S.E. ExTC sem III CBGS M-2014

Sub - CTL

QP Code : **NP-18764**

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

N.B. : 1. Attempt Q1 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. Assume suitable data with justification if missing.

1. (a) Determine the z-parameters of the network shown in Fig. 1(a) using y-z parameter relations only. 5

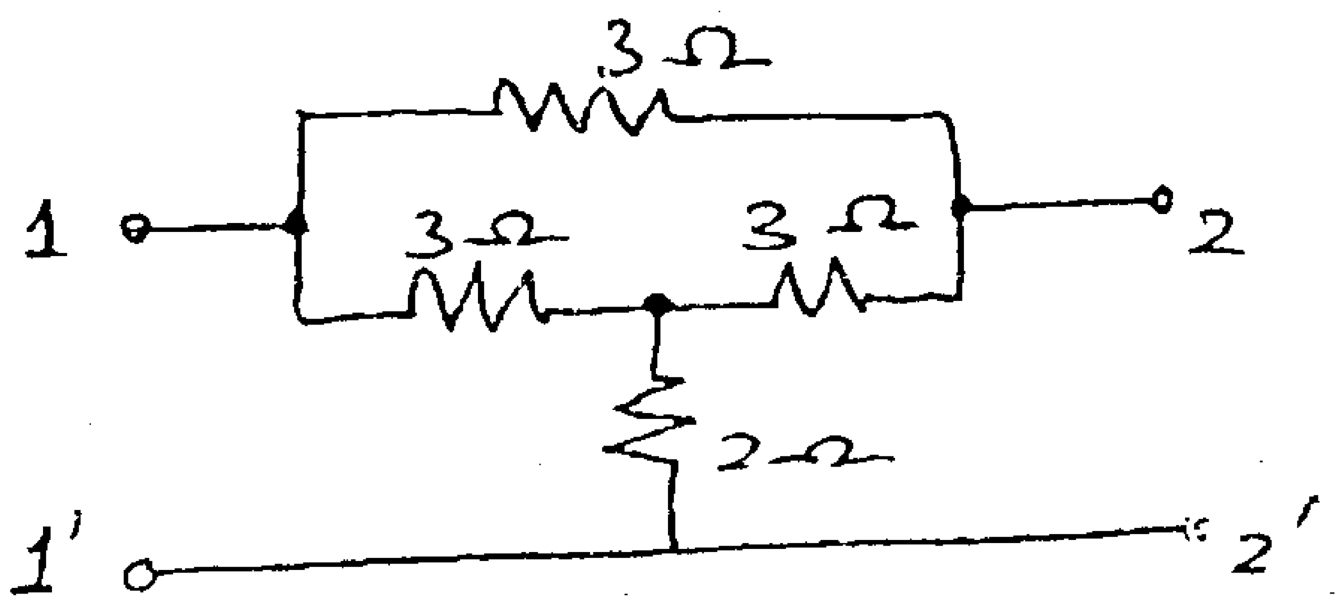

Fig. 1(a)

(b) Test if $F(s) = 2s^6 + 4s^5 + 6s^4 + 8s^3 + 6s^2 + 4s + 2$ 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 40 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. What should be the value of μ so that the circuit becomes reciprocal? 10

