Ref No. Ex/ET/PC/B/T/212/2024

B. ETCE 2ND YEAR 1ST SEMESTER EXAMINATION, 2021

CIRCUIT ANALYSIS AND SYNTHESIS

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

Answers any five questions from the followings. (5×20)

1) A) For the network shown in Fig.1, determine the node voltages. (10)

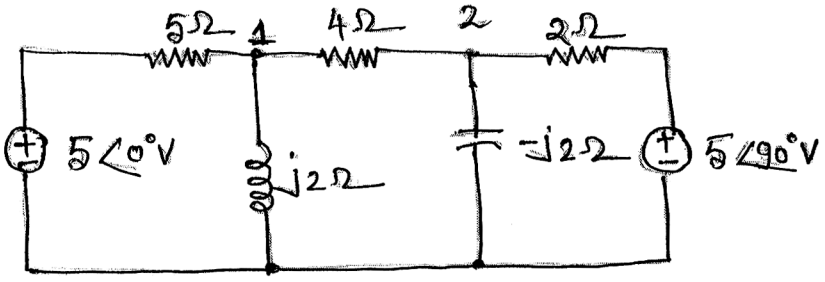

Fig. 1

B) Determine the loop currents i_1 ,i_2,i_3 of the network shown in Fig.2, by mesh analysis, given R_1=R_2=R_3=1 ohm and v_1=v_2=v_3=1 volt. Assume R_4 to be negative resistance of value -5 ohms. (10)

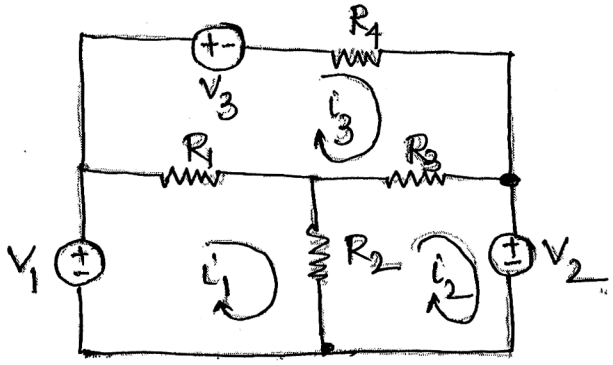

Fig. 2.

2) A) Determine the Fourier expansion in the exponentional from for the square wave given in Fig.3. (12)

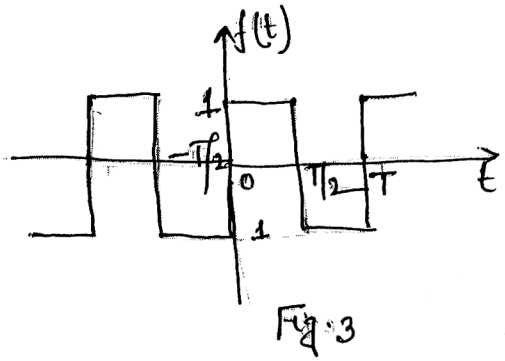

Fig. 3

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CIRCUIT ANALYSIS AND SYNTHESIS

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

B) Determine the output voltage response across the capacitor to a current source excitation $i(t)=e^{-t}U(t)$, as shown in Fig.4. (8)

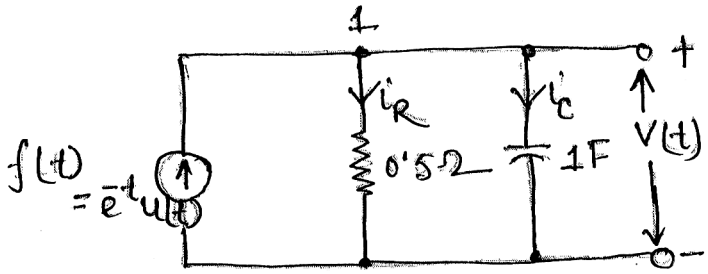

Fig. 4.

