



Electrical Circuits (EE203)
Final Exam, 2nd Term, 2011-2012
May, 27, 2012. 2:00 – 4:00

Electric Circuits



Instructor

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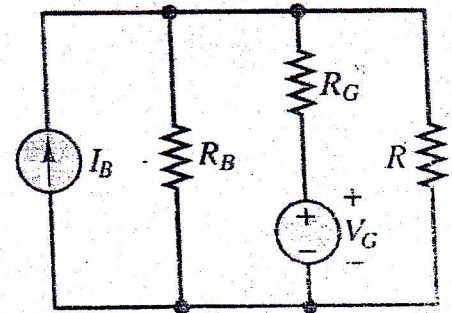


Reem Debes



- Switch off your mobile. No advanced calculators or mobile phones are allowed.
- Hand over your exam sheets with your scratch paper.
- Show work and write the final answer & units inside the box, to get credit on problems.
- Answer all problems directly on the exam sheet only.
- Feel free to use the blank space on the exam sheets for scratch work.
- Please keep 😊, 🍌 & 🍷. Don't 🙄, 🤔, 🤔, 🤔 & 🤔. Take your 🕒 & enjoy yourself.

- Q1-(7Pts) For the circuit shown, where: $I_B = 10A$, $V_G = 12V$, $R_G = 5\Omega$,
 $R_B = R = 10\Omega$. By using superposition, determine the:
- a- Voltage across R . b- Power dissipated in R .
- c- Can be used the superposition method for power calculations, and why?

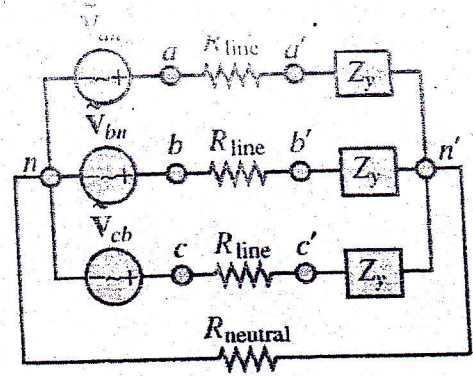


a-

b-

c-

- Q5 (12pts) For three phase circuit shown, where: $V_{an} = 220 \angle 0^\circ$ V, balanced +ve sequence (a-b-c), 50 Hz, $Z_y = 4 + j3 \Omega$, $R_{line} = 0.1 \Omega$, $R_{neutral} = 10 \Omega$. Determine the:
- rms $I_{aa'}$ phasor current.
 - rms $I_{nn'}$ phasor current.
 - Total generated real power.
 - Power factor.
 - Total generated complex (apparent) power.
 - Total generated reactive power.
 - Total Power losses in the lines.
 - Sketch and label the power triangle phasor diagram.



MechFamily

h-

a-

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c-

d-

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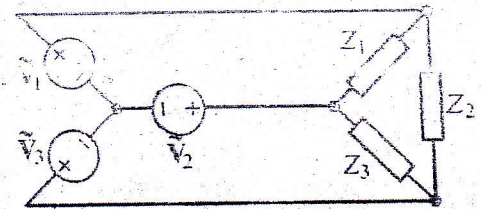
f-

g-

Q6- (9Pis) For three phase circuit shown, where $V_1 = 220 \angle 0^\circ$ V, +ve sequence (1-2-3), 50 Hz, $Z_1 = Z_2 = Z_3 = 4 - j3 \Omega$.

