

STUDENT NUMBER  Letter

## SYSTEMS ENGINEERING

### Written examination

Tuesday 14 November 2023

Reading time: 9.00 am to 9.15 am (15 minutes)

Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

### QUESTION AND ANSWER BOOK

#### Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	20	20	20
B	14	14	80
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

#### Materials supplied

- Question and answer book of 29 pages
- Detachable insert of miscellaneous formulas in the centrefold
- Answer sheet for multiple-choice questions

#### Instructions

- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.
- All written responses must be in English.

#### At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.
- You may keep the detached insert.

**Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.**

**SECTION A – Multiple-choice questions****Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

**SECTION B****Instructions for Section B**

Answer **all** questions in the spaces provided.

All calculations must show appropriate formulas and working.

Where an answer box is provided, write your final answer in the box.

If an answer box has a unit printed in it, give your answer in that unit.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

**SAMPLE**  
Number of questions and mark allocations  
may vary from the information indicated.

# **SYSTEMS ENGINEERING**

## **Written examination**

### **FORMULA SHEET**

#### **Instructions**

Please remove from the centre of this book during reading time.

This formula sheet is provided for your reference.

## Systems Engineering formulas

### Mechanical

$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} \times 100\%$	$\text{efficiency}_{\text{total}} = \text{efficiency}_1 \times \text{efficiency}_2$
$F = ma$	force due to gravity = mass $\times$ acceleration due to gravity
$P = \frac{W}{t}$	work done = $\frac{\text{force in direction moved}}{\text{direction moved}} \times \text{distance}$
torque = twisting force $\times$ perpendicular distance to pivot point	moment = force $\times$ perpendicular distance to pivot point
$F_1d_1 = F_2d_2$	$P = \frac{F}{A}$
speed = $\frac{\text{distance}}{\text{time}}$	mechanical advantage = $\frac{\text{load}}{\text{effort}}$
gear ratio final = gear ratio 1 $\times$ gear ratio 2	gear or pulley ratio = $\frac{\text{speed of driver (rpm)}}{\text{speed of driven (rpm)}}$
$\frac{\text{Gear A rpm}}{\text{Gear B rpm}} = \frac{\text{Gear B number of teeth}}{\text{Gear A number of teeth}}$	$\frac{\text{Pulley A rpm}}{\text{Pulley B rpm}} = \frac{\text{diameter of Pulley B}}{\text{diameter of Pulley A}}$
velocity ratio = $\frac{\text{distance moved by effort}}{\text{distance moved by load}}$	

### Electrical

electrical energy efficiency $= \frac{\text{useful energy output}}{\text{total energy input}} \times 100\%$	$I = \frac{V}{R}$		
$P = VI$	$P = \frac{E}{t}$		
$f = \frac{1}{T}$	$V_x = \frac{R_x}{R_{\text{total}}} \times V_{\text{supply}}$		
$\frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}$	$V_{\text{peak}} = \sqrt{2}V_{\text{RMS}}$		
resistors in series	$R_t = R_1 + R_2 + R_3 + \dots$	resistors in parallel	$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$
two resistors in parallel	$R_t = \frac{R_1 \times R_2}{R_1 + R_2}$	capacitors in series	$\frac{1}{C_t} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots$
capacitors in parallel	$C_t = C_1 + C_2 + C_3 + \dots$		

**General**

area of circle = $\pi r^2$ ( $\pi = 3.14$ )
circumference of circle = $2\pi r$

**Resistor colour codes**

Colour	Value	Colour	Value	Colour	Tolerance
black	0	green	5	brown	1%
brown	1	blue	6	red	2%
red	2	violet	7	gold	5%
orange	3	grey	8	silver	10%
yellow	4	white	9		



VCE SYSTEMS ENGINEERING  
Written Examination  
ANSWER SHEET – 2023

STUDENT NAME:

JOHN STUDENT

STUDENT NUMBER

9	9	1	2	3	4	5	6	A
0	0	0	0	0	0	0	0	
1	1		1	1	1	1	1	E
2	2	2		2	2	2	2	F
3	3	3	3		3	3	3	G
4	4	4	4	4		4	4	J
5	5	5	5	5	5		5	L
6	6	6	6	6	6	6		R
7	7	7	7	7	7	7	7	T
8	8	8	8	8	8	8	8	W
		9	9	9	9	9	9	X

INSTRUCTIONS:



SIGN HERE IF YOUR NAME AND NUMBER ARE PRINTED CORRECTLY.

SIGNATURE: *J. Student*

If your name or number on this sheet is incorrect, notify the Supervisor.  
Use a **PENCIL** for **ALL** entries. For each question, shade the box which indicates your answer.  
All answers must be completed like **THIS** example: 

A		C	D	E
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Marks will **NOT** be deducted for incorrect answers.  
**NO MARK** will be given if more than **ONE** answer is completed for any question.  
If you make a mistake, **ERASE** the incorrect answer – **DO NOT** cross it out.

SUPERVISOR USE ONLY



Shade the **"ABSENT"** box if the student was absent from the examination.

**ABSENT**

SUPERVISOR'S INITIALS

ONE ANSWER PER LINE					ONE ANSWER PER LINE				
1	A	B	C	D	11	A	B	C	D
2	A	B	C	D	12	A	B	C	D
3	A	B	C	D	13	A	B	C	D
4	A	B	C	D	14	A	B	C	D
5	A	B	C	D	15	A	B	C	D
6	A	B	C	D	16	A	B	C	D
7	A	B	C	D	17	A	B	C	D
8	A	B	C	D	18	A	B	C	D
9	A	B	C	D	19	A	B	C	D
10	A	B	C	D	20	A	B	C	D