3) A) Determine the Laplace transform of the following time functions

i) t-exp(-at) ii) 5exp(-3t)cos5t (5)

B) For the given Laplace transform

$$Y(s) = \frac{17s^3+7s^2+s+6}{s^5+3s^4+5s^3+4s^2+2s}$$

Find the initial value and final value of the corresponding time function y(t). (5)

C) Apply the Laplace transform method to determine the mesh current in the circuit shown in Fig.5. Assume the switch is closed at t=0. (10)

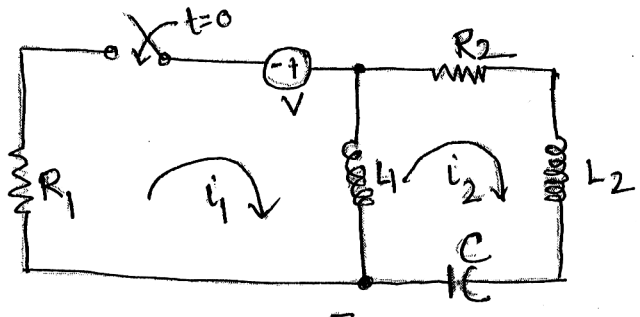

Fig. 5

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

4) A) Using the principle of superposition, calculate the voltage $V_2(t)$in Fig.6. Assume $R_1=R_2=1\Omega$, $R_3=0.5\Omega$, C=2F, $\beta=2$, $\alpha=1$, i(t)=sint, V(t)=t. (10)

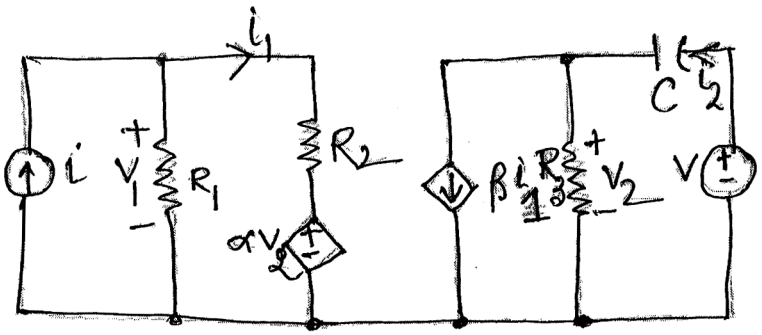

Fig. 6

B) Find Thevenin's equivalent at terminals A,B of the network in Fig.7. Then determine the current through resistor R_L. (10)

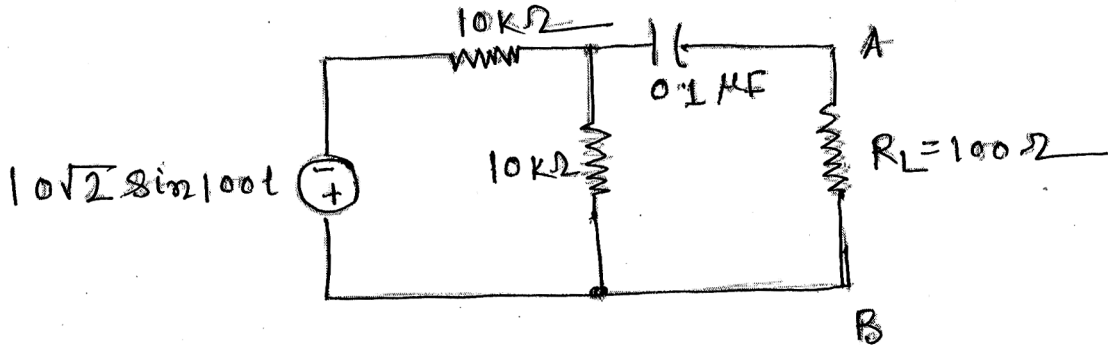

Fig. 7.

5) A) An RLC series circuit has R=1kΩ, L=100mH, C=10μF. If a voltage of 100 is applied across the series combination , determine i) resonant frequency ii) Q-factor and iii) half power frequencies. Derive the necessary relation you use. (12)

B)In the network shown in Fig.8, find the value of C for resonance to take place when ω=500rad/s. Determine the branch currents. (8)

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CIRCUIT ANALYSIS AND SYNTHESIS

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

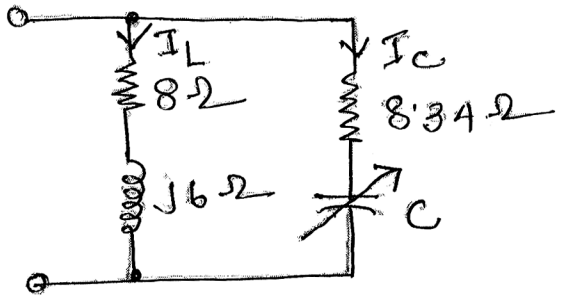

Fig. 8.