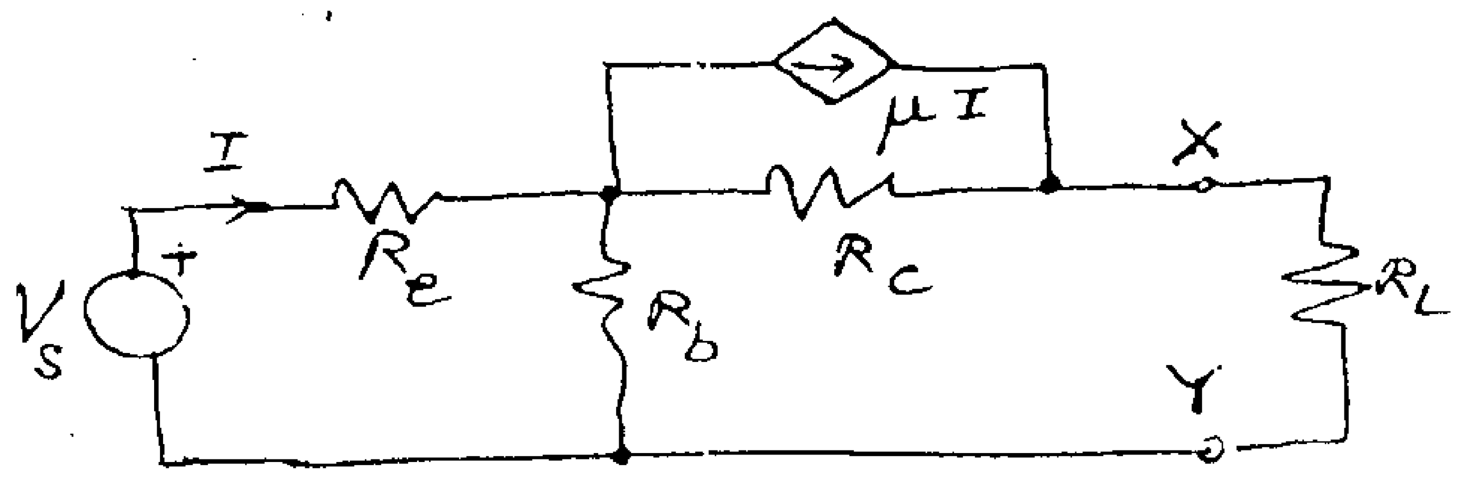

Fig. 2(a)

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

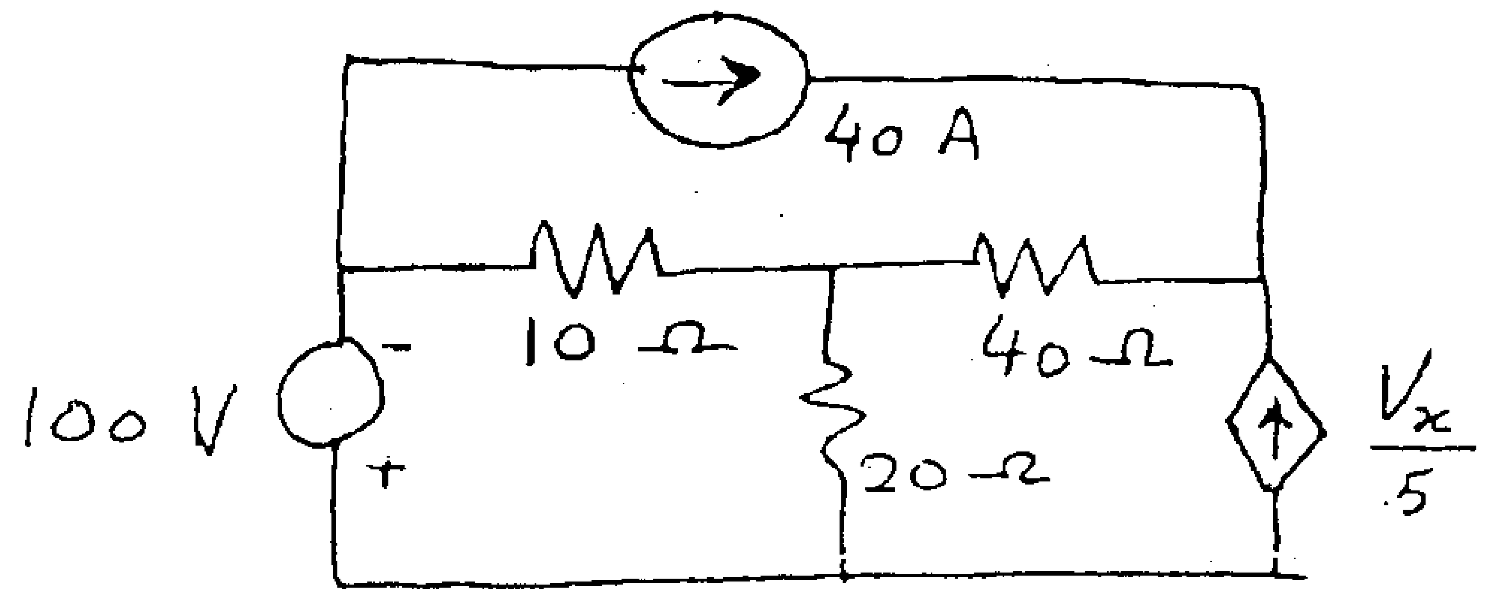

Fig. 2(b)

