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

I B. Tech II Semester Regular/Supplementary Examinations, April/May - 2019
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) Determine V in the circuit shown in figure 1(a). (2M)

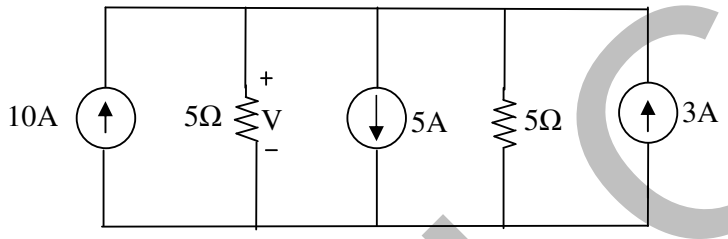

Figure 1(a)

b) Draw the dual of the network shown in figure 1(b). (2M)

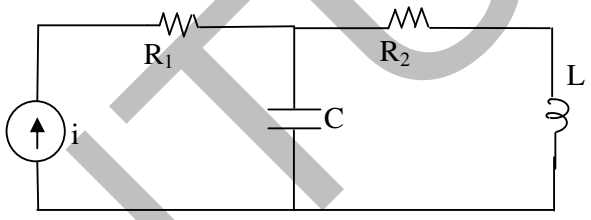

Figure 1(b)

c) A Coil of 100 turns is linked by a magnetic flux of 20mWb. If this flux is reversed in a time of 2ms, calculate the average emf induced. (2M)

d) What is the average value for a resultant current having 10A of DC component and 10A of peak value of AC Component. (2M)

e) Define selectivity and bandwidth of a series resonant circuit. (2M)

f) State Superposition theorem. (2M)

g) What are the uses of source transformation? (2M)

PART –B

2. a) Explain the star-delta transformation and delta-star transformation and derive the expressions for equivalent resistances. (7M)
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b) Find the power absorbed by each element in the circuit shown in figure 1(b). (7M)

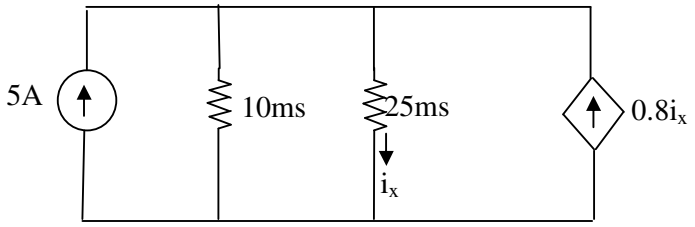

Figure 2(b)

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

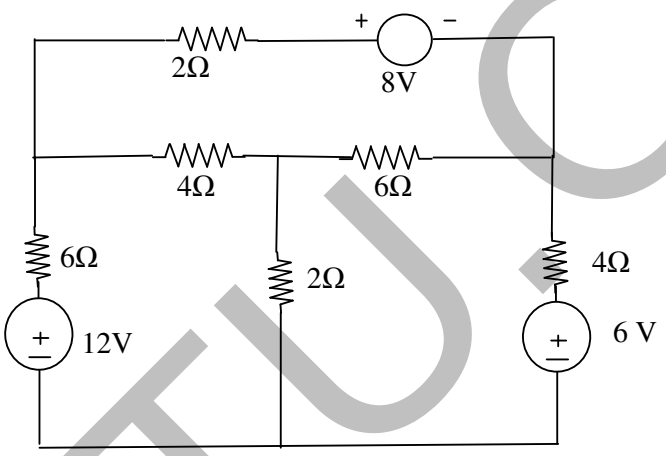

Figure 3

4. a) Two coupled coils with L_1=0.01H and L_2=0.04H and K=0.6 are connected in four different ways i.e series aiding, series opposing, parallel aiding and parallel opposing. Find the equivalent inductance in each case. (7M)

b) Explain the following terms: (7M)
(i) Reluctance (ii) mmf (iii) Co-efficient of coupling (iv) Magnetic flux density (v) Magnetic field strength.

