S. E. SEM - III C.B.G.S. 16/12/13
(EXTC)
Circuits and Transmission Lines

V-A4-II-Ex-13-G-24

Con. 9950-13. **GX-12194**

(3 Hours) **[Total Marks : 80**

N.B. : (1) Attempt Question No. 1 and any 3 from the **remaining** questions. In all 4 questions are to be **attempted**.
(2) **All** sub-questions of the **same** question should be answered at **one** place only in their serial, orders, and **not** scattered.
(3) Write everything in **ink only**. **Pencil** is **not allowed**.
(4) Assume suitable **data** with **justification** if missing.

1. (a) Determine the the y-parameters of the network shown in **Fig. 1(a)**. **5**

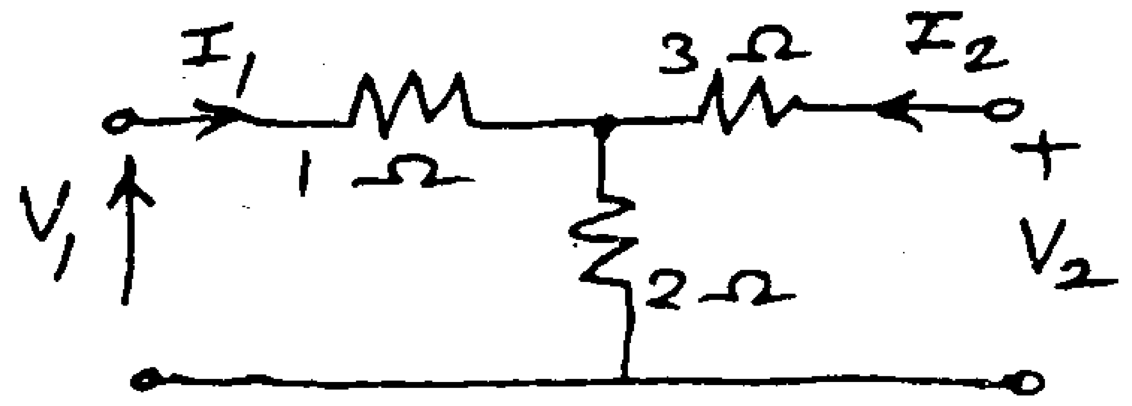

Fig. 1(a)

(b) Test if $F(s) = s^6 + 2s^5 + 3s^4 + 4s^3 + 3s^2 + 2s + 1$ is a Hurwitz polynomial. **5**

(c) Both the coils connected in series have self inductance of 40 mH. The total inductance of the circuit is found to be 120 mH. Determine the (i) mutual inductance between the coils and (ii) the coefficient of coupling. **5**

(d) Find Foster I and II, and Cauer I and II circuits for the driving point admittance $Y(s) = s + 1$. **5**

2. (a) Find the Thevenin equivalent across the terminals XY for the circuit shown in **Fig.2(a)** using mesh matrix method. **10**

