ID:	Sec:	Name:

BRAC University

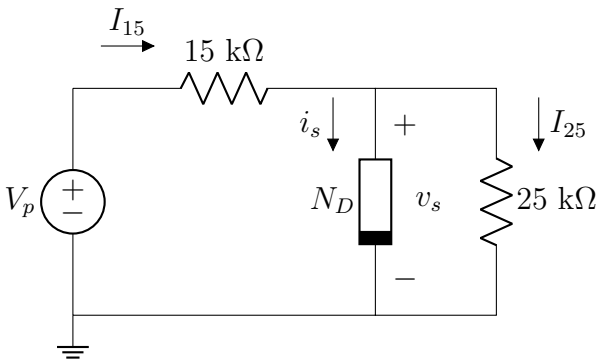
Semster: Spring 2020
Course No: CSE251
Course Title: ELECTRONIC DEVICES AND CIRCUITS
Section: 11
Faculty: ABA

Set: 01

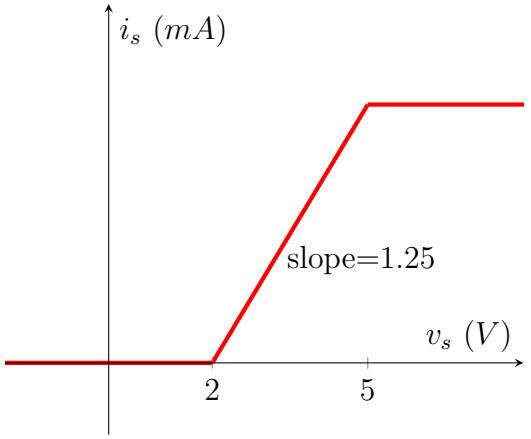
Midterm
Full Marks: 40
TIme: 2 hours
Date: March 10, 2022

Answer all 4 questions. All the questions carry equal marks.

Question 1 [CO1] 10



(a) A circuit with a non-linear device N_D



(b) IV Characteristics of the non-linear device N_D

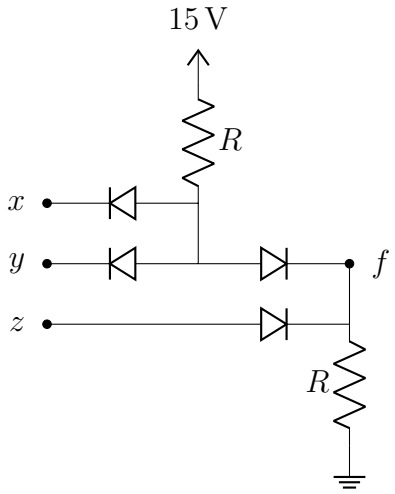
(a) **Identify** the equivalent linear circuit models for the 3 linear segments in the IV characteristics of the non-linear device N_D and **calculate** the model parameters. [3]

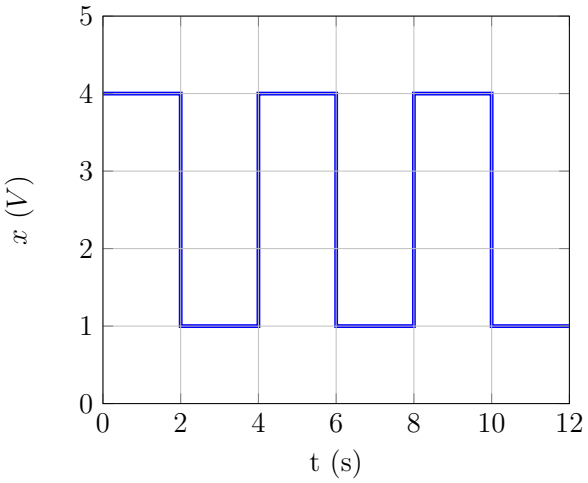
(b) **Show** the alternative representation of the circuit in Figure (a). [2]

(c) **Detect** the operating region for the device when $v_s = 3$ V and **calculate** the current through the device, i_s, for this voltage. [2]

(d) **Apply** KVL and KCL to calculate the value of voltage source V_p when $v_s = 3$ V. [3]

Question 2 [CO2] 10





Set: 01

For this question, all of the diodes are ideal.

(a) Assuming x, y, z are boolean variables, **analyze** the circuit on the left to find an expression of f in terms of x, y, and z. [3]

(b) **Analyze** the circuit on the left again to find the waveform (voltage vs time graph) of f assuming x, y, z are voltage signals, where $y = 2$ V, $z = 3$ V, and x has a waveform as shown in the figure on the right. [5]

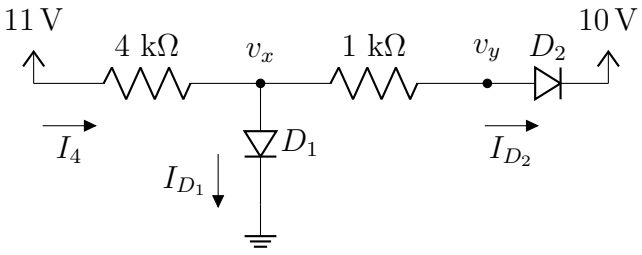
(c) **Design** a circuit using ideal diodes to implement the logic function $f = x.y.z$.
Here "." denotes logical AND. [2]

Bonus: **Design** a circuit using ideal diodes to implement the XOR logic function between x and y, assuming you have access to x, $\bar{x}$, y, and $\bar{y}$. [3]

Question 3 [CO1] **10**

(a) **Analyze** the following circuit to find the values of I_{D_1}, I_{D_2}, v_x, and v_y. Here, **use** the Method of Assumed State using the CVD model of diode with $V_{D_0} = 0.5$ V. [7]

(b) **Validate** your assumptions about the states of the diodes. [3]



Question 4 [CO2] **10**

A voltage waveform $v_i = 10\sin(100\pi t)$ V is input to a full-wave rectifier with a load resistance of $R = 50$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Show** the circuit of the rectifier. **Label** the input and output voltages properly. [2]

(b) **Calculate** the DC value of the output voltage. [1]

(c) **Contrast** the value found in part (b) with that when a 5 μF capacitor is connected in parallel with the load. [2]

(d) **Identify** the two diodes will be ON in the positive half cycle. [1]

Now the two diodes from part (d) are replaced with Germanium diodes [$V_{D_0} = 0.2$ V].

(e) **Explain** the change in the voltage transfer characteristics and output voltage waveform of the circuit. Hence, calculate the peak of the output voltage in this case. [3+1]

ID:	Sec:	Name:

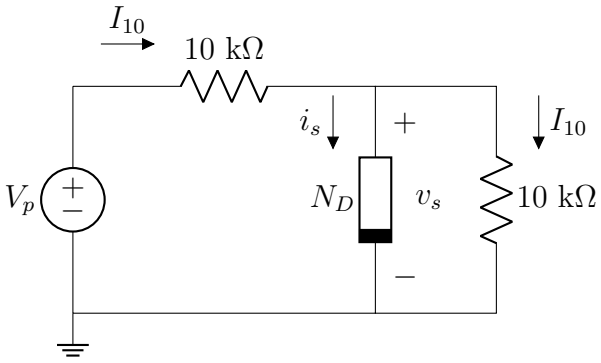
BRAC University

Set: 02

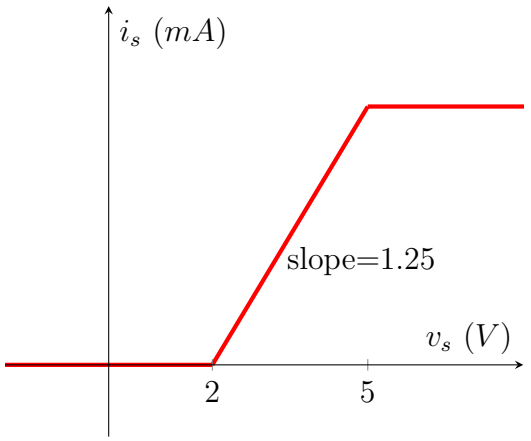
Semster: Spring 2020
Course No: CSE251
Course Title: ELECTRONIC DEVICES AND CIRCUITS
Section: 11
Faculty: ABA

