# II B.TECH - I SEMESTER EXAMINATIONS - MAY, 2011 

## ELECTRICAL CIRCUITS

 (COMMON TO EEE, ECE, ETM)Time: 3hours

Max. Marks: 75

Answer any FIVE questions<br>All Questions Carry Equal Marks

1.a) Write the volt-ampere relationship of $\mathrm{R}, \mathrm{L}$ and C elements.
b) Explain the independent and dependent sources.
2. Find the voltage to be applied across 'A-B' in order to drive a current of 10 A into the circuit as shown in below figure 1 using star-delta transformation.


Figure 1
3.a) Define the following terms:
i) RMS value
ii) Average value
iii) Form factor
iv) Peak factor
b) Determine the average and effective values of saw-tooth waveform as shown in below figure 2.


Figure 2
4.a) Explain the procedure to draw the locus diagram of R-L series circuit when L is varying.
b) A series RLC circuit has to be designed so that it has a band width of 320 Hz and inductance of the coil is 0.2 H . It is has to resonate at 350 Hz , determine the resistance of coil and capacitance of condenser. If the applied voltage is 150 V , determine the voltage across capacitor and coil.
5.a) Compare and contrast electric and magnetic circuit.
b) Two coils having 500 and 1000 turns, respectively, are wound side by side on a closed iron circuit of area of cross-section $100 \mathrm{~cm}^{2}$ and mean length 800 cm . Calculate the coefficients of self induction of the two coils and the mutual induction between the two. Neglect leakage. Take $\mu_{r}$ as 2000. If a current steadily grows from 0 to 1 A in 0.1 sec , in the first coil, find emf induced in the other coil.
6.a) Explain the following terms with respect to graph theory
i) Node
ii) tree
iii) link
iv) sub-graph
b) Find the branch currents as shown in following figure 3 by using the concept of tie-set matrix.


Figure 3
7. Determine the load resistance to receive maximum power from the source, also find the maximum power delivered to the load in the circuit shown in below figure 4.


Figure 4
8. Find the current through the capacitor and voltage across $4-\Omega$ resistance of the AC network shown in figure 5 by using superposition theorem.


Figure 5
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1.a) Describe the source transformation technique.
b) The current waveform for the pure inductance of 3 m H is shown in below figure 1. Draw the voltage and power wave forms.


Figure 1
2.a) Obtain the expressions for star-delta equivalence of resistive network.
b) Calculate the current in the $5 \Omega$ resistor using kirchoff's laws for the network shown in below figure 2 .


Figure 2
3.a) Define the following terms:
i) Impedance
ii) Reactance
iii) Phase deference
iv) Power factor
b) A circuit consists of a resistance of $15 \Omega$, a capacitance of $200 \mu \mathrm{~F}$ and inductor of 0.05 H all in series. If supply of $230 \mathrm{~V}, 50 \mathrm{~Hz}$ is applied to the ends of circuit. Calculate
i) Current in the coil
ii) Potential difference across each coil
iii) Frequency at which current would have unity power factor.
4.a) Derive the expression for band width of RLC series circuit.
b) A series circuit consisting of $\mathrm{R}=500 \Omega, \mathrm{~L}=0.5 \mathrm{H}$ and $\mathrm{C}=15 \mu \mathrm{~F}$ is connected to a variable frequency supply of 120 V . If the frequency is varied through 40 to 80 Hz , draw the locus diagram of current. Determine the current and p.f at 40 and 80 Hz frequency.
5.a) State and explain Faraday's laws of electromagnetic induction.
b) Self-inductance of two coupled coils are $\mathrm{L}_{1}=10 \times 10^{-3} \mathrm{H}$ and $\mathrm{L}_{2}=20 \times 10^{-3} \mathrm{H}$. The coefficient of coupling ( K ) being 0.75 in the air, find voltage in the second coil, and the flux of first coil, provided the second coil has 500 turns and the circuit current is $\mathrm{I}_{1}=2 \sin 314 \mathrm{t} \mathrm{A}$.
6.a) Illustrate the super mode analysis with an example.
b) For the network shown in figure 3 determine all branch currents and the voltage across the $6-\Omega$ resistor by loop current analysis.