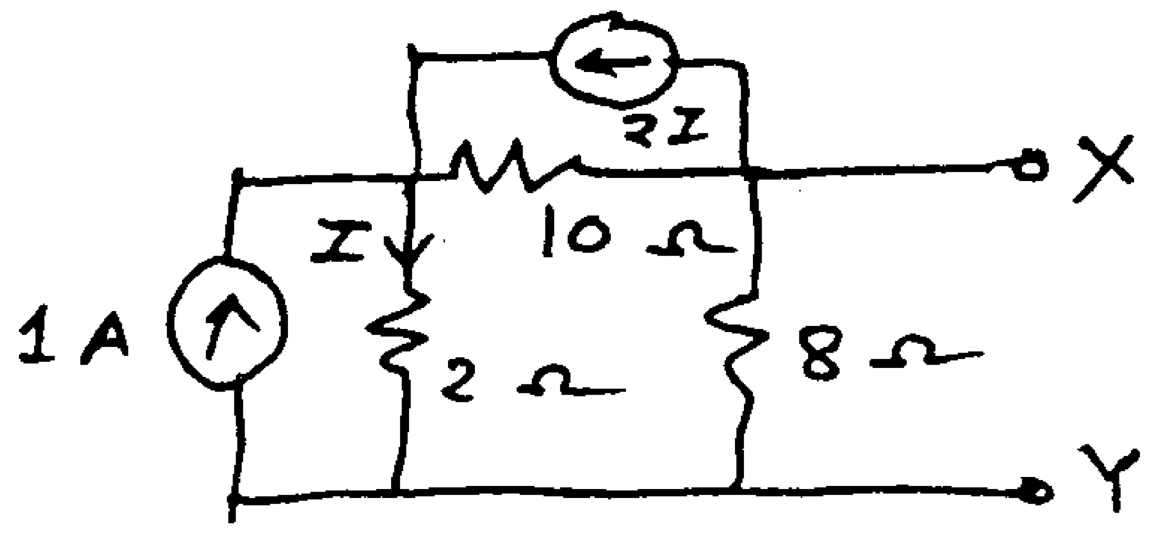

Fig. 2(a)

(b) Find the magnitude of the controlled source in the circuit shown in **Fig.2(b)** by node analysis. **5**

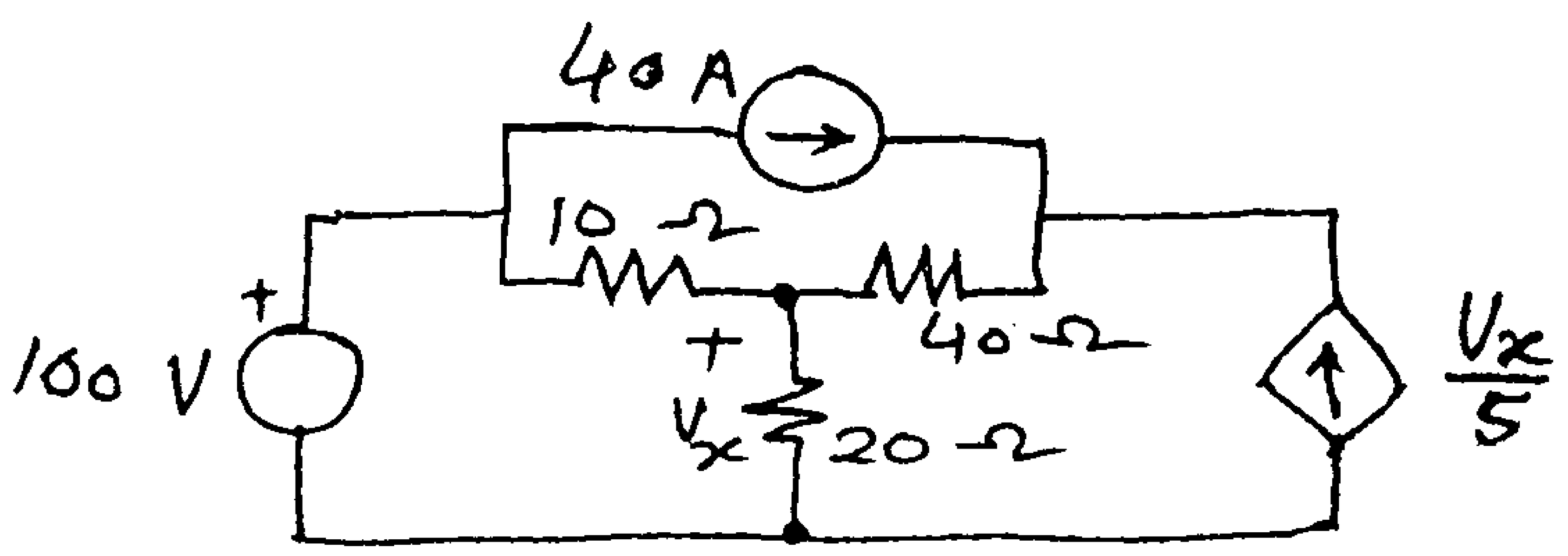

Fig. 2(b)

(c) Check if the following polynomials are Hurwitz polynomials. **5**

(i) $s^2 + 8$ (ii) $(s + 2)^3$

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3. (a) Synthesize the driving point function $F(s) = \dfrac{(s^2+1)(s^2+9)}{s(s^2+4)}$ when F(s) is a driving point **10**
(i) impedance (ii) admittance. Test if the circuit obtained are canonic.