Midterm
Full Marks: 40
TIme: 2 hours
Date: March 10, 2022

Question 1 [CO1] **10**



(a) A circuit with a non-linear device N_D



(b) IV Characteristics of the non-linear device N_D

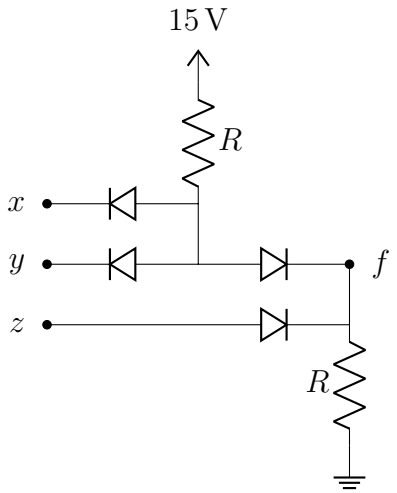
(a) **Identify** the equivalent linear circuit models for the 3 linear segments in the IV characteristics of the non-linear device N_D and **calculate** the model parameters. [3]

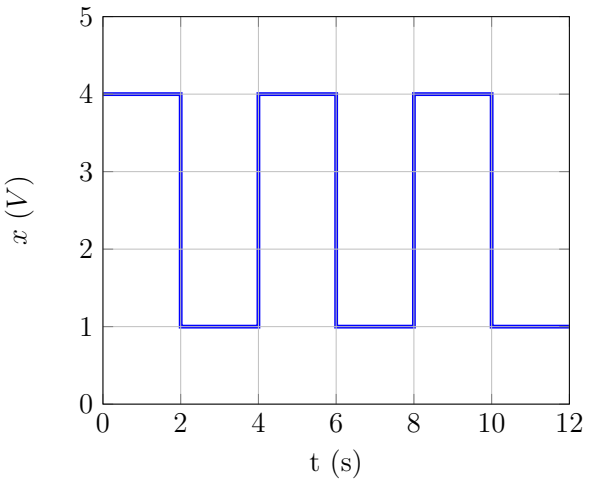
(b) **Show** the alternative representation of the circuit in Figure (a). [2]

(c) **Detect** the operating region for the device when $v_s = 3$ V and **calculate** the current through the device, i_s, for this voltage. [2]

(d) **Apply** KVL and KCL to calculate the value of voltage source V_p when $v_s = 3$ V. [3]

Question 2 [CO2] **10**





For this question, all of the diodes are ideal.

Set: 02

(a) Assuming x, y, z are boolean variables, **analyze** the circuit on the left to find an expression of f in terms of x, y, and z. [3]

(b) **Analyze** the circuit on the left again to find the waveform (voltage vs time graph) of f assuming x, y, z are voltage signals, where $y = 2$ V, $z = 3$ V, and x has a waveform as shown in the figure on the right. [5]

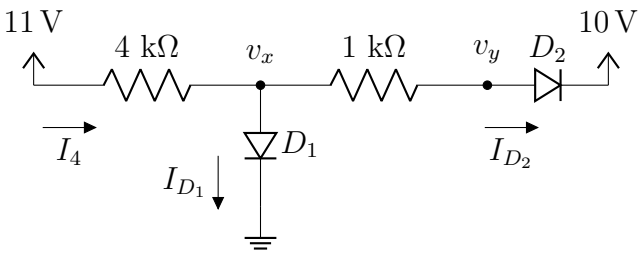
(c) **Design** a circuit using ideal diodes to implement the logic function $f = x.y.z$.
Here "." denotes logical AND. [2]

Bonus: **Design** a circuit using ideal diodes to implement the XOR logic function between x and y, assuming you have access to x, $\bar{x}$, y, and $\bar{y}$. [3]

Question 3 [CO1] **10**

(a) **Analyze** the following circuit to find the values of I_{D_1}, I_{D_2}, v_x, and v_y. Here, **use** the Method of Assumed State using the CVD model of diode with $V_{D_0} = 0.5$ V. [7]

(b) **Validate** your assumptions about the states of the diodes. [3]



Question 4 [CO2] **10**

A voltage waveform $v_i = 10\sin(100\pi t)$ V is input to a full-wave rectifier with a load resistance of $R = 50$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Show** the circuit of the rectifier. **Label** the input and output voltages properly. [2]

(b) **Calculate** the DC value of the output voltage. [1]

(c) **Contrast** the value found in part (b) with that when a 5 μF capacitor is connected in parallel with the load. [2]

(d) **Identify** the two diodes will be ON in the positive half cycle. [1]

Now the two diodes from part (d) are replaced with Germanium diodes [$V_{D_0} = 0.2$ V].

(e) **Explain** the change in the voltage transfer characteristics and output voltage waveform of the circuit. Hence, calculate the peak of the output voltage in this case. [3+1]

ID:	Sec:	Name:

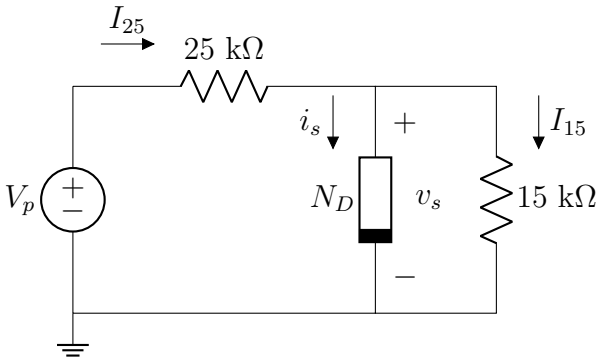
BRAC University

Semster: Spring 2020
Course No: CSE251
Course Title: ELECTRONIC DEVICES AND CIRCUITS
Section: 11
Faculty: ABA

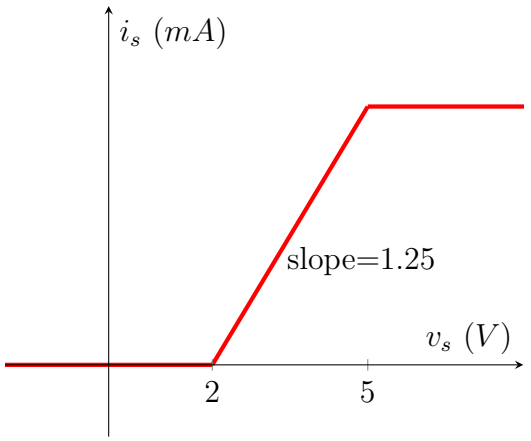
Set: 03

Midterm
Full Marks: 40
TIme: 2 hours
Date: March 10, 2022

Question 1 [CO1] **10**



(a) A circuit with a non-linear device N_D



(b) IV Characteristics of the non-linear device N_D

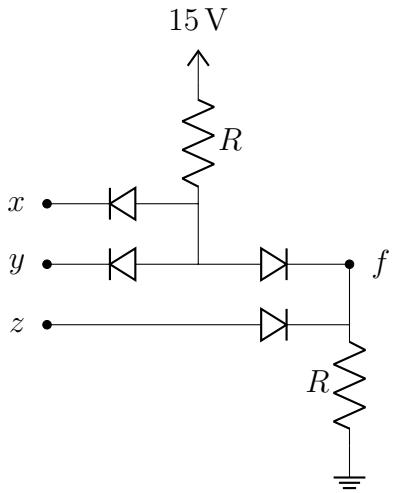
(a) **Identify** the equivalent linear circuit models for the 3 linear segments in the IV characteristics of the non-linear device N_D and **calculate** the model parameters. [3]

