

Complete, fold and seal
(see note 2 below)

SURNAME: Davies

FORENAME(S): Jed Lloyd.

Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

1	Student Number	1708151
2	Title of Examination Paper	Further Engineering Mathematics
3	Module Code	SGEE5001
4	Date and Time of Examination	21/05/19 09:30-12:00
5	Examination Venue	Coleg Sir Gor G43
6	Seat Number	
7	Number of Answer Books handed in	1 / 1

(Gweler yr ochr arall am y fersiwn Cymraeg)

[illegible]

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

Llyfr Atebion Arholiadau

Cyfarwyddiadau i Ymgeiswyr

12 Tudalen

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, plynwch e' a' seilio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgriften ddarlennadwy. Gall yr Arholwyr naill ai anwybyddu sgrïp annarllennadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwgo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllt/wr/gwylwyr.
8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchriadu.

(See the other side for English version)

7	Nifer y Llyfrau Atebion a gyflwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Archoliad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyrwr	

Rhestrwch rfa'u'r cwestiynau a ymgelisiwyd gennyh	
At Ddibenion y Swyddfa	

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:

a)

x	f	fx	$f(x-\bar{x})^2$
6	7	42	46.96
7	21	147	53.1
8	25	200	8.7
9	19	171	3.19
10	14	140	27.83
11	9	99	52.27
12	5	60	58.14
63	100	859 ✓	250.2

$$\bar{x} = \frac{\sum fx}{\sum f} = \frac{859}{100} = 8.59 \quad \checkmark$$

$$\sigma = \sqrt{\frac{\sum f(x-\bar{x})^2}{\sum f}} = \sqrt{\frac{250.2}{100}} = \sqrt{2.502} = 1.58 \quad \checkmark$$

b).

i).

$$\binom{n}{k} p^k q^{n-k}$$

Where,

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

$$n=3 \quad k=1 \quad p=0.6 \quad q=0.4.$$

$$\binom{3}{1} = \frac{3!}{1!(3-1)!} = \frac{3!}{1!2!} = 3.$$

$$P(1 \text{ out of } 3) = 3 \times 0.6^1 \times 0.4^2$$

$$= \underline{0.72}.$$

ii).

$$n=4 \quad k=3 \quad p=0.6 \quad q=0.4$$

$$\binom{4}{3} = \frac{4!}{3!1!} = 4.$$

$$P(3 \text{ out of } 4) = 4 \times 0.6^3 \times 0.4$$

$$= 0.3456$$

$$n=4 \quad k=4 \quad p=0.6 \quad q=0.4.$$

$$\binom{4}{4} = \frac{4!}{4! \times 0!} = 1$$

$$P(4 \text{ out of } 4) = 1 \times 0.6^4 \times 0.4^0$$

$$= 0.1296.$$

$$P(\text{At least } 3) = 0.3456 + 0.1296$$

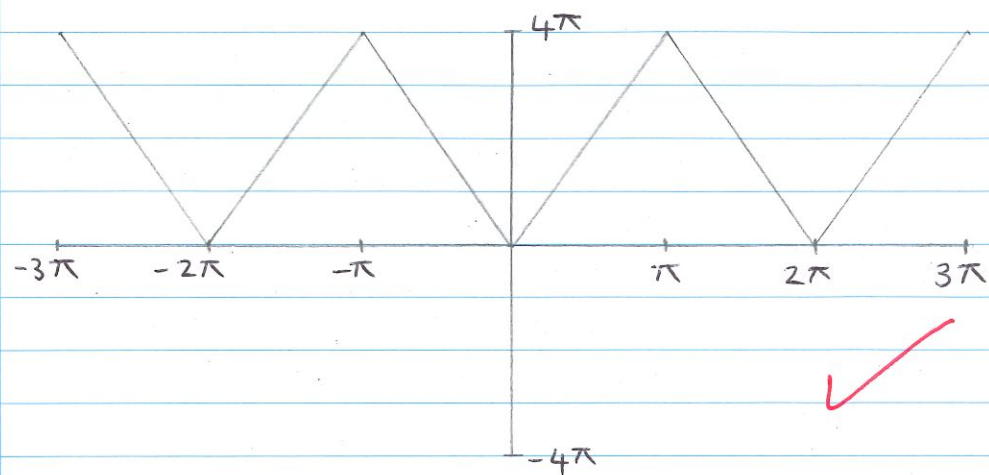
$$= \underline{0.4752}.$$

17

$$\frac{24}{25}$$

Section B

4.



