BITS PILANI , DUBAI CAMPUS

2nd Year, SECOND SEMESTER 2013 – 2014

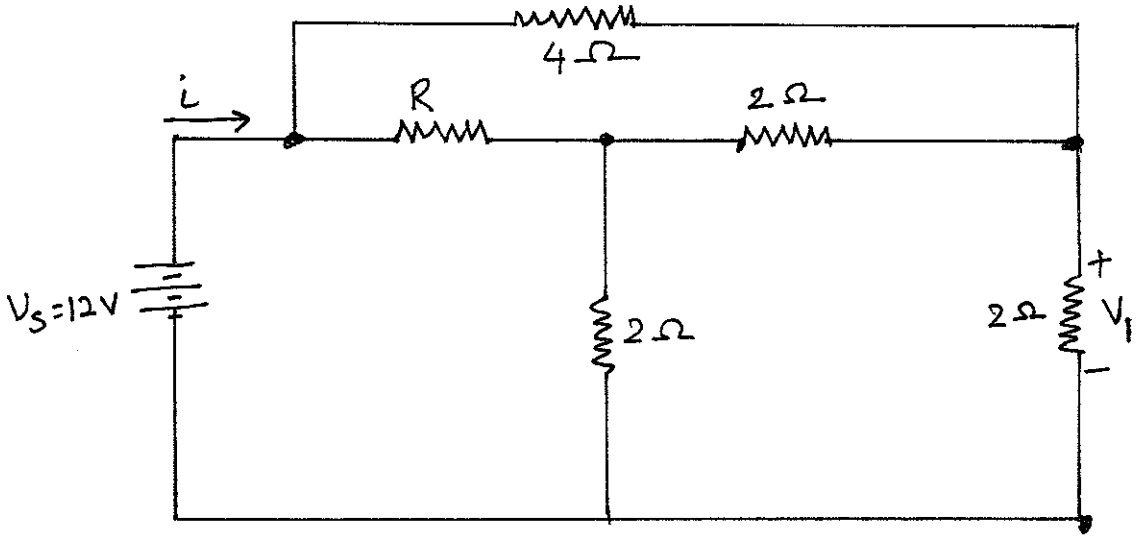
Comprehensive exam (Closed Book)

Course Code:	**EEE F111**	Date:	**27.05.14 FN**
Course Title:	**Electrical Sciences**	Maximum Marks:	**80 marks**
Duration:	**3 hours**	Weightage:	**40%**

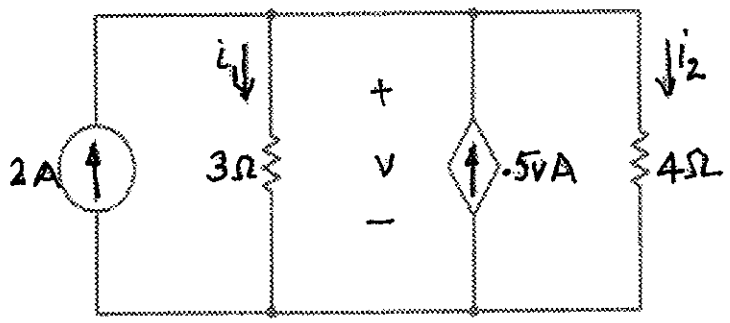
Instruction: This paper consists of TWELVE questions. Answer all the questions. Part A , B and C must be answered in separate booklets.

PART A

Q1. Consider the nonseries – parallel circuit shown below. When R = ½ Ω , then v_1 = 6 volts. Determine the resistance $R_{eq} = V_S / i$ loading the battery. **[7M]**

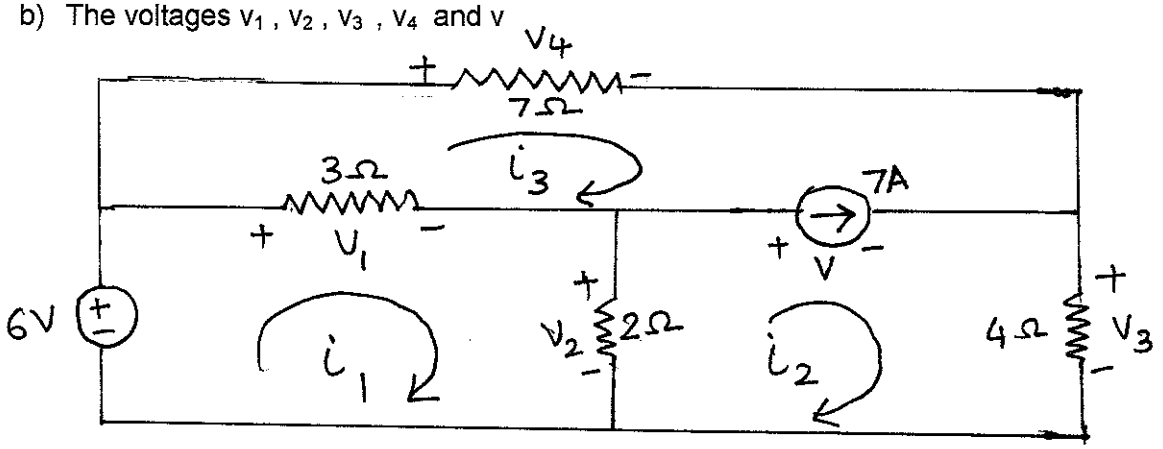


Q2. Consider the following circuit and determine the values of v, i_1 and i_2 . **[5M]**