5. a) A Voltage $v(t)$ =141.4 sin (314t+10^0) is applied to a circuit and a steady current given by $i(t)$ = 14.14 sin (314t-20^0) is found to flow through it. Determine: (i) Power factor of the circuit (ii) Power delivered to the circuit. Also draw the phasor diagram. (7M)

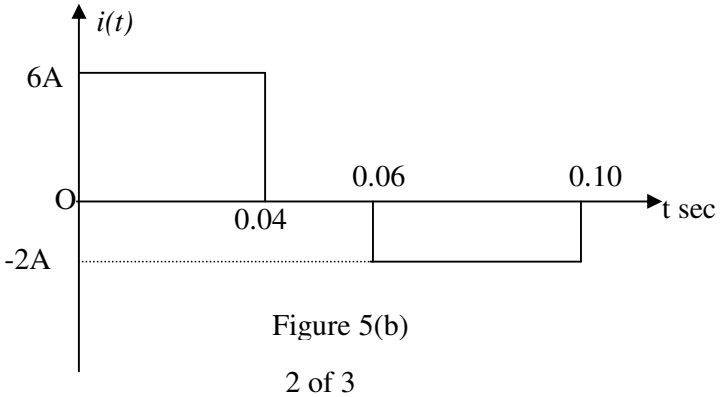

Figure 5(b)

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b) A varying current, with a periodic waveform as shown in figure 5(b), flows through an 8Ω resistor. Determine (i) mean value (ii) rms value (iii) heat dissipated in the resistor in 5 minutes. (7M)

6. a) Show that the locus of current of a series circuit consisting of resistance and inductance with resistance varied and inductance reactance fixed, when supplied by a constant AC Voltage source, lies on circular path. (7M)

b) An RLC Series circuit consists of R=1kΩ, L=100mH, C=10μF. If a voltage of 100V is applied across the combination, determine resonant frequency, quality factor and bandwidth. (7M)

7. a) Find the Thevenin's equivalent circuit with respect to terminals A and B for the network shown in figure 7(a). (7M)

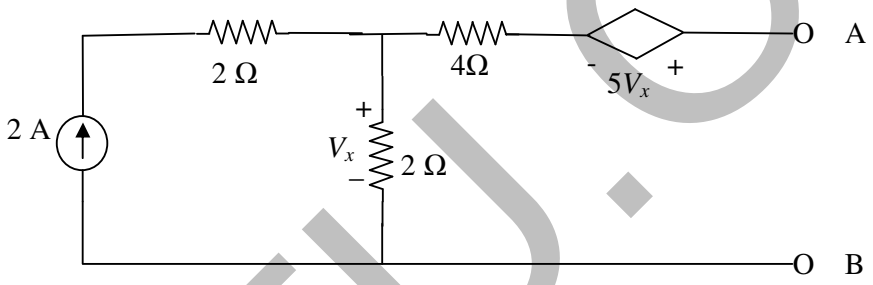

Figure 7(a)

b) State and explain reciprocity theorem. Is this theorem valid for network with two sources? Substantiate your answer. (7M)

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PART –A

1. a) Find the equivalent resistance between terminals A-B of the network shown in figure 1(a). (2M)

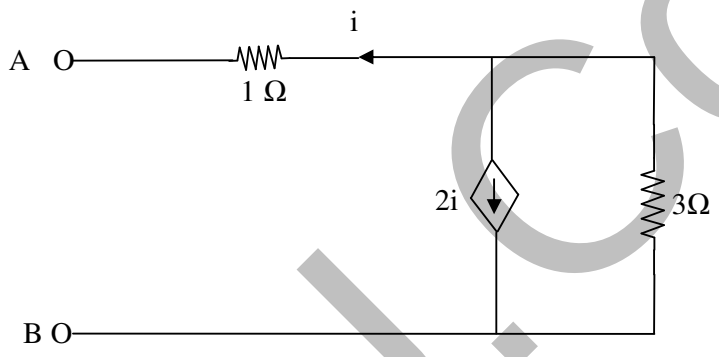

Figure 1(a)

b) Give the differences between an equivalent network and a dual network. (2M)

c) State Faraday's law of electromagnetic induction. (2M)

d) The instantaneous value of emf is v =300 sin 800πt. What is the average value and rms value of the emf? (2M)

e) In an AC Circuit, containing pure inductance, the voltage applied is 110V, 50Hz while the current is 10A. What is the value of inductance in the Circuit? (2M)

f) State Millman's theorem. (2M)

g) State KVL and KCL. (2M)