(b) Find the voltage transfer function of a loaded two port network N in terms of the y-parameters $(y_{11}, y_{12}, y_{21}, y_{22})$ of the network N and load admittance Y_L. **5**

(c) The parameters of a transmission line are : $G = 2{\cdot}25$ m℧/km, $R = 65$ Ω/km, $L = 1{\cdot}6$ mH/km, $C = 0{\cdot}1$ μF/km. Find Z_0 and γ at a frequency of 1GHz. **5**

4. (a) Determine the ABCD parameters of the network shown in **Fig. 4(a)**. **10**

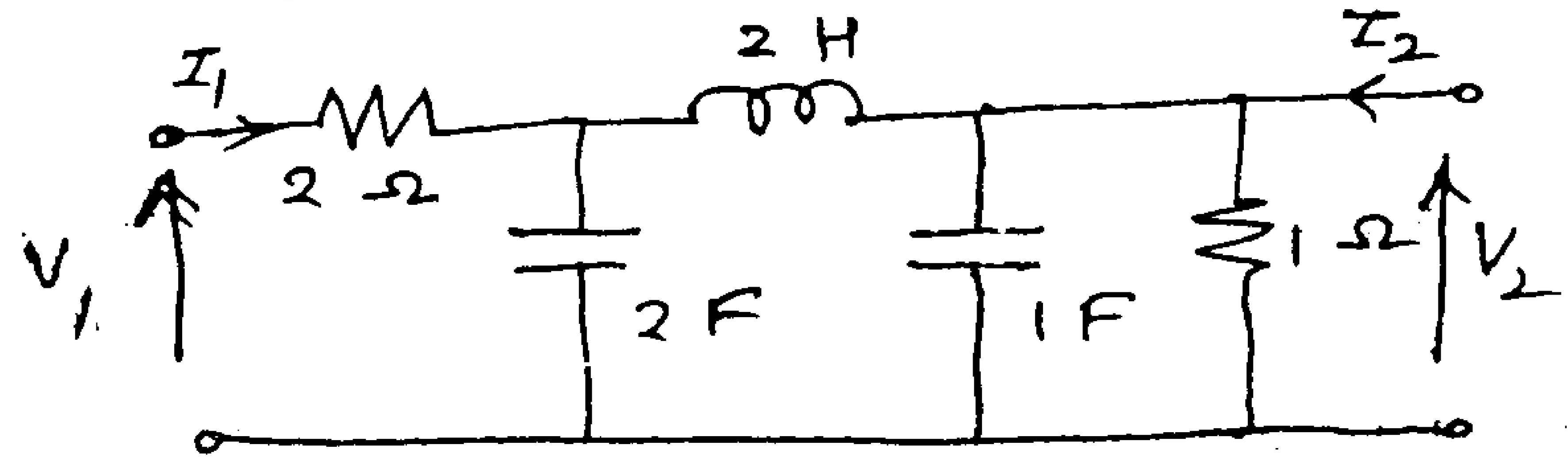

Fig. 4(a)

(b) Determine the current transfer function for the circuit shown in **Fig. 4(b)** first finding the Norton equivalent across XY and then Thevenin equivalent across AB under the condition $\omega^2 L_1 C_1 = \omega^2 L_2 C_2 = 1$. **5**

