

FEDERAL UNIVERSITY OF TECHNOLOGY, OVERRI
 SCHOOL OF ELECTRICAL SYSTEM AND ENGINEERING TECHNOLOGY
 DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
 HARMATTAN SEMESTER EXAMINATION 2019/2020 SESSION
 EEE 409 (ELECTRICAL ENGINEERING ANALYSIS IV)

INSTRUCTION: ANSWER FIVE QUESTIONS ONLY. TIME ALLOWED: 3 HRS

- *1 (a) As a pupil engineer, saddled with management of an electrical network, discuss the seven variables to be considered about SLFE (7 MKS)
- (b) Use a one line diagram to indicate a model interconnected with a Z_{ser} impedance and two shunt admittances Y_{sh} . The two bus voltages are V_1 and V_2 respectively and the powers are SG_1 and SG_2 . Indicate the respective loads tapped from each bus.. Hence from the model, express the powers, the loss factors, impedance in the buses. Show that $V_1 = |V_1| < \delta_1$ (13 MKS)
2. From figure 2 below, determine the output voltage of the first - order filters for the following frequencies :(a) 1 KHZ (7MKS)(b) 2 KHZ (7MKS) (c) 20 KHZ (6MKS)

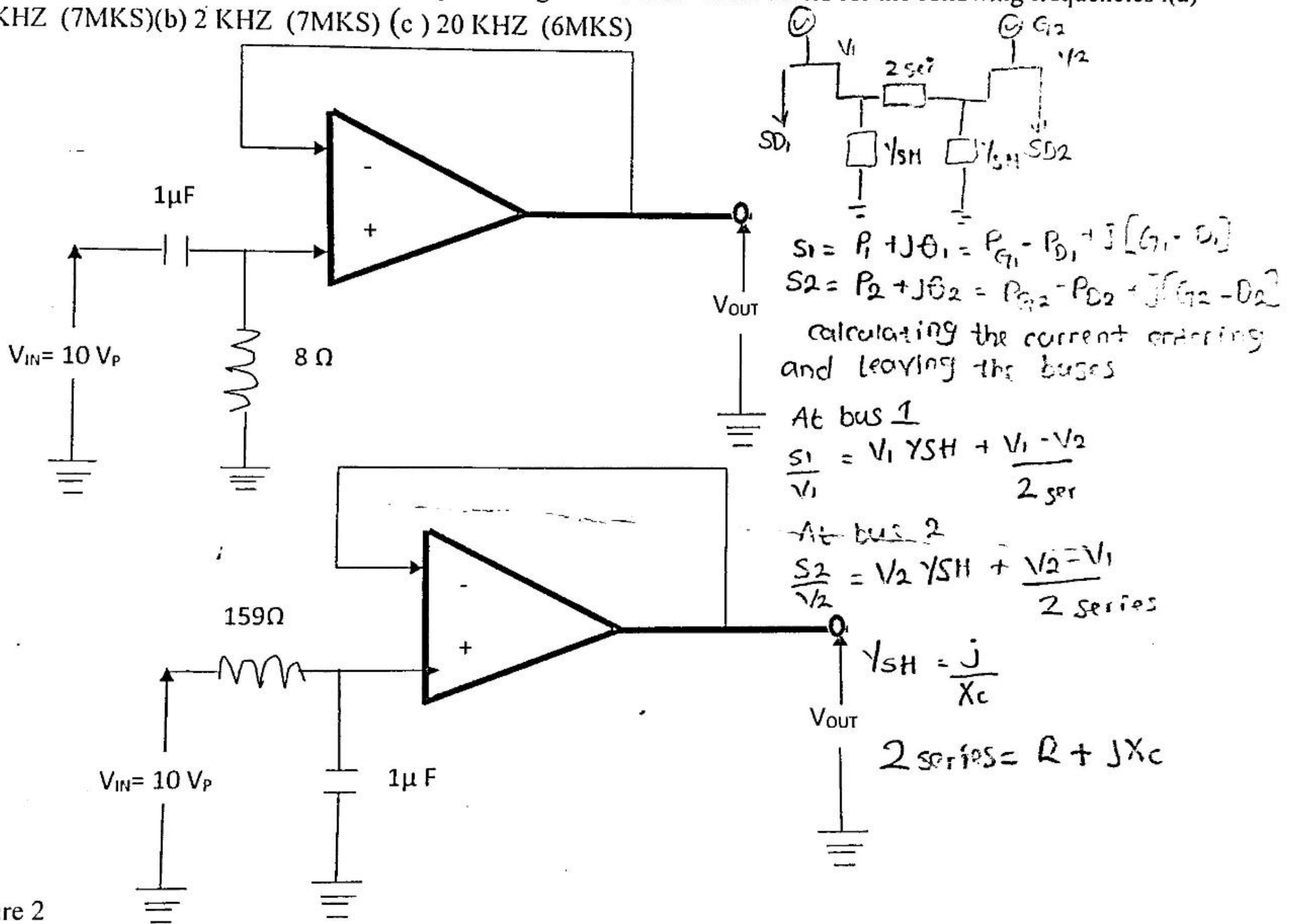


Figure 2

- 3 (a) Find the differential equations relating V_1 and $V_2(t)$ for the networks shown in figure 3 a and b below using the appropriate equations

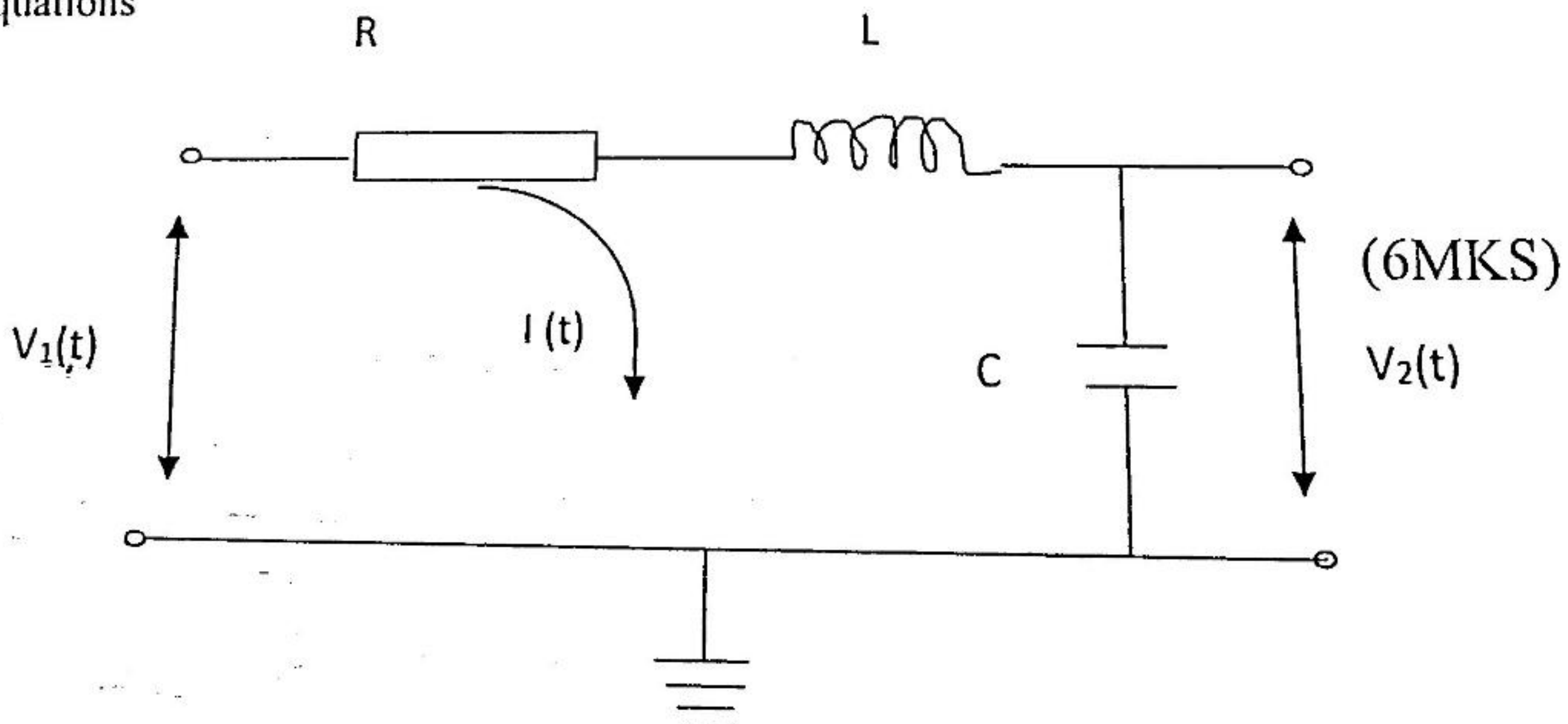


Figure 3a

3 (b)