PART -B

2. a) Using source transformation, find the voltage V in the circuit shown in figure 2(a). (8M)

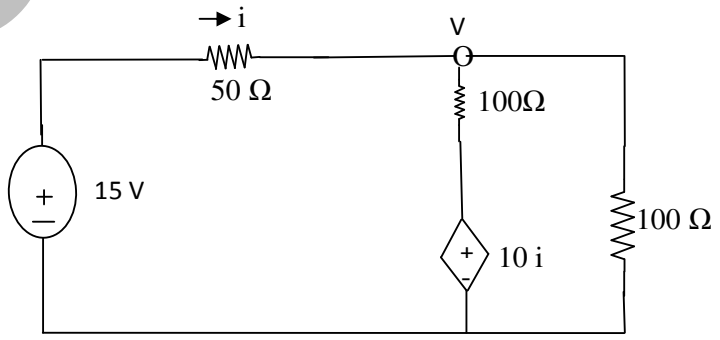

Figure 2(a)
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b) Explain the salient features of mesh and nodal analysis. (6M)

3. Draw the graph of the network shown in figure 3 and select a suitable tree to write tie-set schedule. Also find the three loop currents. (14M)

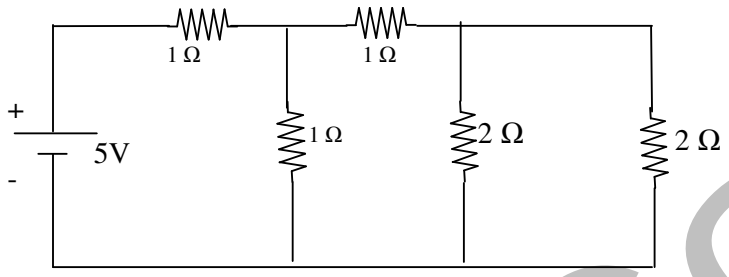

Figure 3

4. a) Two coupled coils with self inductance L_1=0.2H and L_2=0.6H have a coupling co-efficient K=0.6. The number of turns in coil 2 is 1000. If the current in coil 1 is i_1=10 sin 400t amperes, determine the voltage at coil 2 and maximum flux set up by coil 1. (7M)

b) A rectangular shaped core is made of mild steel plate 15mm ×20mm cross-section. The mean length of the magnetic path is 18cm. The exciting coil has 300turns and 0.7 amperes current. Calculate (i) magnetizing force (ii) flux density (iii) reluctance (iv) flux of magnetic circuit. Assume relative permeability of mild steel as 940. (7M)

5. a) A Series circuit of two pure elements has the following applied voltage and resulting current, v =225 sin (300t+45^0), i=8.5 sin (300t+15^0). Find the elements comprising the circuit. If the voltmeter, ammeter, wattmeter, frequency meter and power factor meter are connected in the circuit, what will be their respective readings. (7M)

b) Calculate the form factor for the saw-tooth waveform shown in figure 5(b). (7M)

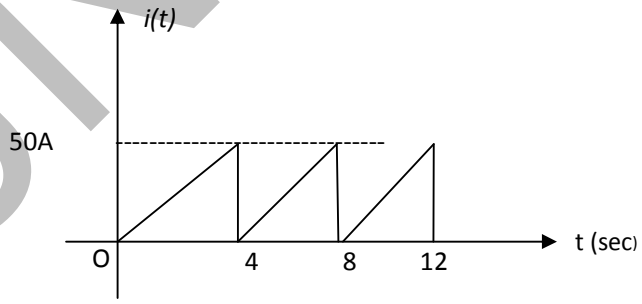

Figure 5(b)