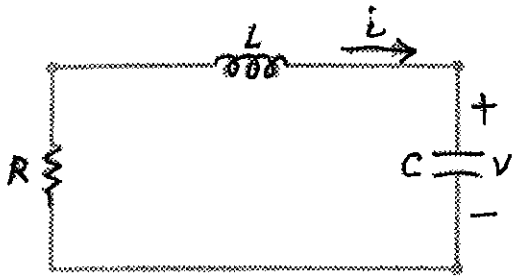


Q3. For the circuit shown below, calculate the following using Mesh Analysis. **[8M]**

a) Mesh currents i_1 , i_2 and i_3
b) The voltages v_1 , v_2 , v_3 , v_4 and v

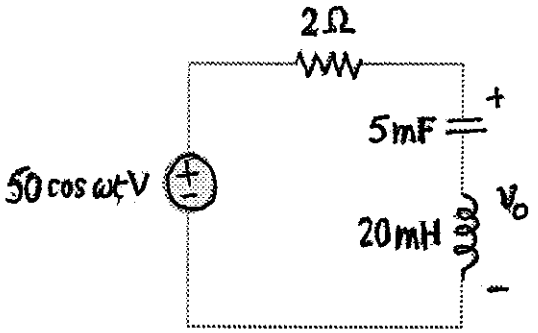


Q4. Determine the natural responses v(t) and i(t) for t > 0 for the series RLC circuit shown below. R= 5Ω, L= ½ H and C = 1/8 F given that the initial conditions are v(0) = 2v and i(0) = 1A. **[10M]**



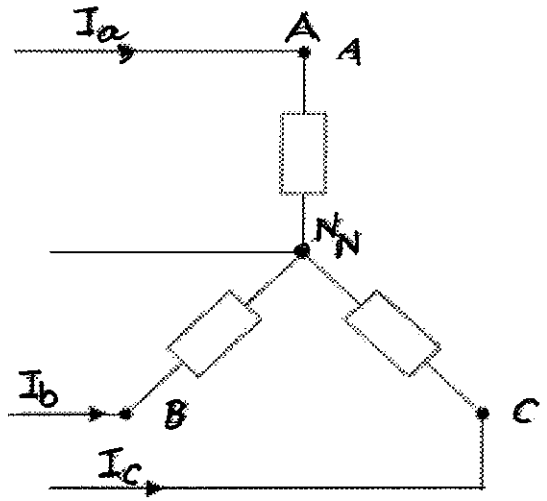
PART B

Q5. What value of ω will cause the forced response v_o in the figure to be zero? **[5M]**



Q6. A coil has an mmf of 600 At, and a reluctance of 3 x 10^6 At/Wb. Find the total flux Φ. **[4M]**

Q7. A balanced three-phase Y-source with V_{Ph} = 210 V rms drives a Y-connected three-phase load with phase impedance Z_A = 80 Ω, Z_B = 60 + *j*90 Ω, and Z_C = *j*80 Ω. Calculate the line currents and total complex power delivered to the load. Assume that the neutrals are connected as shown. **[8 M]**

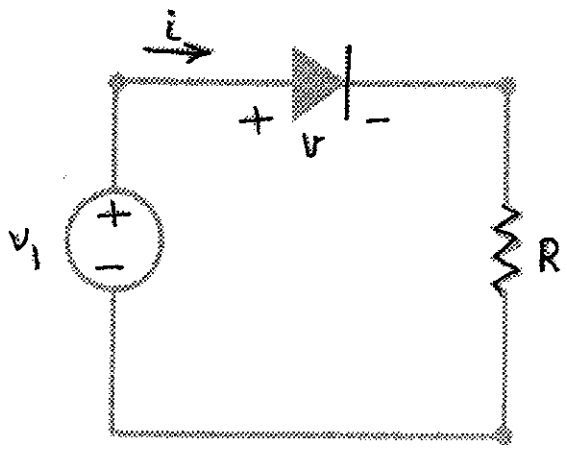


Q8. A germanium diode (η=1) has saturation current of 10μA at 300 K

a) Find the current for the case that the forward bias voltage is 0.3V

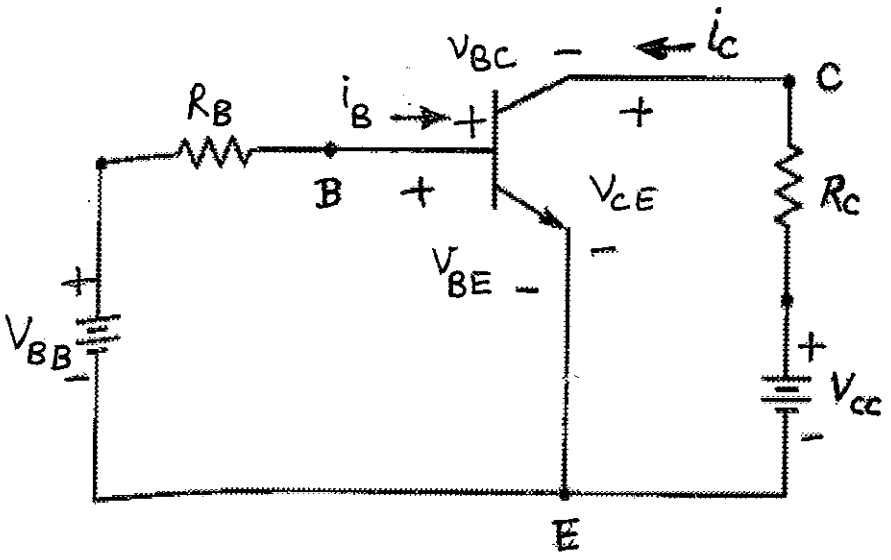
b) Find the forward bias voltage that results in a current of 0.5A

c) In the circuit given, if v_1 is 12V, what value of R results in a current of 0.5A? **[8 M]**