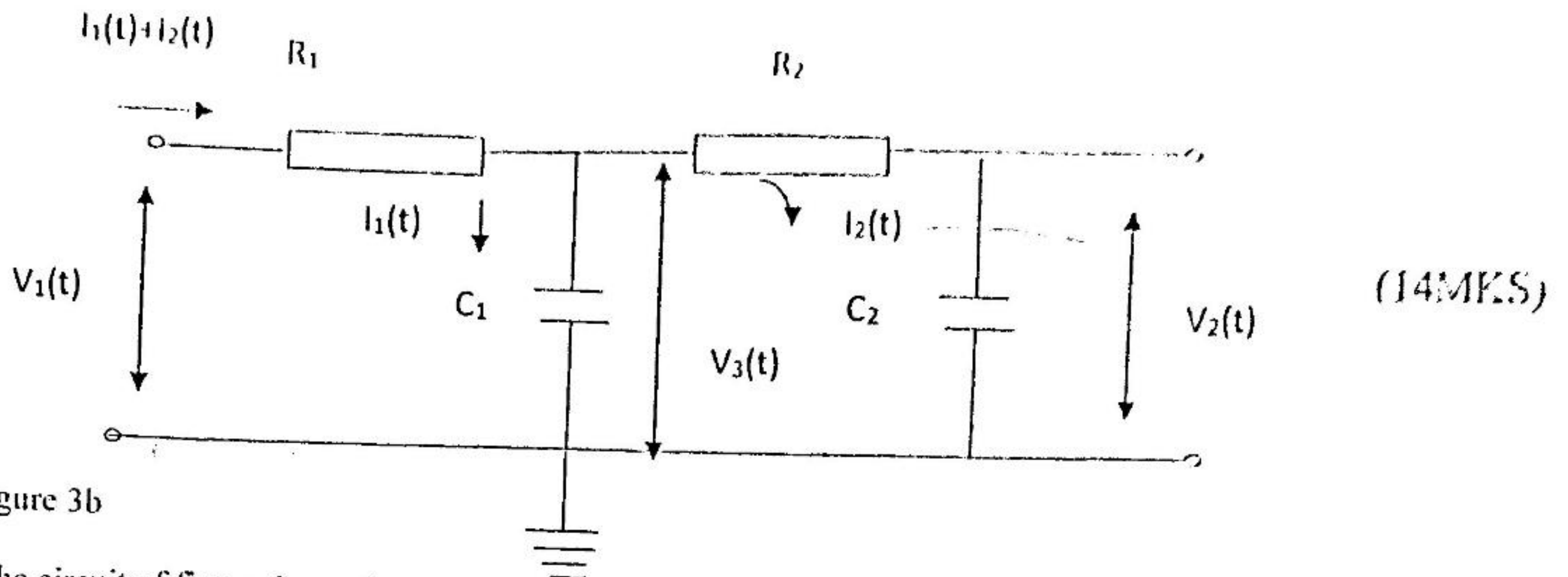


Figure 3b

4(a) For the circuit of figure 4, use the superposition principles to write an expression for the unknown branch current i_x . 10 (MKS)