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

(i) $s+8$ (ii) $(s+8)^7$

3. (a) Synthesize the driving point function $F(s)=\frac{(s^2+4)(s^2+16)}{s(s^2+9)}$ when $F(s)$ is driving point (i) impedance (ii) admittance. Test if the circuits obtained are canonic. 10

(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: $G = 2.25$ mΩ/km, $R = 65$ Ω/km, $L = 1.6$ mH/km, $C = 0.1$ μF/km. Find characteristic impedance and the propagation constant of the line at a frequency of 1 GHz. 5

4. (a) Determine the z-parameters of the network shown in Fig. 3(a). 10

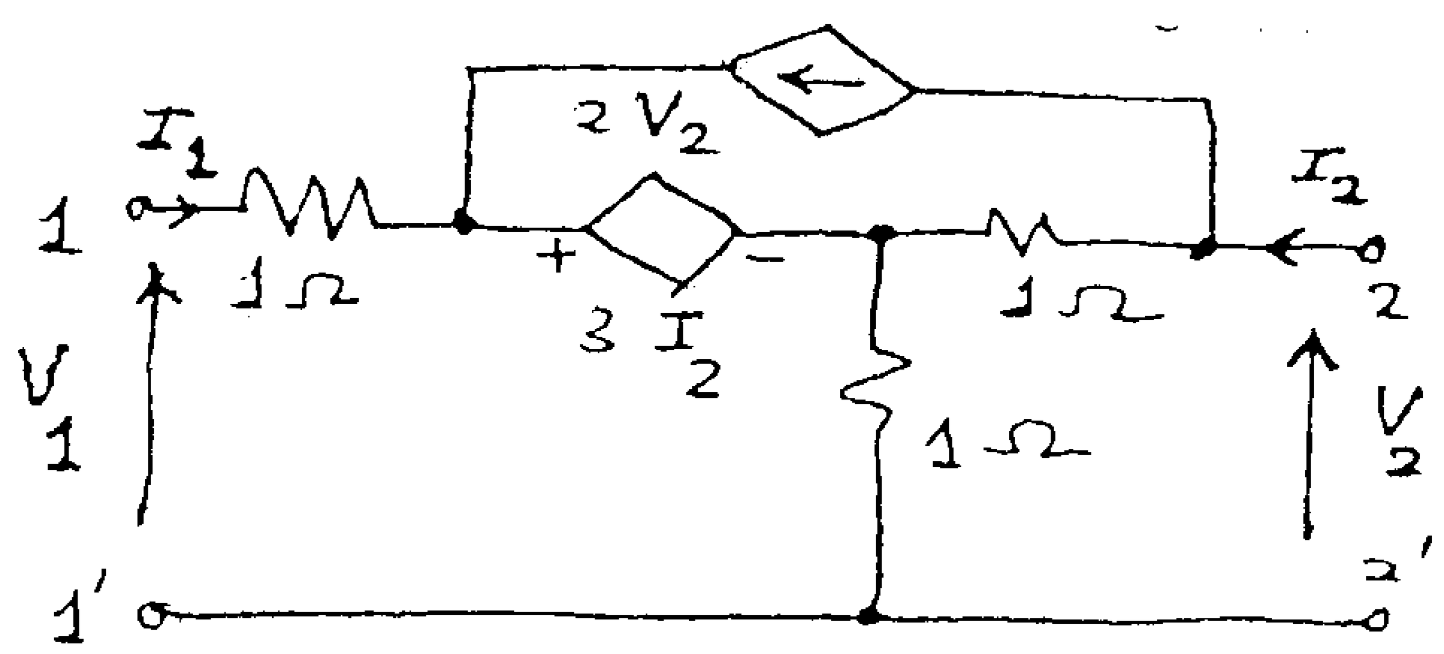

Fig. 3(a)