Determine the:

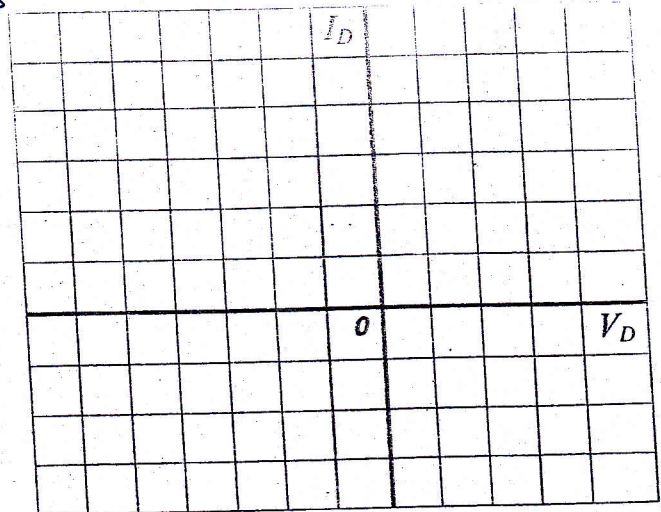
- rms V_{23} phasor voltage.
- Z_3 rms phasor current.
- Total absorbed real power.
- Power factor.
- Power factor it's leading or lagging.
- What is the type of the components (inductor/capacitor) that can be used to correct (improve) the Power factor?



MechFamily

a-	
b-	
c-	
d-	
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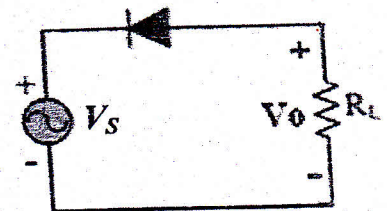
Q7-(3Pts) Plot and label the $i-v$ characteristics of diode showing the operating regions and voltages.



Q8-(6Pts) For the circuit shown, where: $V_S = 10V$ (rms), $R_L = 10\Omega$, $V_T = 0.7V$.

Determine the:

- Peak value of the source voltage V_S .
- Peak value of the output voltage V_O .
- Average (DC) value of the load current I_L .
- On the same plot sketch and label the source and output voltages.
- If a capacitor of $100\mu F$ is connected in parallel with R_L , on the same plot sketch and label the source and output voltages.



MechFamily

a-

b-

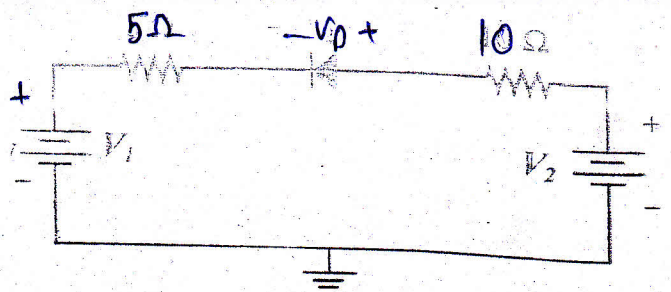
c-

d-

e-

Q9- (5pts) For the circuit shown, where $V_1 = 10V$

- $V_2 = 2V$, $V_D = 0.6V$. Determine the:
- a- Diode Current I_D
 - b- Diode Voltage V_D
 - c- What is the bias of the diode?



a-

b-

c-

- Q10- (7pts) a- Draw the full-wave bridge rectifier circuit, where: $V_S = 12V$ (rms), $R_L = 100\Omega$, $V_D = 0.6V$.
- b- Find the average (DC) value of the load current I_L .
 - c- On the same plot sketch and label the source and output voltages.
 - d- If the source frequency $f_S = 100Hz$. What is the frequency of the rectified output voltage?

a-

c-

b-

d-

Q4- (14pts) A 220V(rms), 50Hz, 2kW, 0.8 lagging pf, single phase electric motor. Find the:

- a- Motor current in phasor form. b- Complex (apparent) power absorbed by the motor.
- 1- To correct (improve) the pf to 0.95 lagging, a shunt capacitor connected with the motor. Find the:
- c- Source current in phasor form. d- Complex (apparent) power absorbed by the load.
- e- The value of the capacitor required to make the correction.
- 2- To correct (improve) the pf to unity, a series capacitor connected with the motor. Find the:
- f- Source current in phasor form. g- Complex (apparent) power absorbed by the load.
- h- The value of the capacitor required to make the correction.
- i- Describe in general which method is better for pf correction a series or parallel, and why?