Even Function. ✓

Therefore, $b_n = 0$. ✓

$$a_0 = \frac{2}{\pi} \int_0^{\pi} f(x) dx$$

$$a_n = \frac{2}{\pi} \int_0^{\pi} f(x) \cos nx dx$$

$$a_0 = \frac{2}{\pi} \int_0^{\pi} 4x dx = \frac{2}{\pi} \left[\frac{4x^2}{2} \right]_0^{\pi}$$

$$= \frac{2}{\pi} \left[\frac{4(\pi)^2}{2} \right] - 0$$

$$= 4\pi. \quad \checkmark$$

$$a_n = \frac{2}{\pi} \int_0^{\pi} 4x \cos nx dx.$$

$$\int 4x \cos nx dx \text{ by parts.}$$

$$\int u \frac{dv}{dx} dx = uv - \int v \frac{du}{dx} dx.$$

Let,

$$u = 4x$$

$$\frac{du}{dx} = 4$$

$$\frac{dv}{dx} = \cos nx$$

$$v = \frac{1}{n} \sin nx \quad \checkmark$$

$$\int 4x \cos nx dx = (4x) \left(\frac{1}{n} \sin nx \right) - \int \left(\frac{1}{n} \sin nx \right) (4) dx \quad \checkmark$$

$$= \frac{4x}{n} \sin nx - \int \frac{4}{n} \sin nx$$

$$= \frac{4x}{n} \sin nx + \frac{4}{n^2} \cos nx. \quad \checkmark$$

$$a_n = \frac{2}{\pi} \left[\frac{4x}{n} \sin nx + \frac{4}{n^2} \cos nx \right]_0^{\pi} \quad \checkmark$$

$$= \frac{2}{\pi} \left[\frac{(4\pi)}{n} \sin(n\pi) + \frac{4}{n^2} \cos n\pi \right] +$$

$$\frac{2}{\pi} \left[\frac{(4 \cdot 0)}{n} \sin(n \cdot 0) + \frac{4}{n^2} \cos n \cdot 0 \right] \quad \checkmark$$

$$= \frac{2}{\pi} \left[\frac{4}{n^2} \cos n\pi \right] + \frac{2}{\pi} \left[\frac{4}{n^2} \cos n \cdot 0 \right]$$

$$= \frac{8}{\pi n^2} \cos n\pi + \frac{8}{\pi n^2} \cos n \cdot 0$$

$$a_n = \frac{8}{\pi n^2} \cos n\pi \quad \times$$

$$n=1 \quad \frac{8}{\pi(1)^2} \cos(\pi) = \frac{-8}{\pi(1)^2}$$

$$n=2 \quad \frac{8}{\pi(2)^2} \cos(2\pi) = \frac{8}{\pi(2)^2}$$

$$n=3 \quad \frac{8}{\pi(3)^2} \cos(3\pi) = \frac{-8}{\pi(3)^2}$$

$$f(x) = \frac{1}{2} a_0 + \sum_{n=1}^{\infty} (a_n \cos nx + b_n \sin nx)$$

$$= \frac{1}{2} (4\pi) \left[\frac{8}{\pi(1)^2} \cos x - \frac{8}{\pi(3)^2} \cos 3x - \frac{8}{\pi(5)^2} \cos 5x - \frac{8}{\pi(7)^2} \cos 7x \dots \right]$$

$$\frac{22}{25}$$

2.