(b) Determine the voltage transfer function for the circuit shown in Fig. 4(b) under the condition $\omega^2 L_1 C_1 = \omega^2 L_2 C_2 = 1$. 5

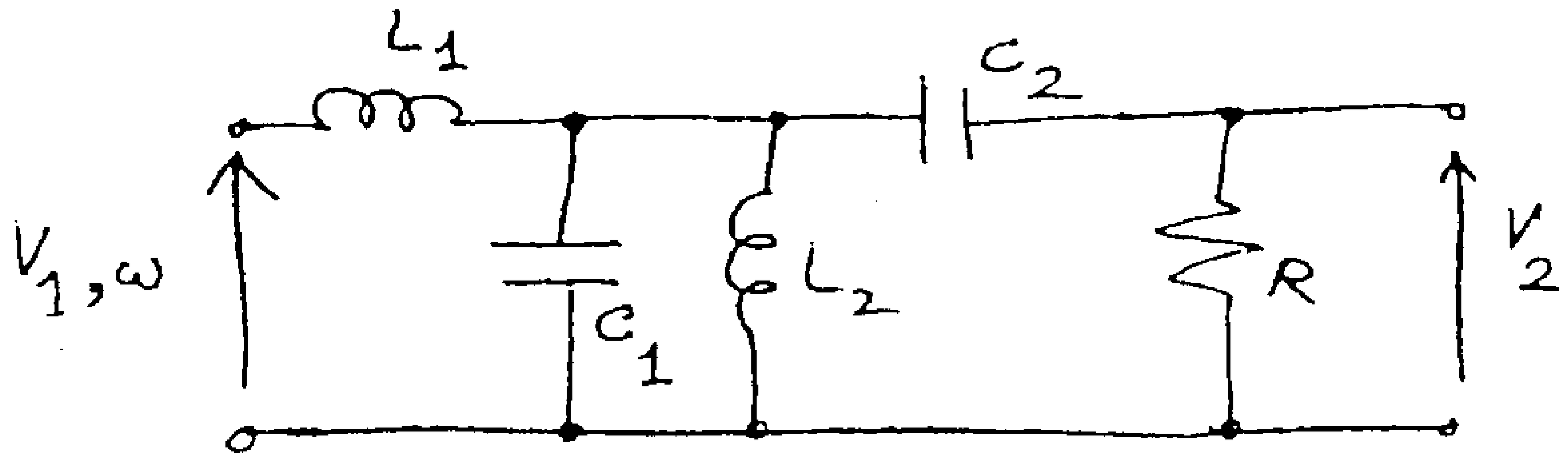

Fig. 4(b)

(c) Test if $F(s) = \dfrac{s^3 + 6s^2 + 7s + 7}{s^2 + 2s + 1}$ 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 the current through the switch at $t = 0^+$. 10