6) A) Determine the Y and Z- parameters of the network shown in Fig.9 (13)

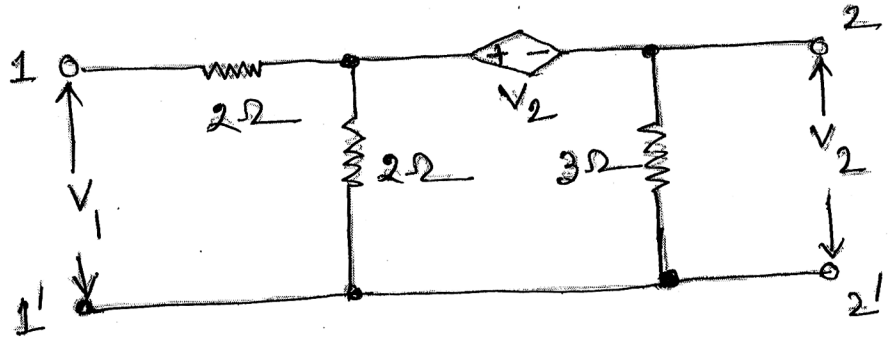

Fig. 9.

B) Design a composite low-pass filter to be terminated in 600Ω. It must have a cut-off frequency of $1kH_z$ with very high attenuation at $1050H_z$, $1250H_z$ and infinity. Draw the complete composite low-pass T-section. (7)

7) A) Write the driving-point impedance of the ladder network in Fig.10. (10)

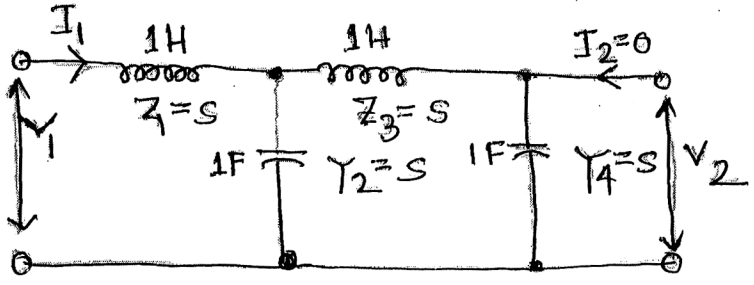

Fig. 10

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

B) Find the function V_0/V_{IN} for the circuit shown in Fig.11. (10)

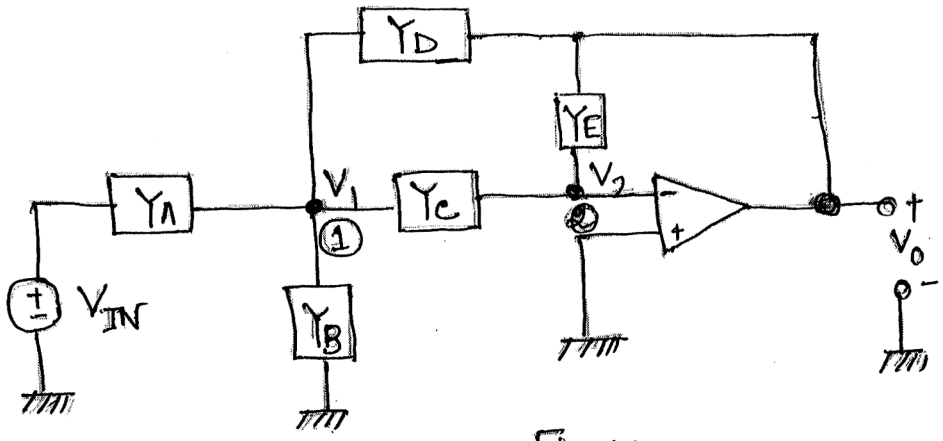

Fig. 11

8) A) Synthesize first and second Foster and Caurer forms of the LC driving point impedance function

$$Z_D(s) = \frac{(s^2+1)(s^2+16)}{s(s^2+4)}$$ (10)

B) Synthesize the Foster I and II forms of the R-C driving point function

$$Z_D(s) = \frac{2s^2+12s+16}{s^2+s+3}$$ (10)

9) Write short note: (Any Four) 4×5

i. PRF
ii. LC driving point impedance function
iii. Maximum power transform theorem
iv. Passive and active filters
v. Fourier and Laplace transforms
vi. Source transformation
vii. Series and Parallel RLC circuits
viii. Node and mesh analysis.