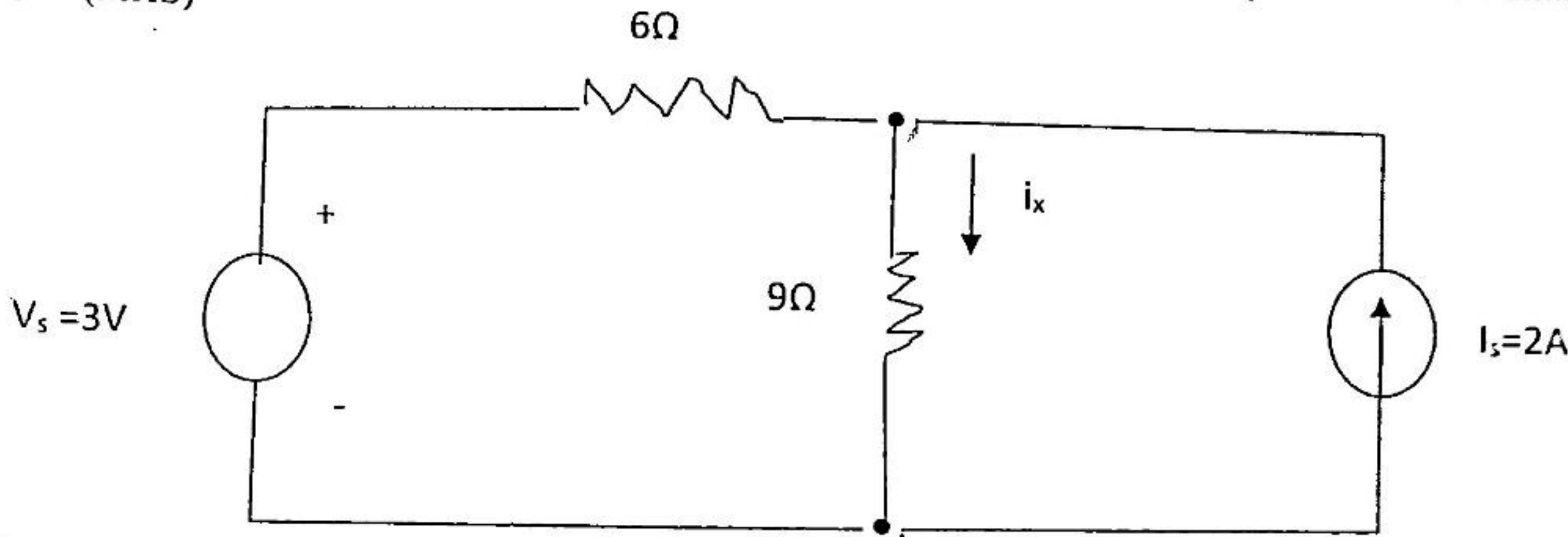


Figure 4

- 4 (b) Explain the following terms
- i linear elements and linear circuits (4 MKS)
 - ii With good illustrations Nodal analysis (6MKS)

5 (a) As an upcoming engineer, show how control variables could be physically used to manipulate the state variables in a power system. (7MKS)

(bi) How much power will a half-wave dipole radiate when it has an antenna rms current of 20 A (3MKS)

(ii) Calculate the physical length of a half-wave dipole antenna for a 100-MHz transmitter. (3MKS)

(c) Explain three major tools used for engineering analysis (7MKS)

6(a). Define a communication network. (2marks). Describe briefly the following network services and in each mention what makes it specific. (I). Radio and television broadcasting. (II). Telephone service (III). Cellular telephone (iv). Electronic mail (v). Video on demand (vi). Streamed audiovisual service. (2marks each).

6(b). Explain how each of the following facilitates client/server interaction in communication network (I). World Wide Web (WWW) (II). Uniform Resource Locator (URL). (3marks each).

7(a). Explain with good illustrations each of the following terms as applied to communication network (I). Switching approach (II). Terminal (III). Information representation (iv). Transmission system (v). Routing (vi). Addressing (vii). Multiplexing. (2marks each).

7(b). Use a good diagram to explain a Hierarchical telephone network structure. (6marks).

$$V_1(t) - V_2(t) = iR + L \frac{di}{dt} \dots \text{eqn 1}$$

$$V_2(t) = \frac{1}{C} \int i dt \dots \text{eqn 2}$$

differentiate both sides

$$\frac{dV_2(t)}{dt} = \frac{1}{C} \cdot i$$

$$i = C \frac{dV_2}{dt} \dots \text{eqn 3}$$

Putting ① into ③

$$V_1(t) - V_2(t) = R \frac{C dV_2}{dt} + L \frac{d}{dt} \left(C \frac{dV_2}{dt} \right)$$

$$V_1(t) - V_2(t) = R \frac{C dV_2}{dt} + L C \frac{d^2 V_2}{dt^2}$$

$$V_1(t) = V_2(t) + R C \frac{dV_2}{dt} + L C \frac{d^2 V_2}{dt^2}$$