Code No: R161208 **R16** SET - 1

I B. Tech II Semester Regular Examinations, April/May - 2017
ELECTRICAL CIRCUIT ANALYSIS – I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is Compulsory
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) State Kirchhoff's laws. (2M)
   b) List out different dual elements for basic electrical elements. (2M)
   c) What is Faraday's law of electromagnetic induction? (2M)
   d) What is the difference between instantaneous power and complex power? (2M)
   e) What is the significance of quality factor in series resonant circuit? (2M)
   f) State Norton's theorem. (2M)
   g) A series RLC circuit has a resonant frequency of 12 kHz. If R=5 ohms and X_L=300 ohms at resonance, what is the bandwidth. (2M)

PART –B

2. a) Distinguish between independent and dependent sources. (4M)
   b) A triangular wave is shown in Figure 1. It is applied to R, L and C individually. Estimate the current in each element. (10M)

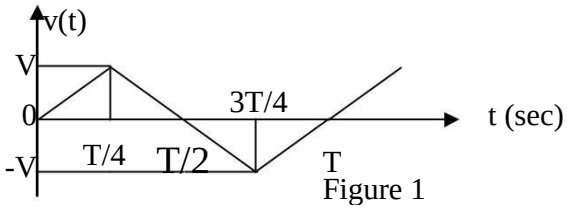

Figure 1

3. a) Explain the concept of duality between two electrical networks. Clearly distinguish between equivalent and dual network. (5M)
   b) Find and draw the maximum possible number of trees for the network shown in Figure 2. (9M)

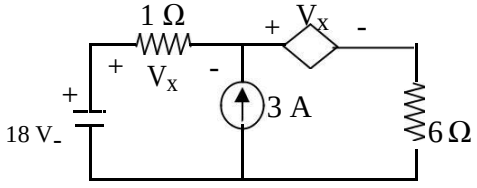

Figure 2

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4. a) Explain the dot convention in coupled circuits. (4M)

b) The air gap in a magnetic circuit is 1.5 mm long and 2500 mm^2 in cross sectional area. Calculate (i) the reluctance of the air gap (ii) the MMF required to set up a flux of $800x10^{-6}$ Wb in the air gap. (5M)

c) A mild steel ring having a cross sectional area of 500 m^2 and a mean circumference of 400 mm has a coil of 200 turns wound uniformly around it. Calculate: (i) the reluctance of the ring and (ii) the current required to produce a flux of 800 μ Wb in the ring. Assume that μ_r is 380. (5M)

5. a) A 20 ohms resistance and 30 mH inductance are connected in series and the circuit is fed from 230 V, 50 Hz AC supply. Find (i) Inductive reactance and total impedance (ii) current in the circuit (iii) voltage across resistance and inductance (iv) real, reactive and apparent power (v) Power factor. (7M)

b) Calculate RMS value, average value, form factor for the saw waveform shown in Figure 3. (7M)

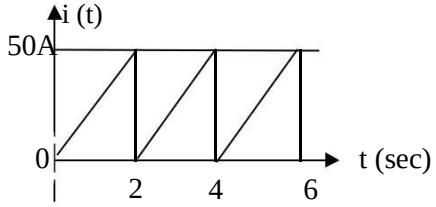

Figure 3

6. a) A variable frequency source of V=200 volt is applied to a series R-L circuit having R=5Ω and L=5 mH. Draw I-locus considering sample frequencies ω=0,500,1000,2000 and 5000 rad/sec. (7M)

b) Show that the locus of current of a series circuit consisting of resistance and inductance with resistance varies and inductive reactance fixed, when supplied by a constant ac voltage source, lies on a circular path. (7M)

7. a) State and explain Maximum Power Transfer theorem. (7M)

b) Verify the reciprocity theorem for the following circuit shown in Figure 4. (7M)

