



INTERNAL ASSESSMENT APPROVAL FORM (INCLUDING COLLABORATIVE PROVISION)

This form is used to ensure that assessment specifications have been through an internal review process prior to external examination/approval and release to students. It should be completed for each assessment for a particular module. The assessment tasks, criteria and marking scheme should accompany this form.

PARTNER (and taught location if relevant):	Coleg Sirgar			
EXTERNAL EXAMINER NAME:	TO BE CONFIRMED			
ASSESSMENT AUTHOR:	AINLEY THOMAS			
MODULE TITLE:	MECHANICAL ENGINEERING & MATHEMATICS 2			
MODULE CODE:	SGDM 5013	MODULE LEVEL:	5	
COMPONENT NO. (e.g. 1 of 2):	1	COMPONENT WEIGHTING (e.g. 50% of the module):	50%	
ASSESSMENT PERIOD	☒ Semester 1	☐ Semester 1 Re-sit	☐ Semester 2	☐ Semester 2 Re-sit
TYPE OF ASSESSMENT:	☐ Coursework		☒ Examination	
LANGUAGE OF ASSESSMENT:	ENGLISH		TRANSLATION REQUIRED (Y/N):	N
FOR EXAMINATIONS ONLY. SPECIFY BELOW ANY ADDITIONAL MATERIAL(S) TO BE USED IN THE EXAMINATION				
This box will expand as you type				

INTERNAL MODERATOR PLEASE TICK TO INDICATE THAT THE ASSESSMENT INCLUDES:		Please ✓		Comments
		YES	NO	
1	Tasks that are specified clearly, accurately and comprehensibly, with appropriate use of language and neat presentation	✓		
2	Tasks which enable the module learning outcomes to be demonstrated (as per the module syllabus)	✓		
3	Tasks which conform to the assessment described in the module syllabus	✓		
4	Tasks which are written at the appropriate level of the Framework for Higher Education Qualifications (see http://www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf?sfvrsn=170af781_14).	✓		
5	Clear criteria for assessment and guidance about how marking/grading will be applied	✓		MARKING EVIDENT
6	Guidance about expected evidence for submission, e.g. essay or report, word count, bibliography and references			N/A
7	Reference to good academic conduct, for example referencing, plagiarism and Turnitin			N/A
8	Actions to complete NONE This box will expand as you type			
SIGNATURE OF APPROVAL:		SIGNATURE		DATE
INTERNAL MODERATOR: I confirm that this version of the assessment specification is ready		C. J. ✓		2-10-19

to be sent to the Partnership Team Leader		
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ONLY TO BE COMPLETED IF THE ASSESSMENT IS LINKED TO A COLLABORATIVE PARTNER

PARTNERSHIP TEAM LEADER PLEASE TICK TO INDICATE THAT THE ASSESSMENT INCLUDES:		Please ✓		Comments
		YES	NO	
1	Tasks that are specified clearly, accurately and comprehensibly, with appropriate use of language and neat presentation			
2	Tasks which enable the module learning outcomes to be demonstrated (as per the module syllabus)			
3	Tasks which conform to the assessment described in the module syllabus			
4	Tasks which are written at the appropriate level of the Framework for Higher Education Qualifications (see http://www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf?sfvrsn=170af781_14).			
5	Clear criteria for assessment and guidance about how marking/grading will be applied			
6	Guidance about expected evidence for submission, e.g. essay or report, word count, bibliography and references			
7	Reference to good academic conduct, for example referencing, plagiarism and Turnitin			
8	Actions to complete <i>This box will expand as you type</i>			
SIGNATURE OF APPROVAL:		SIGNATURE		DATE
PTL: I confirm that this version of the assessment specification is ready to be sent to the External Examiner				

UWTSD PROVISION: please submit the completed document to the appropriate Programme Director.

COLLABORATIVE PROVISION: please submit the completed document (or make available electronically) to the Partnership Team Leader. This must be in accord with specific arrangements for sharing electronic documents (e.g. via SharePoint or similar).