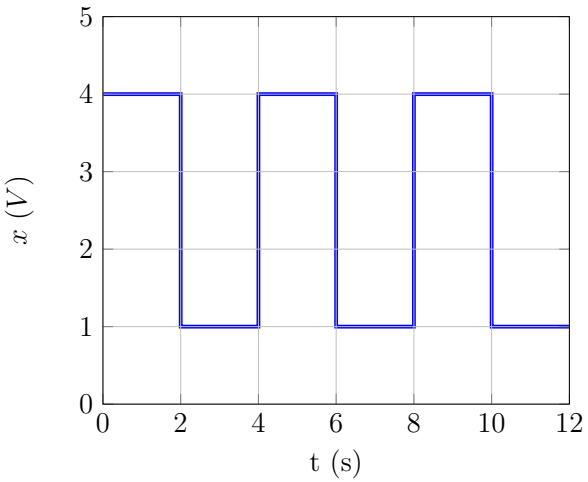
(b) **Show** the alternative representation of the circuit in Figure (a). [2]

(c) **Detect** the operating region for the device when $v_s = 3$ V and **calculate** the current through the device, i_s, for this voltage. [2]

(d) **Apply** KVL and KCL to calculate the value of voltage source V_p when $v_s = 3$ V. [3]

Question 2 [CO2] **10**





For this question, all of the diodes are ideal.

Set: 03

(a) Assuming x, y, z are boolean variables, **analyze** the circuit on the left to find an expression of f in terms of x, y, and z. [3]

(b) **Analyze** the circuit on the left again to find the waveform (voltage vs time graph) of f assuming x, y, z are voltage signals, where $y = 2$ V, $z = 3$ V, and x has a waveform as shown in the figure on the right. [5]

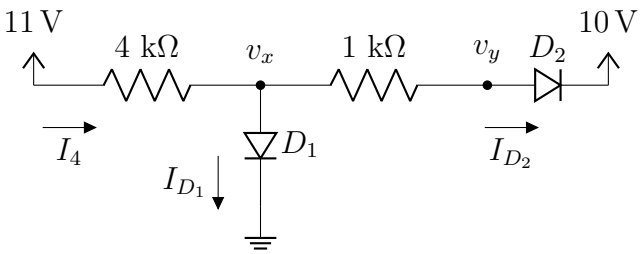
(c) **Design** a circuit using ideal diodes to implement the logic function $f = x + y + z$. Here "+" denotes logical OR . [2]

Bonus: **Design** a circuit using ideal diodes to implement the XOR logic function between x and y, assuming you have access to x, $\bar{x}$, y, and $\bar{y}$. [3]

Question 3 [CO1] **10**

(a) **Analyze** the following circuit to find the values of I_{D_1}, I_{D_2}, v_x, and v_y. Here, **use** the Method of Assumed State using the CVD model of diode with $V_{D_0} = 0.5$ V. [7]

(b) **Validate** your assumptions about the states of the diodes. [3]



Question 4 [CO2] **10**

A voltage waveform $v_i = 10\sin(100\pi t)$ V is input to a full-wave rectifier with a load resistance of $R = 50$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Show** the circuit of the rectifier. **Label** the input and output voltages properly. [2]

(b) **Calculate** the DC value of the output voltage. [1]

(c) **Contrast** the value found in part (b) with that when a 5 μF capacitor is connected in parallel with the load. [2]

(d) **Identify** the two diodes will be ON in the positive half cycle. [1]

Now the two diodes from part (d) are replaced with Germanium diodes [$V_{D_0} = 0.2$ V].

(e) **Explain** the change in the voltage transfer characteristics and output voltage waveform of the circuit. Hence, calculate the peak of the output voltage in this case. [3+1]

ID:	Sec:	Name:

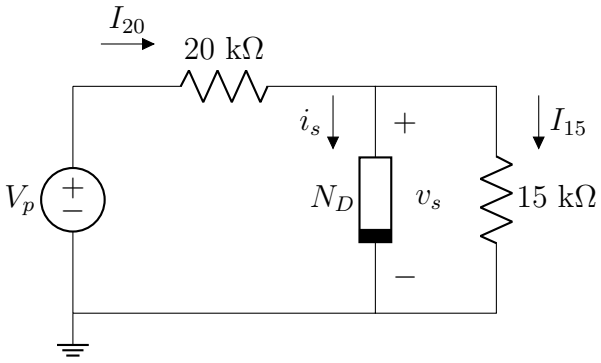
BRAC University

Set: 04

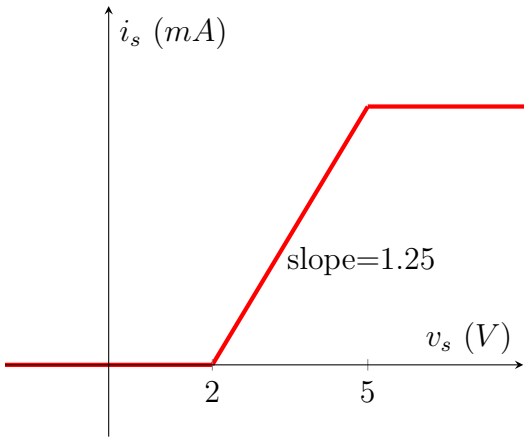
Semster: Spring 2020
Course No: CSE251
Course Title: ELECTRONIC DEVICES AND CIRCUITS
Section: 11
Faculty: ABA

Midterm
Full Marks: 40
TIme: 2 hours
Date: March 10, 2022

Question 1 [CO1] **10**



(a) A circuit with a non-linear device N_D



(b) IV Characteristics of the non-linear device N_D

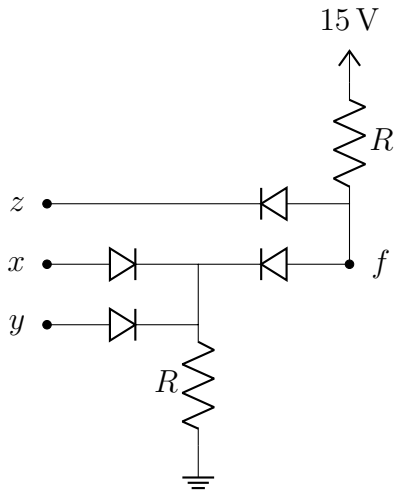
(a) **Identify** the equivalent linear circuit models for the 3 linear segments in the IV characteristics of the non-linear device N_D and **calculate** the model parameters. [3]

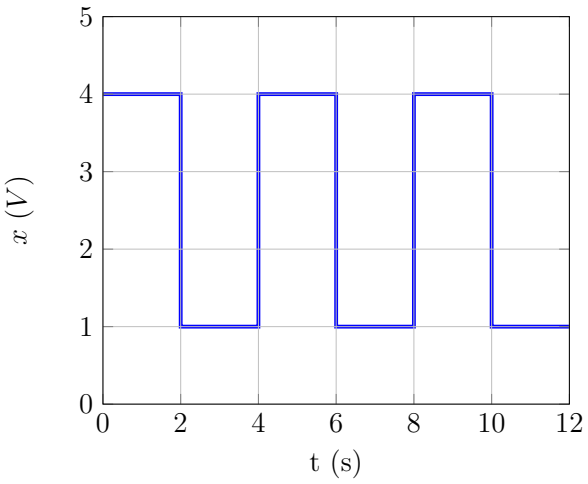
(b) **Show** the alternative representation of the circuit in Figure (a). [2]

(c) **Detect** the operating region for the device when $v_s = 3$ V and **calculate** the current through the device, i_s, for this voltage. [2]

(d) **Apply** KVL and KCL to calculate the value of voltage source V_p when $v_s = 3$ V. [3]

Question 2 [CO2] **10**





For this question, all of the diodes are ideal.

