Ref No. Ex/ET/PC/B/T/212/2023 (S)

B. ETCE 2ND YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2023
CIRCUIT ANALYSIS AND SYNTHESIS

Time: 3 Hours **Full Marks: 100**

Part I: 30 Marks

Answer any **One (1)** Question from the followings: 30×1

1. (a) What do you mean by passive and active elements? Give examples. 4
   (b) What is a complex frequency? Explain its significance. 4
   (c) Explain how Q acts as an amplification factor in resonant circuits? 4
   (d) State the advantage offered by graph theory as applied to electric circuit problems. Explain the terms: branch, link, tree, co-tree and loop. 3 + 5
   (e) Explain what you mean by critical frequencies of driving point admittance function. What are the different properties of a driving point reactance function? 2 + 3
   (f) What are the properties of the R-L driving point impedance and R-C admittance function? 5
2. (a) The voltage waveform $v(t)$ across a capacitor C is shown in Fig. 1. Plot the current through C as a function of time t. 10
   (b) In the circuit of Fig. 2, determine the voltage V_0 using source transformation. 10
   (c) In the circuit of Fig. 3, L_1 1500 μH, L 200 μH and C_1 0.001 μF. If free oscillations are set up in the circuit by some means, at what frequencies would they occur? 10

Part II: 60 Marks

Answer any **Four (4)** Question from the followings: 15×4

1. For the network shown in Fig. 4, draw the graph, tree and obtain a cut-set schedule and equilibrium node equations and solve for node voltages and branch currents. 15
2. (a) Using nodal analysis, find the current and voltages in all the branches of the network for the circuit shown in Fig. 5. 7
   (b) Find the voltage V across 12 Ω resistance using Norton's theorem for the circuit shown in Fig. 6. 8
3. (a) Find Y-parameters for the network shown in Fig. 7. 8
   (b) Find the value of L for which the circuit of Fig. 8 is resonant at a frequency ω 10,000 rad/sec. 7
4. (a) A filter section is to have design impedance of 500 Ω, a cut-off frequency of 5 KHz and a frequency of infinite attenuation of 4 KHz. Determine the value of components if the section is to be m-derived π-filter.
   (b) Design a active notch filter for f_0 2 KHz, Q 10. Assume C 500 pF.
5. (a) The driving point impedance across the terminal 1, 2 in the network of Fig. 9 is $Z_D(s)$ $(2s^2 + 2)/(s^3 + 2s^2 + 2s + 2)$
   If $Z(s)$ is an LC network, synthesize it in the first Foster form. Also find R. 8
   (b) The polynomial form of driving point impedance is
   $Z_D(s)$ $(2s^2 + 8s + 6)/(s^2 + 6s + 8)$
   Determine the First Cauer form of network. 7
6. (a) Find the Laplace Transform of the functions
   (i) $f(t)$ $e^{-at} \sin \omega t\, u(t)$ 2
   (ii) $f(t)$ $t \cos \omega t\, u(t)$ 2
   (b) Using the convolution theorem evaluate the inverse Laplace Transform for the following function

[Turn over

Ref No. Ex/ET/PC/B/T/212/2023 (S)

B. ETCE 2ND YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2023
CIRCUIT ANALYSIS AND SYNTHESIS

Time: 3 Hours **Full Marks: 100**

F(s) $1/(s \cdot a)^2$ 3

(c) Find the *i(t)* in the circuit (Fig. 10) when the switch *"k"* is closed at *t* 0 (using Laplace Transform). 8

7. (a) Suppose that a periodic voltage is expressed as

$$v(t) = V_0 + \sum_{n=1}^{\infty} V_n \cos(n\omega_0 t - \alpha_n)$$

then calculate the average power and plots power spectra. 7

(b) In Fig. 11 $v_i(t)$ 10 *sgn(t)*volt. Using Fourier Transform method find $v_c(t)$ and plot $v_c(t)$ versus *t*. 8