The assessment tasks, criteria and marking scheme should accompany this form

THIS DOCUMENT IS ALSO AVAILABLE IN WELSH



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

LOCATION: Coleg Sir Gar

LLEOLIAD: Coleg Sir Gar

LEVEL 5

LEFEL 5

EXAMINATION PERIOD
NOVEMBER 2019

CYFNOD ARHOLIADAU
TACHWEDD 2019

MODULE CODE: SGDM5013
Mechanical Engineering Mathematics 2

Exam 1

TIME: 1 HOUR

ANSWER THREE QUESTIONS

Equipment or materials required – Calculators are permitted.

Adnoddau neu ddefnyddiau sydd eu hangen - Caniateir cyfrifiannellau.

- 1 Use Gaussian Elimination to solve:

$$\begin{bmatrix} 1 & 1 & 2 \\ 1 & 0 & 3 \\ 2 & 5 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 11 \\ 9 \\ 30 \end{bmatrix}$$

Show a calculation to confirm your answers

[20 marks]

- 2 (a) Obtain the determinant

$$\begin{vmatrix} 2 & 3 & -1 \\ 3 & 1 & 2 \\ 1 & 2 & -5 \end{vmatrix}$$

- (b) Now use Cramer's rule to find z given:

$$\begin{bmatrix} 2 & 3 & -1 \\ 3 & 1 & 2 \\ 1 & 2 & -5 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 13 \\ -11 \end{bmatrix}$$

[20 marks]

- 3 **First Order Differential Equations**

Solve:

(a) $\frac{dy}{dx} = 2x + 4$, given $y(1) = 4$

(b) $\frac{ds}{dt} + 3s = 6$, given $y(0) = 3$, giving your answer in terms of s

[20 marks]

- 4 **Second Order Differential Equations**

Solve:

$$4\frac{d^2y}{dx^2} + 20\frac{dy}{dx} + 125y = 0, \text{ given when } x = 0, y = 3 \text{ and } \frac{dy}{dx} = 2.5$$

[20 marks]

Test 1 Solutions/Mark Scheme (2019-20)

				Qu total
1.	$\begin{bmatrix} 1 & 1 & 2 \\ 1 & 0 & 3 \\ 2 & 5 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 11 \\ 9 \\ 30 \end{bmatrix}$ $R_2 - R_1 \text{ and } R_3 - (2 \times R_1)$ $\begin{bmatrix} 1 & 1 & 2 & 11 \\ 0 & -1 & 1 & -2 \\ 0 & 3 & -2 & 8 \end{bmatrix}$ $R_3 + (3 \times R_2)$ $\begin{bmatrix} 1 & 1 & 2 & 11 \\ 0 & -1 & 1 & -2 \\ 0 & 0 & 1 & 2 \end{bmatrix}$ from R_3, $z = 2$ " R_2, $-y + 2 = -2$ $y = 4$ " R_1, $x + 4 + 2(2) = 11$ $x = 3$ confirmation calc	2		
		6		
		2		
		4		
		4		
		2		20
2a	cofactor of 2 = -9 " of 3 = 17 " of -1 = 5 $\therefore \text{Det} = (-9 \times 2) + (17 \times 3) + (5 \times (-1))$ $= -18 + 51 - 5 = 28$	6		
		2		
b)	$\begin{vmatrix} 2 & 3 & 4 \\ 3 & 1 & 13 \\ 1 & 2 & -11 \end{vmatrix}$ 28 cofactor of 2 = -37 " of 3 = 46 " of 4 = 5 $\therefore \text{Det} = (-37 \times 2) + (46 \times 3) + (5 \times 4)$ $= -74 + 138 + 20$ $= 84$	2		
		6		
		2		
	$\therefore Z = \frac{84}{28} = 3$	2		20

Test 1 Solutions/Mark Scheme (2019-20)

