Circuits and Systems 2
Final Exam Fall 2021

Q1. **Marks 20**

Find the Thevenin equivalent circuit of the ac circuit shown in Figure 1.

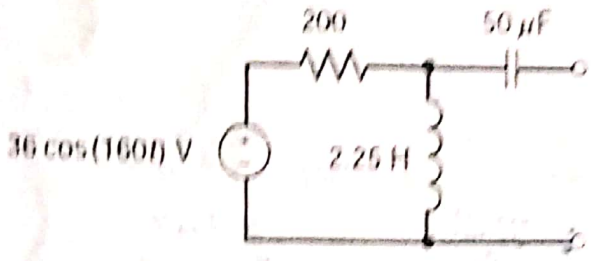


Figure 1

Q2. **Marks 20**

A customer's plant has two parallel loads connected to the power utility's distribution lines. The first load consists of 50 kW of heating and is resistive. The second load is a set of motors that operate at 0.86 lagging power factor. The motors' load is 100 kVA. Power is supplied to the plant at 10,000 volts rms. Determine the total current flowing from the utility's lines into the plant and the plant's overall power factor.

Q3 **Marks 10+10**

a. A 4-kW, 110-Vrms load, as shown in Figure 3a, has a power factor of 0.82 lagging. Find the value of the parallel capacitor that will correct the power factor to 0.95 lagging when ω= 377 rad/s.

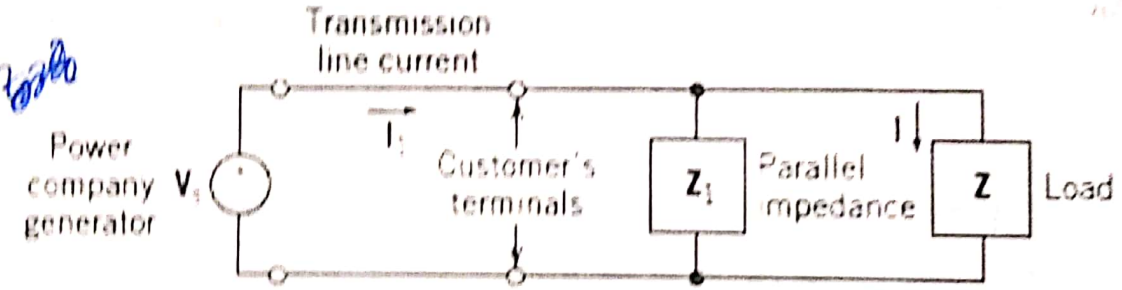


Figure 3a

b. For the circuit of Figure 3b, find Z_L to obtain the maximum power transferred when the Thevenin equivalent circuit has $V_t = 80\angle 0^\circ$ V and $Z_t = 12+j16\ \Omega$.
Also, determine the maximum power transferred to the load.

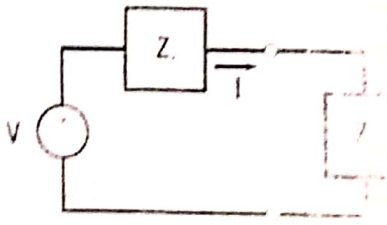


Figure 3b

$I = \frac{V}{R}$

Q4. C5 (Synthesis) PLO 3 (Design/Development of Solutions) **Marks 20**

Consider the circuit shown in Figure 4a. The input to the circuit is the voltage of the voltage source $v_i(t)$. The output is the node voltage at the output terminal of the op amp $v_o(t)$. The network function that represents this circuit is $H(\omega) = \frac{Vo(\omega)}{Vi(\omega)}$

The corresponding magnitude Bode plot is also shown in Figure 4b. **Design** the circuit by finding the proper values of capacitances C_1 and C_2.

