VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY (VSSUT), ODISHA

Odd Mid Semester Examination for Academic Session 2025-26

COURSE NAME: B.Tech

SEMESTER: 3^{rd}

BRANCH NAME: ELECTRICAL ENGINEERING EEA, EEB

SUBJECT NAME: NETWORK THEORY

FULL MARKS: 30

TIME: **90 Minutes**

Answer **All** Questions.

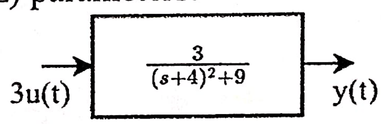
The figures in the right hand margin indicate Marks. *Symbols carry usual meaning.*

Q1. Answer all Questions. [2 × 3]

a) Explain the concept of the coefficient of coupling and derive the relationship between the self-inductances, mutual inductance and the coefficient of coupling for two series-connected coils. - CO1

b) Explain the meaning of a symmetrical network and a reciprocal network, and state the conditions for symmetry and reciprocity separately in terms of both admittance (Y) parameters and impedance (Z) parameters. - CO2

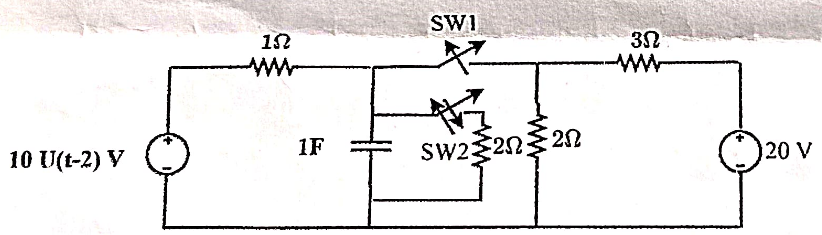
c) - CO3



For the above figure, plot y(t), and asses its stability using BIBO stability criteria.

Q2. [8]

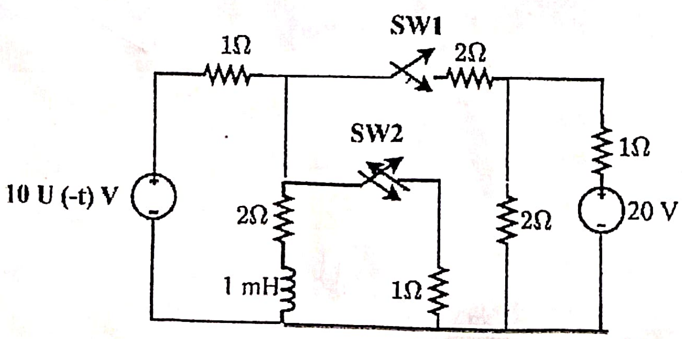
- *CO1*



For the given circuit, switch **SW1** is closed and switch **SW2** is open for a sufficiently long time so that the circuit reaches steady state. At t = 0 sec., **SW1** is opened and **SW2** is closed. At t = 2 sec., **SW2** is opened again. Determine the expression for the voltage across the capacitor during each switching interval and plot the corresponding voltage waveform. Also, calculate the time constant of the circuit for each switching period.

OR

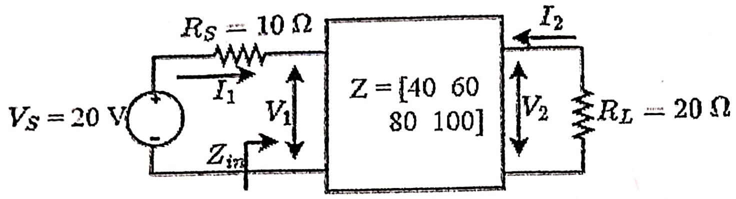
- CO1



For the given circuit, switch **SW1** and switch **SW2** is open for a sufficiently long time so that the circuit reaches steady state. At t = 0 sec., **SW2** is closed. At t = 5 m. sec., **SW1** closed and **SW2** is opened again. Determine the expression for the current through the inductor during each switching interval and plot the corresponding current waveform. Also, calculate the time constant of the circuit for each switching period.

[5+3]

- CO2



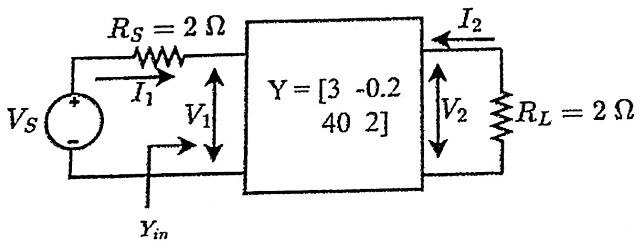
For the **two-port network** shown in the above figure, the **impedance matrix (Z)** is shown. Find-

a) Input impedance (Z_{in}) as shown in the figure.

b) Average power delivered to the load (R_L).

OR

- CO2



For the **two-port network** shown in the above figure, the **admittance matrix (Y)** is shown. Find-

a) Input admittance (Y_{in}) as shown in the figure.

b) Obtain the voltage gain ($\frac{V_2}{V_S}$).

[5+3]

- CO3

$$F_1(s) = \frac{2bs^2+as+2b}{\frac{a}{4}s^2+bs+\frac{a}{4}}$$, where **a** and **b** are real constants.

If $F_1(s)$ represents a **driving-point immittance function,**

1. Determine the admissible domain of **a** and **b** by applying the necessary conditions (point by point) that a function must satisfy to be a driving-point immittance function.
2. For **b** varying from **1** to **5**, find the corresponding range of values of **a**.

OR

- CO3

$$F_2(s) = \frac{\frac{b}{4}s^2+as+\frac{b}{4}}{as^2+bs+4a}$$, where **a** and **b** are real constants.

If $F_2(s)$ represents a **network function,**

1. Determine the range of values of **a** and **b** by applying the conditions and restrictions (point by point) of poles and zeros of a network function.
2. Determine the relationship between **a** and **b** when the above function has only real poles.