Set: 04

(a) Assuming x, y, z are boolean variables, **analyze** the circuit on the left to find an expression of f in terms of x, y, and z. [3]

(b) **Analyze** the circuit on the left again to find the waveform (voltage vs time graph) of f assuming x, y, z are voltage signals, where $y = 2$ V, $z = 3$ V, and x has a waveform as shown in the figure on the right. [5]

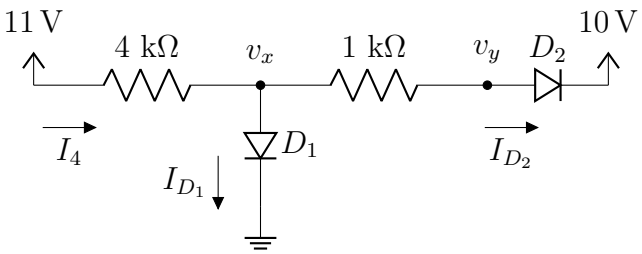
(c) **Design** a circuit using ideal diodes to implement the logic function $f = x + y + z$. Here "+" denotes logical OR . [2]

Bonus: **Design** a circuit using ideal diodes to implement the XOR logic function between x and y, assuming you have access to x, $\bar{x}$, y, and $\bar{y}$. [3]

Question 3 [CO1] **10**

(a) **Analyze** the following circuit to find the values of I_{D_1}, I_{D_2}, v_x, and v_y. Here, **use** the Method of Assumed State using the CVD model of diode with $V_{D_0} = 0.5$ V. [7]

(b) **Validate** your assumptions about the states of the diodes. [3]



Question 4 [CO2] **10**

A voltage waveform $v_i = 10\sin(100\pi t)$ V is input to a full-wave rectifier with a load resistance of $R = 50$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Show** the circuit of the rectifier. **Label** the input and output voltages properly. [2]

(b) **Calculate** the DC value of the output voltage. [1]

(c) **Contrast** the value found in part (b) with that when a 5 μF capacitor is connected in parallel with the load. [2]

(d) **Identify** the two diodes will be ON in the positive half cycle. [1]

Now the two diodes from part (d) are replaced with Germanium diodes [$V_{D_0} = 0.2$ V].

(e) **Explain** the change in the voltage transfer characteristics and output voltage waveform of the circuit. Hence, calculate the peak of the output voltage in this case. [3+1]

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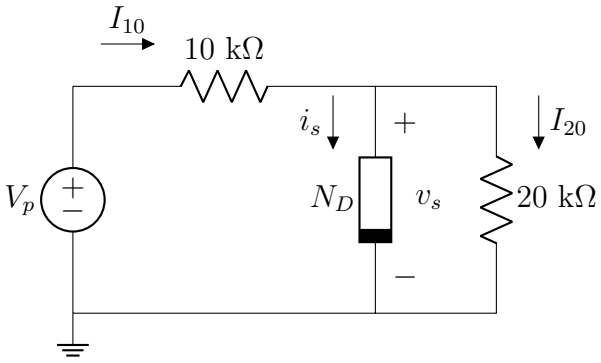
BRAC University

Semster: Spring 2020
Course No: CSE251
Course Title: ELECTRONIC DEVICES AND CIRCUITS
Section: 11
Faculty: ABA

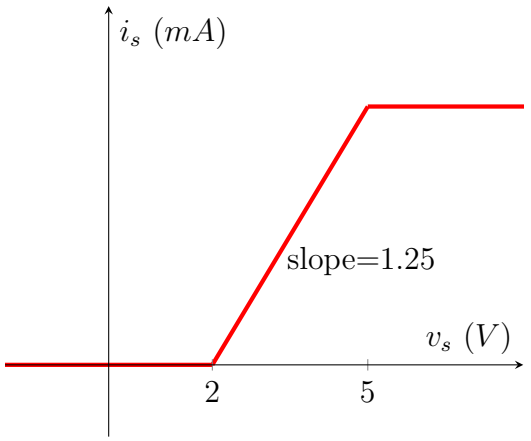
Set: 05

Midterm
Full Marks: 40
TIme: 2 hours
Date: March 10, 2022

Question 1 [CO1] **10**



(a) A circuit with a non-linear device N_D



(b) IV Characteristics of the non-linear device N_D

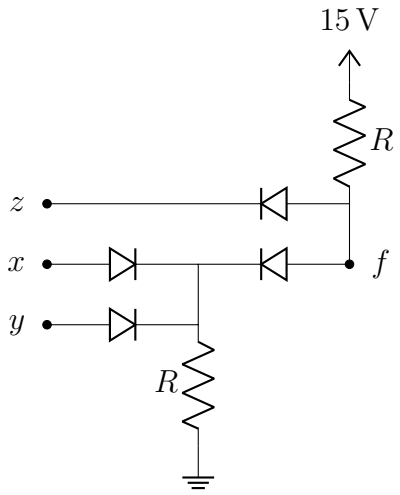
(a) **Identify** the equivalent linear circuit models for the 3 linear segments in the IV characteristics of the non-linear device N_D and **calculate** the model parameters. [3]

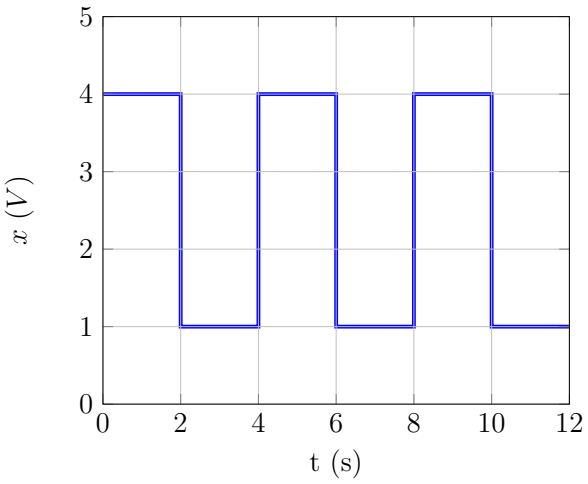
(b) **Show** the alternative representation of the circuit in Figure (a). [2]

(c) **Detect** the operating region for the device when $v_s = 3$ V and **calculate** the current through the device, i_s, for this voltage. [2]

(d) **Apply** KVL and KCL to calculate the value of voltage source V_p when $v_s = 3$ V. [3]

Question 2 [CO2] **10**





For this question, all of the diodes are ideal.

Set: 05

(a) Assuming x, y, z are boolean variables, **analyze** the circuit on the left to find an expression of f in terms of x, y, and z. [3]

(b) **Analyze** the circuit on the left again to find the waveform (voltage vs time graph) of f assuming x, y, z are voltage signals, where $y = 2$ V, $z = 3$ V, and x has a waveform as shown in the figure on the right. [5]

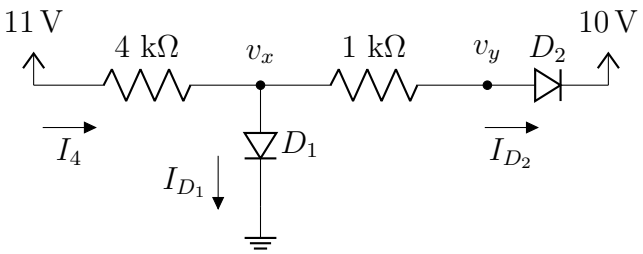
(c) **Design** a circuit using ideal diodes to implement the logic function $f = x + y + z$.
Here "+" denotes logical OR . [2]

Bonus: **Design** a circuit using ideal diodes to implement the XOR logic function between x and y, assuming you have access to x, $\bar{x}$, y, and $\bar{y}$. [3]

Question 3 [CO1] **10**

(a) **Analyze** the following circuit to find the values of I_{D_1}, I_{D_2}, v_x, and v_y. Here, **use** the Method of Assumed State using the CVD model of diode with $V_{D_0} = 0.5$ V. [7]

(b) **Validate** your assumptions about the states of the diodes. [3]



Question 4 [CO2] **10**

A voltage waveform $v_i = 10\sin(100\pi t)$ V is input to a full-wave rectifier with a load resistance of $R = 50$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Show** the circuit of the rectifier. **Label** the input and output voltages properly. [2]

(b) **Calculate** the DC value of the output voltage. [1]

(c) **Contrast** the value found in part (b) with that when a 5 μF capacitor is connected in parallel with the load. [2]

(d) **Identify** the two diodes will be ON in the positive half cycle. [1]

Now the two diodes from part (d) are replaced with Germanium diodes [$V_{D_0} = 0.2$ V].