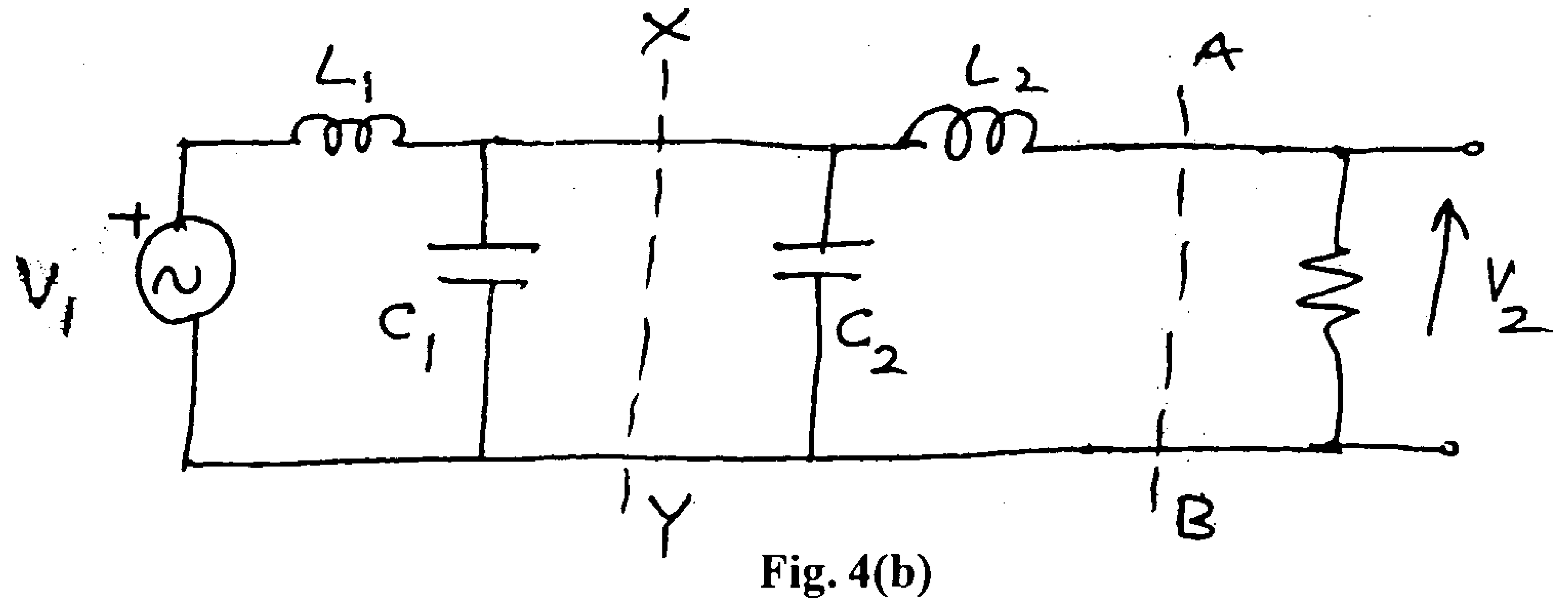

Fig. 4(b)

(c) Test if $F(s) = \dfrac{s^3 + 6s^2 + 7s + 3}{s^2 + 2s + 1}$ is a Positive Real Function. **5**

5. (a) The network shown in **Fig. 5(a)** attains steady-state with the switch K open. At $t = 0$, the switch is closed. Determine $i_1(0^+)$, $i_2(0^+)$, $i_3(0^+)$. **10**