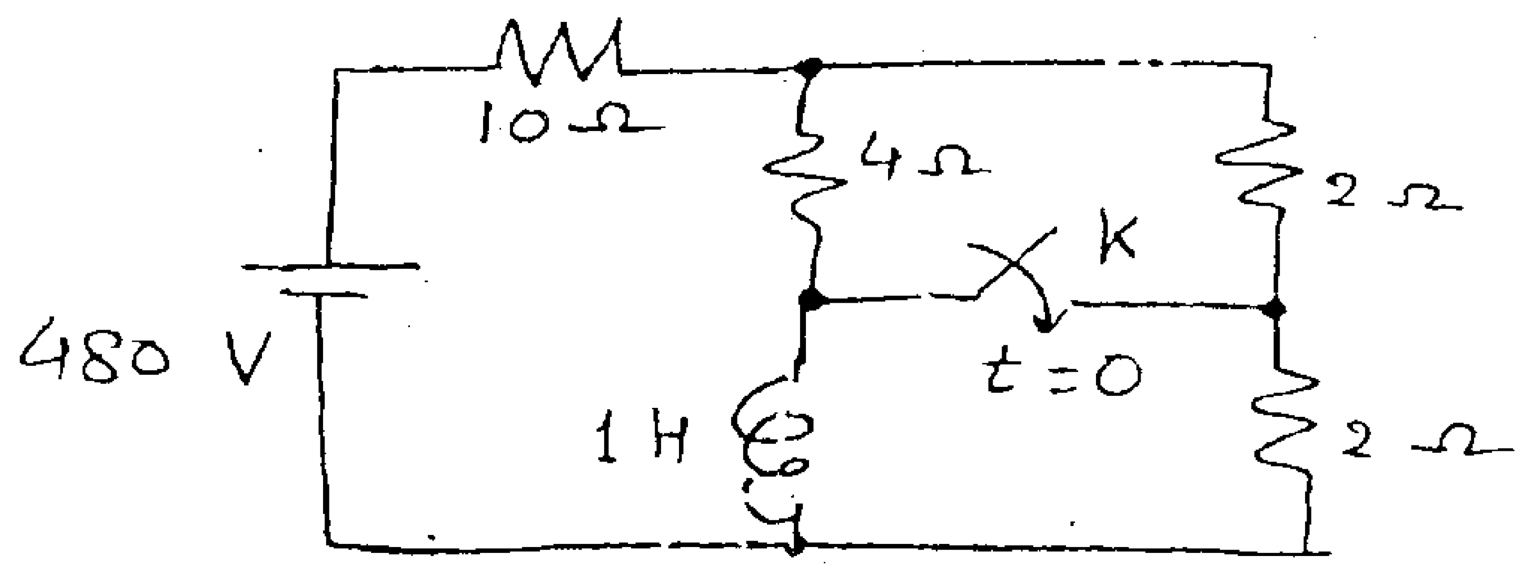

Fig. 5(a)

(b) In the circuit shown in Fig. 5(b) the two coupled coils have negligible resistances. Find the current I_2 when the input $v_i(t) = 100\sqrt{2}\sin 5000t$V. 5