6. a) Find the resonance frequency for the parallel resonant circuit when R_L and L are connected in branch 1, and R_C and C are connected in branch 2, and branch 1 and branch 2 are connected in parallel to an alternating voltage source. (7M)

b) A series circuit with R=50Ω, L=0.1H, C=10μF has an applied voltage V=100$\angle 0^0$. Find maximum voltage across the inductor and the frequency at which it occurs. (7M)

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7. a) Verify the reciprocity theorem using the network given in figure 7(a). (7M)

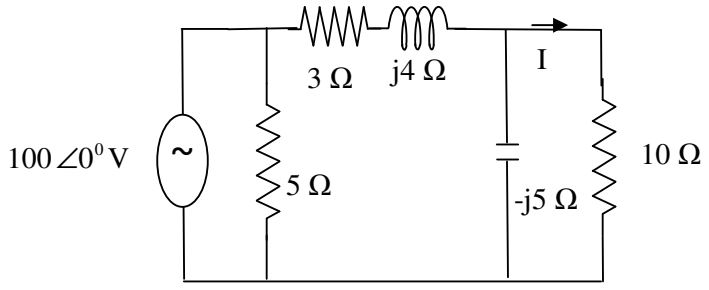

Figure 7(a)

b) State and explain Superposition theorem. Is this theorem valid for power calculations? Substantiate your answer. (7M)

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PART –A

1. a) Find the equivalent resistance between terminals A-B in the network shown in figure 1(a). (2M)

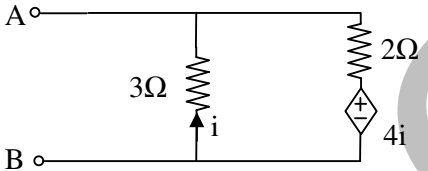

Figure 1(a)

b) Explain the degree of a node with examples. (2M)

c) Define reluctance and permeance of a magnetic circuit. (2M)

d) A pure capacitor of 50μF offers a reactance of 50Ω against an AC supply of 100V. What is the capacitor current and frequency of the supply? (2M)

e) An RLC series circuit consists of R=1kΩ, L=100mh, C=10μF. If a voltage of 100V is applied across the combination, what is the Quality factor and bandwidth at resonance. (2M)

f) State Reciprocity theorem. (2M)

g) Define reactive power and complex power. (2M)

PART -B

2. a) Explain the source transformation with examples. (6M)

b) Use nodal analysis to determine V_1 and power being supplied by dependent current source in the circuit shown in figure 2(b). (8M)

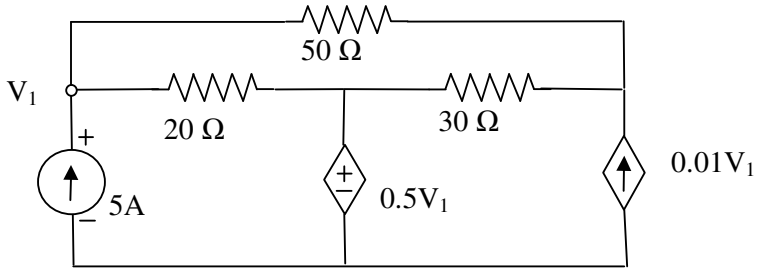

Figure 2(b)
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3. For a network shown in figure 3, derive the cutset matrix and find various branch voltages and currents. (14M)

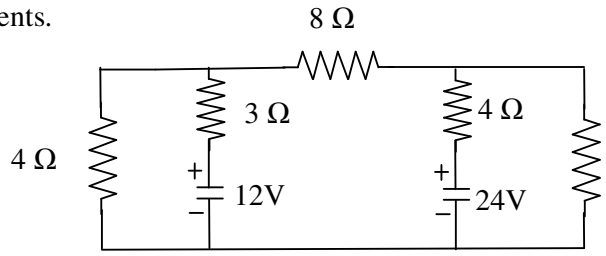

Figure 3

4. a) Two coils have a coupling co-efficient K=0.85 and coil 1 has 250 turns. The current in coil 1 is 2A and total fulx is 0.3mWb. When the current i_1 is reduced linearly to zero in 2 milli-seconds, the voltage induced in the coil is 63.75V. Find L_1, L_2, M and N_2. (7M)

   b) A Steel ring of 25cm mean diameter and of circular cross-section 3cm in diameter has an air gap of 1.5mm length. It is wound uniformly with 750 turns of wire carrying a current of 2.1A. Calculate (i) Magnetomotive force, (ii) Flux density in air gap (iii) Magnetic flux (iv) relative permeability of steel ring (v) Total reluctance. Assume that iron part takes about 35% of the total magnetomotive force. (7M)

