



Prifysgol Cymru
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Trinity Saint David

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.

Complete, fold and seal
(see note 2 below)

SURNAME: Smith

FORENAME(S): Joshua

1	Student Number	SMITH6836261
2	Title of Examination Paper	Electrical Principles Theory
3	Module Code	GOEE5001
4	Date and Time of Examination	15/05/25 13:30
5	Examination Venue	68860
6	Seat Number	D2
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	
2	
3	
4	
Q2	21
Q2	6
Q3	0
Q4	4
Total	31/100

(Gweler yr ochr arall am y fersiwn Cymraeg)

42
31% ✓

1 a)

$$ZL = S \times Z(s) = 2s^2 + \frac{1000s}{s^2} + 6s$$

? 0Q121/30Q1a0/5

b)

$$i) \{3e^{3t} \cos(2t) + t^2 + 0.7s\}$$

$$= \frac{3(s+3)}{(s+3)^2 + 2^2} + \frac{2}{s^3} + \frac{0.7s}{s}$$

$$= \frac{3}{s+3} + \frac{2}{s^3} + \frac{0.7s}{s}$$

Q1b9/10

$$ii) 2\{\sin(4t)e^t + 5e^{-3t}\}$$

$$= \frac{4}{(s+1)^2 + 4^2} + \frac{5}{s+3}$$

$$iii) 2\{e^{2t}(3-t^2) + \frac{3\pi}{2}\}$$

$$= 3e^{2t} - e^{2t}t^2 + \frac{3\pi}{2} \quad 3\pi/2 = 4.71$$

$$= \frac{3}{s-2} - \frac{2}{(s-2)^3} + \frac{4.71}{s}$$

$$iv) t \cosh(2t) + e^{-2t}$$

$$= \frac{s^2 - 2^2}{(s^2 + a^2)^2} + \frac{1}{s+a}$$

$$v) [e^{-4t}t^3 - 3e^t \sin(e^2t)]$$

$$= \frac{3e^2}{(s+4)^4} - \frac{3e^2}{(s-1)^2 + e^4}$$

c)

voltage $80e^{-10t}$ $R = 4\Omega$ $L = 0.5$

$$L \frac{di}{dt} + Ri = 80e^{-10t} u(t)$$

$$0.5 \frac{di}{dt} + 4i = 80e^{-10t}$$

$$0.5sI(s) + 4I(s) = \frac{80}{s+10}$$

$$I(s)(0.5s + 4) = \frac{80}{s+10}$$

$$I(s) = \frac{80}{(0.5s + 4)(s + 10)}$$

$$= \frac{160}{(s + 8)(s + 10)}$$

$$160 = \frac{A_1}{s+8} + \frac{A_2}{s+10}$$

$$160 = A_1(s+10) + A_2(s+8)$$

$$s = -10$$

$$160 = A_1(-10+8) + A_2(-10+10)$$

$$= A_1(18) + A_2(0)$$

error carried forward

$$160 = A_1(18)$$

$$A_1 = 8.88$$

E.C.F

Q1C

12/15

$$s = -8$$

$$160 = A_1(-8+8) + A_2(-8-10)$$

$$160 = A_2(-18) \quad \text{E.C.F.} \quad \underline{\underline{1}}$$

$$A_2 = -8.88 \quad \text{X} \quad \text{E.C.F.}$$

$$I_s = \frac{8.88}{s+8} + \frac{-8.88}{s+8} \quad \text{E.C.F.}$$

$$I(t) = 8.88e^{8t} - 8.88e^{8t} \quad \text{X}$$

$\uparrow$
 E.C.F.

2

a)

Q26/30

$$i) \text{ sketch } \frac{1}{s} + \frac{3}{s^2 + 0.2^2} + \frac{4}{s^2 + 0.3^2} + \frac{\pi}{2s}$$

$$x(t) = 2 + 3\cos(0.2t) + \cos(0.25t + \frac{\pi}{2}) + 4\cos(0.3t - \pi)$$

$$X(s) = \frac{2}{s} + \frac{3(s)}{s^2 + 0.2^2} + \frac{s}{s^2 + 0.25 + \frac{\pi}{2}} + \frac{4(s)}{s^2 + 0.3 - \frac{\pi}{5}}$$