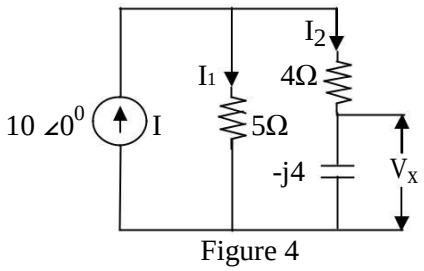

Figure 4

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PART –A

1. a) What are the uses of source transformation? (2M)
   b) What are the properties of a tie-set matrix? (2M)
   c) Define MMF and reluctance. (2M)
   d) What is the significance of power factor in AC circuits? (2M)
   e) What is a locus diagram? (2M)
   f) State reciprocity theorem. (2M)
   g) What is the quality factor of a coil of R=10 ohms, L=0.1 H, C=0.1 µF? (2M)

PART -B

2. a) The current is 15 mH inductor can be expressed as $i(t)=(2-e^{-1000t})$ mA. Find (i) voltage across the inductor (ii) instantaneous power. (7M)
   b) Two groups of resistances, one consisting of 4 ohms, 6 ohms and 12 ohms in parallel and other consisting of 3 ohms and 6 ohms in parallel are connected in series with a source of 10 V having an internal resistance of 1 ohm. Calculate the resistance of entire circuit, the potential drop across each group and current in each resistance. (7M)

3. Find out currents through and voltages across all branches of the network shown in Figure 1, with the help of its tie-set schedule. (14M)

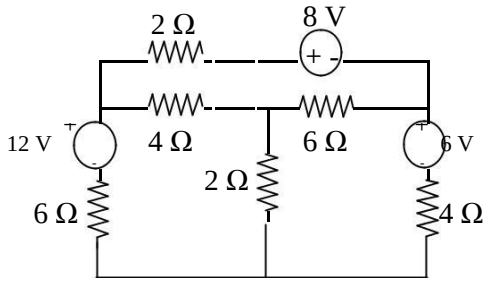

Figure 1

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4. a) Derive an expression for co-efficient of coupling in a magnetic circuit. (5M)
   b) Explain Faradays Laws of Electro magnetic Induction. (3M)
   c) Two coils having 750 and 1200 turns, respectively, are wound on a common non-magnetic core. The leakage flux and mutual flux, due to a current of 7.5A in coil 1, is 0.25 mWb, and 0.75 mWb, respectively. Calculate: i) Self Inductance, ii) Mutual Inductance, iii) coefficient of coupling. (6M)

5. a) A voltage of 200 V is applied to a series circuit consisting of a resistance, a choke coil and a capacitance. If the respective voltages across these components are 170 V, 150 V and 100 V. The current in the circuit is 4 A. Find the power factor of the circuit. (7M)
   b) A time varying current, with a periodic wave form is shown in Figure 2, flows through an 8W resistor. Determine (i) mean value (ii) rms value (iii) heat dissipated in 5 minutes. (7M)

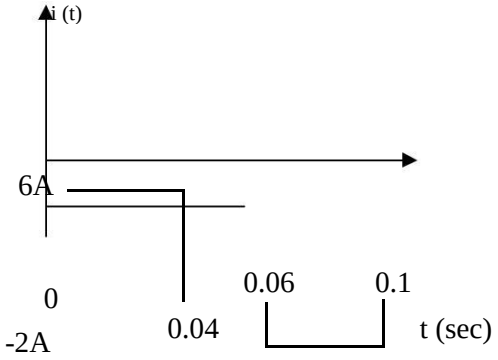

Figure 2

6. a) For a given series RLC circuit with R=120Ω, L=0.6H and C=70μF, Calculate the resonance, lower and upper half power frequencies. (7M)
   b) Show that the resonant frequency ω_0 of an RLC series circuit is the geometric mean of $\omega_1$and ω_2, the lower and upper half-power frequencies respectively. (7M)

7. a) State and explain Millman's theorem. (6M)
   b) Find Thevenin's and Norton's equivalent circuits for the network shown in Figure 3. (8M)

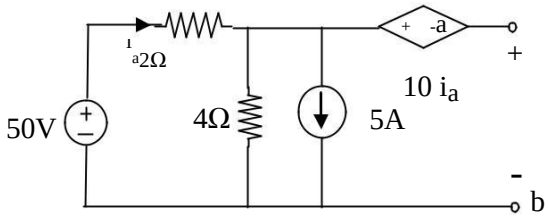

Figure 3

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I B. Tech II Semester Regular Examinations, April/May - 2017
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PART –A