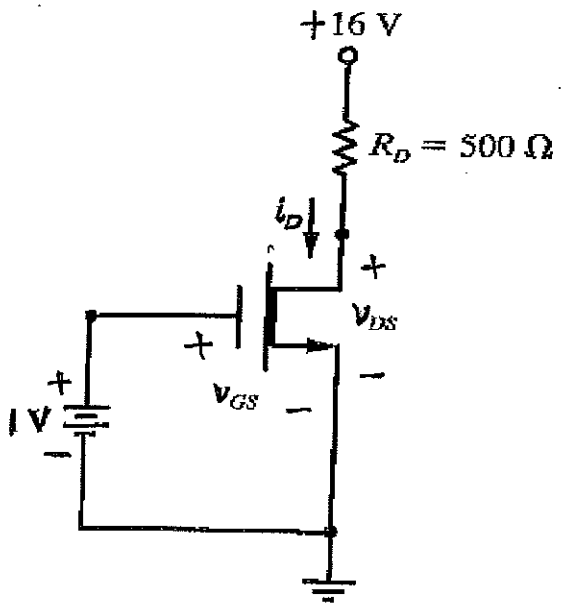


PART C

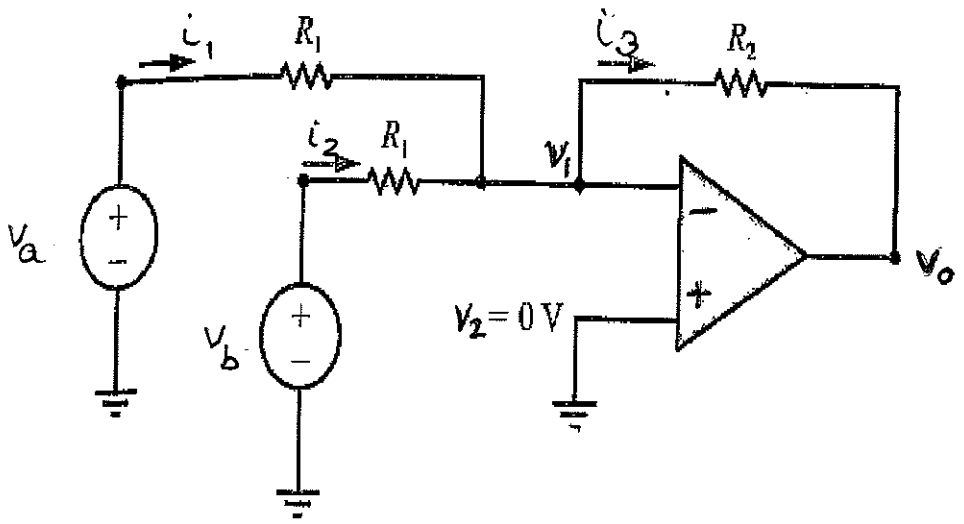
Q9. Consider a silicon npn transistor with β= 100 in common emitter configuration as shown below, where R_B = 330 kΩ, R_C = 2.7 kΩ, V_{BB} =V_{CC} = 10 V.Take V_{BE} = 0.7volts and Vγ=0.5volts.Verify that the transistor is operating in the active region . **[10M]**



Q10. Consider the MOSFET circuit shown below where the depletion NMOS transistor has I_{DSS} = 8m A and V_P = -2 volts. Obtain the values for V_{GS} , I_D and V_{DS} . **[6M]**

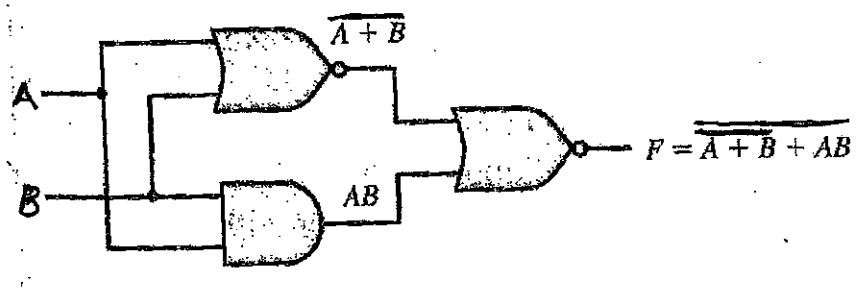


Q11. Calculate the values of V_O , i_1 , i_2 and i_3 for the following op amp when $R_1 = 2k\Omega$, $R_2 = 10\ k\Omega$, $v_a = -0.5 \cos(1000\pi t)$ and $v_b = 0.3 \cos(2000\pi t)$. **[5M]**



Q12. Consider the logic circuit where the output is characterized by the following binary function. Draw the corresponding truth table. **[4M]**

$$F = \overline{\overline{A + B} + AB}$$



END OF PAPER

BITS PILANI, DUBAI CAMPUS

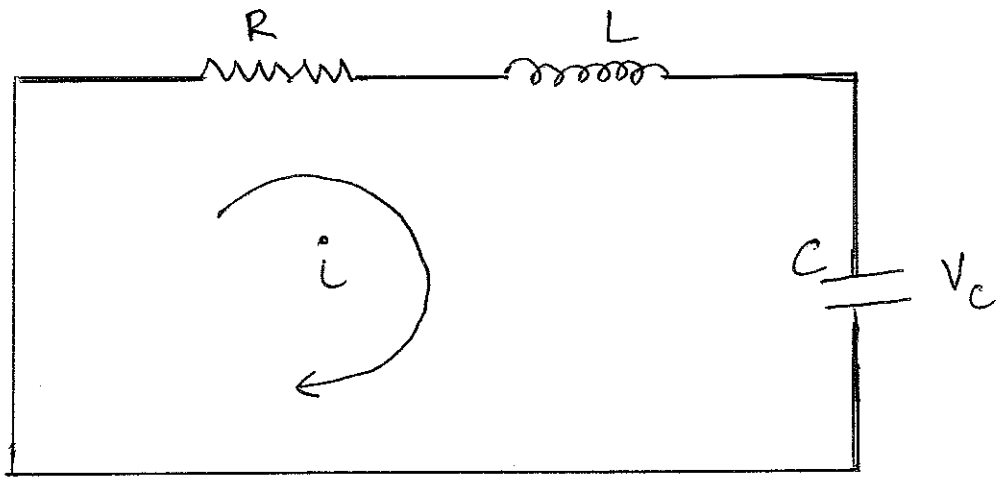
1st Year, SECOND SEMESTER 2013 – 2014

TEST – 2 (Open Book)

