

Page 1/17

Abdulwahab Zanain

ZAN 15826802

21/05/2021

Module Code: PoEE5001

ELECTRICAL PRINCIPLES THEORY

[68 %]

Q1=[5/20]

Q2=[8/20]

Q3=[19/20]

Q4=[10/10]

Q5=[26/30]

Module code: E0005002

Page 12/17

Abdelwahab Zain

Zain5826802

21/05/2021

Question (1)

$$\text{total } R_1 = (-j25) + 40 \quad Q1 = [5/20]$$

$$R_2 = j60 + 70$$

$$\text{total } R = \frac{(j25 + 40)(j60 + 70)}{(j60 + 70) + (-j25) + 40}$$

$$R = \frac{-j1500 + 2400j - 1750j + 2800}{120 + 85}$$

$$= \frac{j850 + 2800}{195}$$

$$= \frac{2800 + j850}{195}$$

$$= 14.36 + j4.34 \, \Omega$$

$$= 15.0 \angle 16.81^\circ \, \Omega$$

$$I = \frac{V}{R} = \frac{100}{15.0 \angle 16.81}$$

$$= 6.6 \angle -16.81^\circ \, A$$

correct method
error carried over

Abdulwahab zanain

Zan15826802
21/05/2021

Question (1)

Current in R = 70 A

Q1=[5/20]

$$I_A = \frac{(Z_B)}{Z_A + Z_B} I_T \quad \times$$

$$I_A = \left[\frac{70 + j60}{(40 - j25) + (70 + j60)} \right] (6.6 \angle 16.81^\circ)$$

$$= \left[\frac{70 + j60}{110 + j35} \right] (6.6 \angle 16.81^\circ)$$

$$= \frac{70 + j60}{195} \quad \times$$

$$= (0.358 + j0.307) (6.6 \angle 16.81^\circ)$$

$$= (0.47 \angle 40.78^\circ) (6.6 \angle 16.81^\circ)$$

$$= 3.102 \angle 57.59^\circ \text{ A} \quad \times$$

moodle code: G0005002 page 14/17

Abdulwahab Zanain

Zan15826802

21/05/2021

Question (1)

$$I_B = \left(\frac{Z_a}{Z_a + Z_b} \right) I_T$$

$$I_B = \frac{(40 - j25)}{(70 + j60) + (40 - j25)} \quad \times$$

$$I_B = \frac{(40 - j25)(6.6 < 16.81)}{(70 + j60 + (40 - j25))} \quad (6.6 < 16.81)$$

$$I_B = \frac{(40 - j25)}{195} (6.6 < 16.81)$$

$$= (0.205 - 0.128j) (6.6 < 16.81)$$

$$= 0.2416 \angle 31.98^\circ \text{ A}$$

$$= 1.59 \angle 48.79^\circ \text{ A} \quad \times$$

Abdullwahab Zarein

Zan15826202

21/05/2021

Question (2) **Q2=[8/20]**

$$V_{th} = \frac{8 + (-j6)}{4 + (8 + (-j6))} \times 10$$

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

$$= 6.641 \angle 0^\circ$$

$$a) V_{th} = \frac{8 - j6}{(8 - j6) + 4} (10)$$

$$V_{th} = \frac{8 - j6}{12 - j6} \times 10$$

$$V_{th} = \frac{8 - j6}{12 - j6} \times \frac{12 + j6}{12 + j6} (10)$$

$$V_{th} = \frac{96 - 72j + 48j + 36}{144 + 36} (10)$$

$$V_{th} = \frac{132 - 24j}{180} (10)$$

[5/5]

$$V_{th} = (0.73 - 0.13j) (10)$$

$$V_{th} = 7.3 - 1.3j \text{ or } 7.4 \angle -10.1^\circ \text{ Volt}$$

7-2) @ module code: iBoees002 page 6/17

Abdulwahab zarain

Zan 15826802

21/05/2021

Question 2 (B)

$$Z+H = \frac{(8-j6)4}{8+j} + j5$$

$$Z+H = \frac{(8-j6)4}{(8-j6)+4} + j5$$

$$Z+H = \frac{32-j24}{12-j6} + j5$$

$$Z+H = \frac{32-j24}{12-j6} \times \frac{(8+j6)}{(8+j6)} + j5$$

$$Z+H = \frac{256-j192 + 192-144}{96+36}$$

$$= \frac{304-j192}{132}$$

[3/5]

$$= 2.30 - j1.45 \text{ or } 2.72 \angle -32.23^\circ$$

Abdelmuhab Zaman

zan15826802
21/05/2021

QUESTION 1(3)