1. a) What are the differences between dependent and independent sources? (2M)
b) What are the properties of a cut-set matrix? (2M)
c) What is the significance of coefficient of coupling in magnetic circuits? (2M)
d) Draw the power triangle and represent real, reactive power and apparent power. (2M)
e) Define bandwidth and selectivity. (2M)
f) State superposition theorem. (2M)
g) A series circuit has R=4 ohms, L=25 mH, and C=150 μF. What is the bandwidth? (2M)

PART –B

2. a) State and explain KVL and KCL with an example. (5M)
b) Draw the waveforms for i_R, i_L, i_C for the circuit shown in Figure 1, when it is excited by a voltage source having a waveform shown in Figure 2. (9M)

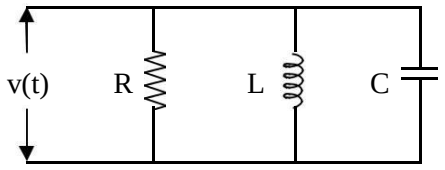

Figure 1

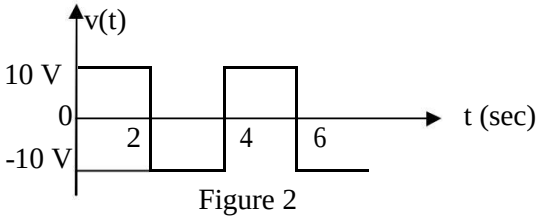

Figure 2

3. a) What is duality? Explain the procedure to obtain the dual of the given planar network. (6M)
b) Find the current in each branch and voltage across each branch of the network shown in Figure 3, using tie-set schedule. (8M)

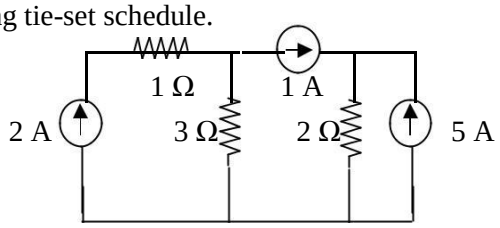

Figure 3

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4. a) Prove that for series magnetic circuit having different reluctance segments, total reluctance will be the sum of individual reluctances. (4M)

b) Define (i) self inductance (ii) mutual inductance (iii) MMF(vi)Flux (v) Reluctance (4M)

c) Two coils have a mutual inductance of 0.4 H, if the current in one coil is varied from 4A to 2A in 0.5sec, calculate (i) The average e.m.f induced in the second coil (ii) The rate of change of flux linked with the second coil assuming that it is wound with 300 turns. (6M)

5. a) A coil of power factor 0.9 is in series with a 120 μF capacitor. When the circuit is connected to a 50 Hz supply, the potential difference across the coil is equal to the potential difference across the capacitor. Find the resistance and inductance of the coil. (7M)

b) Find the RMS value and average value of the waveform shown in Figure 4. (7M)

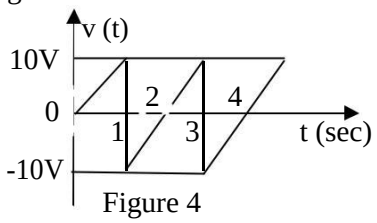

Figure 4

6. a) A coil of 2.2Ω resistance and 0.01H is connected in series with a capacitor across 220V mains. Find the value of capacitance such that the maximum current flows in the circuit at a frequency of 100Hz. Also, find the current and voltage across the capacitor. (7M)

b) Find C which results in resonance in the circuit shown in Figure 5, when ω=5000rad/s. (7M)

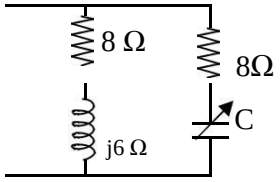

Figure 5

7. a) State and explain Norton's theorem. (6M)

b) Using Thevenin's theorem, find the current flowing through 1.5 ohms resistance between A and B for the network shown in Figure 6. (8M)