MechFamily

a-

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d-

e-

f-

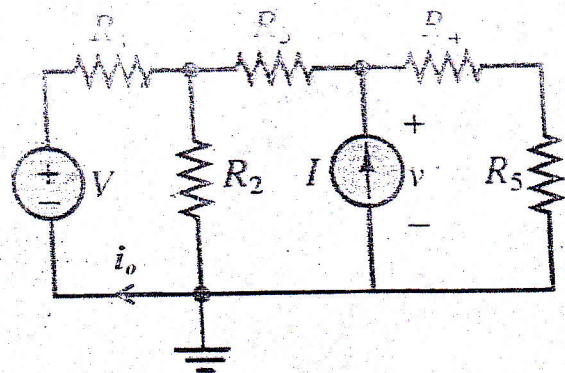
g-

h-

i-

Q2-(6Pts) For the circuit shown, where: $V=12V, I=3A$
 $R_1=6\Omega, R_2=6\Omega, R_3=0$ (zero) $\Omega, R_4=1\Omega, R_5=3\Omega$.
 By using proper Source Transformation technique, determine the:

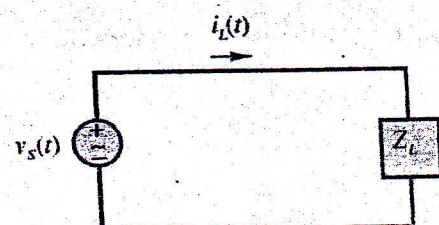
- a- Current I_o . b- Voltage V across the I source.



Q3-(6Pts) For the circuit shown, where: $v_s(t) = 311 \cos(\omega t)$ V.

$i_L(t) = 2.83 \sin(\omega t + 55^\circ)$ A. Determine the:

- a- rms phasor voltage. b- rms phasor current.
 c- Phasor load impedance. d- Load power factor.
 e- Power factor it's leading or lagging.
 f- Load is Resistive, Capacitive or Inductive.



a-

b-

a-

b-

c-

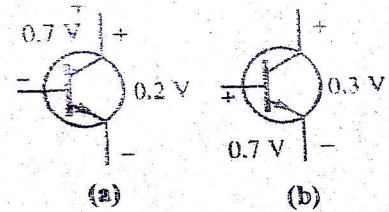
d-

e-

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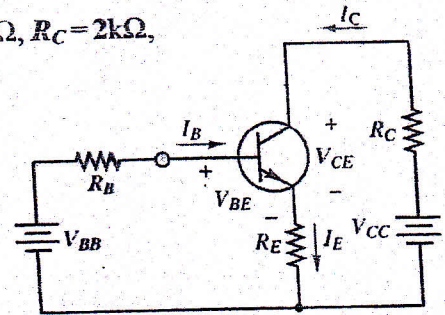
Q11-(3Pts) For the shown BJTs, Determine the operating region and whether the BE and BC junctions are forward or reverse biased.

BJT	BE junction	BC junction	Operating Region
(a)			
(b)			



Q12-(10Pts) For the circuit shown, where: $V_{BB} = 5V$, $V_{CC} = 15V$, $R_B = 12k\Omega$, $R_C = 2k\Omega$, $R_E = 1k\Omega$, $V_\gamma = 0.6V$, $\beta = 100$. Determine the:

- a- Base Current I_B .
- b- Collector Current I_C .
- c- Emitter voltage V_E .
- d- V_{CE} voltage.
- e- Operating region.