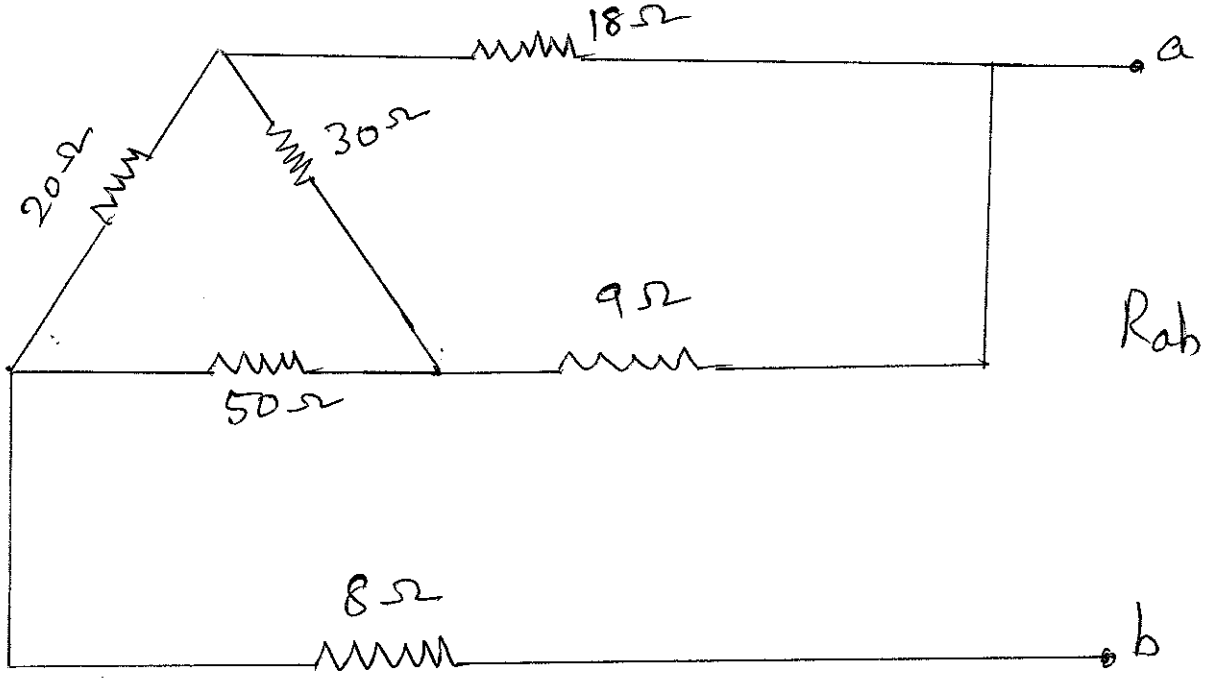
Course Code:	**EEE F111**	Date:	**27.4.2014**
Course Title:	**Electrical Sciences**	Maximum Marks:	**40**
Duration:	**50 minutes**	Weightage:	**20%**

Instruction: ***Answer all the questions.***

Q1. Consider the following RLC series circuit in which R= 10Ω , L = 5H, C = 2m F , i(0) = 3 m A and v_C (0)=4 volts. Find i(t) at t > 0. [13M]

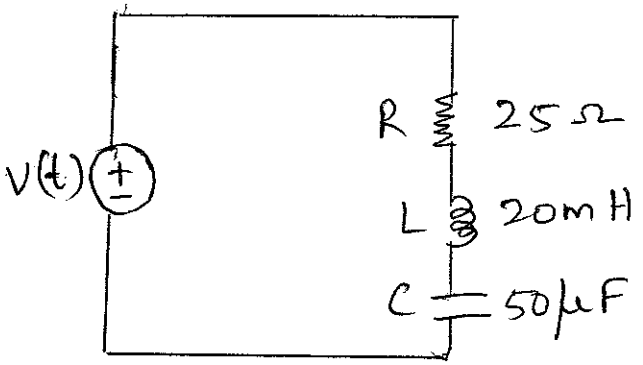


Q2. Find the equivalent resistance R_{ab} for the circuit given below. [8M]

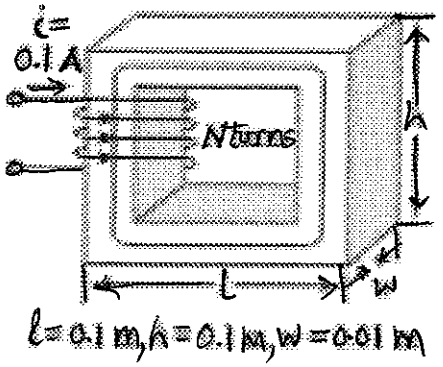


Q3. Determine the equivalent impedance of the network shown in the circuit below if the frequency is 60Hz. Compute the current i(t) if the voltage source is

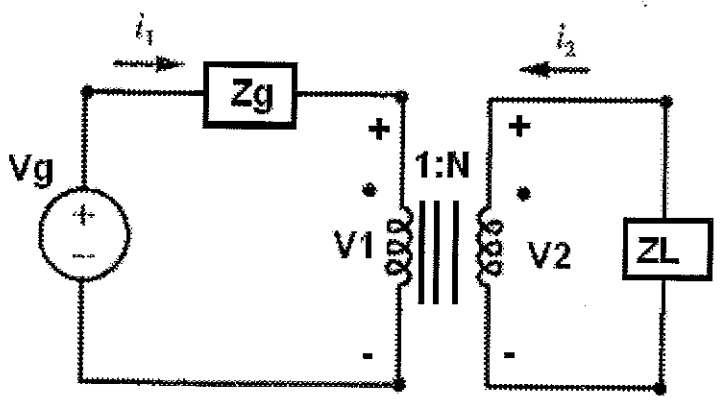
$v(t) = 50 \cos(\omega t + 30^{o})$ volts [6M]



