

12 Pages

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.**

SURNAME: SHANNON

FORENAME(S): ANDREW, JOHN

1	Student Number	SHA09098546
2	Title of Examination Paper	Electronic Principles Theory
3	Module Code	M280003
4	Date and Time of Examination	4 th May 9:30
5	Examination Venue	68860
6	Seat Number	6
7	Number of Answer Books handed in	

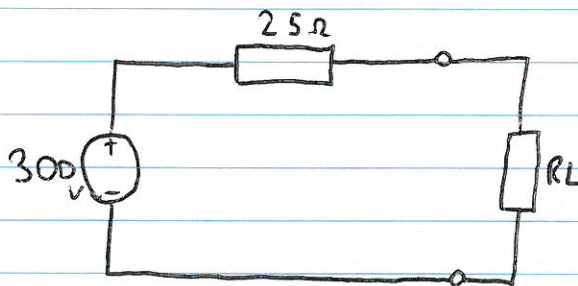
List the numbers of the questions you have attempted	Office Use
Q ₁	10
Q ₂	22
Q ₃	5
Q ₄	5
Office Use	42%

1a) ~~VTH~~

$$R_{TH} = \frac{30 \times 150}{30 + 150}$$

$$\frac{4500}{180} = 25 \Omega$$

$$V_{TH} = \frac{\cancel{360}}{\cancel{180}} \quad \frac{360 \times 150}{150 + 30} = \frac{54000}{180} = 300V \quad \checkmark$$

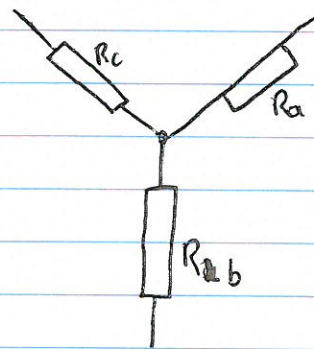
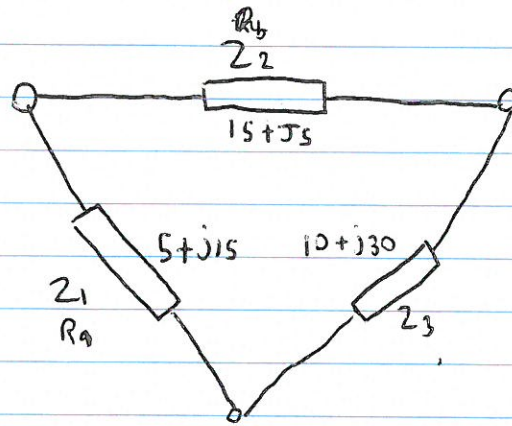

 $R_L = 25 \Omega$ for max power $\checkmark$

$$ii) \quad \frac{300}{2} = 150 \quad \frac{V^2}{R} = P$$

$$\frac{150^2}{25} = 900W \quad \checkmark$$

10

 $\checkmark$



$$R_a = \frac{R_1 \times R_2 + R_2 R_3 + R_3 R_1}{R_1} \quad +$$

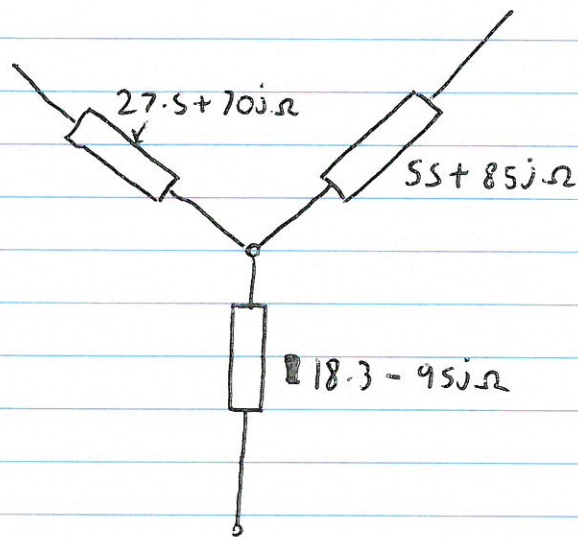
$$\frac{(5 + j15)(15 + j5) + (15 + j5)(10 + j30) + (5 + j15)(10 + j30)}{5 + j15} \quad \begin{matrix} \text{D} \\ \checkmark \end{matrix}$$