5. a) A Choke coil connected across a 250V, 50Hz supply takes a current of 10A at 0.8 power factor lagging. What will be the power taken by the choke when connected across 220V, 25Hz supply? (7M)

   b) If the complex power S in branch (3+j6)Ω is 1500VA, what will be the indication on the ammeter shown in figure 5(b). Also find the complete power information. (7M)

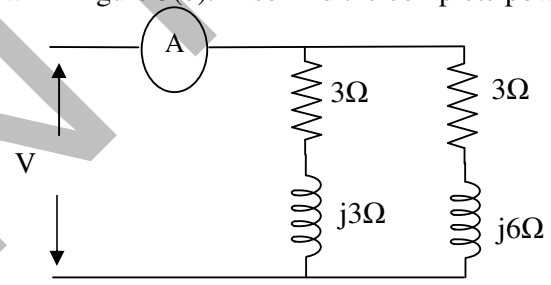

Figure 5(b)

6. a) Explain the meaning of half-power frequencies and derive the expressions for a series RLC Circuit. (7M)

   b) A Coil of inductance 2H and resistance of 10Ω in series with condenser 'C' is supplied at constant voltage from variable frequency. If the maximum current is 10A at 75Hz, find the value of C and also determine the frequency when the current is 5A. (7M)

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7. a) Using the principle of superposition, calculate the current through 4Ω resistor in the network shown in figure 7(a). (8M)

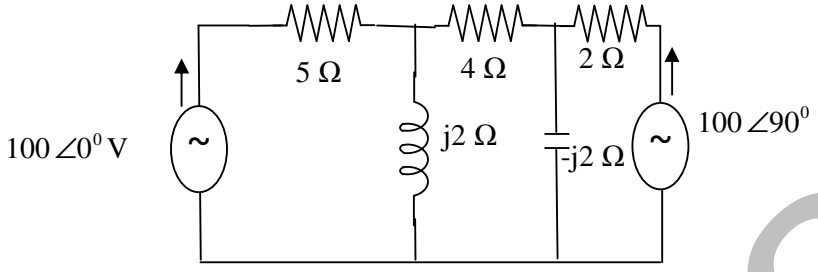

Figure 7(a)

b) State and explain maximum power transfer theorem. What the applications and limitations of this theorem. (6M)

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PART –A

1. a) What is the value of V_2 in the circuit shown in figure 1(a). (2M)

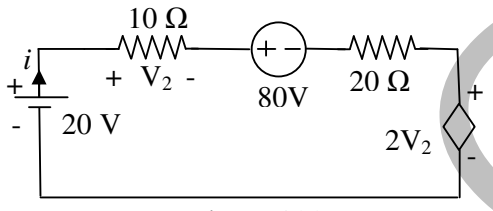

Figure 1(a)

b) What is meant by a planar circuit and a non-planar circuit? (2M)

c) Define fringing flux and leakage flux. (2M)

d) An RLC Series circuit has R=8Ω, X_L=6.283Ω, X_C=22.736Ω. What is the impedance and power factor of the circuit? (2M)

e) What is a locus diagram? What are the benefits with locus diagram? (2M)

f) State compensation theorem. (2M)

g) What is meant by lagging and leading power factors? (2M)

PART -B

2. a) State and explain the Kirchhoff's current and voltage laws with suitable examples. (6M)

b) Determine the voltage across 3Ω resistor using mesh analysis for the circuit shown in figure 2(b). (8M)