(e) **Explain** the change in the voltage transfer characteristics and output voltage waveform of the circuit. Hence, calculate the peak of the output voltage in this case. [3+1]

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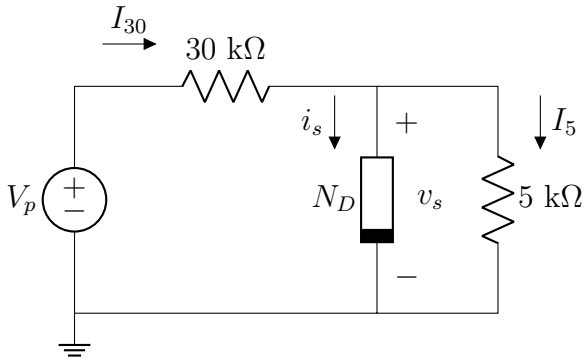
BRAC University

Semster: Spring 2020
Course No: CSE251
Course Title: ELECTRONIC DEVICES AND CIRCUITS
Section: 11
Faculty: ABA

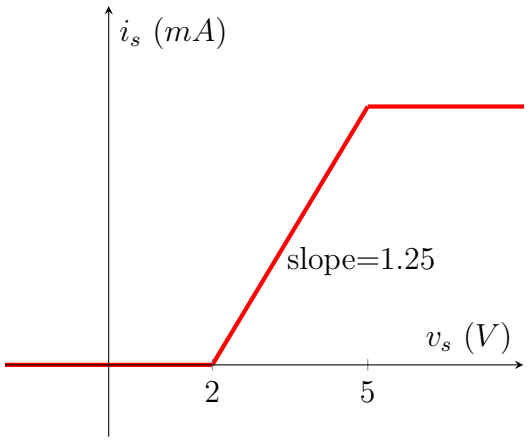
Set: 06

Midterm
Full Marks: 40
TIme: 2 hours
Date: March 10, 2022

Question 1 [CO1] **10**



(a) A circuit with a non-linear device N_D



(b) IV Characteristics of the non-linear device N_D

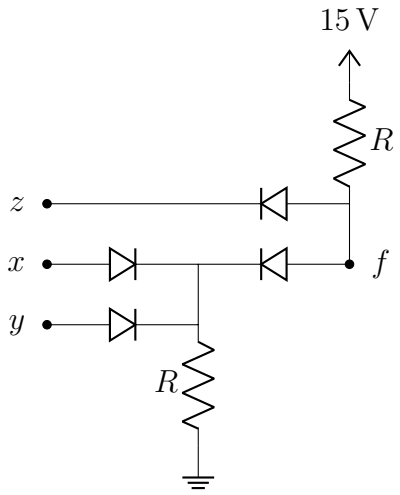
(a) **Identify** the equivalent linear circuit models for the 3 linear segments in the IV characteristics of the non-linear device N_D and **calculate** the model parameters. [3]

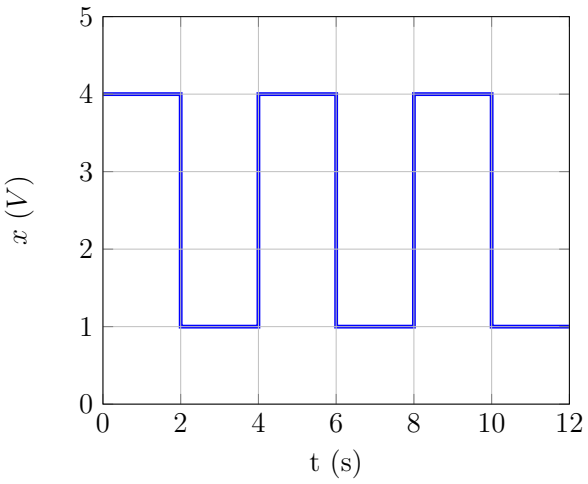
(b) **Show** the alternative representation of the circuit in Figure (a). [2]

(c) **Detect** the operating region for the device when $v_s = 3$ V and **calculate** the current through the device, i_s, for this voltage. [2]

(d) **Apply** KVL and KCL to calculate the value of voltage source V_p when $v_s = 3$ V. [3]

Question 2 [CO2] **10**





For this question, all of the diodes are ideal.

Set: 06

(a) Assuming x, y, z are boolean variables, **analyze** the circuit on the left to find an expression of f in terms of x, y, and z. [3]

(b) **Analyze** the circuit on the left again to find the waveform (voltage vs time graph) of f assuming x, y, z are voltage signals, where $y = 2$ V, $z = 3$ V, and x has a waveform as shown in the figure on the right. [5]

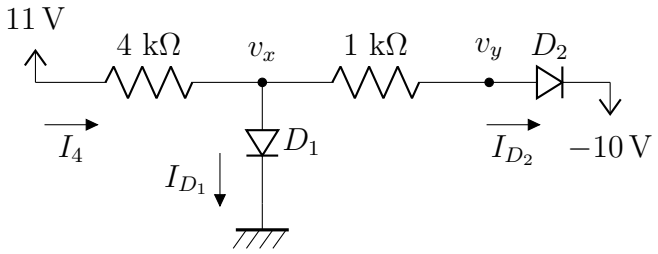
(c) **Design** a circuit using ideal diodes to implement the logic function $f = x + y + z$. Here "+" denotes logical OR . [2]

Bonus: **Design** a circuit using ideal diodes to implement the XOR logic function between x and y, assuming you have access to x, $\bar{x}$, y, and $\bar{y}$. [3]

Question 3 [CO1] 10

(a) **Analyze** the following circuit to find the values of I_{D_1}, I_{D_2}, v_x, and v_y. Here, **use** the Method of Assumed State using the CVD model of diode with $V_{D_0} = 0.5$ V. [7]

(b) **Validate** your assumptions about the states of the diodes. [3]



Question 4 [CO2] 10

A voltage waveform $v_i = 10\sin(100\pi t)$ V is input to a full-wave rectifier with a load resistance of $R = 50$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Show** the circuit of the rectifier. **Label** the input and output voltages properly. [2]

(b) **Calculate** the DC value of the output voltage. [1]

(c) **Contrast** the value found in part (b) with that when a 5 μF capacitor is connected in parallel with the load. [2]

(d) **Identify** the two diodes will be ON in the positive half cycle. [1]

Now the two diodes from part (d) are replaced with Germanium diodes [$V_{D_0} = 0.2$ V].

