University of Mumbai

Examination 2020 under Cluster 06

(Lead College: Vidyavardhini's College of Engg Tech)

Examinations Commencing from 7th January 2021 to 20th January 2021

Program: **Electronics Engineering**

Curriculum Scheme: Rev 2019

Examination: SE Semester III

Course Code: ELC304 and Course Name: **Electrical Networks Analysis and Synthesis**

Time: 2 hour Max. Marks: 80

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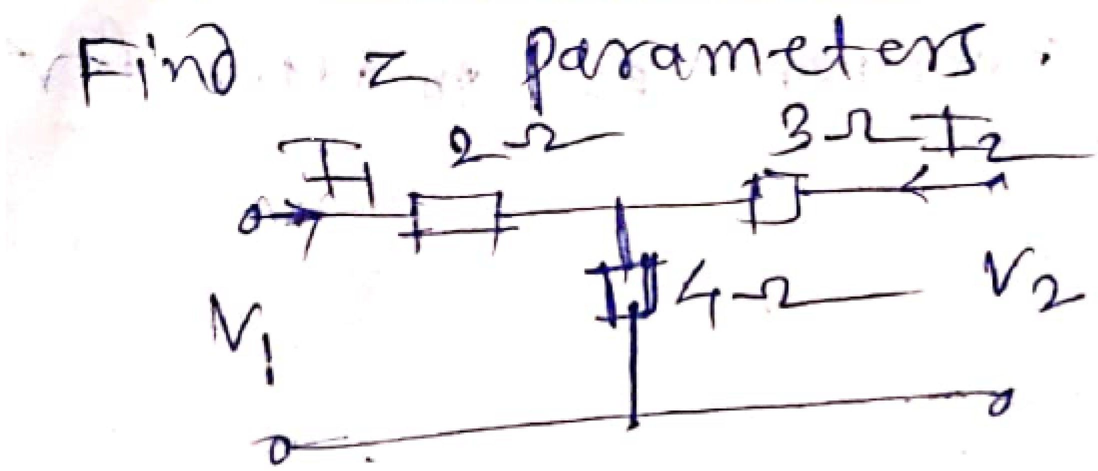
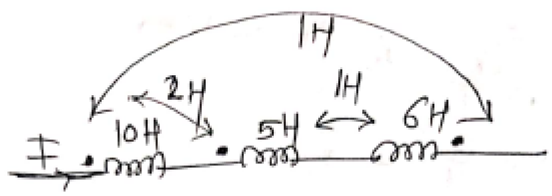
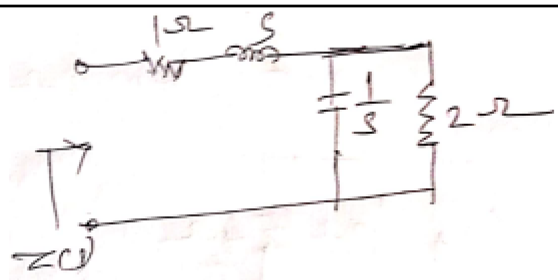
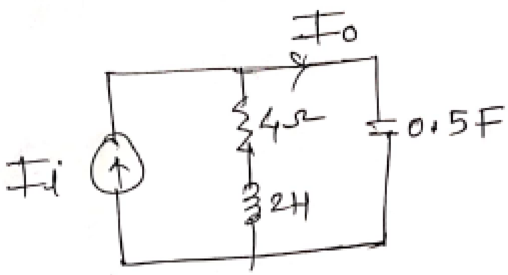
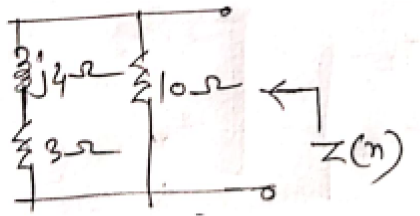
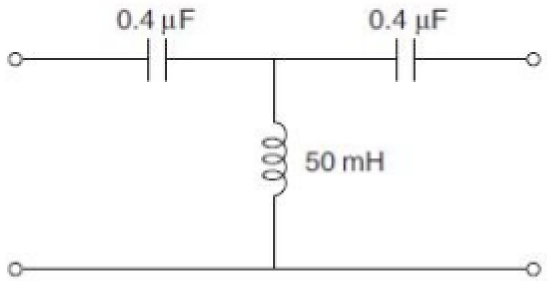
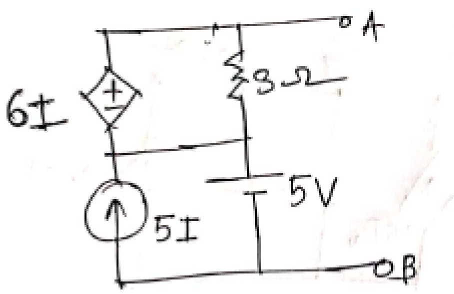
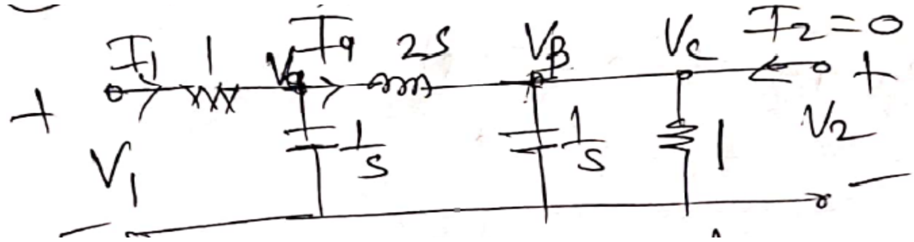
Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Which is the condition of symmetry for h parameters
Option A:	h12 = -h21
Option B:	h11h22-h12h21 = 1
Option C:	h11h21-h12h22 = 1
Option D:	h11 = 22
2.	A dependent source
Option A:	May be a current source or a voltage source
Option B:	Is always a voltage source
Option C:	Is always a current source
Option D:	Neither a current source nor a voltage source
3.	
Option A:	$\begin{bmatrix} 6 & 4 \\ 4 & 7 \end{bmatrix}$
Option B:	$\begin{bmatrix} 4 & 6 \\ 6 & 7 \end{bmatrix}$