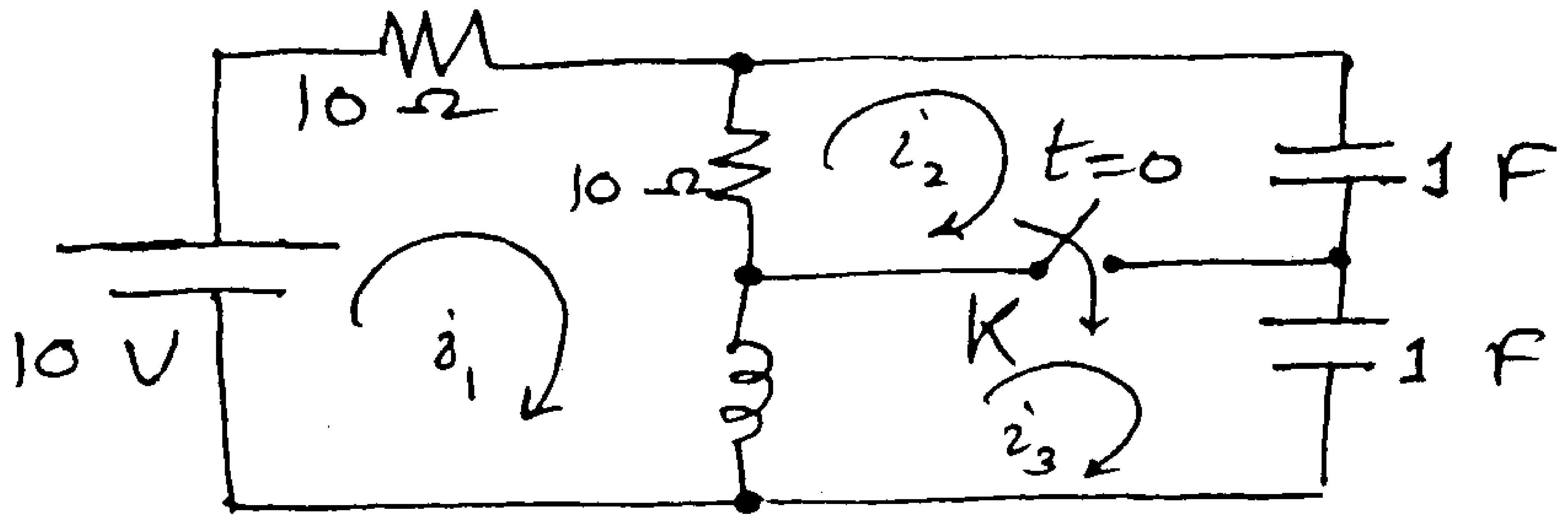

Fig. 5(a)

(b) In the circuit shown in **Fig. 5(b)** the two coupled coils have neglibible resistances. Find the current I_2 when the input $v_i(t) = 10\sqrt{2}\sin 5000\,t$ V. Is the circuit reciprocal ? 5