Q3=[19/20]

Solution

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

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

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

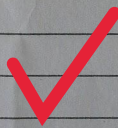
$$a_0 = \frac{1}{2\pi} \int_{-\pi}^0 1 dx + \frac{1}{2\pi} \int_0^{\pi} 0 dx$$

$$a_0 = \frac{1}{2\pi} [x]_{-\pi}^0 + \frac{1}{2\pi} [x]_0^{\pi}$$

[5/5]

$$= \frac{1}{\pi} (0 - (-\pi))$$

$$\therefore a_0 = 1$$



Abdulwahad zanain

zanain15826802

21/05/2021

Question (3)

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

$$a_n = \frac{1}{\pi} \int_{-\pi}^0 f(x) \cos nx \, dx + \frac{1}{\pi} \int_0^{\pi} f(x) \cos nx \, dx$$

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

$$= \frac{1}{\pi} \left(\left[\frac{\sin nx}{n} \right]_{-\pi}^0 \right) \quad [5/5]$$

$$= \frac{1}{n\pi} (\sin nx)_{-\pi}^0$$

$$= \frac{1}{n\pi} [\sin 0 - \sin(-n\pi)]$$

$$= \frac{1}{n\pi} [0 + \sin(n\pi)]$$

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

$$a_n = 0$$

Abdulwahab Zaman

Zam 15826802
21/05/2021

Question (3)

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

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

$$= \frac{1}{\pi} \left[-\frac{\cos nx}{n} \right]_{-\pi}^0$$

$$= \frac{-1}{n\pi} [\cos nx]_{-\pi}^0$$

$$= \frac{1}{n\pi} (1 - \cos(-n\pi))$$

$$b = \frac{-1}{n\pi} (1 - (-1)^n) \quad [6/6]$$

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

$$a = 1 \quad a_n = 0 \quad b_n = \frac{-1}{n\pi} (1 - (-1)^n)$$

Fourier series

$$f(x) = \frac{1}{2} - \frac{2}{\pi} \left(\sin x + \frac{1}{3} \sin 3x + \frac{1}{5} \sin 5x \right) \quad [3/4]$$

Abdullahah zain

Zan 15826802

21/05/2021

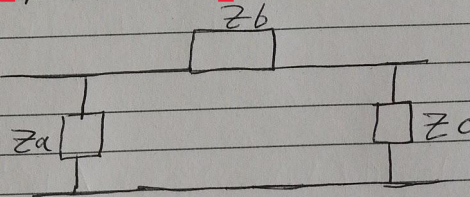
Question 4

$$Z_1 = 10 \Omega$$

$$Z_3 = 20 \Omega$$

$$Z_2 = j20$$

Q4=[10/10]



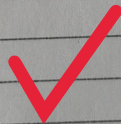
$$Z_a = \frac{Z_1 + Z_2 + Z_1 Z_3 + Z_2 Z_3}{Z_3}$$

$$Z_a = \frac{(10)(j20) + 10(20) + j20(20)}{20}$$

[4/4]

$$= \frac{j200 + 200 + j400}{20} = \frac{200 + j600}{20}$$

$$= 10 + j30 \Omega$$



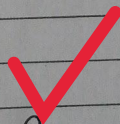
$$Z_b = \frac{Z_1 Z_2 + Z_1 Z_3 + Z_2 Z_3}{Z_2}$$

$$= \frac{(10)(j20) + 10(20) + j20(20)}{j20}$$

$$= \frac{200 + j600}{j20}$$

[3/3]

$$= 30 - j10 \Omega$$



module code: E0ee5001

page 11/27

Abdulkarim zain

Zan15826802

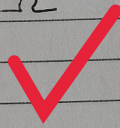
21/05/2021

Question 4

$$Z_C = \frac{Z_1 Z_2 + Z_1 Z_3 + Z_2 Z_3}{Z_1}$$

$$Z_C = \frac{(10)(j20) + 10(20) + j20(20)}{10 - j2}$$

$$= \frac{200 + j600}{10}$$



$$= 20 + j60 \Omega \quad [3/3]$$

Abdulwahab zanain

Zan15826802
21/05/2022

Question 5 (A)

