Ref No:

Ex/EE/T/211/2019

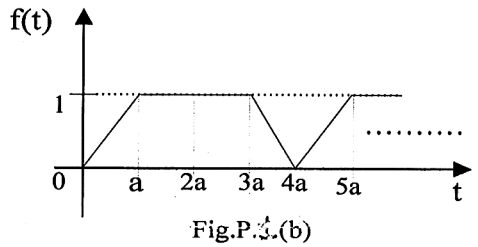
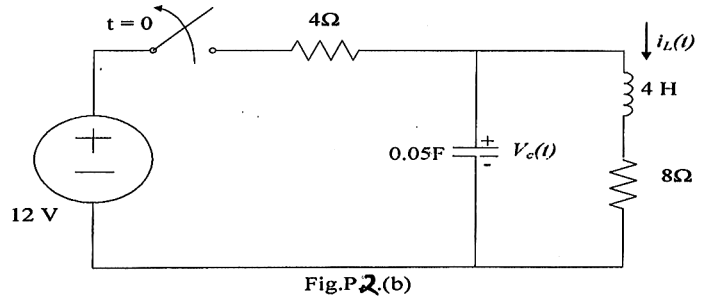
B.E. ELECTRICAL ENGINEERING SECOND YEAR FIRST SEMESTER - 2019

SUBJECT: - CIRCUIT THEORY

Time: Three hours

Full Marks: 100
(**50** marks for this part)

Use a separate Answer-Script for each part

No. of Question		PART -I Answer any Three Questions All the parts of a particular question are to be answered sequentially. (Two marks reserved for well organized answers)	Marks
1)	a)	A series combination of resistance R Ohm, inductance L Henry and capacitance C Farad is switched on across a DC voltage source of V volts. Derive the expression for the current in the circuit for the various roots of the characteristic equation. Assume that the initial current through the inductor = I_o Ampere and the initial voltage across the capacitor = v_o volts. Sketch the waveforms of the current.	(10)
	b)	Find the Laplace transform of the periodic waveform as shown below  Fig.P.3.(b)	(6)
2)	a)	A series combination of inductance L and capacitance C (both initially relaxed) has been switched across a dc voltage source at t = 0. Derive expression for the current in the circuit. Comment on the result.	(6)
	b)	The network shown in Fig.P.2.(b) has reached its steady state with switch closed. The switch is opened at t =0. Find the expression of $i_L(t)$ in the figure given below after the switch is opened.  Fig.P.2.(b)	(10)

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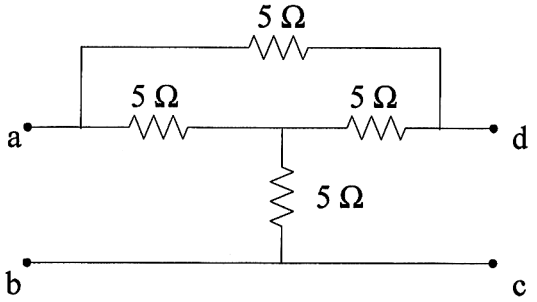
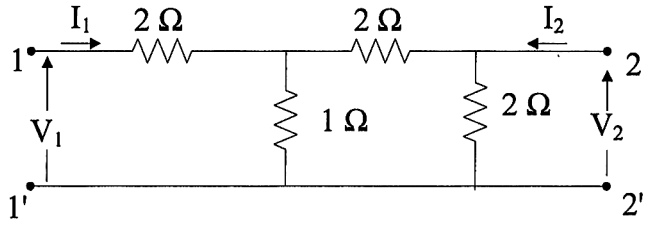
3)	a)	Write a short note on the "concept of complex frequency".	(8)
	b)	A voltage pulse of 10 V magnitude and 5 μsec duration is applied to an initially relaxed series RC network. Find the current flowing through the circuit if R= 10Ω and C =0.05μF.	(8)
4)	a)	Obtain the Y parameter of the network shown in Fig.P.4.(a)  Fig.P.4.(a)	(10)
	b)	Obtain the open circuit impedance parameters in terms of hybrid parameters.	(6)
5)	a)	Prove that for a passive reciprocal network $g_{12} = g_{21}$ where g_{12} and g_{21} have their usual meanings with respect to a two port network.	(6)
	b)	For the network shown in Fig.P. 5. (b) Derive its open circuit impedance parameters and transmission parameters.  Fig.P. 5.(b)	(10)

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B. ELECTRICAL ENGINEERING 2ND YEAR 1ST SEMESTER EXAMINATION, 2019

Subject: CIRCUIT THEORY **Time: Three Hours** **Full Marks: 100**

Part II (50 marks)

Answer All Questions

Question No. Marks

Q1 Answer **(a) and (b)** or **(c) and (d)**

Q1 (a) Using Source transformation solve for the currents through R_2 and R_3 in the circuit of Figure Q1(a). 9