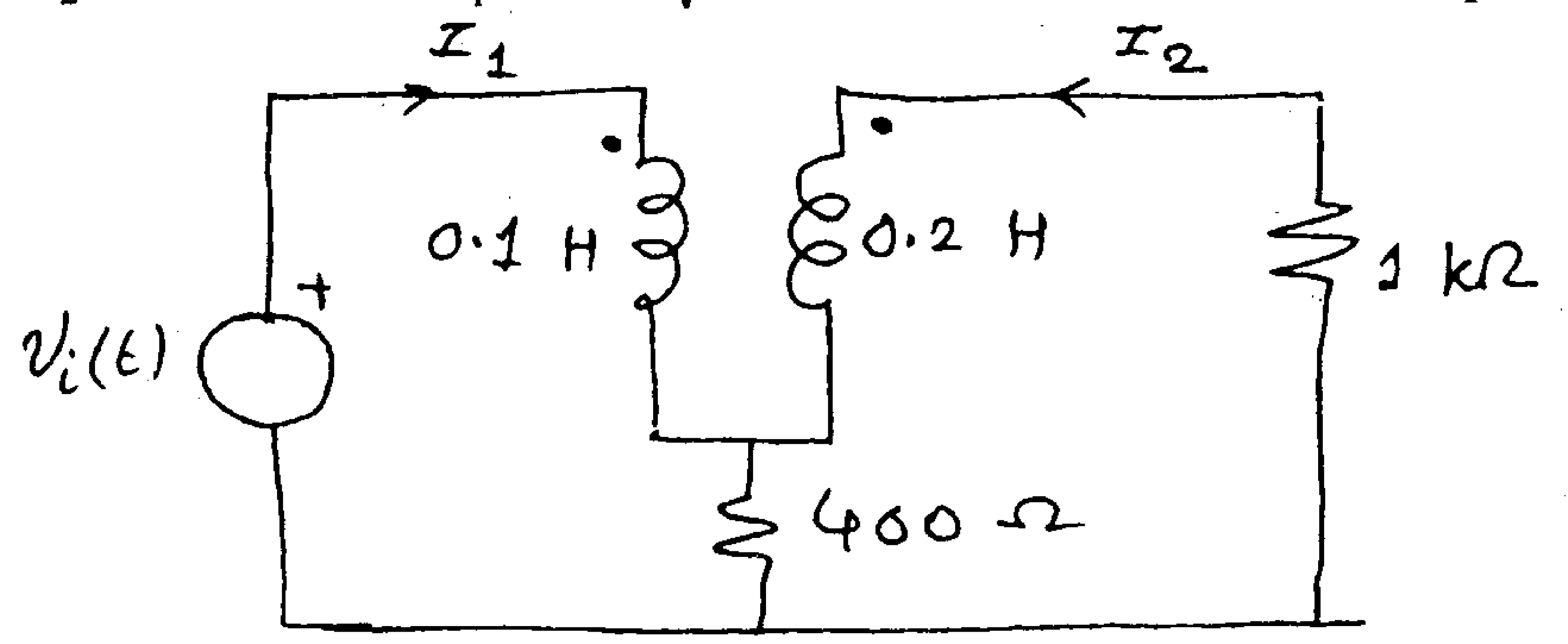

Fig. 5(b)

(c) A generator of 1 V, 1 kHz supplies power to a 1000 km open wire terminated in Z_0 having the following parameters. 5

R = 10·4 Ω/km
L = 3·97 mH/km
G = 0·8 μ℧/km
C = 0·00835 μF/km

Calculate the power delivered at the receiving end.

6. (a) Why is impedance matching required ? **10**
Draw the following normalized quantities on the Smith chart.
(i) (1 + j1) Ω,
(ii) (2 – j1) Ω,
(iii) (0·5) Ω,
(iv) (j0·5) Ω