Q2a0/5

$$ii) x(t) = 1 + 10\cos(2\pi(60)t + \frac{\pi}{8}) + 2\cos(2\pi(300)t + \frac{\pi}{4})$$

$$X(s) = \frac{1}{s} + \frac{10(s)}{s^2 + 3600\pi} + \frac{\pi}{8} + \frac{2(s)}{s^2 + 3600\pi} + \frac{\pi}{4}$$

b)

$$a_0 = \frac{1}{\pi} \int_{-\pi}^{\pi} f(x) dx \checkmark$$

Q2b

$$= \frac{1}{2\pi} \int_{-\pi}^{\pi} 1 dx \quad \times \text{ incorrect intervals used}$$

6/25

$$= \frac{1}{2\pi} (\pi - \pi)$$

integration method
not been shown
0

$$= 0$$

$$a_n = \frac{1}{\pi} \int_{-\pi}^{\pi} f(x) \cos nx dx \checkmark$$

$$= \frac{1}{\pi} \int_{-\pi}^{\pi} 1 \cos nx dx$$

incorrect intervals
used. integration
method correct.

$$= \frac{1}{\pi} \left[\frac{\sin nx}{n} \right]_{-\pi}^{\pi}$$

$$\frac{1}{\pi n} [\sin x]_{-\pi}^{\pi} \quad \text{E.C.F.}$$

$$\frac{1}{\pi} [\sin \pi + \sin -\pi] = 0$$

$$a_n = 0$$

incorrect intervals used, integration method correct. Partial marks given for some Fourier understanding

$$b_n = \frac{1}{\pi} \int_{-\pi}^{\pi} f(x) \sin nx \, dx$$

$$= \frac{1}{\pi} \int_{-\pi}^{\pi} 1 \sin nx \, dx + ?$$

$$= \frac{1}{\pi} \left[-\frac{\cos nx}{n} \right]_{-\pi}^{\pi}$$

$$= \frac{1}{n\pi} [\cos x]_{-\pi}^{\pi} \quad \text{E.C.F.}$$

$$= \frac{1}{n\pi} [-\cos \pi + \cos -\pi] \quad \text{E.C.F.}$$

if n is even $b_n = 0$ if n is odd

$$b_n = \frac{3}{n\pi} \quad \text{E.C.F.}$$

$$f(x) = \frac{a_0}{2} + a_1 \cos x + a_2 \cos 2x + a_3 \cos 3x \dots$$

$$+ b_1 \sin x + b_2 \sin 2x + b_3 \sin 3x \dots$$

Sub. the values of a_0, a_n and b_n

3

a)

$$I_{Th} = \frac{-j6}{(4+8+j6)} \times 10$$

$$= \frac{-j6}{12-j6} \times 10$$

$$= \frac{-j6 \times 10}{144 - j^2 36}$$

$$= \frac{-j60 + 36}{144 + 36}$$

$$= \frac{-j60 + 36}{180}$$

$$V_{Th} = \frac{-j6}{8+4-j6} = \frac{-j6}{12-j6} = \frac{-j6}{j6} \times 10 = -j10$$

$$Z_{Th} = \frac{(4+8)j6}{(4+8)-j6} = \frac{j6}{j6} + j5 = j6$$

Q30/20Q3a0/10Q3b0/3Q3c0/7

a)

$$R_a = (10 + j6)(2 + j4) + (8 + j4)(12 + j4) + (12 + j8)(10 + j6)$$

Q44/20

$$80 + j24 + 96 + j32 + 120 + j48$$

$$\frac{296 + j104}{10 + j6}$$

Correct method
error carried forwardQ4a4/10

$$\frac{2960 + j1664 + j1040 + j^2 624}{100 - j60 + j60 + j^2 36}$$

$$\frac{2336 + j2664}{64}$$

$$\frac{2336 + j2664}{64}$$

$$= 36.5 + j41.625$$

$$= 54.71049.56$$

$$R_b = \frac{296 + j104}{8 + j4} \times \frac{8 - j4}{8 - j4}$$

$$= \frac{2368 + j1184 + j832 + j^2 416}{64 - j32 + j32 - j^2 16}$$

$$= \frac{1952 + j2016}{48}$$

$$= \frac{1952}{48} + j\frac{2016}{48} = 40.67 + j42$$

$$= 58.46 \angle 45.92$$

$$R_c = \frac{296 + j104}{12 + j8} \times \frac{12 - j8}{12 - j8} \quad \text{E.C.F.} \quad \frac{1}{2}$$

$$= \frac{3552 + j2368 + j1248 + 832}{(144) + 1?}$$

Q4b0/10