Part III: 10 Marks

Answer any **One (1)** Question from the followings: 10×1

1. Make a comparative study between Laplace and Fourier Transform.
2. Make a comparative study between LPF, HPF, BPF and BEF
3. Make a comparative study between Driving point and Transfer impedance

Ref No. Ex/ET/PC/B/T/212/2023 (S)

B. ETCE 2ND YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2023
CIRCUIT ANALYSIS AND SYNTHESIS

Time: 3 Hours | Full Marks: 100

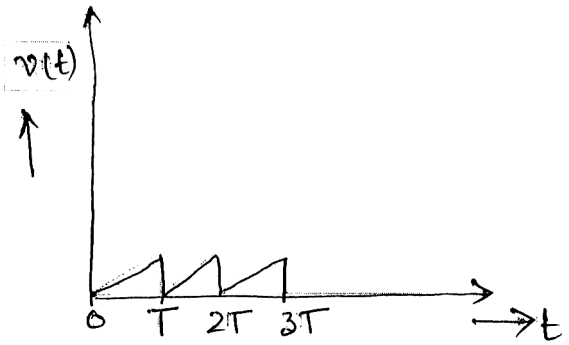

Fig. 1

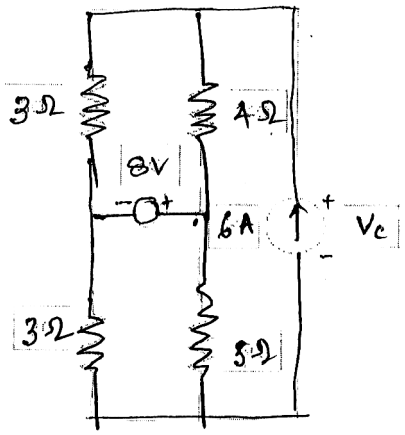

Fig. 2

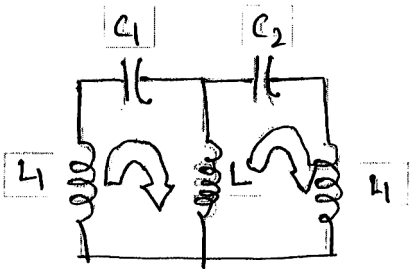

Fig. 3

Ref No. Ex/ET/PC/B/T/212/2023 (S)

B. ETCE 2ND YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2023
CIRCUIT ANALYSIS AND SYNTHESIS

Time: 3 Hours **Full Marks: 100**

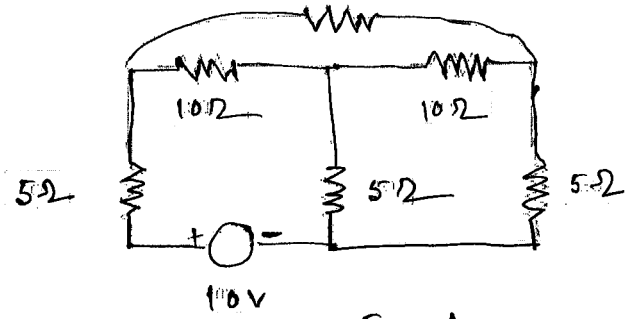

Fig. 4

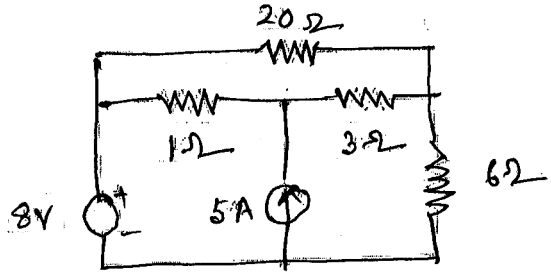

Fig. 5

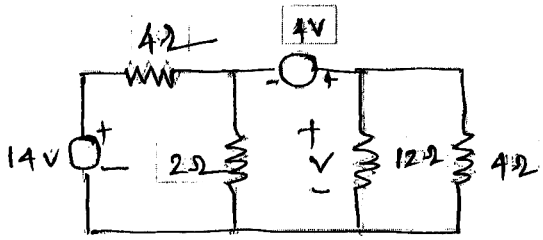

Fig. 6

Ref No. Ex/ET/PC/B/T/212/2023 (S)