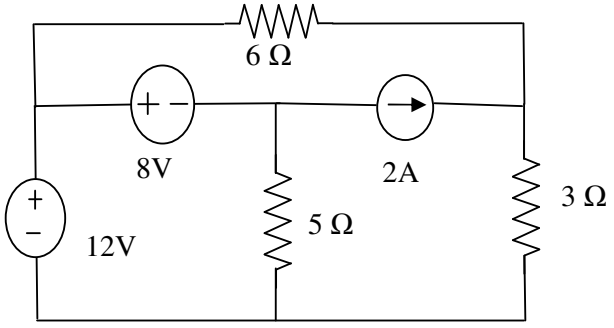

Figure 2(b)
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3. For the network shown in figure 3, obtain the oriented graph of the network and write the cut-set schedule of the graph and determine loop currents. (14M)

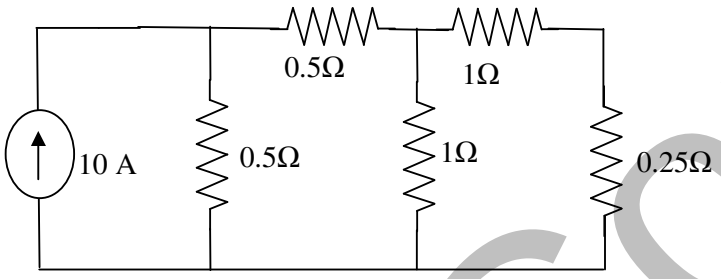

Figure 3

4. a) The combined inductance of two coils connected in series is 0.6 or 0.1 depending on the relative directions of the coils. If one of the coil when isolated has a self inductance of 0.2H, calculate (i) mutual inductance, (ii) Co-efficient of coupling. (7M)

   b) An iron ring, cross-sectional area of 5cm^2 and mean length 100cm, has an air-gap of 2cm cut in it. Threee separate coils having 100, 200, and 300 turns are wound on the ring and carry currents of 1A, 2.5A and 3A respectively such that they produce additive fluxes in the ring. Relative permeability of the ring material is 1000. Calculate the flux in the air gap. (7M)

5. a) A resistance and an inductance are connected in series across 250V, AC supply. When the frequency is 40Hz, the current is 1.9A and when the frequency is 50Hz, the current is 1.7A. Determine (i) resistance and inductance of the circuit (ii) power factor of the circuit at 50Hz (iii) power consumed at 50Hz. (6M)

   b) The impedance of a circuit is (6+j8)Ω and an applied phasor voltage is V=50 $\angle 45^0$ Volts. Determine the power triangle values. (4M)

   c) What is meant by the rms value of an ac quantity? Explain its practical importance. (4M)

6. a) A Series RLC Circuit with L=25mH and C=70μF has a lagging phase angle of 20^0 at ω=2000 rad/sec. At what frequency will the phase angle be 30^0 leading? (7M)

   b) Obtain values of R, L and C in series RLC Circuit that resonants at 1.5kHz and consumes 50W from a 50V AC source operating at resonant frequency. The bandwidth is 0.75kHz. (7M)

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7. a) Find the value of R_L to be connected between terminals AB in figure 7(a), for maximum transfer of power and maximum value of power. (7M)

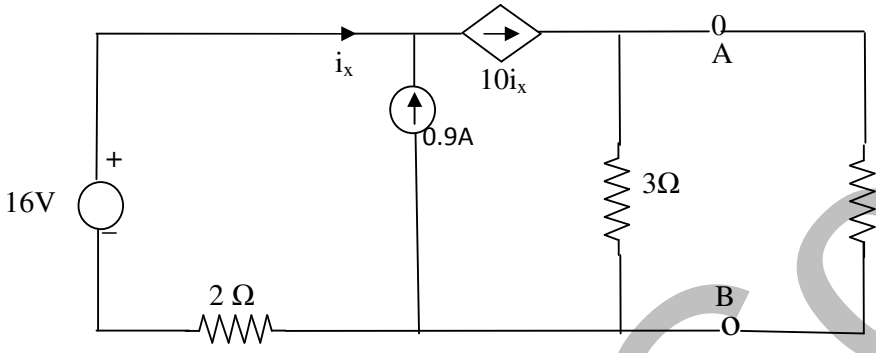

Figure 7(a)

b) State and explain thevenin's theorem. Also explain the limitations of this theorem. (7M)