Q4. Calculate mmf, reluctance, flux, flux density and the field intensity on the magnetic structure shown below. Assume N= 500 turns and relative permeability of 1000. **[5M]**



Q 5. For the ideal transformer circuit shown below, find (a) $i_1(t)$, (b) $i_2(t)$, (c) $v_1(t)$ and (d) $v_2(t)$. Assume N = 2, Zg is a 2 H inductor, Z_L is a ½ F capacitor and $V_g(t) = 15\cos 2t$.[8M]



BITS PILANI, DUBAI CAMPUS

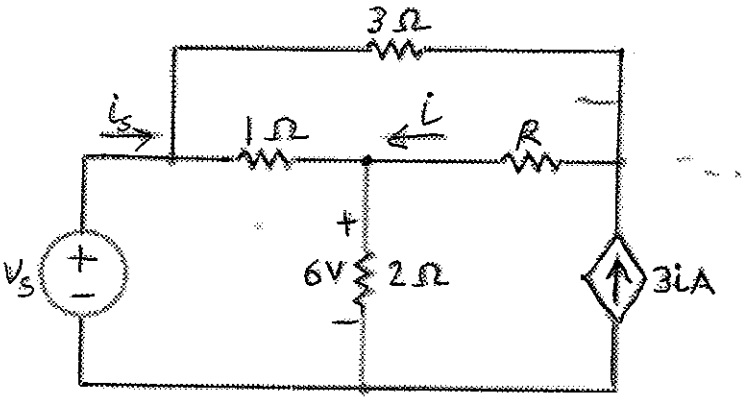
1st Year, SECOND SEMESTER 2013 – 2014

TEST – 1 (Closed Book)

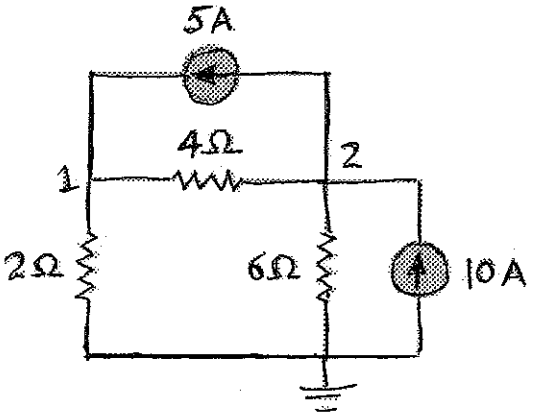
Course Code:	**EEE F111**	Date:	**09 .03.2014**
Course Title:	**Electrical Sciences**	Maximum Marks:	**50**
Duration:	**50 minutes**	Weightage:	**25%**

Instruction: ***Answer all the questions.***

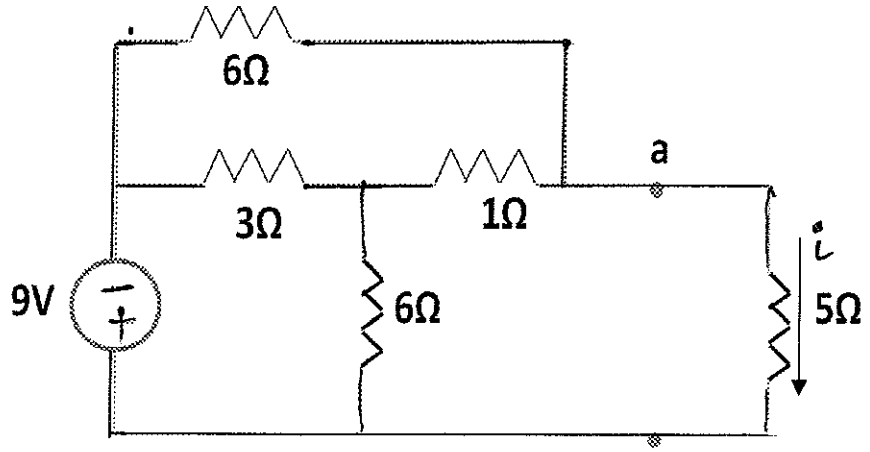
Q1. For the circuit shown below, suppose R =10Ω. Determine the source voltage v_s and the equivalent resistance R_{eq} . [12 M]



Q2. Calculate the node voltages and the current through the 4Ω and the 2Ω resistors in the following circuit. [12 M]

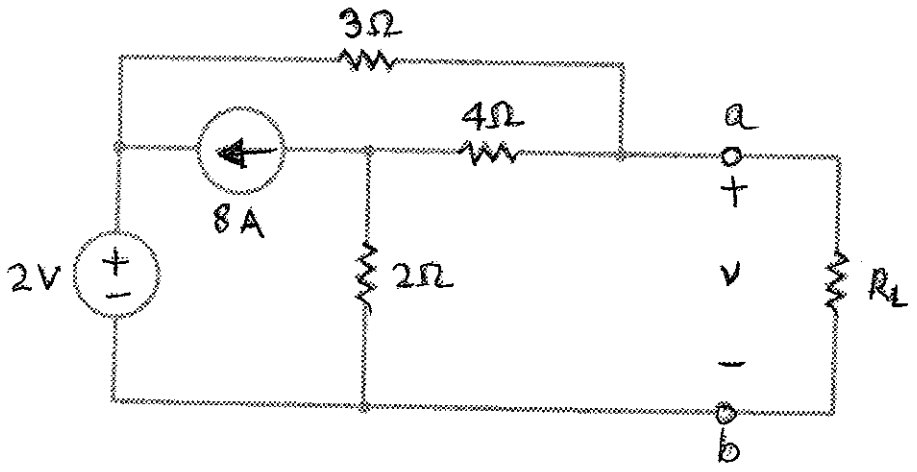


Q3. Find and draw the Norton equivalent of the circuit to the left of terminal a and b. Use this result to find the current **i** through the 5Ω resistor. [12 M]



