Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	ELECTRIC CIRCUITS II
COURSE CODE	:	BEJ 10403
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER ALL QUESTIONS 2.THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.** 3.STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Based on **Figure Q1(a)**, determine:

(i) $v(0^+)$ and $i(0^+)$ (4 marks)

(ii) $\frac{dv(0^+)}{dt}$ and $\frac{di(0^+)}{dt}$ (4 marks)

(iii) $v(\infty)$ and $i(\infty)$ (2 marks)

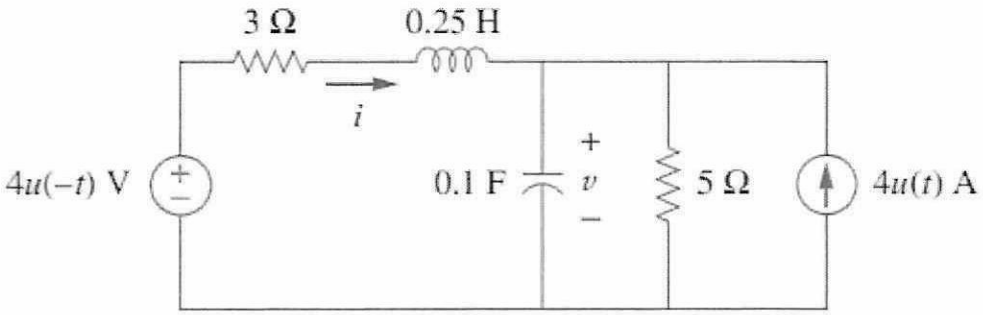

Figure Q1(a)

(b) Based on the circuit in **Figure Q1(b)**, calculate the value of resistor, R that is needed to have a critically damped response.

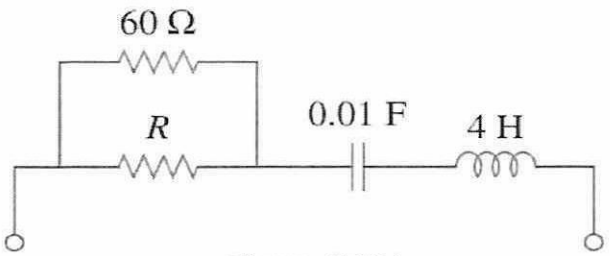

Figure Q1(b)

(4 marks)

(c) Determine the output voltage, $v_o(t)$ for the circuit in **Figure Q1(c)**. (11 marks)

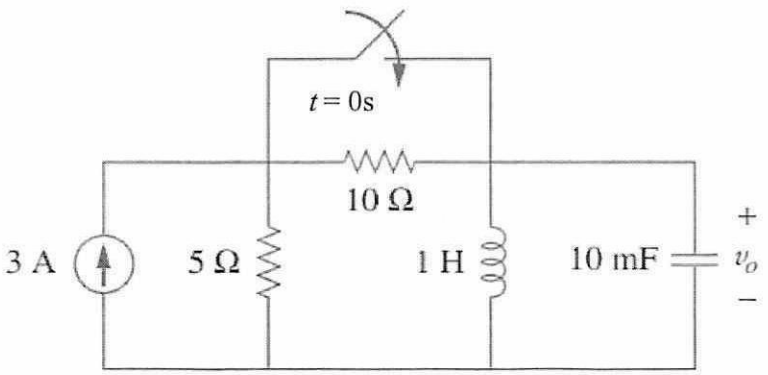

Figure Q1(c)

Q2 (a) Solve the current, *i(t)* for the circuit in **Figure Q2(a)**. *Hint:* use mesh analysis.

(10 marks)

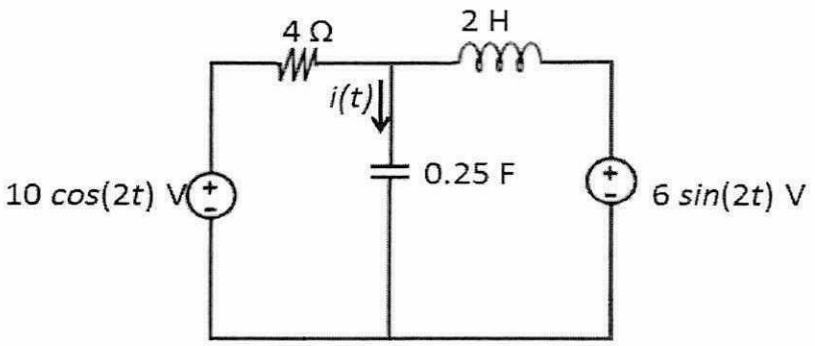

Figure Q2(a)

(b) For the circuit in **Figure Q2(b)**,

(i) determine the value of voltage, V_x.