Option C:	$\begin{bmatrix} 4 & 6 \\ 4 & 6 \end{bmatrix}$
Option D:	$\begin{bmatrix} 6 & 4 \\ 7 & 4 \end{bmatrix}$
4.	Application of Norton's theorem to a circuit yields
Option A:	Equivalent current source and impedance in series
Option B:	Equivalent current source and impedance in parallel
Option C:	Equivalent impedance
Option D:	Equivalent current source
5.	In time domain analysis, the initial condition from $t = -\infty$ to $t = 0^-$ denotes
Option A:	Just after switching condition
Option B:	Steady State Condition
Option C:	After switching condition
Option D:	Just before switching condition
6.	Which is this function $z(s) = \frac{4(s^2+1)(s^2+9)}{s(s^2+4)}$
Option A:	RC Function
Option B:	RL Function
Option C:	LC Function
Option D:	RLC Function
7.	Find equivalent inductance. 
Option A:	12 H
Option B:	13 H
Option C:	15 H
Option D:	21 H
8.	Find driving point impedance Z(S).

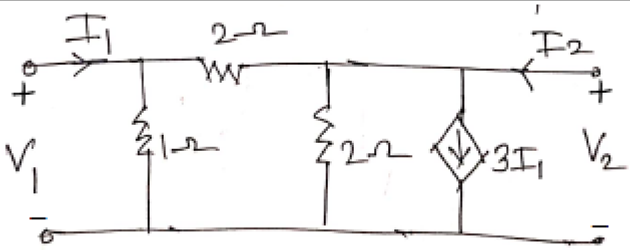
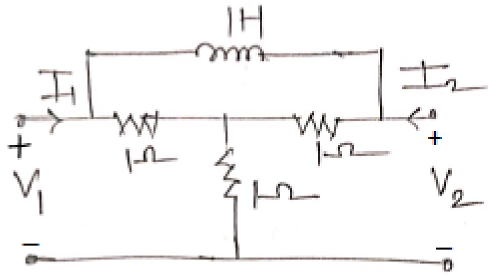
	