(b) FindZ(s) for the circuit shown in **Fig. 6(b)**. 5

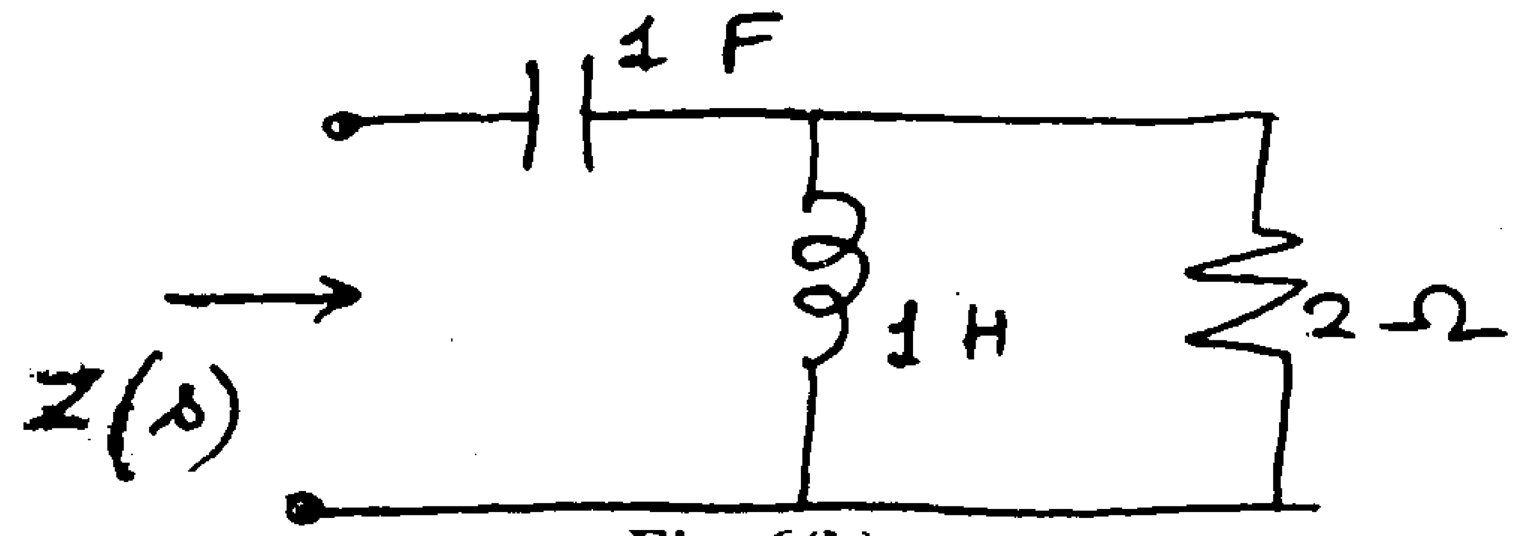

Fig. 6(b)

(c) Find current i(t) through R in the circuit shown in Fig.6(c) using Laplace transform. Why is the frequency domain method preferred to the classical time domain method ? 5

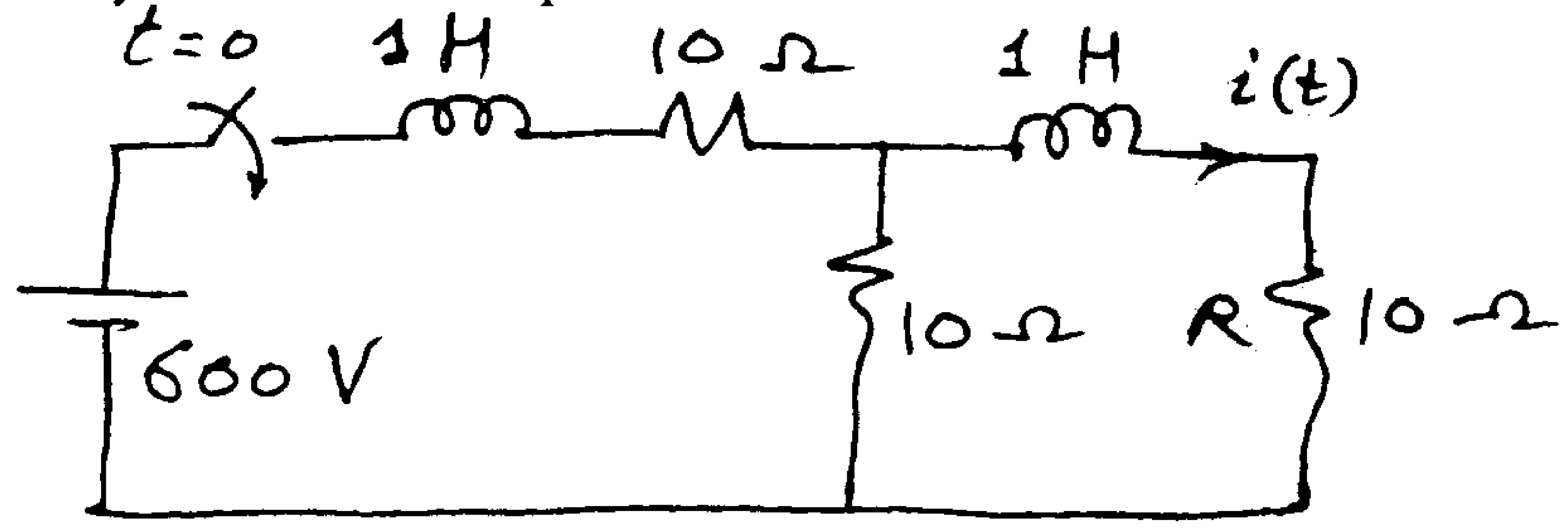

Fig. 6(c)

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