(12 marks)

(ii) find the current, *i(t)*.

(3 marks)

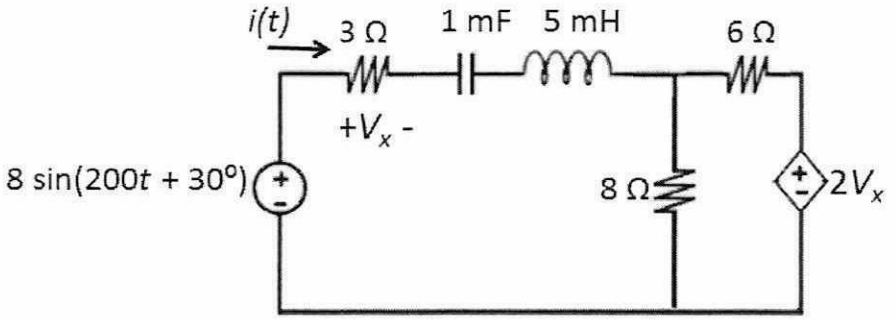

Figure Q2(b)

Q3 (a) A voltage source, $V_s = 20\ cos(2t)\ V$ and current source, $I_s = 4\ cos(2t)\ A$ are applied for the circuit in **Figure Q3(a)**.

(i) Find the Thevenin equivalent circuits at terminals *a-b*.

(8 marks)

(ii) An impedance Z_L is placed across terminals *a-b*, find the maximum power that can be transferred to the load.

(4 marks)

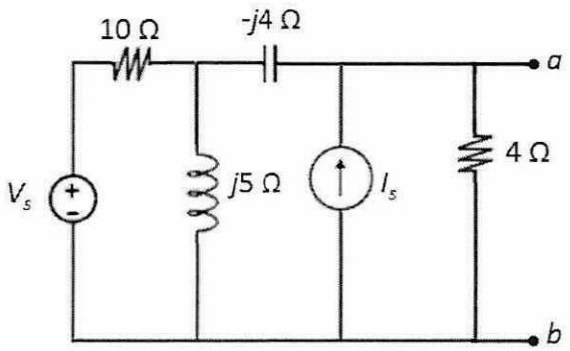

Figure Q3 (a)

(b) For the power system in **Figure Q3(b)**,

(i) find the average power

(5 marks)

(ii) find the reactive power

(2 marks)

(iii) find the power factor

(2 marks)

(iv) find the parallel element required that will give a unity power factor when connected to the system.

(4 marks)

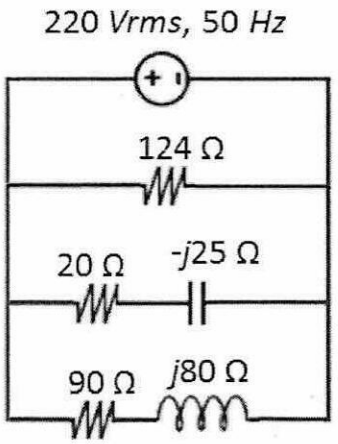

Figure Q3(b)

Q4 (a) **Figure Q4(a)** shows a two-port network circuit.

(i) Calculate the admittance parameters of the circuit. (10 marks)

(ii) If given that $I_1 = 1\,A$ and $I_2 = -0.5\,A$, find V_1 and V_2. (3 marks)

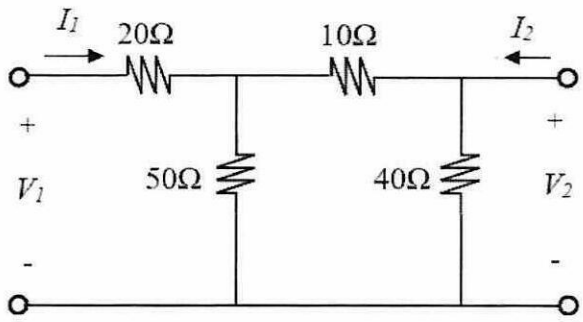

Figure Q4(a)