(e) **Explain** the change in the voltage transfer characteristics and output voltage waveform of the circuit. Hence, calculate the peak of the output voltage in this case. [3+1]

ID:	Sec:	Name:

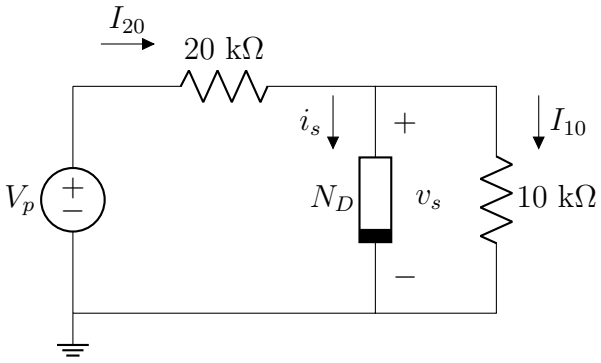
BRAC University

Set: 07

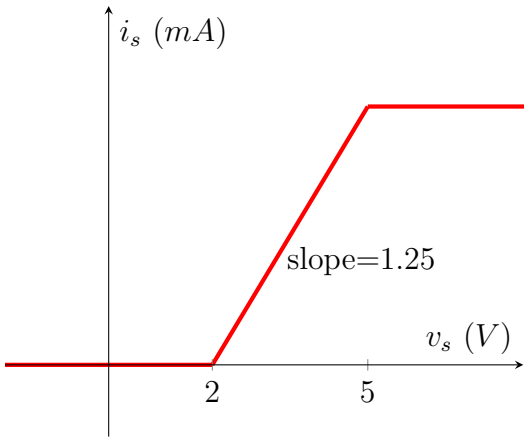
Semster: Spring 2020
Course No: CSE251
Course Title: ELECTRONIC DEVICES AND CIRCUITS
Section: 11
Faculty: ABA

Midterm
Full Marks: 40
TIme: 2 hours
Date: March 10, 2022

Question 1 [CO1] **10**



(a) A circuit with a non-linear device N_D



(b) IV Characteristics of the non-linear device N_D

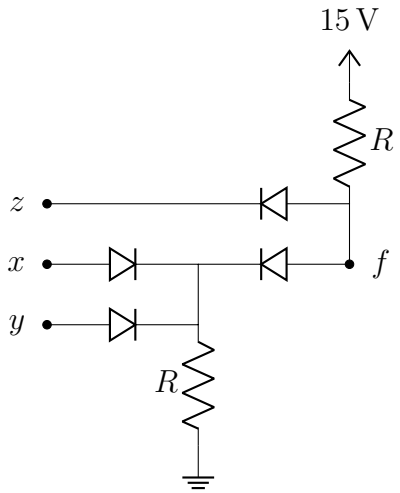
(a) **Identify** the equivalent linear circuit models for the 3 linear segments in the IV characteristics of the non-linear device N_D and **calculate** the model parameters. [3]

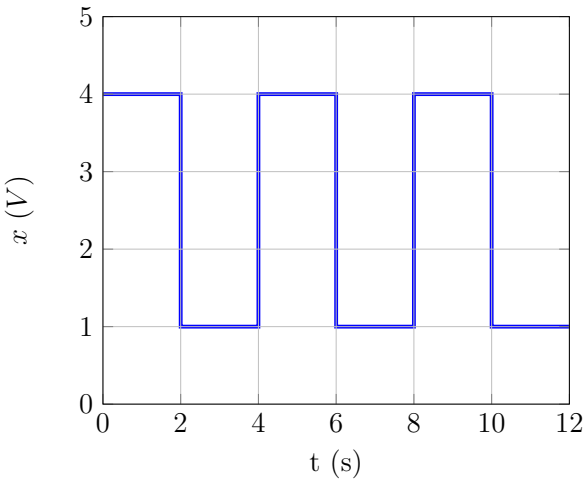
(b) **Show** the alternative representation of the circuit in Figure (a). [2]

(c) **Detect** the operating region for the device when $v_s = 3$ V and **calculate** the current through the device, i_s, for this voltage. [2]

(d) **Apply** KVL and KCL to calculate the value of voltage source V_p when $v_s = 3$ V. [3]

Question 2 [CO2] **10**





For this question, all of the diodes are ideal.

Set: 07

(a) Assuming x, y, z are boolean variables, **analyze** the circuit on the left to find an expression of f in terms of x, y, and z. [3]

(b) **Analyze** the circuit on the left again to find the waveform (voltage vs time graph) of f assuming x, y, z are voltage signals, where $y = 2$ V, $z = 3$ V, and x has a waveform as shown in the figure on the right. [5]

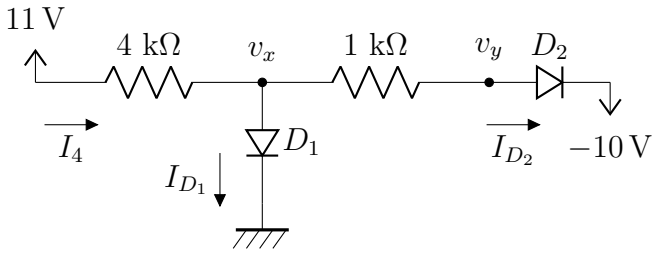
(c) **Design** a circuit using ideal diodes to implement the logic function $f = x + y + z$. Here "+" denotes logical OR . [2]

Bonus: **Design** a circuit using ideal diodes to implement the XOR logic function between x and y, assuming you have access to x, $\bar{x}$, y, and $\bar{y}$. [3]

Question 3 [CO1] **10**

(a) **Analyze** the following circuit to find the values of I_{D_1}, I_{D_2}, v_x, and v_y. Here, **use** the Method of Assumed State using the CVD model of diode with $V_{D_0} = 0.5$ V. [7]

(b) **Validate** your assumptions about the states of the diodes. [3]



Question 4 [CO2] **10**

A voltage waveform $v_i = 10\sin(100\pi t)$ V is input to a full-wave rectifier with a load resistance of $R = 50$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Show** the circuit of the rectifier. **Label** the input and output voltages properly. [2]

(b) **Calculate** the DC value of the output voltage. [1]

(c) **Contrast** the value found in part (b) with that when a 5 μF capacitor is connected in parallel with the load. [2]

(d) **Identify** the two diodes will be ON in the positive half cycle. [1]

Now the two diodes from part (d) are replaced with Germanium diodes [$V_{D_0} = 0.2$ V].

(e) **Explain** the change in the voltage transfer characteristics and output voltage waveform of the circuit. Hence, calculate the peak of the output voltage in this case. [3+1]

ID:	Sec:	Name:

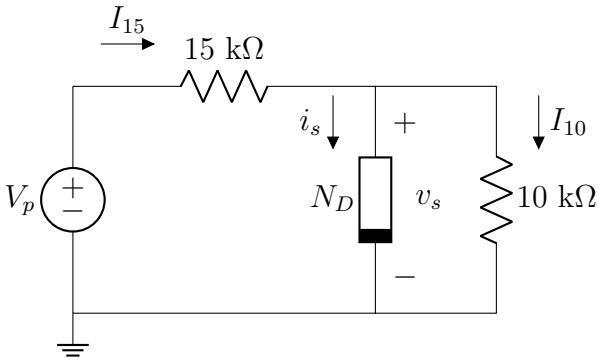
BRAC University

Set: 08

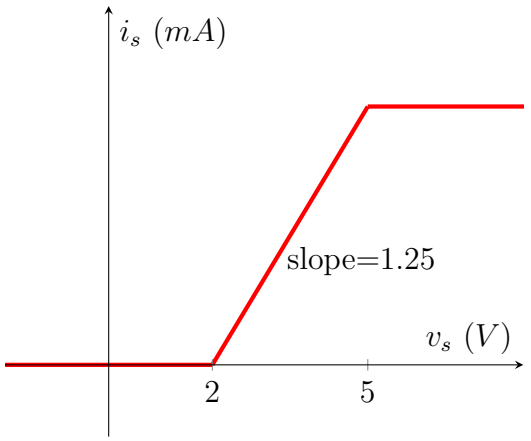
Semster: Spring 2020
Course No: CSE251
Course Title: ELECTRONIC DEVICES AND CIRCUITS
Section: 11
Faculty: ABA