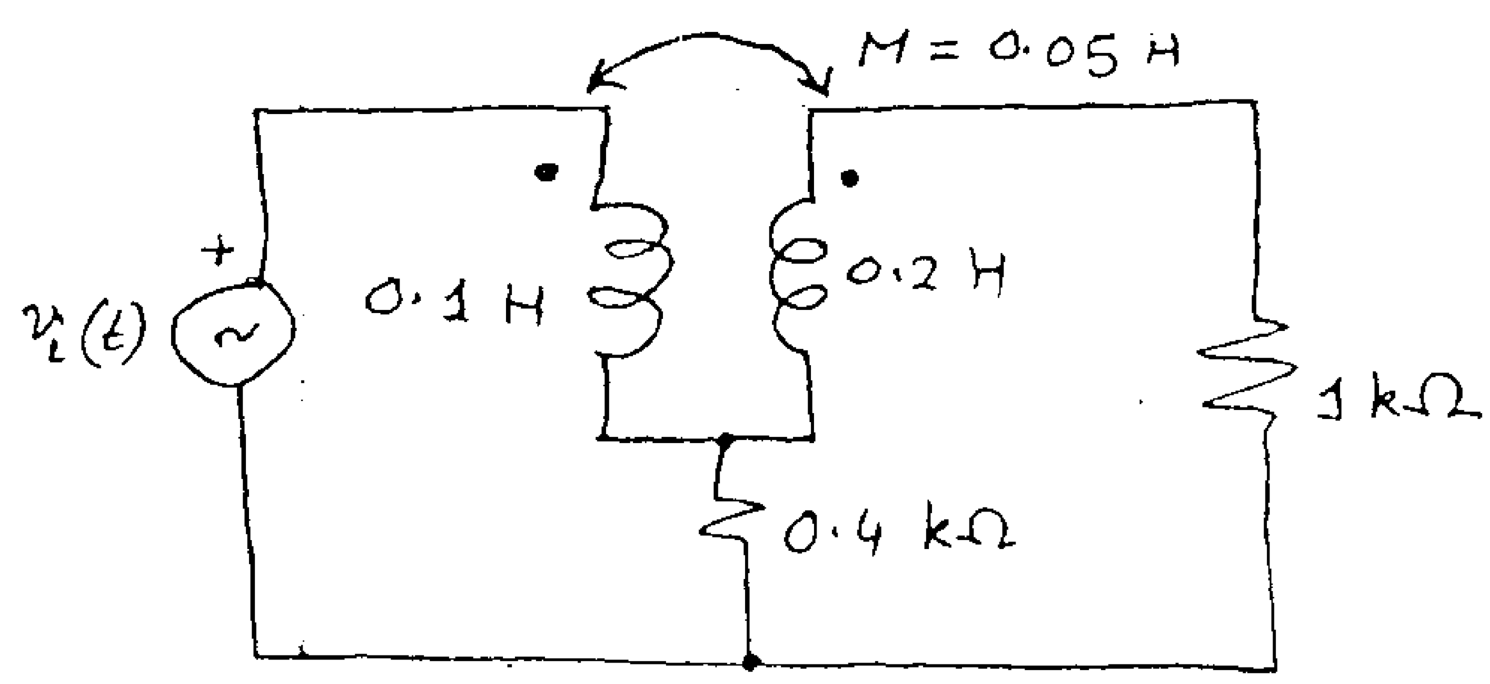

Fig. 5(b)

(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

$R = 10.4\ \Omega/\text{km}$
$L = 3.07\ \text{mH/km}$
$G = 0.8\ \mu\Omega/\text{km}$
$C = 0.00835\ \mu\text{F/km}$

Calculate the power delivered at the receiving end.

6. (a) Find and expression for current $i(t)$ through R in the circuit shown in Fig. 6 (a) using Laplace transform. Assume that the circuit is overdamped. Why is the frequency domain method preferred to the classical time domain method? **10**

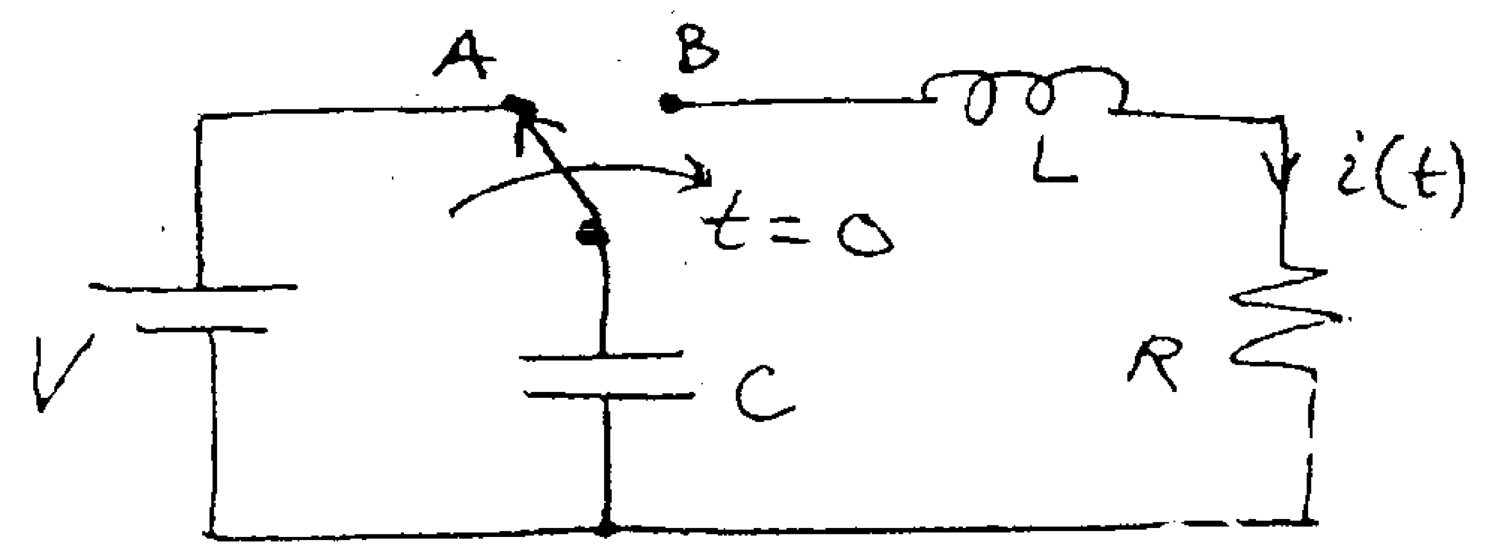

Fig. 6(a)

