - knowledge of engineering principles – 40%?
 - communication skills – 10%?
 - understanding the impacts of engineering – 10%?
 - management and problem-solving – 10%?
 - the application of engineering methodology – 10%?
- weight individual tasks between 10% and 40%?
- schedule tasks so that students have ample opportunities to achieve the specified outcomes before being assessed in the task?
- schedule tasks so that later tasks carry more weight?

Step 10: Develop each assessment task and marking guidelines

When designing and fully developing each assessment task it is important to consider the following key questions.

- Does the task fit into the overall teaching and learning program?
- Does each task take place after students have had structured learning experiences to achieve the specified outcomes?
- Does it follow the weightings or components required by the syllabus?
- What outcomes will the task assess?
- Does this type of task best assess student achievement?
- Will I be able to mark the task to reflect student achievement of the outcomes assessed by the task?
- Does the wording of the task provide clear directions to students about what they are expected to do?
- Will the students understand the language?
- Is the language consistent with the Board of Studies glossary of keywords?
- Does the task allow students to show a range of achievement levels?

When developing the marking scheme it is important to consider the following questions.

- Does my marking scheme address the range of outcomes addressed in the task?
- Do the marking guidelines reflect the information provided to students about the task?
- Does my marking scheme indicate the marks to be awarded for different levels of performance?
- Is the marking scheme feasible to apply and can it be used fairly and equitably?
- Do the marking guidelines provide feedback to students about their standard of performance and indicate areas for improvement?

In reviewing how the task will be presented to students you need to consider the following.

- Have I provided students with clear information and expectations about the task?
- Do the students know what they have to do to be awarded marks?

When considering the type of feedback that will be provided to students by the task, you need to consider the following.

- Does the task provide opportunities for feedback to students which will assist them in their learning?
- In what form will feedback be provided to the students?
- Will the task provide useful feedback on the effectiveness of the teaching program?