Option A:	$\frac{2s^2 - 3s + 3}{2s + 1}$
Option B:	$\frac{2s^2 + 3s + 3}{2s + 1}$
Option C:	$\frac{2s^2 + 3s - 3}{2s + 1}$
Option D:	$\frac{2s^2 - 3s - 3}{2s + 1}$
9.	The necessary and sufficient condition for a rational function F(S)to be the driving point impedance of an RC network is that all poles and zeros should be
Option A:	Simple and lie on the negative real axis in the s plane.
Option B:	Complex and lie in the left half of s plane.
Option C:	Complex and lie in the right half of s plane.
Option D:	Simple and lie on the positive real axis of the s plane.
10.	For the given network find poles and zeros of function I_o/I_i 
Option A:	Zeros at -0,-2 and poles at 1,1
Option B:	Zeros at 0,-2 and poles at 1,1
Option C:	Zeros at 0,-2 and poles at -1,-1
Option D:	Zeros at 0,2 and poles at -1,-1
11.	Which is the condition of symmetry for ABCD parameters
Option A:	AD-BC = 1
Option B:	B = C
Option C:	AB – CD = 1

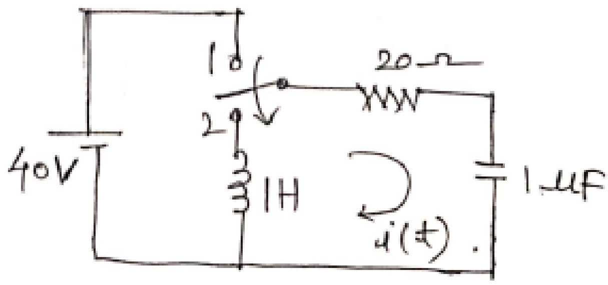
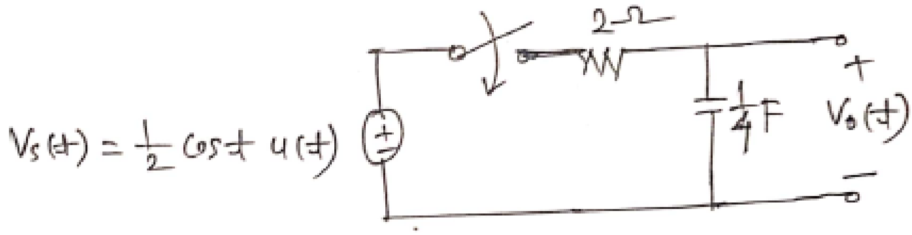
Option D:	A = D
12.	Calculate Z(n) 
Option A:	3.86 angle 36.03^0 ohm
Option B:	3.86 angle -36.03^0 ohm
Option C:	3.68 angle 36.03^0 ohm
Option D:	3.68 angle -36.03^0 ohm
13.	The concept on which superposition theorem based is
Option A:	Reciprocity
Option B:	Duality
Option C:	Non-linearity
Option D:	Linearity
14.	The cut-off frequency of given circuit is 
Option A:	3.183 kHz
Option B:	795.77 Hz
Option C:	1.591 kHz
Option D:	253.3 Hz
15.	Find the voltage V_{AB} 
Option A:	11 I
Option B:	3+6 I
Option C:	6 I+5
Option D:	31 I