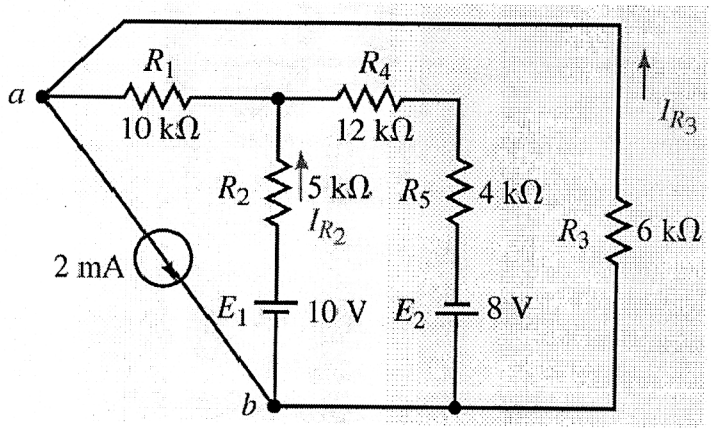


Fig. Q1(a)

Q1 (b) For the circuit shown in Figure Q1(b), find the values of Thevenin's equivalent voltage (V_{TH}) and resistance (R_{TH}). 8

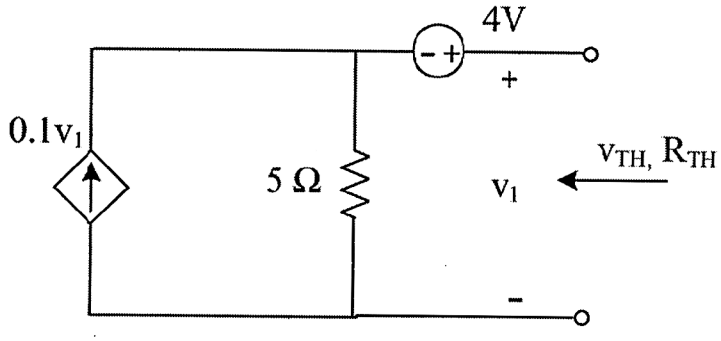


Fig. Q1(b)

Q1 (c) Find the Thevenin's equivalent of the circuit shown in Figure Q1(c) across the terminals 'a-b'. 12

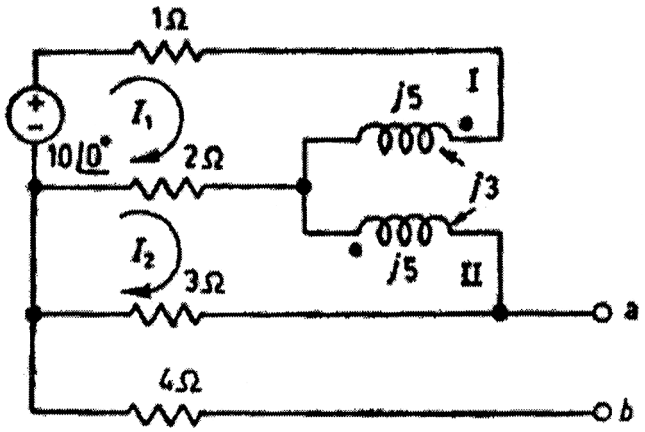


Fig. Q1(c)

Q1 (d) In the circuit shown in Figure Q1(d), find the power supplied by the 10V voltage source. 5

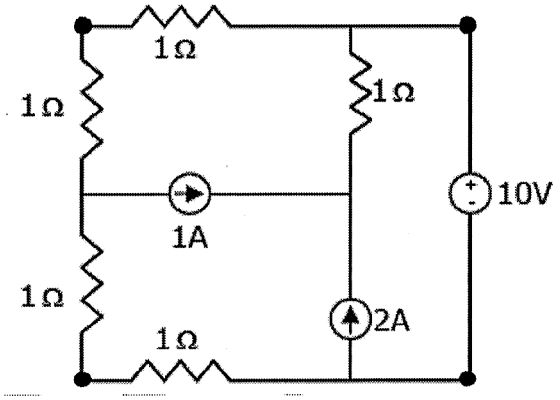


Fig. Q1(d)

Q2 Answer **(a) and (b)** or **(c) and (d)**

Q2 (a) Find the total inductance of the series coils shown in Figure Q2(a). 5

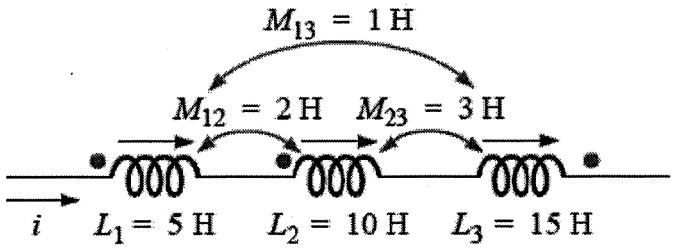


Fig. Q2(a)

Q2 (b) Find the equations for the loop currents $I_1(s)$ and $I_2(s)$ for the circuit shown in Figure Q2(b), after the switch is brought from position 1 to position 2 at $t = 0$. 12

