

Autumn Examinations 2017/2018

Module Title: Mathematics for Technology

Module Code: MATH6023

School: School of Building and Civil Engineering
School of Mechanical and Process Engineering

Programme Title: Bachelor of Science (Honours) in Construction Management - Year 1
Bachelor of Science (Honours) in Quantity Surveying - Year 1
Bachelor of Science in Construction - Year 1
Bachelor of Science in Architectural Technology – Year 1
Bachelor of Science in Interior Architecture – Year 1
Bachelor of Science (Honours) in Architectural Technology – Year 1
Bachelor of Science (Honours) in Interior Architecture – Year 1

Programme Code: CCNMG_8_Y1
CQTSU_8_Y1
CCONS_7_Y1
TARCH_7_Y1
DIARC_7_Y1
CARCT_8_Y1
DINAR_8_Y1

External Examiner: Dr. J. Cruickshank

Internal Examiners: Ms. K. Bullen, Mr. D. O’Shea.

Instructions: Answer **question 1** from **Section A** and any **three questions** from **Section B**.

Duration: 2 Hours

Sitting: Autumn 2018

Requirements for this examination: Mathematics Tables and Graph Paper.

Note to Candidates: Please check the **Programme Title** and the **Module Title** to ensure that you have received the correct examination. **If in doubt please contact an Invigilator.**

You must show your workings to get full marks

Section A
(Compulsory)

1. During a busy week in June, the employees of a construction company were required to do some overtime. The table below shows the number of overtime hours worked.

Number of overtime hours	Number of Employees
4	4
5	6
6	5
7	3
8	2

- (i) What was the median number of hours worked, justify your answer.
- (ii) What was the modal (mode) number of hours worked, justify your answer.
- (iii) Calculate the mean number of overtime hours worked.
- (iv) Calculate the standard deviation from the mean.
- (v) Represent the number of overtime hours worked on a pie chart.

(25 marks)

Section B

(Answer any three questions from this section)

2. (a) The perimeter of a rectangle is 80 metres. The length of the rectangle is 4.8 metres longer than the width.
- (i) Calculate the length and width of the rectangle
 - (ii) Calculate the area of this plot.
 - (iii) Calculate the length of the diagonal of the rectangle. (7 marks)

(b) Solve for x in each of the following equations:

(i) $9^{x+3} = \frac{1}{3^{3-5x}}$

(ii) $2x^2 + x - 15 = 0$ (10 marks)

- (c) The total price of five bags of cement is the same as the total price of eight bags of tile adhesive. The total price of six bags of cement and seven bags of tile adhesive is €697.20. Calculate the price of a bag of cement and the price of a bag of tile adhesive. (8 marks)

3. (a) From a point x metres away from a perpendicular building, a surveyor measured the angle of elevation of the top of the building to be 40° . When he moved 50 metres further away from the building the angle of elevation was then 25° .
- Represent this information on a diagram.
 - Calculate the height of the building.
 - How far away from the building was the surveyor at the start.
(i.e. find the value of x)
- (11 marks)

- (b) Given the formula:

$$A = \frac{20}{X} + \frac{800}{Y}$$

- Make X the subject of this formula.
 - Find the value of A when $X = 4 \times 10^{-3}$ and $Y = 2.5 \times 10^2$. (9 marks)
- (c) An item costs €55.35 including 23% VAT. By how much would the price of this decrease if the VAT rate changed to 13.5%? (5 marks)

4. (a) Draw a graph of the function, $f(x) = 4x^2 - 4x - 15$ for $-2 \leq x \leq 3$

Use the graph to solve:

- $4x^2 - 4x - 15 = 0$
 - $f(x) = -10$ (13 marks)
- (b) The table below gives values of G and H which are related by the law

$G = aH + b$, where a and b are constants.

G	47	38	23	14	8
H	15	30	55	70	80

- Verify the law exists by drawing an appropriate graph.
- Find approximate values for a and b .
- State the law.
- Use your graph, or otherwise, to find the value of H when $G = 30$.

(12 marks)

5. (a) A triangular field has sides of 87 metres, 59 metres and 42 metres.
- (i) Calculate the area of this field, correct to two decimal places.
 - (ii) Calculate the size of the smallest angle in the field, correct to one decimal place. (11 marks)
- (b) An empty cylindrical storage tank has a capacity of 942.5 litres and a perpendicular height of 1.2 metres.
- (i) Find the cost to fill three quarters of the tank with fuel costing 45.2 cent per litre.
 - (ii) Determine the volume of the tank, in cubic metres, correct to four decimal places.
 - (iii) Calculate the radius of the tank, correct to one decimal place.
 - (iv) Calculate the total surface area of the tank, correct to two decimal places (14 marks)

Statistical Formulae

Mean (\bar{x})

$$\bar{x} = \frac{\sum fx}{\sum f}$$

Standard deviation (σ)

$$\sigma = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}} \quad \text{or} \quad \sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$