				Qu total
3	a) $\frac{dy}{dx} = 2x + 4$ $y(1) = 4$ $y = \int (2x + 4) dx$ $y = \frac{2x^2}{2} + 4x + C$ $y = x^2 + 4x + C$ G. S. $4 = 1^2 + 4(1) + C$ $C = -1$ $\therefore y = x^2 + 4x - 1$	4		
		2		
		2	8	
	b) $\frac{ds}{dt} + 3s = 6$ $y(0) = 3$ $I.F. = \int 3 dt = 3t = e^{3t}$ $S e^{3t} = \int e^{3t} \cdot 6 dt$ $= 2e^{3t} + C$ G. S. $3e^0 = 2e^0 + C$ $3 = 2 + C$ $C = 1$ $\therefore S e^{3t} = 2e^{3t} + 1$ $\therefore$ or $S = 2 + e^{-3t}$	3		
		1		
		3		
		2		
		1		
		2	12	20

Test 1 Solutions/Mark Scheme (2019-20)

				Qu total
4	$4 \frac{d^2 y}{dx^2} + 20 \frac{dy}{dx} + 125y = 0$ $4k^2 + 20k + 125 = 0$ $k = \frac{-20 \pm \sqrt{20^2 - 4(4)(125)}}{2(4)}$ $= \frac{-20 \pm \sqrt{-1600}}{8}$ $= -2.5 \pm j5$ When $x=0$, $y=3$ $y = e^{-2.5x} (A \cos 5x + B \sin 5x)$ $3 = e^0 (A \cos 0 + B \sin 0)$ $A = 3$ $\frac{dy}{dx} = e^{-2.5x} (-5A \sin 5x + 5B \cos 5x)$ $-2.5e^{-2.5x} (A \cos 5x + B \sin 5x)$ When $x=0$, $\frac{dy}{dx} = 2.5$ $2.5 = e^0 (-5A \sin 0 + 5B \cos 0)$ $-2.5e^0 (A \cos 0 + B \sin 0)$ $2.5 = 5B - 2.5A$ Since $A=3$ $2.5 = 5B - 7.5$ $B = \frac{10}{5} = 2$ $\therefore y = e^{-2.5x} (3 \cos 5x + 2 \sin 5x)$	4 3 2 4 2 3 2		20



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LOCATION: Coleg Sir Gar

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LEVEL 5

LEFEL 5

**EXAMINATION PERIOD
FEBRUARY 2020**

**CYFNOD ARHOLIADAU
CHWEFROR 2019**

**MODULE CODE: SGDM5013
Mechanical Engineering Mathematics 2**

Exam 1 (RESIT)

TIME: 1 HOUR

ANSWER THREE QUESTIONS

Equipment or materials required – Calculators are permitted.

Adnoddau neu ddefnyddiau sydd eu hangen - Caniateir cyfrifiannellau.

- 1 (a) Obtain the determinant

$$\begin{vmatrix} 2 & 1 & -5 \\ 1 & -1 & 1 \\ 4 & 2 & -3 \end{vmatrix}$$

- (b) Now use Cramer's rule to find z given:

$$\begin{bmatrix} 2 & 1 & -5 \\ 1 & -1 & 1 \\ 4 & 2 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -11 \\ 6 \\ -8 \end{bmatrix}$$

[20 marks]

- 2 Use Gaussian Elimination to solve:

$$\begin{bmatrix} 1 & -4 & -2 \\ 2 & 1 & 2 \\ 3 & 2 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 21 \\ 3 \\ -2 \end{bmatrix}$$

Confirm your answers by calculation

[20 marks]

- 3 **First Order Differential Equations**

Solve:

- (a) $\frac{dy}{dx} + 2y = 5e^{-2x}$, given $x(0) = 3$, giving your answer in terms of y
(b) $\frac{dy}{dx} = 2x + 3$, given $y(1) = 6$

[20 marks]

- 4 **Second Order Differential Equations**

Solve:

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 5y = 0, \text{ given when } x = 0, y = 0 \text{ and } \frac{dy}{dx} = 1$$

[20 marks]

Test 1 Solutions/Mark Scheme (2019-20)