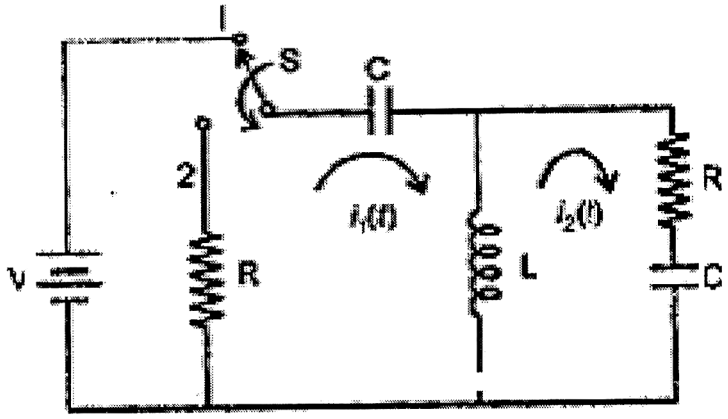


Fig. Q2(b)

Q2 (c) Find the currents I_1, I_2 and I_3 in the circuit shown in Figure Q2(c). 12

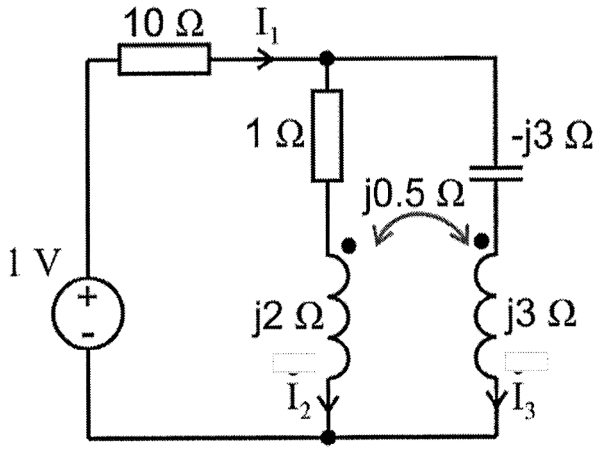
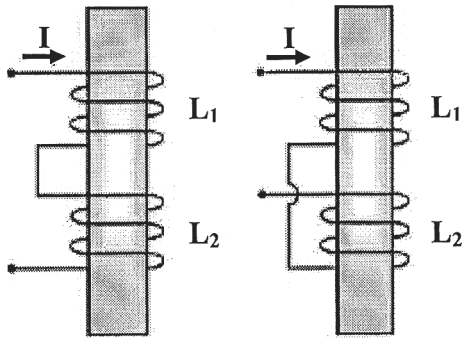


Fig. Q2(c)

Q2 (d) Put dots to indicate polarities of the mutually coupled coils connected in series as shown in Figure Q2(d) and Q2(e). 5



(d) (e)

Fig. Q2 (d) and (e)

Q3 Answer **(a) and (b)** or **(c) and (d)**

Q3 (a) In the context of the Graph of an electrical network define the concept of Incident Matrix.

Justify the following statement: "*All Paths are Subgraph but all Subgraphs are not Path*". 2+4

Q3 (b) Draw the graph of the network shown in Figure Q3(b) and obtain the equilibrium equation in matrix form on the node basis. 10

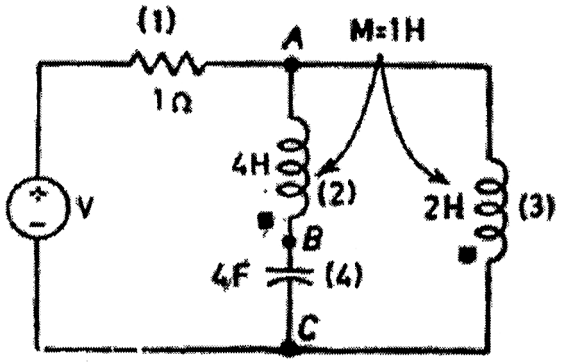


Fig. Q3(b)

Q3 (c) Define Tie-set for a network graph.

With the help of an example, show how Kirchhoff's Voltage law can be written in terms of basic Tie-Set matrix. 2+8

Q3 (d) For the circuit shown in Figure Q3(d), draw the graph to obtain the reduced incidence matrix **A** and show that **AJ=0**, where **J** represents the branch current vector, will yield the node equations. 6

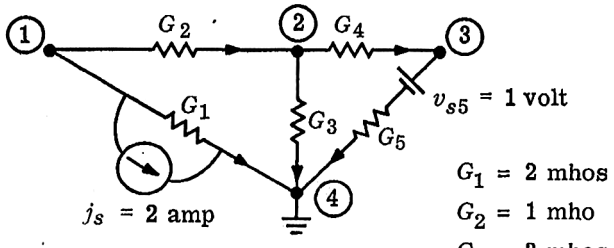


Fig. Q3(d)