Figure 3
7.a) State and explain superposition theorem.
b) Find thevenin's equivalent circuit for the circuit shown in below Figure 4.


Figure 4
8.a) State and explain the maximum power transfer theorem.
b) Determine the current I in the branch AB of circuit shown in figure 5 by using Norton's theorem.


Figure 5
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1.a) Distinguish between ideal and practical sources and draw their characteristics.
b) Calculate the value of ' $R$ ' in the circuit shown in below figure 1 , if the power supplied by both the sources is equal.


Figure 1
2.a) State and explain kirchoff's laws.
b) Determine the current in the $5 \Omega$ resistor for the circuit shown in below figure 2 .


Figure 2
3.a) Define the RMS value and obtain an expression for the RMS value of sinusoidal current.
b) Determine the circuit current and p.f for the following network shown in figure 3. [7+8]


Figure 3
4.a) Explain the procedure to draw the locus diagram of $\mathrm{R}-\mathrm{C}$ series circuit when ' C ' is varying.
b) An impedance coil having $\mathrm{R}=20 \Omega$ and a 50 Hz inductive reactance of $22 \Omega$ is connected to $110 \mathrm{~V}, 60 \mathrm{~Hz}$ source. A series circuit consisting of resistor, $\mathrm{R}=10 \Omega$ and variable capacitor is then connected in parallel with coil
i) For what value of ' C ' will the circuit be in resonance?
ii) Calculate two line currents at resonance.
5.a) Explain the importance of dot convention in coupled circuits.
b) A mild steel ring has a mean circumference of 1000 mm and a uniform area of crosssection of $600 \mathrm{~mm}^{2}$. Calculate the MMF required producing a flux of 500 nWb , assuming permeability of mild steel as 1200 . An air gap of 2 mm in length is now cut in the ring. Determine the flux produced, if the MMF remains constant.
[7+8]
6.a) Explain the super mesh Analysis with an example.
b) For the resistive network as shown in below figure 4, write a cut set schedule and equilibrium equations on voltage basis. Hence obtain value of branch voltage and branch currents.


Figure 4
7. Use Thevenin's theorem to find the current through the $5-\Omega$ resistor in figure 5 .


Figure 5
8.a) State and explain compensation theorem.
b) Using Millman's theorem find the current through $R_{L}$ in the circuit shown in figure 6 .


Figure 6

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Answer any FIVE questions
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Max. Marks: 75
1.a) Compare active and passive elements and give examples for each.
b) Explain the source transformation technique.
2. Determine the resistance between the terminals 'A-B' in the network shown in below figure 1.


Figure 1
3.a) Explain the significance of j-operator. What are the different forms of expressing the sinusoidal quantity in complex form?
b) Compute the RMS and average values of square wave form shown in below figure 2.


Figure 2
4.a) Explain the procedure to draw the lows diagram of R-L-C series circuit when varying $\mathrm{X}_{\mathrm{L}}$ and $\mathrm{X}_{\mathrm{C}}$.
b) A series resonant circuit has the following parameters:

Resonance frequency $=3 \times 10^{6} \mathrm{~Hz}$,
Band width $=10^{5} \mathrm{~Hz}$ and $\mathrm{R}=4 \Omega$.
Calculate L and C of the network, half power frequency and power quality.
5.a) Derive the relation between self inductance, mutual inductance and coefficient of coupling.
b) A mild steel ring has a mean circumference of 600 mm and a uniform cross-sectional area of $350 \mathrm{~mm}^{2}$. Calculate the MMF required producing a flux of $600 \mu \mathrm{~Wb}$ when an air gap of 1 mm length is now cut in ring. Also determine the flux produced if MMF remains constant. Given relative permeability of mild steel is 1200 .
6.a) Describe the procedure to construct the dual of a network with an example.
b) Find the current and voltages across the registers of the network shown in below figure 3 .


Figure 3
7. Find the current in the $7-\Omega$ resistor across AB of the network shown in figure 4 using superposition theorem.


Figure 4
8. For the network shown in figure 5, replace the circuit to the left of terminals ' $A B$ ' with a Thevenin equivalent. The determine current in the $(2-\mathrm{j} 2) \Omega$ impedance connected to the equivalent circuit.


Figure 5
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