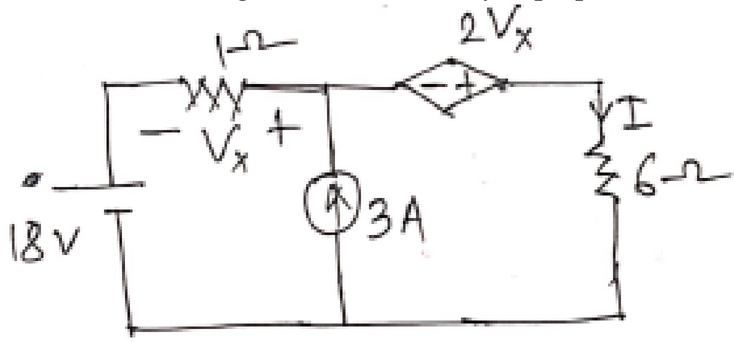
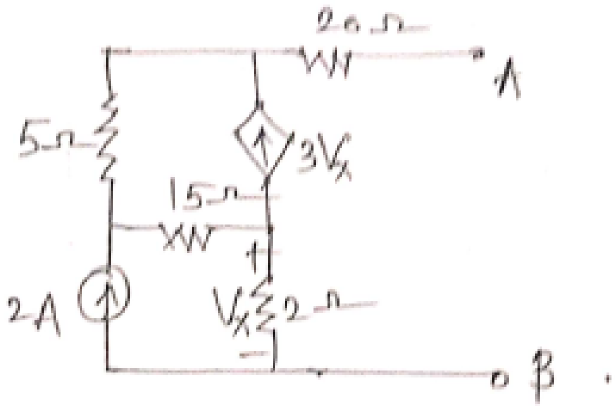
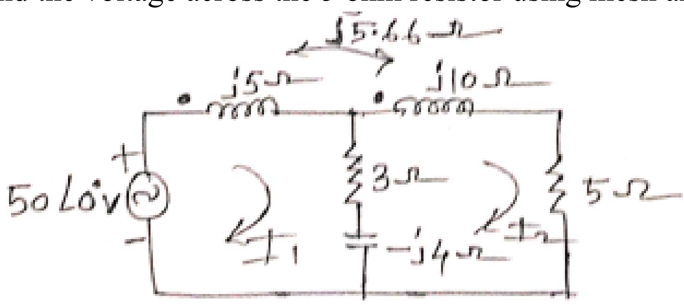
16.	Two identical sections of the network are connected in cascade having ABCD parameters as $\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} 7 & 8 \\ 2.5 & 3 \end{bmatrix}$, Find Overall ABCD parameters
Option A:	$\begin{bmatrix} 80 & 69 \\ 25 & 29 \end{bmatrix}$
Option B:	$\begin{bmatrix} 69 & 25 \\ 80 & 29 \end{bmatrix}$
Option C:	$\begin{bmatrix} 29 & 25 \\ 80 & 69 \end{bmatrix}$
Option D:	$\begin{bmatrix} 69 & 80 \\ 25 & 29 \end{bmatrix}$
17.	Kirchhoff's current law states that
Option A:	Net current flow at the junction is positive
Option B:	Algebraic sum of the currents meeting at the junction is zero
Option C:	No current can leave the junction without some current entering it
Option D:	Current can leave the junction without some current entering it
18.	At $t = 0^-$, No saturation condition has been reached. At t = 0, Switching action for application of DC source to inductive circuit. At $t = 0^+$, What will be the status of inductor?
Option A:	As it is
Option B:	Open Circuit
Option C:	Short Circuit
Option D:	Current Source
19.	In Maximum Power Transfer Theorem Pmax is
Option A:	$\frac{Vth}{2Rth}$
Option B:	$\frac{Vth^2}{2Rth}$
Option C:	$\frac{Vth^2}{4Rth}$
Option D:	

	$\frac{Vth^2}{2RL}$
20.	For the given ladder network which is not correct. 
Option A:	VC =V2
Option B:	Vb = V2
Option C:	Va = Vb
Option D:	Va = 2sIa + Vb