			Qu total
1(a)	$\begin{array}{l} 2, \text{ minor} = 1 \quad \text{cofactor} = 1 \\ 1, \quad \quad \quad = -7 \quad \quad \quad = 7 \\ -5, \quad \quad \quad = 6 \quad \quad \quad = 6 \end{array}$ $\therefore \det = (2 \times 1) + (1 \times 7) + ((-5) \times 6)$ $= -21$	6	
(b)	$Z = \begin{vmatrix} 2 & 1 & -11 \\ 1 & -1 & 6 \\ 4 & 2 & -8 \end{vmatrix}$ $= -21$	2	
	$\begin{array}{l} 2, \text{ minor} = -4, \text{ cofactor} = 4 \\ 1, \quad \quad \quad = -32 \quad \quad \quad = 32 \\ -11, \quad \quad \quad = 6 \quad \quad \quad = 6 \end{array}$ $\therefore \det = (2 \times (-4)) + (1 \times 32) + ((-11) \times 6)$ $= -42$	6	
	$\therefore Z = \frac{-42}{-21} = 2$	2	20.

Test 1 Solutions/Mark Scheme (2019-20)

							Qu total
2	$\begin{bmatrix} 1 & -4 & -2 \\ 2 & 1 & 2 \\ 3 & 2 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 21 \\ 3 \\ -2 \end{bmatrix}$						
	$R2 - 2R1 \text{ and } R3 - 3R1$				2		
	$\begin{bmatrix} 1 & -4 & -2 & 21 \\ 0 & 9 & 6 & -39 \\ 0 & 14 & 5 & -65 \end{bmatrix}$				6		
	$9 \times R3 - 14 R2$				2		
	$\begin{bmatrix} 1 & -4 & -2 & 21 \\ 0 & 9 & 6 & -39 \\ 0 & 0 & -39 & -39 \end{bmatrix}$				4		
	$R2 \div 9 \text{ and } R3 \div (-39)$						
	$\begin{bmatrix} 1 & -4 & -2 & 21 \\ 0 & 1 & 2/3 & -13/3 \\ 0 & 1 & 1 & 1 \end{bmatrix}$						
	From $R3$, $z = 1$						
	" $R2$, $y + 2/3(1) = -13/3$						
	" $y = -5$						
	" $R1$, $x - 4(-5) - 2(1) = 21$				4		
	$x = 3$				2		
	confirm calc						20

Test 1 Solutions/Mark Scheme (2019-20)

				Qu total
30.)	$\frac{dy}{dx} + 2y = 5e^{-2x}, \quad x(0) = 3.$ $\int 2 dx = 2x \quad \therefore \text{IF} = e^{2x}$ $ye^{2x} = \int 5e^{-2x} \cdot e^{2x} dx$ $ye^{2x} = \int 5 dx$ $ye^{2x} = 5x + C \quad \text{G.S}$ $3e^0 = 5(0) + C$ $C = 3$ $\therefore ye^{2x} = 5x + 3$ $y = e^{-2x}(5x + 3)$	3 1 3 2 1 2	12	
b	$\frac{dy}{dx} = 2x + 3, \quad y(1) = 6.$ $y = \int (2x + 3) dx$ $y = \frac{2x^2}{2} + 3x + C \quad \text{G.S.}$ $6 = 1^2 + 3(1) + C$ $C = 2$ $\therefore y = x^2 + 3x + 2.$	4 2 2	8	20

Test 1 Solutions/Mark Scheme (2019-20)

				Qu total
4	$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 5y = 0 \quad \text{when } x=0, y=0$ $\frac{dy}{dx} = 1$ $m^2 - 2m + 5 = 0$ $m = \frac{2 \pm \sqrt{(-2)^2 - 4(1)(5)}}{2(1)}$ $= \frac{2 \pm \sqrt{4 - 20}}{2}$ $= \frac{2 \pm \sqrt{-16}}{2}$ $= 1 \pm j2$ $\therefore y = e^x (A \cos 2x + B \sin 2x)$ $0 = e^0 (A \cos 0 + B \sin 0)$ $A = 0$ $\frac{dy}{dx} = e^x (-2A \sin 2x + 2B \cos 2x) + e^x (A \cos 2x + B \sin 2x)$ $1 = e^0 (-2A \sin 0 + 2B \cos 0)$ $+ e^0 (A \cos 0 + B \sin 0)$ $1 = 2B + A$ Since $A = 0$ $1 = 2B$ $B = 0.5$ $\therefore y = e^x (0.5 \sin 2x)$	4 3 2 4 2 3 2		20