MechFamily

a-

b-

c-

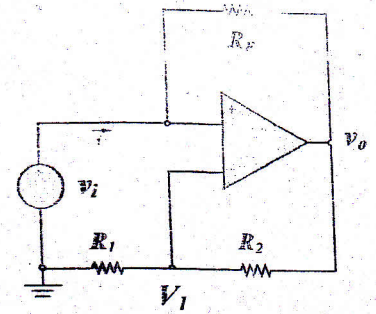
d-

e-

Q13-(10pts) For the OP-AMP circuit shown, where: $V_i = 1.2\text{ V}$, $R_1 = 2\text{ k}\Omega$

$R_2 = 4\text{ k}\Omega$, $R_F = 6\text{ k}\Omega$. Determine the:

- V_i voltage.
- Output voltage v_o .
- Input current i .
- Voltage gain A_v .
- Name the circuit.



a-

b-

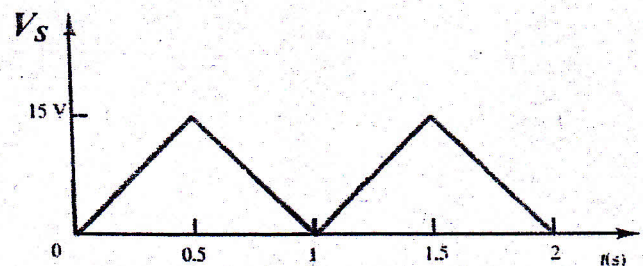
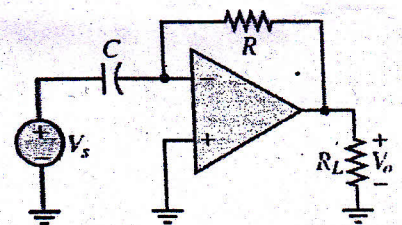
c-

d-

e-

Q14-(5pts) For the OP-AMP circuit shown, where: $C = 0.1\text{ mF}$, $R = 10\text{ k}\Omega$, $R_L = 1\text{ k}\Omega$.

- Name the circuit.
- Write an expression of V_o .
- Plot the output voltage V_o referred to the source voltage V_s as a function of time.



c-

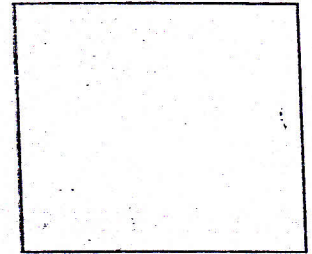
a-

b-

Q14-(4Pts) a- Fill in the blank cells in the table by a proper result depends on the rules of Boolean algebra.

Boolean Algebra	Result	Boolean Algebra	Result
$0 + X$		$X \cdot \bar{X}$	
$1 + X$		$X + X \cdot Z$	
$X + X$		$X \cdot (X + Y)$	
$X \cdot X$		$X + \bar{X} \cdot Y$	

b- Use Truth table to prove that $= AB + \bar{A}B$.

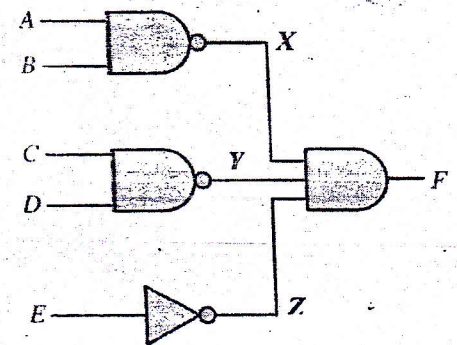


Q15-(3Pts) For the logic circuit shown. a- Determine the Boolean function describing the operation of the output F .

b- Build a truth table of this logic circuit, function by X, Y, Z .

a-

b-

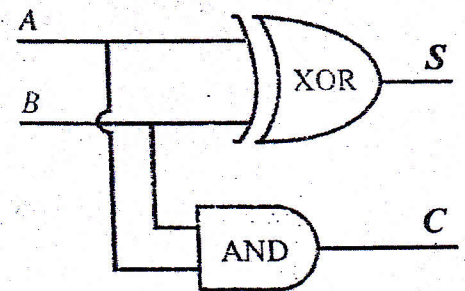


Q16-(4Pts) For the logic circuit shown.

a- Determine the Boolean function describing the operation of the outputs S and C .

b- Build a truth table of this logic circuit.

c- Name the acts of this logic circuit.



a-

c-

b-