(b) Find the voltage transfer function for the circuit shown in Fig. 6(b). Assume $L = CR^2$. **5**

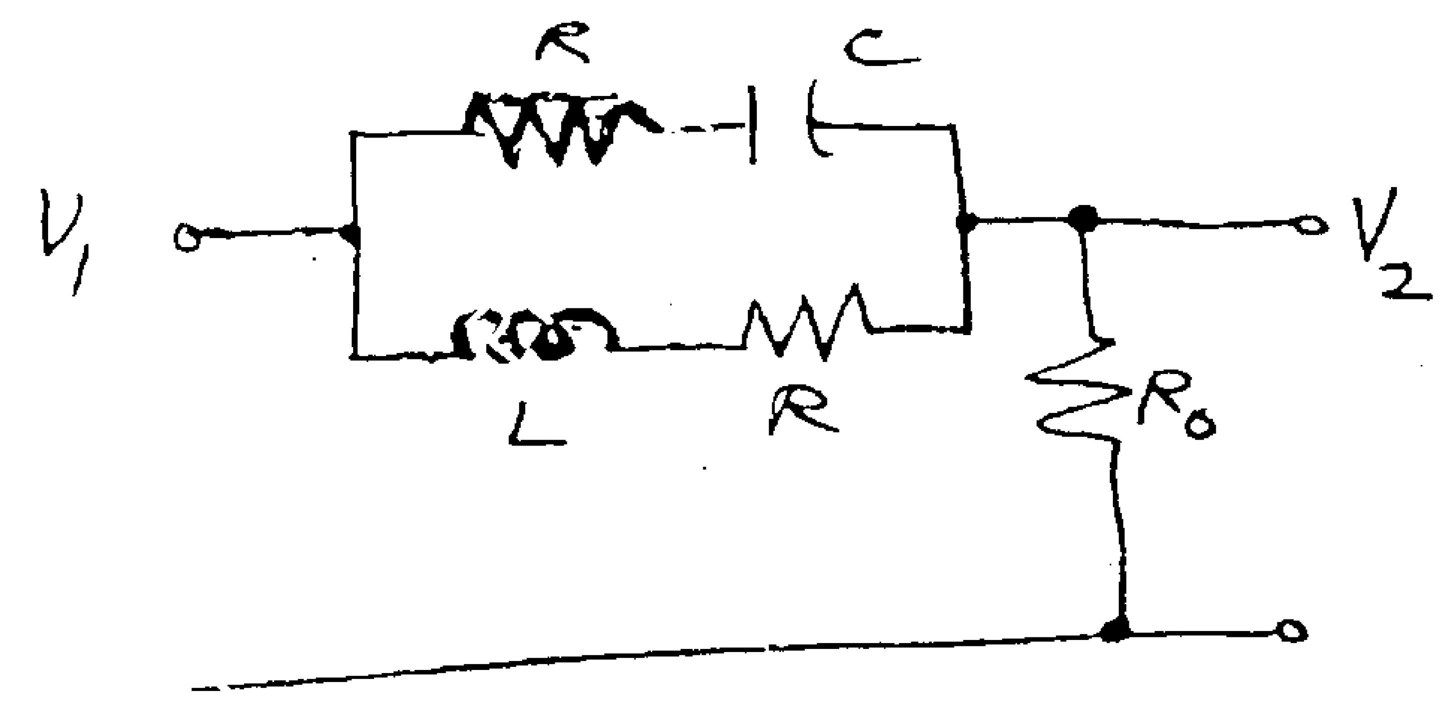

Fig. 6(b)

(c) Draw the following normalized quantities on the Smith chart. **5**

(i) $(2 + j2)\ \Omega$,
(ii) $(4 - j2)\ \Omega$,
(iii) $(1.0)\ \Omega$,
(iv) $(j1.0)\ \Omega$