Q4..Consider the circuit shown below.

a) Find and draw the Thevenin equivalent of the circuit to the left of terminals a and b.
b) Use the Thevenin equivalent circuit to find **v** and the power absorbed by R_L when R_L = 3 Ω.
c) Determine the value of R_L , which absorbs the maximum amount of power and find this power. [14M]



A

BITS Pilani, Dubai Campus

Dubai International Academic City, Dubai, UAE

I Year, SECOND SEMESTER, 2013 – 14

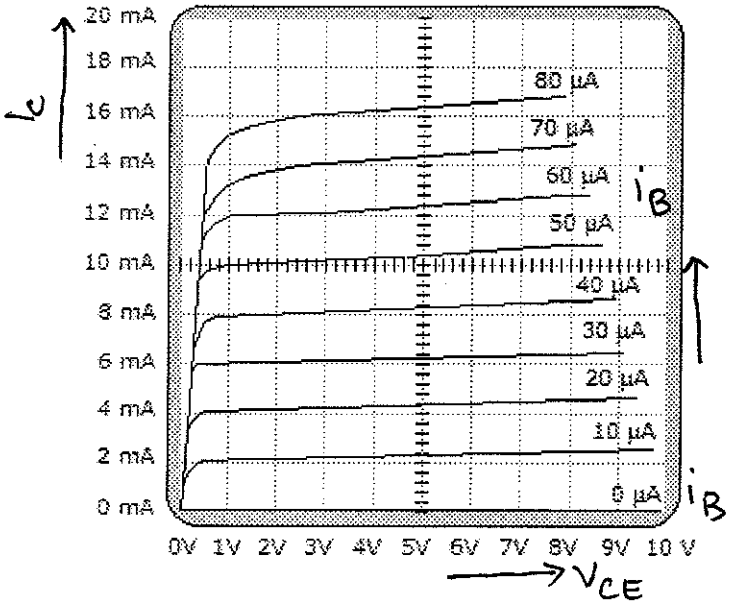
QUIZ – 2

Course code:	**EEE F111**	Date:	11.5.**14**
Course Title:	**Electrical Sciences**	Maximum Marks :	**14**
Duration:	**20 minutes**	Weightage:	7%

Name of the student		**ID No.**
Name of the faculty		**Section:**

Answer all questions

1. Calculate β for I_C = 15 mA and V_{CE} = 5 V. **[2M]**



2. A transistor has a β of 250 and a base current, i_B, of 20 µ A. The collector current, i_C, equals _____ **[1 M]**

3. Which of the following is true for a bipolar transistor? **[1 M]**

(a) Both base and emitter are heavily doped.
(b) Collector is moderately doped and the emitter is heavily doped.
(c) The collector is heavily doped and emitter is lightly doped.
(d) Both the collector and emitter are heavily doped.

4. Draw the circuit symbol for n–channel and p–channel JFET. **[1 M]**

5. Write the conditions for v_{DS} and v_{GS} for the JFET to operate in the active region.

[2M]

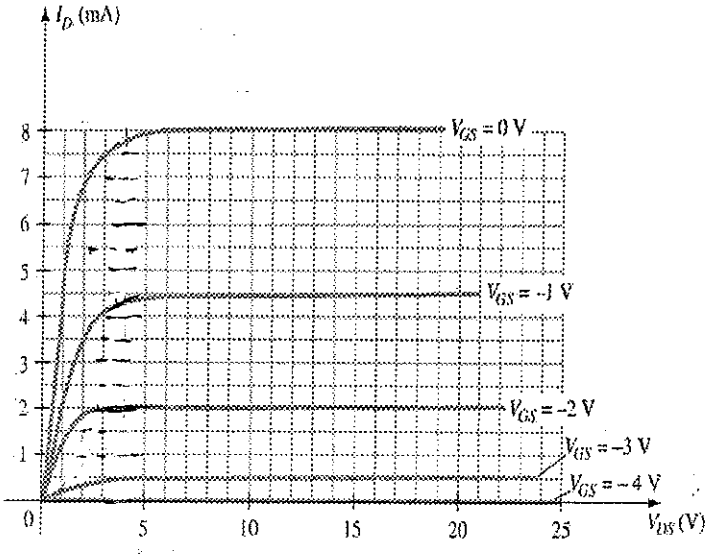
6. Draw the circuit diagram showing currents and the polarities of the voltages, when npn BJT is in active region in common emitter configuration by using the circuit symbol.
[2M]

7. When a junction transistor is operated under saturated conditions, both the _____ and _____ junction are _____ **[1 M]**

8. A current ratio of i_C / i_E is usually less than one and is denoted as _____ **[1 M]**

9. In which region does the JFET behave as a resistor? **[1 M]**

10.. Mark I_{DSS}, V_P, and active region in the following graph. **[2 M]**



B

BITS Pilani, Dubai Campus

Dubai International Academic City, Dubai, UAE

I Year, SECOND SEMESTER, 2013 – 14

QUIZ – 2

Course code: **EEE F111**
Course Title: **Electrical Sciences**
Duration: **20 minutes**

Date: 11.5.**14**
Maximum Marks : **14**
Weightage: 7%

Name of the student		**ID No.**
Name of the faculty		**Section:**

Answer ALL questions

1. A transistor has a β of 250 and a base current, i_B, of 20 μ A. The collector current, i_C, equals _____ **[1 M]**

2. A current ratio of i_C / i_E is usually less than one and is denoted as _____ **[1 M]**

3. When a junction transistor is operated under saturated conditions, both the _____ and _____ junction are _____ **[1 M]**