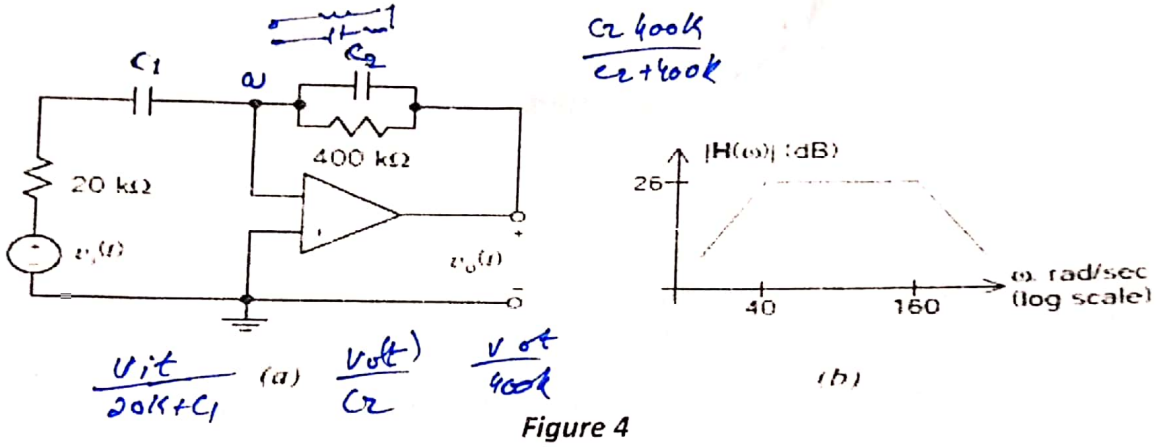


Figure 4

Q5. C4 (Analysis) PLO 2 (Problem Analysis)

Consider the circuit shown in Figure 5. The input to the circuit is the voltage of the voltage source 24 V. The output of this circuit, the voltage across the capacitor, is given by $v_o(t) = 16 - 12e^{-0.6t}$ V when t > 0

Analyze the circuit using Laplace Transform and determine the value of the capacitance C.

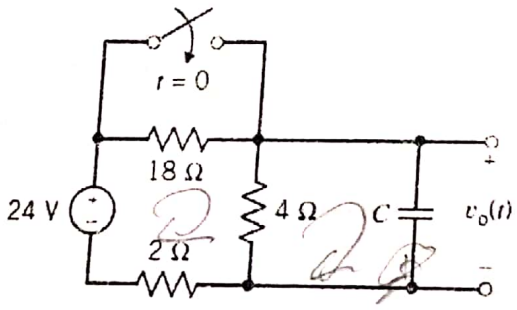
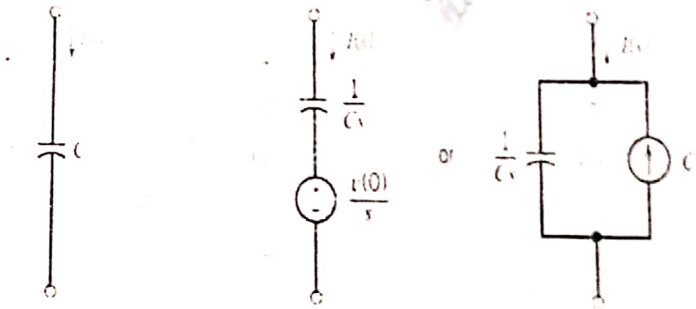


Figure 5



Time-Domain and Complex Frequency-Domain representations of Capacitor

{Use Transformation $\mathcal{L}\{e^{-at}\} \rightarrow \frac{1}{s+a}$ }

End

DEPARTMENT OF BASIC SCIENCES AND ISLAMIAT

University of Engineering and Technology, Peshawar

Paper: Complex Variables (BSI-362)
Final-Term Examination Fall-2021
(Computer System Engineering)

Time Allowed: 03 hours | Max Marks: 60

Note: Attempt all questions:

Question No 1 (CLO-1, PLO-1, 6+6)

(a) Find "a" and "b" so that the given function is harmonic and find a harmonic conjugate

$$u = ax^3 + bxy$$

(b) Find the principal value of $(1+i)^{1-i}$

Question No 2 (CLO-1, PLO-1. 6+6)