$$(75 + j20) + (150 + j35) + (50 + j45) \quad +$$

$$\frac{275 + 100j}{5 + j15} = 55 + 85j$$

$$R_b = \frac{275 + 100j}{15 - j5} = 18.3 - 95j$$

$$R_c = \frac{275 + 100j}{10 + j30} = 27.5 + 70j$$



8

29

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

$$a_0 = \frac{1}{2\pi} \int_{-\pi}^{\pi} f(x) dx$$

$$a_0 = \frac{1}{2\pi} \int_0^{\pi} 1 dx + \frac{1}{2\pi} \int_{-\pi}^0 0 dx$$

$$a_0 = \frac{1}{2\pi} 1x + 0$$

$$a_0 = \frac{1}{2\pi} [\pi - 0]$$

$$a_0 = \frac{1}{2}$$

✓

8

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

✓

$$a_n = \frac{1}{\pi} \int_0^{\pi} 1 \cos nx dx + \frac{1}{\pi} \int_{-\pi}^0 0 \cos nx dx$$

$$a_n = \frac{1}{\pi} \sin nx + 0$$

$$a_n = \cancel{\frac{1}{\pi}} \cancel{\frac{1}{\pi}} \quad \frac{1}{\pi} \sin[\pi - 0]$$

$$a_n = 0$$

8

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

$$b_n = \frac{1}{\pi} \int_0^{\pi} 1 \sin nx \, dx + \frac{1}{\pi} \int_{-\pi}^0 0 \sin nx \, dx$$

$$b_n = \frac{1}{\pi} [-\cos nx]_0^{\pi} + 0$$

$$b_n = \frac{1}{\pi} (-\cos[\pi - 0])$$

$$b_n = -0.31$$

6.

$$f(x) = \frac{1}{2} + \sum_{n=1}^{\infty} [0.017 \cos nx + 0.31 \sin nx]$$

3)

a)

$$i) e^{4t} + 5 = \frac{1}{s-4} + \frac{5}{s} \quad \checkmark$$

2 ✓

$$ii) \cos(2t) + 7\sin(2t) = \frac{1}{s^2+2^2} + 7 \frac{2}{s^2+2^2} \quad \checkmark$$

2 ✓

$$iii) (t^2 + 4t + 2)e^{3t}$$

$$e^{3t}t^2 + e^{3t}4t + e^{3t}2 \quad \checkmark$$

$$\frac{1}{s-3} \cdot \frac{2}{s^3} + \frac{1}{s-3} \cdot \frac{4}{s} + \frac{1}{s-3} \cdot \frac{2}{s} \quad \times$$

0 ✓

$$iv) 6e^{5t}\cos(2t) - e^{7t}$$

$$\frac{(2)}{(s+5)^2+2^2} - \frac{1}{s+7} \quad \checkmark$$

1 ✓

$$v) V(t) = 5e^{-2t}\sin(4t)$$

$$\mathcal{L}^{-1}(V(s)) = 5 \frac{1}{s-2} \frac{4}{s^2+4^2} \quad +$$

b) $s \frac{dx}{dt} + 3x = 4$

$$s sX(s) + \frac{3x}{s} = \frac{4}{s}$$

~~Ans~~ $s sX(s) = \frac{4}{s} - \frac{3x}{s}$ X

0

4a)

$$V = 100\text{V}$$

$$Z_1 = 10 + j0\Omega \quad \text{Polar form}$$

$$Z_2 = 5 + j0\Omega$$

$$Z_3 = 0 + j10\Omega$$

~~$$X_L = 2\pi f$$~~
$$V = IR$$

~~$$Z_T =$$~~
$$Z_T = \left(\frac{Z_2 \times Z_3}{Z_2 + Z_3} \right) + Z_1 \quad \checkmark$$

$$\left(\frac{5 + j0 \times 0 + j10}{5 + j0 + 0 + j10} \right) + 10 + j0\Omega \quad \checkmark$$

~~$$0 + j10$$~~
$$\frac{0 + j10}{5 + j10} \Omega \quad \checkmark$$

$$(0) + 10 + j0\Omega \quad \checkmark$$

$$V = 100\text{V}$$

$$I = \frac{100}{(10 + j0)\Omega} \quad \checkmark$$

ERROR CARRIED

Z_1

Polar

Rec

$$\text{Current for } Z_1 = \frac{100}{10+j0} = 10+j0 \text{ A} = 10 \angle 0^\circ \text{ A}$$

$$\text{Current for } Z_2 = \frac{100}{5+j0} = 20+j0 \text{ A} = 20 \angle 0^\circ \text{ A}$$

$$\text{Current for } Z_3 = \frac{100}{0+j10} = 0+j10 \text{ A} = 0 \angle 1.57 \text{ rad}$$

$$Z_1 \text{ polar form} = 10+j0 = \text{Rec form} = 10 \angle 0^\circ$$

$$Z_2 \text{ } 5+j0 \text{ polar form} = \text{Rec form} = 5 \angle 0^\circ$$

$$Z_3 \text{ } 0+j10 \text{ polar form} = \text{Rec form} = 0 \angle 1.57$$

$$V = IR$$

$$R_T = 1.57 \text{ } \times$$