B. ETCE 2ND YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2023
CIRCUIT ANALYSIS AND SYNTHESIS

Time: 3 Hours **Full Marks: 100**

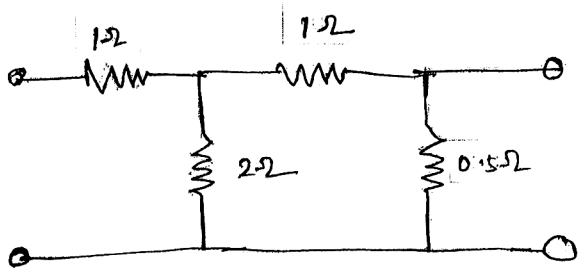

Fig. 7

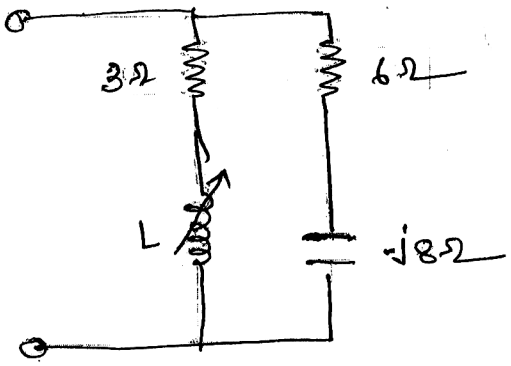

Fig. 8

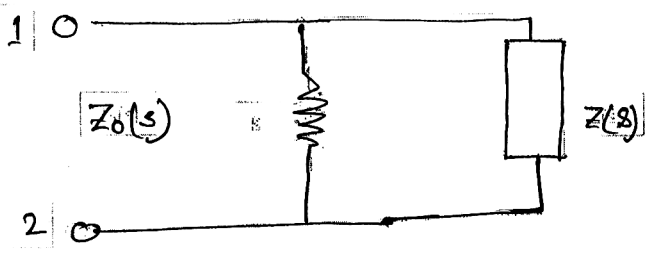

Fig. 9

Ref No. Ex/ET/PC/B/T/212/2023 (S)

B. ETCE 2ND YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2023
CIRCUIT ANALYSIS AND SYNTHESIS

Time: 3 Hours | Full Marks: 100

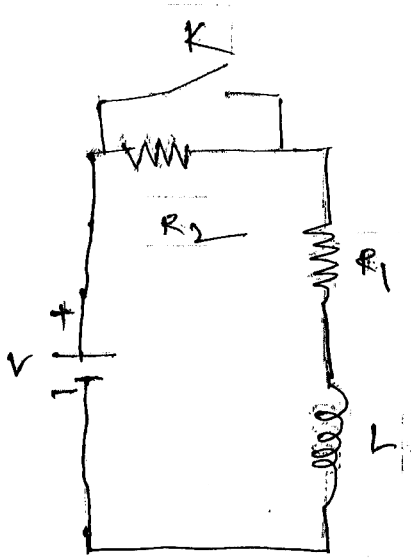

Fig. 10

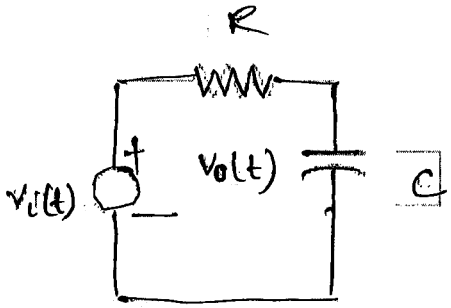

Fig. 11