



# Online Maths Low Stakes Quizzes

**Faculty: Engineering**

**Department: Chemical Engineering**

**Module name: Mathematics Fundamentals/Engineering Mathematics (CENG40007, CENG50007)**

**Degree: Chemical Engineering**

**Level: Undergraduate Year 1 and 2**

**Approximate number of students: 150-160 in each year group**

**Weighting and credit: 10%**

**Module ECTS: 10.0**

## Assessment overview

This is a flexible, learning focused quiz-based mathematics assessment for two maths modules in Chemical Engineering: Mathematical Fundamentals; and Engineering Mathematics. While there is a minimal amount of credit attached to the quizzes (10%) their purpose is formative, i.e. they are designed to help students learn maths concepts. Student learning is facilitated through a level of flexibility as to when to take the quiz, how long to spend on it, allowing unlimited number of attempts without any penalty and an option to work out a problem in a group.

The assessment is run 10 times throughout the academic year, covers approximately 10 questions each time and is linked to topics covered in the modules. To allow flexibility of access it is delivered online via maths aware software called WeBWork.

## Design decisions

### Rationale for the introduction of the formative assessment

In the past one of the problems that was identified by the teaching team was that students were rarely assessed. This meant that students did not learn at regular stages across the year but rather would leave solving all the problem sheets towards the end of term with summative deadlines approaching. Introducing regular assessment with some credit attached to it was thought to eliminate this problem and improve student engagement with learning.

There is a great level of flexibility embedded into the design. Firstly, the assessment can be done individually or as a group. Secondly, the assessment allows multiple attempts. Finally, there is a level of flexibility in terms of when the student takes the assessment. There is a period of time when the quiz is open and the students are welcome to take it at any time within this period and are welcome to spend as much time of the quiz as they wish. All of this is offered to put the emphasis on student learning rather than grades.

### Rationale for electronic delivery

The assessment is online to ensure that students are not disadvantaged if they cannot come onto campus and to allow more flexibility overall in terms of the time and the place they choose to take the assessment. The ease of marking, i.e. quizzes are graded automatically, also makes electronic delivery a more preferable choice.

### Question design

As the software used is maths aware and recognizes equations and equivalences the questions are designed to be short answer questions, where students 'fill-in the blanks' instead of MCQs (Multiple Choice Questions).

In order to make the questions more conducive to student learning the majority of questions are broken down into steps. This means that the

**Interviewee: Vijesh Bhute**

**Role: Teaching Fellow; Fellow of the Higher Education Academy**



students need to answer each step rather than the whole question. The questions are aligned with learning outcomes for each of the sessions and build up the knowledge and skills tested later on and aligned with the learning outcomes of the module. Most questions have an option of providing a 'hint', which is additional information that can help students who are struggling to arrive at the correct solution.

### **Rationale for the software used**

The software was chosen for several reasons. The most important one relates to it being 'Maths aware', i.e. able to read maths equations and recognise equivalences in answers. This made questions designs and input of answers easier. Secondly, the software contained a library of 37000 questions that could be reused therefore made creation of the question banks easier. Finally, the software allows the students to preview their answer before submission which means that issues with incorrect input (such as lack of a comma or brackets) that could generate a wrong answer can be prevented.

### **Fit with other assessments and the programme/module**

This assessment fits in with other assessments on the module. For example, for The Mathematics Fundamentals module the assessment strategy consists of 80% final exam, 10% spring test and 10% is the quizzes. The questions are associated with topics covered in the two modules, to ensure comprehension of concepts. The formative assessments allow students to test their understanding topic by topic which feeds into what is assessed in the final exam albeit at a higher level. The purpose of this assessment is not so much to get the students ready for the exam in terms of practising similar types of questions but rather making sure that they understand the concepts and they can apply them in different contexts.

### **Practicalities**

#### **Assessment organisation and arrangements around delivery**

The questions are randomized and personalised for each student but a level of collaboration is encouraged, not to just put the answer in but rather to

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collaborate on the methodology. Weighting attached to each question is relatively small so if a student wants to, they can skip a problematic question and move on to the next. Assessments are spread out throughout the term so when a topic ends students are given a deadline to complete the quizzes.

If a student is struggling and would appreciate some support, the software has an option of a 'hint' and 'email the teacher button' which notifies the tutor that the student would appreciate help.

### **Preparing students for assessment**

The idea of the formative is introduced at the start of the modules so the students are aware that they will be given quizzes after each of the topics commences.

Once a quiz is made available there is an introduction set that the students need to go through and only then the other sets will open. This allows them to practice.

### **Marking arrangements**

The software can automatically grade the students' responses and output a mark. While there is some credit attached to the assessment it is unconventional because it accepts multiple attempts that students are not penalised for. The assessment allows students to go through the trial and error process with an emphasis on student learning, meaning they can try and fail and learn from those failures in a relatively safe environment that is unlikely to majorly affect their final grade.

### **Feedback arrangements**

Students receive feedback in terms of an answer being correct or incorrect and marks attached to the correct answer, to enable them to get a sense of what went well and what didn't go as well during the assessment. If an answer is correct this is where the feedback ends. If an answer is incorrect there are several other feedback strategies utilised. For students who are really struggling, personalised feedback from the tutor can be provided. Finally, there are detailed step-by-step solutions provided after the deadline, so that students can see where they went wrong and what to improve in the future. Students tend to only access solutions for questions which they got incorrect.