Midterm
Full Marks: 40
TIme: 2 hours
Date: March 10, 2022

Question 1 [CO1] **10**



(a) A circuit with a non-linear device N_D



(b) IV Characteristics of the non-linear device N_D

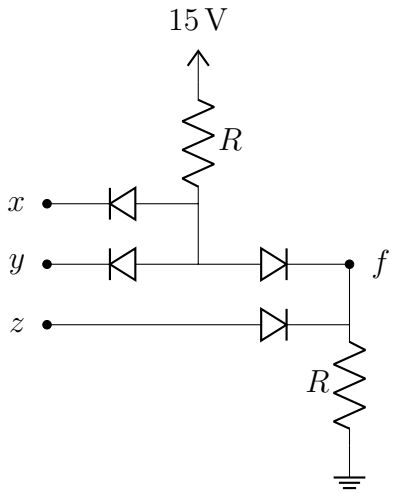
(a) **Identify** the equivalent linear circuit models for the 3 linear segments in the IV characteristics of the non-linear device N_D and **calculate** the model parameters. [3]

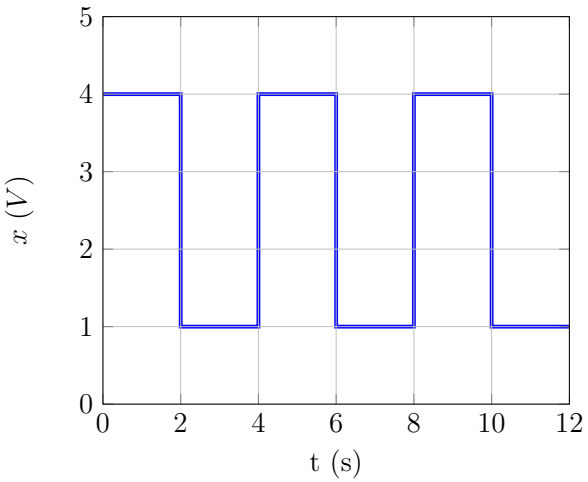
(b) **Show** the alternative representation of the circuit in Figure (a). [2]

(c) **Detect** the operating region for the device when $v_s = 3$ V and **calculate** the current through the device, i_s, for this voltage. [2]

(d) **Apply** KVL and KCL to calculate the value of voltage source V_p when $v_s = 3$ V. [3]

Question 2 [CO2] **10**





For this question, all of the diodes are ideal.

Set: 08

(a) Assuming x, y, z are boolean variables, **analyze** the circuit on the left to find an expression of f in terms of x, y, and z. [3]

(b) **Analyze** the circuit on the left again to find the waveform (voltage vs time graph) of f assuming x, y, z are voltage signals, where $y = 2$ V, $z = 3$ V, and x has a waveform as shown in the figure on the right. [5]

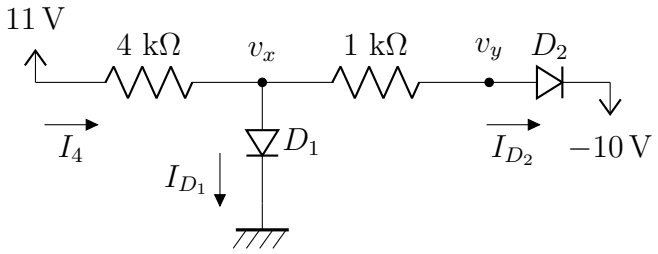
(c) **Design** a circuit using ideal diodes to implement the logic function $f = x + y + z$. Here "+" denotes logical OR . [2]

Bonus: **Design** a circuit using ideal diodes to implement the XOR logic function between x and y, assuming you have access to x, $\bar{x}$, y, and $\bar{y}$. [3]

Question 3 [CO1] **10**

(a) **Analyze** the following circuit to find the values of I_{D_1}, I_{D_2}, v_x, and v_y. Here, **use** the Method of Assumed State using the CVD model of diode with $V_{D_0} = 0.5$ V. [7]

(b) **Validate** your assumptions about the states of the diodes. [3]



Question 4 [CO2] **10**

A voltage waveform $v_i = 10\sin(100\pi t)$ V is input to a full-wave rectifier with a load resistance of $R = 50$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Show** the circuit of the rectifier. **Label** the input and output voltages properly. [2]

(b) **Calculate** the DC value of the output voltage. [1]

(c) **Contrast** the value found in part (b) with that when a 5 μF capacitor is connected in parallel with the load. [2]

(d) **Identify** the two diodes will be ON in the positive half cycle. [1]

Now the two diodes from part (d) are replaced with Germanium diodes [$V_{D_0} = 0.2$ V].

(e) **Explain** the change in the voltage transfer characteristics and output voltage waveform of the circuit. Hence, calculate the peak of the output voltage in this case. [3+1]

ID:	Sec:	Name:

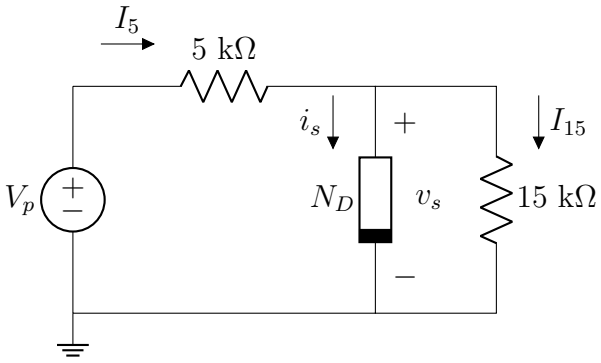
BRAC University

Semster: Spring 2020
Course No: CSE251
Course Title: ELECTRONIC DEVICES AND CIRCUITS
Section: 11
Faculty: ABA

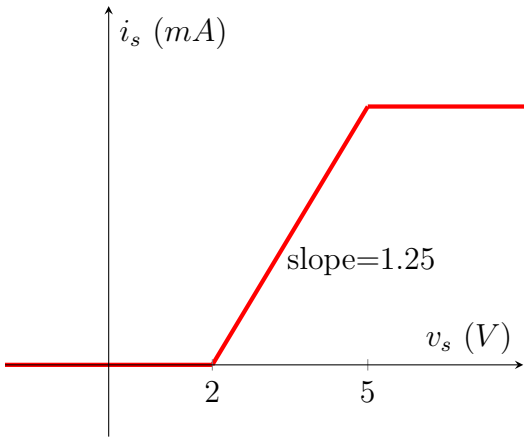
Set: 09

Midterm
Full Marks: 40
TIme: 2 hours
Date: March 10, 2022

Question 1 [CO1] **10**



(a) A circuit with a non-linear device N_D



(b) IV Characteristics of the non-linear device N_D

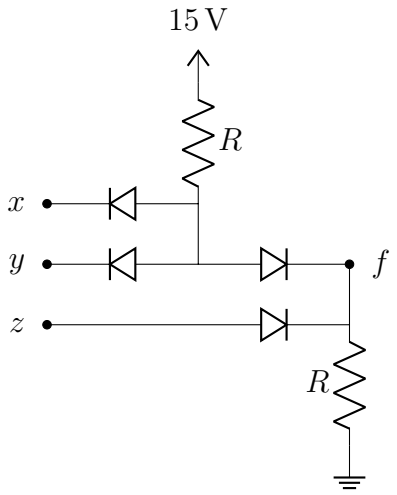
(a) **Identify** the equivalent linear circuit models for the 3 linear segments in the IV characteristics of the non-linear device N_D and **calculate** the model parameters. [3]

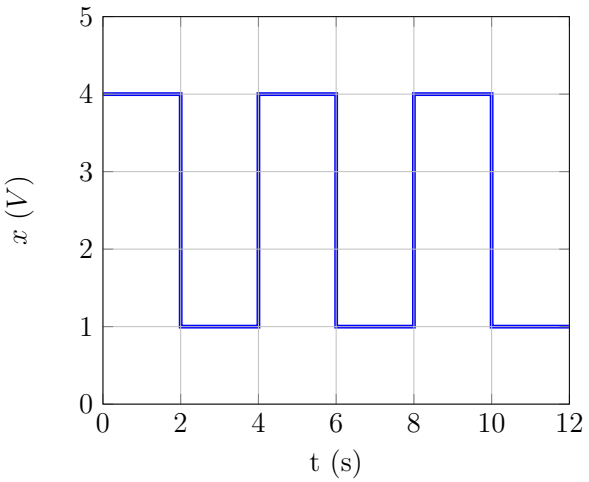
(b) **Show** the alternative representation of the circuit in Figure (a). [2]

(c) **Detect** the operating region for the device when $v_s = 3$ V and **calculate** the current through the device, i_s, for this voltage. [2]

(d) **Apply** KVL and KCL to calculate the value of voltage source V_p when $v_s = 3$ V. [3]

Question 2 [CO2] **10**





For this question, all of the diodes are ideal.