Q2 (20 Marks)	
A	**Solve any Two 5 marks each**
i.	Test Whether the given function is positive real function. $F(s) = \frac{2s^3+2s^2+3s+2}{s^2+1}$
ii.	Synthesis in Cauer II $Z(s) = \frac{(s+1)(s+3)}{s(s+2)}$
iii.	Synthesis in Cauer I $Z(s) = \frac{(s^2+1)(s^2+9)}{s(s^2+4)}$
B	**Solve any One 10 marks each**
i.	Determine Y and ABCD parameters

	
ii.	Find Z- parameters 

Q3 (20 Marks)	
A	**Solve any Two 5 marks each**
i.	In the network shown in figure the switch is changed from the position 1 to the position 2 at t = 0, steady state condition having reached before switching. Find values of i, di/dt, and d^2i/dt^2. At $t = 0^+$ 
ii.	For the network shown in figure, find the response$V_0(t)$ 

iii.	Find the current through 6 ohm resistor by superposition theorem. 
B	**Solve any One 10 marks each**
i.	For the network shown in figure. Find Norton's equivalent network. 
ii.	Find the voltage across the 5 ohm resistor using mesh analysis. 

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Curriculum Scheme: Rev 2019
Examination: SE Semester III
Course Code: ELC304 and Course Name: **Electrical Networks Analysis and Synthesis**
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Q1:

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	B
Q2.	A
Q3.	A
Q4	B
Q5	D
Q6	C
Q7	D
Q8.	B
Q9.	A
Q10.	C
Q11.	D
Q12.	C
Q13.	D
Q14.	B
Q15.	C
Q16.	D
Q17.	B
Q18.	B
Q19.	C
Q20.	C

Important steps and final answer for the questions involving numerical example

Q2(A): (i)

Q2A(ii)

Q2B(i)

Q2A(iii)

Q3A(i)

Q2B(ii)

(5)

$$-\frac{d^2 i}{dt^2} - 20\frac{di}{dt} - 10^6 i - 0 = 0$$

At $t = 0^+$

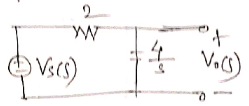
$$-\frac{d^2 i(0^+)}{dt^2} - 20\frac{di}{dt}(0^+) - 10^6 i(0^+) = 0$$

$$\frac{d^2 i}{dt^2}(0^+) = 800\ A/s^2$$

Q3A(ii)

For $t > 0$.

$$V_s(s) = \frac{1}{2}\cdot\frac{s}{s^2+1}$$



By voltage divider rule.

$$V_o(s) = V_s(s) \times \frac{\frac{4}{s}}{2+\frac{4}{s}} = \frac{2V_s(s)}{s+2} = \frac{s}{(s^2+1)(s+2)}$$

$$V_o(s) = \frac{As+B}{s^2+1} + \frac{C}{s+2}$$

$$s = (As+B)(s+2) + C(s^2+1).$$

By solving $A = 0.4,\ B = 0.2,\ C = -0.4$

$$V_o(s) = \frac{0.4s}{s^2+1} + \frac{0.2}{s^2+1} - \frac{0.4}{s+2}$$

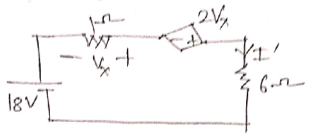
I.L.T.

$$V_o(t) = 0.4\cos t + 0.2\sin t - 0.4e^{-2t}.$$

Q3A(iii)

Q 3 (A)

(iii). Step I



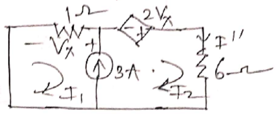
By KVL

$18 - I' + 2V_x - 6I' = 0$

$18 - I' - 2I' - 6I' = 0$ $\quad \left\{ \begin{array}{l} V_x = (-1)I' \\ = -I' \end{array} \right.$

$I' = 2A\ (\downarrow)$

Step II



$V_x = -1I_1 = -I_1$

$I_2 - I_1 = 3 \longrightarrow (2)$

By KVL $-I_1 + 2V_x - 6I_2 = 0$

$-I_1 - 2I_1 - 6I_2 = 0$

$3I_1 + 6I_2 = 0 \quad (3)$

Solving (2) & (3)