$$y'' + 3y' + 2y = e^t$$

$$y=0 \\ y'=1$$

$$(s^2 \bar{y} - sy_0 - y_1) + 3(s\bar{y} - y_0) + 2\bar{y} = \frac{1}{s-1}$$

$$s^2 \bar{y} - 0 - 1 + 3s\bar{y} - 3 + 2\bar{y} = \frac{1}{s-1}$$

$$s^2 \bar{y} + 3s\bar{y} + 2\bar{y} = \frac{2}{s-1} \quad (-1)$$

$$\bar{y}(s^2 + 3s + 2) = \frac{2}{s-1}$$

$$\bar{y}(s+1)(s+2) = \frac{2}{s-1}$$

$$\bar{y} = \frac{2}{(s-1)(s+1)(s+2)} \quad \checkmark$$

$$\frac{2}{(s-1)(s+1)(s+2)} = \frac{A}{s-1} + \frac{B}{s+1} + \frac{C}{s+2} \quad \checkmark$$

$$2 = A(s+1)(s+2) + B(s+2)(s-1) + C(s-1)(s+1) \quad \checkmark \quad 13.$$

$$\text{Put } s=1.$$

$$2 = A(1+1)(1+2) + B(0) + C(0)$$

$$2 = 3A$$

$$A = \frac{2}{3} = 0.67 \quad \checkmark$$

Put $s = -1$.

$$2 = A(0) + B(-1+2) + C(0)$$

$$2 = B$$

Put $s = -2$.

$$2 = A(0) + B(0) + C(-2-1)(-2+1)$$

$$2 = -3C \cdot X$$

$$C = \frac{2}{-3} = -0.67. \quad X$$

$$\bar{y} = \mathcal{L}^{-1} \left\{ \frac{A}{(s-1)} + \frac{B}{(s+1)} + \frac{C}{(s+2)} \right\}$$

$$= \mathcal{L}^{-1} \left\{ \frac{0.67}{(s-1)} + \frac{2}{(s+1)} - \frac{0.67}{(s+2)} \right\}$$

$$= 0.67e^t + 2e^{-t} - 0.67e^{-2t}$$

Eck

2

2

$$\frac{18}{25}$$

3.

$$I(0) = 0 \quad I'(0) = 10.$$

$$R = 60 \quad L = 2 \quad C = 0.02$$

$$E = RI + L \frac{dI}{dt} + \frac{1}{C} \int I dt.$$

$$\frac{dE}{dt} = R \frac{dI}{dt} + L \frac{d^2 I}{dt^2} + \frac{1}{C} I.$$

Where $\frac{dE}{dt} = 0$,

$$2 \frac{d^2 I}{dt^2} + 60 \frac{dI}{dt} + 50 I = 0.$$

($\div 2$).

$$\frac{d^2 I}{dt^2} + 30 \frac{dI}{dt} + 25 I = 0.$$

$$am^2 + bm + c = 0.$$

$$m^2 + 30m + 25 = 0.$$

$$m = \frac{-30 \pm \sqrt{30^2 - 4(1)(25)}}{2(1)}$$

$$= \frac{-30 \pm \sqrt{900 - 100}}{2}$$

$$= \frac{-30 \pm \sqrt{800}}{2}$$

$$m_1 = -0.858 \quad m_2 = -29.142$$

Real and Different.

$$y = Ae^{m_1 x} + Be^{m_2 x}$$

$$I = Ae^{-0.858t} + Be^{-29.142t}$$

Where

$$I(0) = 0.$$

$$0 = Ae^0 + Be^0$$

$$0 = A + B$$

$$I'(0) = 10.$$

$$10 = -0.858Ae^{-0.858t} - 29.142Be^{-29.142t}$$

0

1.

$$R=20 \quad C=0.05 \quad E=20e^{-3t} \quad I(0)=0$$

$$E(t) = RI + \frac{1}{C} \int I dt$$

2

1

$$\frac{14}{25}$$