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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	
2	Title of Examination Paper	ELECTRICAL AND ELECTRONIC PRINCIPLES
3	Module Code	SGEE 4000
4	Date and Time of Examination	23/5/22 09:30 - 11:30
5	Examination Venue	COLLEGE STR CAR GRAIG GYM
6	Seat Number	3
7	Number of Answer Books handed in	

Complete, fold and seal
(see note 2 below)

SURNAME: COX

FORENAME(S): OLIVER

List the numbers of the questions you have attempted	Office Use
1	2
2	8
4	1
Total	11

281

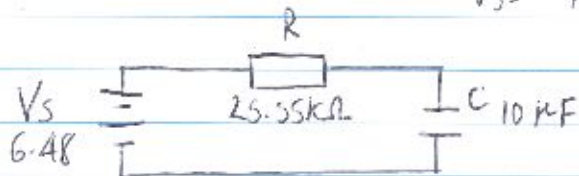
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AGREED.

$$V_s = 12V \quad R_1 = 47k\Omega \quad R_2 = 56k\Omega \quad C_1 = 10\mu F$$

$$1. (a) \frac{R_1 \times R_2}{R_1 + R_2} = \frac{47 \times 10^3 \times 56 \times 10^3}{47 \times 10^3 + 56 \times 10^3} = 25553.398 \Omega \text{ or } 25.55k\Omega$$

$$\frac{R_2}{R_1 + R_2} = 0.54$$

$$V_s = 12 \times 0.54 = 6.48$$



2

$$b) (i) \text{ Time constant} = 5 \times T = \frac{5 \times 6.48}{2.7} = 32.4$$

$$(ii) \frac{12}{2.7} = 4.44s$$

c) i)

$$V_c = V_s (1 - e^{-t/RC})$$

$$3 = 6.48 (1 - e^{-t/RC})$$

$$-6.48 = (1 - e^{-t/RC})$$

$$-7.48 = -e^{-t/RC}$$

$$\ln(7.48) = -t/RC$$

$$-2.01 = -t/RC$$

$$t = -2.01(RC)$$

$$t = 0.51s$$

$$(ii) V_c = V_s (e^{-t/RC})$$

$$3 = 6.48 (e^{-t/RC})$$

$$-6.48 = e^{-t/RC}$$

$$\ln(6.48) = -t/RC$$

$$-1.87 = -t/RC$$

$$t = -1.87 \times (RC)$$

$$= 0.48$$

2

2

$$a) Z_T = \left[\frac{Z_1 Z_2}{Z_1 + Z_2} \right] + Z_3 \quad Z_1 = 3 - j4, Z_2 = 6 + j7, Z_3 = 2.5 - j6.5$$

$$Z_1 Z_2 = (3 - j4)(6 + j7) = 18 + j21 - j24 - j^2 28 = 18 - j3 - (-1)(28) \\ = 18 - j3 - 28 = -10 - j3$$

$$Z_1 + Z_2 = (3 - j4) + (6 + j7) = 9 + j10 - j10$$

$$a) Z_1 Z_2 = (3 - j4)(6 + j7) = 18 + j21 - j24 - j^2 28 \\ = 18 - j3 - (-1)28 \\ = 46 - j3$$

$$Z_1 + Z_2 = 3 - j4 + 6 + j7 = 9 + j3$$

$$\frac{Z_1 Z_2}{Z_1 + Z_2} = \frac{46 - j3}{9 + j3} \times \frac{9 - j3}{9 - j3} = \frac{414 - j138 - j27 + j^2 9}{90}$$

$$= \frac{414 - j165 + (-1)9}{9} = \frac{405 - j165}{9} = 45 - j18.3$$

almost!

$$45 - j18.3 + 2.5 - j6.5 = 47.5 - j11.8$$

methodok.

8

8

8

2 b). $V = 200\text{V}$ 60Hz $L = 0.4\text{H}$ $R = 40\Omega$

(i) Impedance, $X_L = 2\pi fL$
 $= 2\pi \times 60 \times 0.4$
 $= 150.80\Omega$



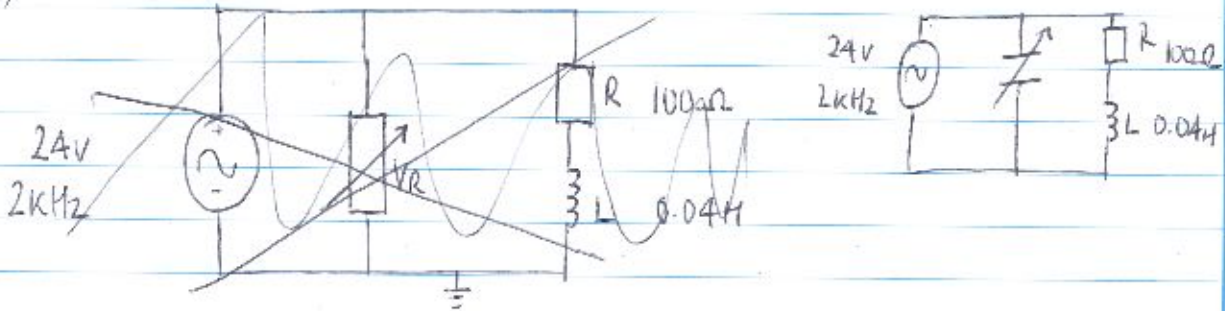
$Z?$

(ii) $I = \frac{V}{R} = \frac{200}{40} = 5\text{A}$



(iii)

4. (i)



RESONANT FREQUENCY, $f_r = \frac{1}{2\pi} \sqrt{\left(\frac{1}{LC} - \frac{R^2}{L^2}\right)}$

$$f_r = \left(\frac{1}{2\pi}\right)^2 \left(\frac{1}{LC} - \frac{R^2}{L^2}\right)$$

$$C = \frac{1}{2\pi^2 \times L \times f_r - \left(\frac{R^2}{L^2}\right)} = \frac{1}{2\pi^2 \times 0.04 \times 2 \times 10^3 - \frac{100^2}{0.04^2}} = 633.26 \mu\text{F}$$

(b) DYNAMIC RESISTANCE, $R_D = \frac{L}{CR} = \frac{0.04}{633.26 \times 10^{-6} \times 100} = 0.63 \Omega$

(c) SUPPLY CURRENT, $I_r = \frac{V}{R_D} = \frac{24}{0.63} = 38.1 \text{ A}$

(d) Q FACTOR, $Q = 2\pi f_r \left(\frac{L}{R}\right) = 2\pi \times 2 \times 10^3 \left(\frac{0.04}{100}\right) = 5.03$

(e) BANDWIDTH, $\text{BW} = f_2 - f_1$

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