4. Which of the following is true for a bipolar transistor? **[1 M]**

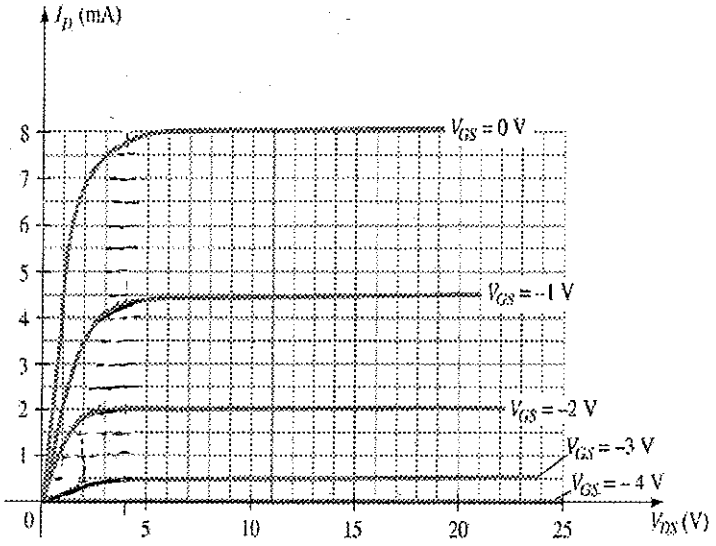
   (a) Both base and emitter are heavily doped.
   (b) Collector is moderately doped and the emitter is heavily doped.
   (c) The collector is heavily doped and emitter is lightly doped.
   (d) Both the collector and emitter are heavily doped.

5 Write the conditions for v_{DS} and v_{GS} for the JFET to operate in the active region. [2M]

6. In which region does the JFET behave as a resistor? **[1 M]**

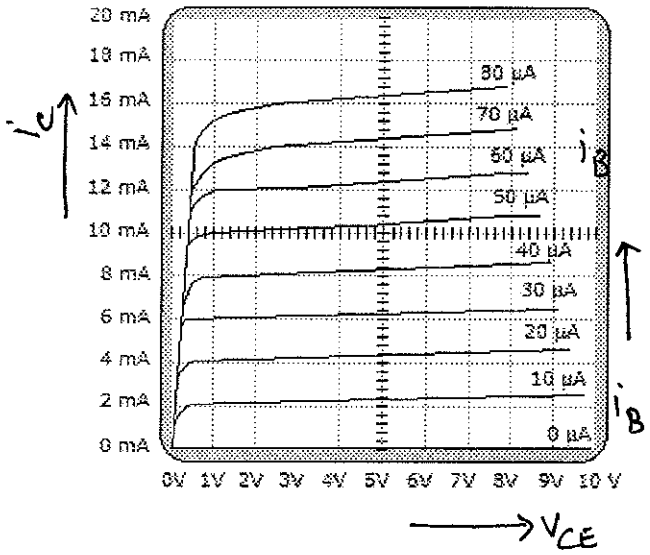
7. Draw the circuit symbol for n–channel and p–channel JFET. **[1 M]**

8. Mark I_{DSS}, V_P, and active region in the following graph. **[2 M]**



9. Draw the circuit diagram showing currents and the polarities of the voltages, when npn BJT is in active region in common emitter configuration by using the circuit symbol. [2M]

10. Calculate β for I_C = 15 mA and V_{CE} = 5 V. **[2M]**



A

BITS Pilani, Dubai Campus

Dubai International Academic City, Dubai, UAE

I Year, SECOND SEMESTER, 2013 – 14

QUIZ – 1

Course code:	**EEE F111**	Date:	**23.3.14**
Course Title:	**Electrical Sciences**	Maximum Marks :	**16**
Duration:	**20 minutes**	Weightage:	**8%**

Name of the student		**ID No.**
Name of the faculty		**Section:**

Answer ALL questions

1. Find the capacitance of a capacitor that stores 8 C of charge at 4 V. [1M]

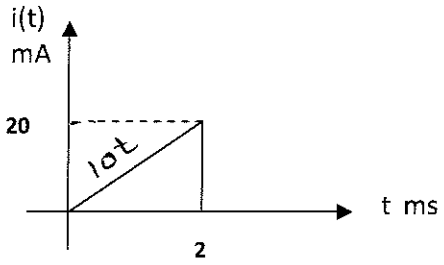
2. Find the total capacitance of two capacitors in series, when both have a value of 150 μF [1M]

3. Find the time constant of a 100 μF capacitor in series with a 100Ω resistor [1M]

4. A 4-henry inductor is in series with a variable resistor. The resistance is increased so that the current drops from 6 amps to 2 amps in 2 seconds. What is the voltage induced? [1M]

5. Find the time constant of a 4 H inductor in series with a 100Ω resistor. [1M]

6. The current in a 10 mH inductor has the waveform shown in the figure below. Determine the voltage waveform.

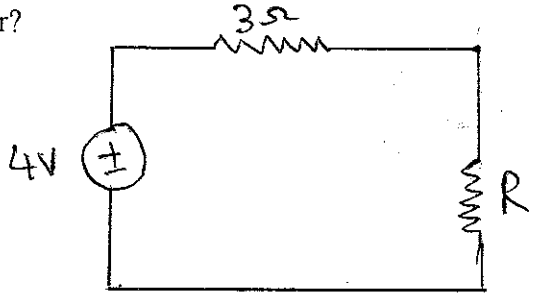


Given :
$i = 10t \; ; \; 0 \le t < 2ms$
$i = 20mA \; ; \; t \ge 2ms$

[3M]

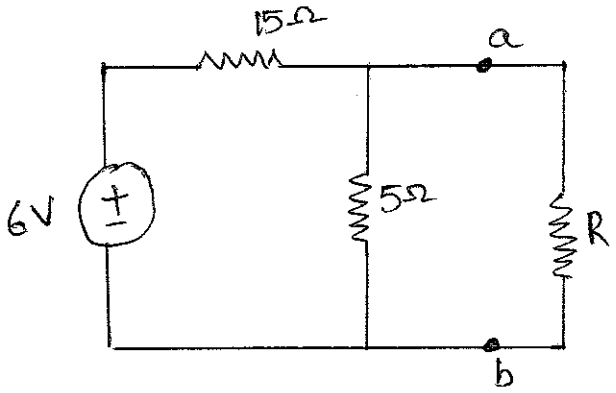
7. The voltage across a 25μF capacitor is given as v(t) = 980sin 377t. Determine the energy stored by it. [1M]