Q5=[26/30]

$$L \frac{di}{dt} + Ri = V$$

$$3 \frac{di}{dt} + 6i = 30e^{-t} \quad [1/1]$$

$$3L \frac{di}{dt} + 6(i) = 30L \cancel{[e^{-t}]} [e^{-t}]$$

$$3Si(s) - 6I(s) = \frac{30}{s+1} \quad [2/2]$$

$$I(s) = \frac{30}{(3s+6)(s+1)} \quad [2/2]$$

$$I(s) = \frac{10}{(s+2)(s+1)}$$

$$\frac{10}{(s+2)(s+1)} = \frac{A1}{(s+2)} + \frac{A2}{(s+1)} \quad [2/2]$$

$$10 = A1(s+1) + A2(s+2)$$

$$s = -1$$

module code: G005002 page 13/17

Abdulwahab zanain

Zan15826802

Question 5 (A) continue

$$20 = A_1(-1+2) + A_2(-1+2)$$

$$10 = 0 + A_2$$

$$A_2 = 10 \quad [2/2]$$

$$s = -2$$

$$10 = A_1(-2+1) + A_2(-2+2)$$

$$10 = -A_1 + 0$$

$$A_1 = -10 \quad [1/1]$$

$$I(s) = \frac{-10}{(s+2)} + \frac{10}{(s+2)}$$

$$I(s) = \frac{10}{(s+2)} - \frac{10}{(s+2)} \quad [1/1]$$

$$I(t) = 10e^{-t} - 10e^{-2t} \quad [1/1]$$

Abdulwahab Zaman

zan15826802

21/05/2021

Question 5 (B)

$$\frac{s+3}{(s+1)(s-1)} = \frac{-A}{(s+1)} + \frac{B}{(s-1)}$$

$$\frac{s+3}{(s+1)(s-1)} = \frac{A(s-1) + B(s+1)}{(s+1)(s-1)}$$

$$A(s-1) + B(s+1) = s+3 \quad [2/2]$$

Taking $s=1$ gives

$$B(1+1) = 1+3$$

$$2B = 4$$

$$\therefore B = \frac{4}{2} = 2 \quad [2/2]$$

taking $s=-1$

$$A(-2) = -1+3$$

$$-2A = 2 \therefore A = \frac{2}{-2} = -1 \quad [2/2]$$

$$\mathcal{L}^{-1} \left[\frac{s+3}{(s+1)(s-1)} \right] = 2 \mathcal{L}^{-1} \left[\frac{s+3}{(s-1)} \right] - \mathcal{L}^{-1} \left[\frac{s+3}{(s+1)} \right]$$

$$= 2(\cancel{s+3})e^t - (\cancel{s+3})e^{-t}$$

[1/2]

module code: Goe 5001

Page 15/17

Abdelwahab Zairin

Zan/5826802

21/05/2021

Question 5 (c)

(i) $(e^{3t} + 7)$

$$L(e^{3t} + 7) = L(e^{3t}) + L(7)$$

$$= \frac{1}{(s-3)} + \frac{7}{s} \quad [2/2]$$

$$= \frac{1(s) + 7(s-3)}{(s-3)s} = \frac{s + 7s - 21}{s^2 - 3s}$$

$$= \frac{8s - 21}{s^2 - 3s}$$

(ii) $\cos(3t) + 2\sin(2t)$

$$L[\cos(3t) + 2\sin(2t)] = \frac{s}{s^2 + 3^2} + 2 \frac{2}{s^2 + 2^2}$$

$$= \frac{s}{s^2 + 9} + \frac{4}{s^2 + 4} \quad [2/2]$$

Abdulwahab zaini

Zan15826802

21/05/2021

Question 5(c)

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

$$L(t^3 + 4t)e^{3t} = (t^3 + 4t)L(e)^{3t}$$

~~$$= \frac{t^3 + 4t}{s^4(s-3)}$$~~

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

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

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

$$= \frac{3}{s^5 - 3s^4} + \frac{4}{s^3 - 3s^2}$$

iv) $5e^{5t} \cos(2t) - e^{3t}$

$$L(5e^{5t} \cos(2t) - e^{3t})$$

$$= 5L(e^{5t} \cos(2t)) - L(e^{3t})$$

$$= 5 \frac{1}{(s-5)} \left[\frac{s}{s^2 + 2^2} \right] - \frac{1}{(s-3)}$$

[1/2]

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

Module code: EEE5002

Page 17/17

Abdulwahab Zain

Zan15826802
21/05/2021

Question 5 (c)

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

$$= \frac{8}{(s+2)^2 + 4^2}$$

[2/2]