(a) Evaluate the integral $\oint_C \coth\frac{1}{2}z\,dz$ C the circle $\left|z-\frac{\pi i}{2}\right| = 1$

(b) Evaluate the integral $\oint_C \frac{4z^3-6}{z(z-1-i)^2}\,dz$

C consists of $|z| = 3$ counter-clockwise and $|z| = 1$ clockwise

Question No 3 (CLO-2, PLO-2, 6+6)

(a) Find the Maclaurin series of $f(z) = \int_0^z \sin t^2 dt$

(b) Evaluate the integral by residue method $\oint_C \frac{z\cosh\pi z}{z^4+13z^2+36}dz$ $|z| = \pi$

Question No 4 (CLO-2, PLO-2, 6+6)

(a) Evaluate the integral $\int_0^{2\pi}\frac{1+\sin\theta}{3+\cos\theta}d\theta$

(b) Find the Cauchy principal value $\int_{-\infty}^{\infty}\frac{x^2}{x^4-1}dx$

Question No 5 (CLO-2, PLO-2, 6+6)

(a) Find the Fourier transform of $f(x) = \begin{cases} e^x & if \quad -1 \le x \le 1 \\ 0 & otherwise \end{cases}$

(b) Find the Complex Temperature field F between two coaxial cylinders of radii r_1 and r_2 having Temperature T_1 and T_2 respectively, where $r_1 = 1, r_2 = 3, T_1 = 0$ and $T_2 = 100$.

Department of Basic Sciences & Islamiat
University of Engineering and Technology Peshawar
Computer System Engineering
Final Term Examination 3rd Semester Fall – 2021
Paper: **Linear Algebra (BSI-111)**
Maximum Marks: 100 Time: 03 Hours

Note: Attempt all questions. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit.

[CLO1]

Q1. **a.** Discuss the consistency of the following system of linear equations

$$5x_1 - 2x_2 + x_3 = 3$$
$$3x_1 + 2x_2 + 7x_3 = 5$$
$$x_1 + x_2 + 3x_3 = 2$$

If found consistent, solve by the Gauss Jordan method.

[Marks-15]

b. Let A be the non-singular matrix $\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$ and let T be the triangle with vertices $(1,1)$, $(-2,2)$ *and* $(2,-3)$. **Describe** the image of the triangle T under the matrix transformation $f: R^2 \to R^2$ defined by $f(u) = Au$.

[Marks-15]

[CLO2]

Q2. **a.** Use the substitution scheme and the matrix $\begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$ code the message WORK HARD.

[Marks-10]

b. Use the matrix of Q2. Part **a.** above, decode the message 33 36 31 33 31 39 41 60 46 57.

[Marks-10]

[CLO2]

Q3. a. Let W be the subset of R^3 consisting of all vectors of the form $\begin{bmatrix} a \\ b \\ c \end{bmatrix}$, where $b = 2a + 1$. **Examine** W is a subspace of R^3 or not ?

[Marks-12]

b. If possible, **determine** a diagonal matrix similar to the following matrix:

$$\begin{bmatrix} -2 & 2 \\ 2 & 1 \end{bmatrix}$$

[Marks-13]

[CLO2]

Q4. a. **Examine** whether the vectors

$p_1(t) = 3t + 1,\ p_2(t) = 3t^2 + 1,\ p_3(t) = 2t^2 + t + 1$

in P_2 are linearly independent or linearly dependent ? [Marks-12]

b. A manufacturer produces two items X *and* Y. X needs 2 hours on machine A and 2 hours on machine B. Y needs 3 hours on machine A and 1 hour on machine B. If machine A can be run for a maximum of 12 hours per day and machine B for 8 hours per day and profits from X *and* Y are Rs. 4 and Rs. 5 per item, respectively. **Formulate** the problem as a linear programming problem and find how many units of each item should be manufactured to maximize the profit ?

[Marks-13]