8. A) What should be the value of R in the following circuit, for it to absorb the maximum power? [1M]

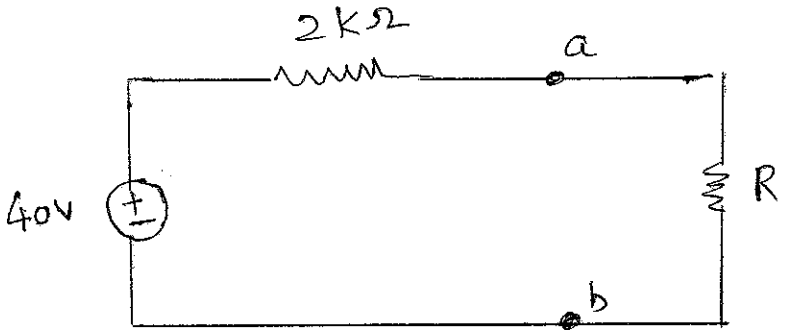


B) Calculate the maximum power absorbed by R in the circuit shown above. [2M]

9. Draw the Thevenin's equivalent to the left of **a and b** in the circuit shown below. [2M]



10. Draw the Norton's equivalent to the left of **a and b** for the Thevenin's circuit shown below. [2M]



B

BITS Pilani, Dubai Campus

Dubai International Academic City, Dubai, UAE

I Year, SECOND SEMESTER, 2013 – 14

QUIZ – 1

Course code: **EEE F111**
Course Title: **Electrical Sciences**
Duration: **20 minutes**

Date: **23.3.14**
Maximum Marks : **16**
Weightage: **8%**

Name of the student		**ID No.**
Name of the faculty		**Section:**

Answer ALL questions

1. Find the capacitance of a capacitor that stores 8 C of charge at 4 V. [1M]

2. The voltage across a 25μF capacitor is given as v(t) = 980sin 377t. Determine the energy stored by it. [1M]

3. Find the time constant of a 100 μF capacitor in series with a 100Ω resistor [1M]

4. A) What should be the value of R in the following circuit, for it to absorb the maximum power. [1M]

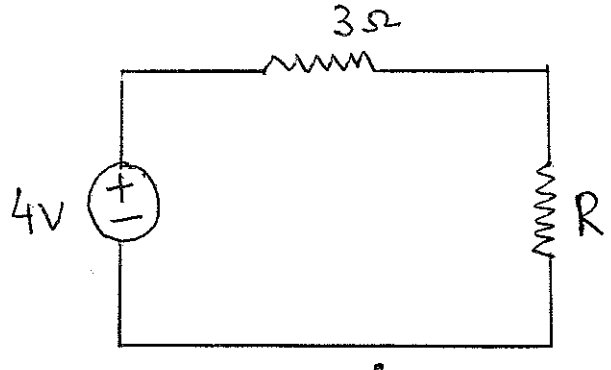
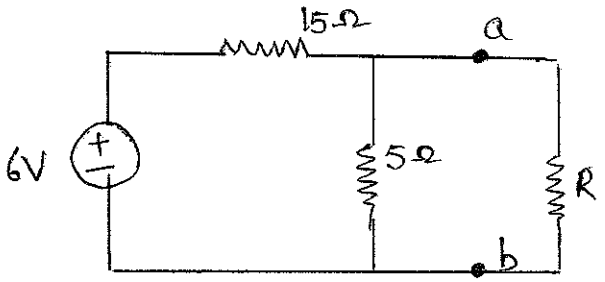


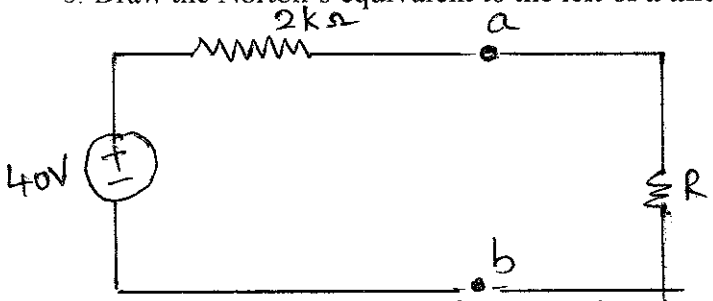
fig 1.

B) Calculate the maximum power absorbed by R in the circuit shown above. (fig 1) [2M]

5. Draw the Thevenin's equivalent to the left of **a and b** in the circuit shown below. [2M]

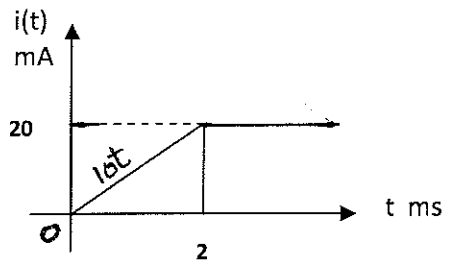


6. Draw the Norton's equivalent to the left of **a and b** for the Thevenin's circuit shown below. [2M]



7. Find the total capacitance of two capacitors in series, when both have a value of 150 μF [1M]

8. The current in a 10 mH inductor has the waveform shown in the figure below. Determine the voltage waveform. [3M]



Given: $i = 10t$; $0 \le t < 2ms$

$i = 20mA$; $t \ge 2ms$

9. Find the time constant of a 4 H inductor in series with a 100Ω resistor. [1M]

10 A 4-henry inductor is in series with a variable resistor. The resistance is increased so that the current drops from 6 amps to 2 amps in 2 seconds. What is the voltage induced? [1M]