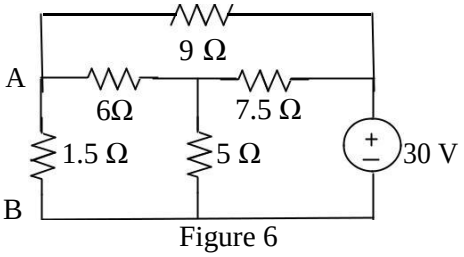

Figure 6

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PART –A

1. a) Write the V-I relations of R, L and C parameter. (2M)
   b) What are the properties of a tree in electrical circuits? (2M)
   c) Write the analogy between electrical and magnetic circuits. (2M)
   d) Define average value and form factor. (2M)
   e) What is the difference between series and parallel resonance? (2M)
   f) State compensation theorem. (2M)
   g) Give the differences between tie-set and cut-set. (2M)

PART –B

2. a) Explain the star – delta and delta – star transformation by deriving relevant (6M) expressions.

   b) Find the current through each branch of the circuit shown in Figure 1, using mesh analysis. (8M)

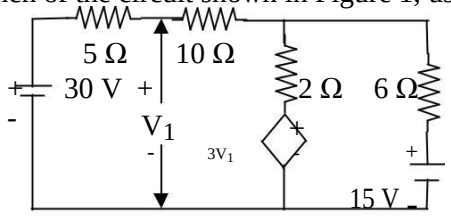

Figure 1

3. For the given network shown in Figure 2, obtain the oriented graph of the network. (14M) Write the cut-set of the graph and determine the loop currents.

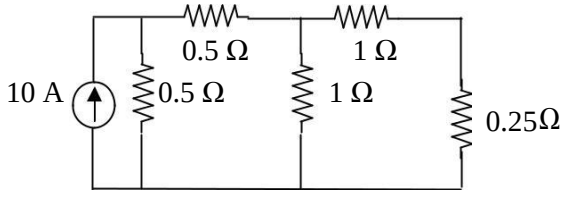

Figure 2

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4.a) The number of turns in two coupled coils are 600 and 1700, respectively. When a current of 6A flows in coil 2, the total flux in this coil is 0.8 mWb, and the flux linking the first coil is 0.5mWb. Calculate L_1, L_2, M and K. (7M)

b) Two coils with a coefficient of coupling of 0.6 between them, are connected in series so as to magnetize i) in one combination in the same direction and ii) in another combination in the opposite direction. The corresponding values of equivalent inductance are 1.8 H and 0.8 H respectively. Find the self inductance of the two coils and the mutual inductance between them. (7M)

5. a) A coil having a resistance of 10 ohms and an inductance of 0.2 H is connected in series with a 100 µF capacitor are fed with 230 V, 50 Hz AC supply. Calculate (i) active and reactive components of current (ii) voltage across the coil. Draw the phasor diagram. (7M)

b) Find the rms and average value of the trapezoidal waveform shown in Figure 3. (7M)

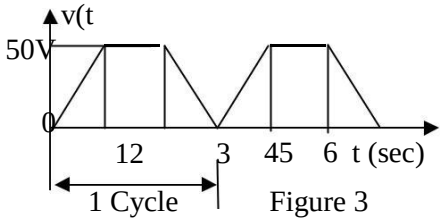

Figure 3

6. a) A constant inductance L is in parallel with a series R-C circuit in which R varies from zero to infinity. This combination is connected to a constant voltage, constant frequency supply. Show that the circuit takes a constant current from the source at all power factors between zero lagging and zero leading, if $X_C=X_L/2$. Draw the relevant locus diagram. (7M)

b) An inductive coil having a resistance of 30 ohm and inductance of 0.03H is connected in series with 0.03 µF capacitor. Calculate i) Q of the coil ii) Resonant frequency and iii) the half-power frequencies. (7M)

7. a) State and explain Thevenin's theorem. (6M)

b) Use superposition theorem to find v_0 in Figure 4. (8M)

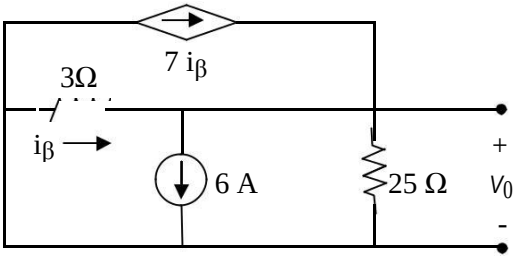

Figure 4