(b) For circuit in **Figure Q4(b)**,

(i) calculate I_1, I_2, V_1 and V_2. (9 marks)

(ii) determine the power dissipated in 10 Ω resistor. (3 marks)

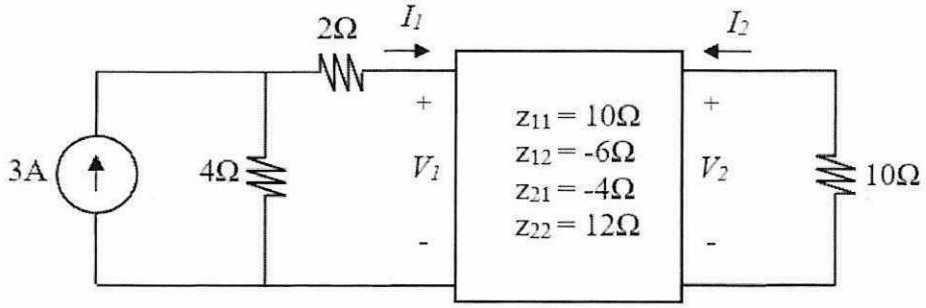

Figure Q4(b)

-END OF QUESTIONS –

FINAL EXAMINATION

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Mathematical Formula

$$\sin(x) = -\sin(x)$$

$$cos(-x) = \cos(x)$$

$$\tan(-x) = -\tan(x)$$

$$\sin 2x + \cos 2x = 1$$

$$\sin(2x) = 2\sin x \cos x$$

$$\cos(2x) = \cos 2x - \sin 2x$$

$$\cos(2x) = 2\cos 2x - 1 = 1 - 2\sin 2x$$

$$sin(x \pm 90°) = \pm \cos x$$

$$cos(x \pm 90°) = \mp \sin x$$

$$sin(x \pm 180°) = \mp sin$$

$$cos(x \pm 180°) = \mp \cos x$$

$$cos^2 x + sin^2 x = 1$$

$$\sin(x \pm y) = \sin x\, cos\, y \pm \cos x\, sin\, y$$

$$\cos(x \pm y) = \cos x\, cos\, y \mp \sin x\, sin\, y$$

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}$$

$$2\sin x \sin y = \cos(x - y) - \cos(x + y)$$

$$2\sin x \cos y = \sin(x + y) + \sin(x - y)$$

$$2\cos x \cos y = \cos(x + y) + cos\,(x - y)$$

$$\cos x \cos y = \frac{1}{2}[\cos(x + y) + cos\,(x - y)]$$

$$j^2 = -1$$

$$z = x + jy = r(\cos\phi + j\sin\phi)$$

$$x(t) = A_1 e^{s_1 t} + A_2 e^{s_2 t}$$

$$x(t) = (A_1 + A_2 t)e^{-\alpha t}$$

$$x(t) = (A_1 \cos\omega_d t + A_2 \sin\omega_d t)e^{-\alpha t}$$

$$a^2 + bx + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$e^{jx} = \cos x + j\sin x \quad \text{(Euler's formula)}$$

$$\cos x = \frac{e^{jx} + e^{-jx}}{2}$$

$$\sin x = \frac{e^{jx} - e^{-jx}}{2j}$$

If $U = U(x)$, $V = V(x)$, and a = constant,

$$\frac{d}{dx}(aU) = a\frac{dU}{dx}$$

$$\frac{d}{dx}(UV) = U\frac{dV}{dx} + V\frac{dU}{dx}$$

$$\frac{d}{dx}(aU^n) = naU^{n-1}$$

$$\frac{d}{dx}(a^U) = a^U \ln a \frac{dU}{dx}$$

$$\frac{d}{dx}(e^U) = e^U \frac{dU}{dx}$$

$$\frac{d}{dx}(\sin U) = \cos U \frac{dU}{dx}$$

$$\frac{d}{dx}(\cos U) = -\sin U \frac{dU}{dx}$$

If $U = U(x)$, $V = V(x)$, and a = constant,

$$\int a\,dx = ax + C$$

$$\int U\,dV = UV - \int V\,dU$$

$$\int \frac{dU}{U} = \ln U + C$$

$$\int \ln x\,dx = x\ln x - x + C$$

$$\int \sin ax\,dx = -\frac{1}{a}\cos ax + C$$

$$\int \cos ax\,dx = \frac{1}{a}\sin ax + C$$