Set: 09

(a) Assuming x, y, z are boolean variables, **analyze** the circuit on the left to find an expression of f in terms of x, y, and z. [3]

(b) **Analyze** the circuit on the left again to find the waveform (voltage vs time graph) of f assuming x, y, z are voltage signals, where $y = 2$ V, $z = 3$ V, and x has a waveform as shown in the figure on the right. [5]

(c) **Design** a circuit using ideal diodes to implement the logic function $f = x + y + z$. Here "+" denotes logical OR . [2]

Bonus: **Design** a circuit using ideal diodes to implement the XOR logic function between x and y, assuming you have access to x, $\bar{x}$, y, and $\bar{y}$. [3]

Question 3 [CO1] **10**

(a) **Analyze** the following circuit to find the values of I_{D_1}, I_{D_2}, v_x, and v_y. Here, **use** the Method of Assumed State using the CVD model of diode with $V_{D_0} = 0.5$ V. [7]

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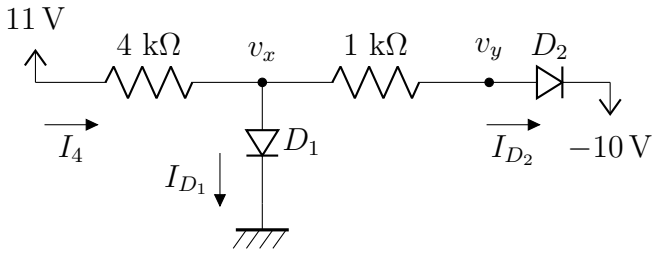

Question 4 [CO2] **10**

A voltage waveform $v_i = 10\sin(100\pi t)$ V is input to a full-wave rectifier with a load resistance of $R = 50$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Show** the circuit of the rectifier. **Label** the input and output voltages properly. [2]

(b) **Calculate** the DC value of the output voltage. [1]

(c) **Contrast** the value found in part (b) with that when a 5 μF capacitor is connected in parallel with the load. [2]

(d) **Identify** the two diodes will be ON in the positive half cycle. [1]

Now the two diodes from part (d) are replaced with Germanium diodes [$V_{D_0} = 0.2$ V].

(e) **Explain** the change in the voltage transfer characteristics and output voltage waveform of the circuit. Hence, calculate the peak of the output voltage in this case. [3+1]

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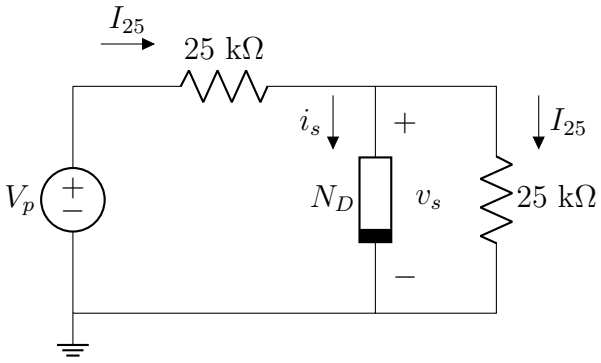
BRAC University

Semster: Spring 2020
Course No: CSE251
Course Title: ELECTRONIC DEVICES AND CIRCUITS
Section: 11
Faculty: ABA

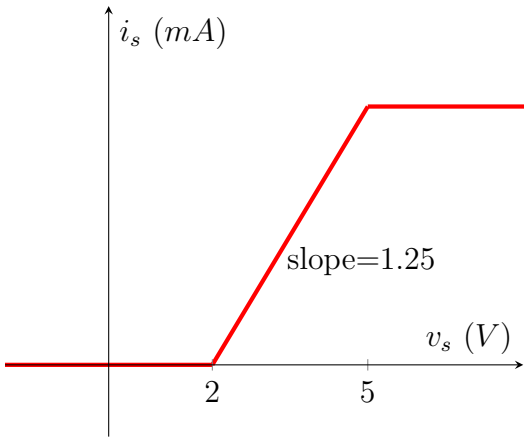
Set: 10

Midterm
Full Marks: 40
TIme: 2 hours
Date: March 10, 2022

Question 1 [CO1] **10**



(a) A circuit with a non-linear device N_D



(b) IV Characteristics of the non-linear device N_D

(a) **Identify** the equivalent linear circuit models for the 3 linear segments in the IV characteristics of the non-linear device N_D and **calculate** the model parameters. [3]

(b) **Show** the alternative representation of the circuit in Figure (a). [2]

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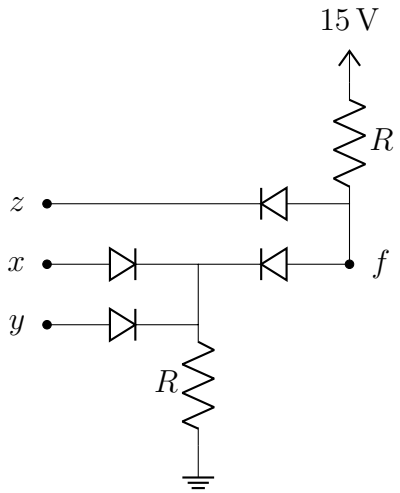
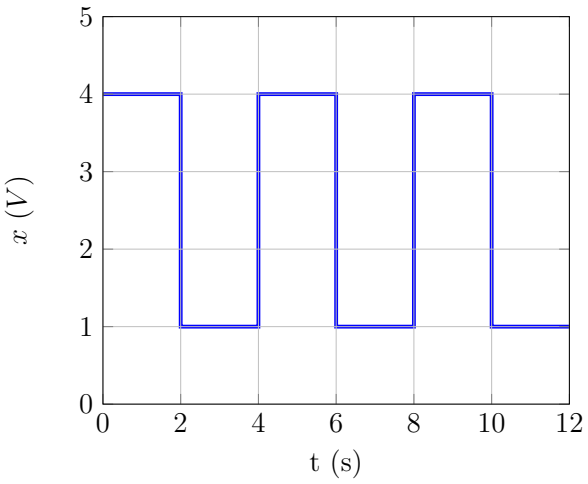
(d) **Apply** KVL and KCL to calculate the value of voltage source V_p when $v_s = 3$ V. [3]

Question 2 [CO2] **10**





For this question, all of the diodes are ideal.

Set: 10

(a) Assuming x, y, z are boolean variables, **analyze** the circuit on the left to find an expression of f in terms of x, y, and z. [3]

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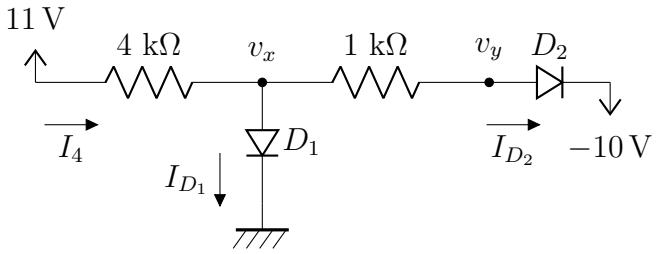

Question 4 [CO2] **10**

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