~~$I_1 = -2A,\ I_2 = 1A = I''$~~

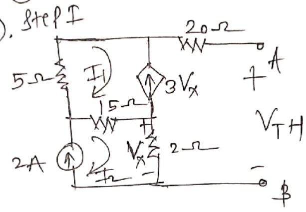
$I_1 = -2A,\ I_2 = 1A(\downarrow) = I''$

$I_{6\Omega} = I' + I'' = 3A\ (\downarrow)$.

(6)

Q 3 (B)

(i). Step I



~~Step I~~

$V_x = 2I_2$

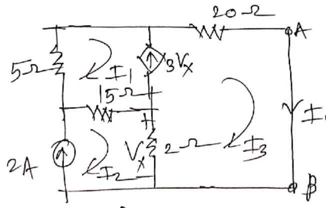
Mesh1 $\quad I_1 = -3V_x = -3(2I_2) = -6I_2$

Mesh2 $\quad I_2 = 2A,\ I_1 = -12A$

For V_{TH} $\quad V_{TH} - 0 + 5I_1 + 15(I_1 - I_2) - 2I_2 = 0$

$V_{TH} = 274\ V$.

Step II



$V_x = 2(I_2 - I_1)$.

$I_2 = 2 \longrightarrow (1)$

Q3B(i)

Mesh 1 and 3 form Supermesh.

Apply KVL

$-5I_1 - 20I_3 - 2(I_3 - I_2) - 15(I_1 - I_2) = 0$

$-20I_1 + 17I_2 - 22I_3 = 0 \longrightarrow (2)$

And

$I_3 - I_1 = 3V_x = 3[2(I_2 - I_1)]$

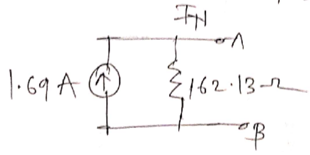
$I_1 + 6I_2 - 7I_3 = 0 \longrightarrow (3)$

Solving (1), (2), (3).

$I_N = I_3 = 1.69\ A$.

Step III

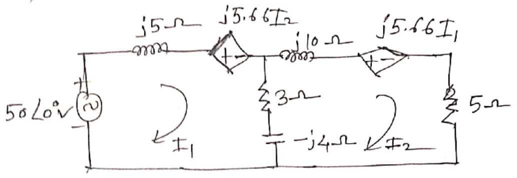
$R_N = \dfrac{V_{TH}}{I_N} = 162.13\ \Omega$



Q3B(ii)

Q 3 (B) ⑦

(ii). Equivalent ckt.



By KVL to mesh 1

$$50\angle 0^\circ - j5I_1 - j5.66I_2 - (3-j4)(I_1-I_2)=0$$

$$(3+j1)I_1 - (3-j9.66)I_2 = 50\angle 0^\circ \quad \text{—①}$$

By KVL to mesh 2

$$-(3-j4)(I_2-I_1) - j10I_2 - j5.66I_1 - 5I_2 = 0$$

$$-(3-j9.66)I_1 + (8+j6)I_2 = 0 \quad \text{—②}$$

In matrix form

$$\begin{bmatrix} 3+j1 & -(3-j9.66) \\ -(3-j9.66) & 8+j6 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 50\angle 0^\circ \\ 0 \end{bmatrix}$$

By cramer rule

$$I_2 = \frac{\begin{vmatrix} 3+j1 & 50\angle 0 \\ -(3-j9.66) & 0 \end{vmatrix}}{\begin{vmatrix} 3+j1 & -(3-j9.66) \\ -(3-j9.66) & 8+j6 \end{vmatrix}}$$

$$I_2 = 3.82\angle -112.14^\circ A.$$

$$V_{5\Omega} = 5I_2 = 19.1\angle -112.14^\circ V.$$

———x———