Started on	Thursday, 4 August 2022, 6:02 PM
State	Finished
Completed on	Thursday, 4 August 2022, 7:44 PM
Time taken	1 hour 42 mins
Grade	**103.00** out of 106.00 (**97**%)

Question **1**

Correct

Mark 2.00 out of 2.00

Which of the following is true ?

Select one:

- a. In intrinsic Silicon at 300°K the number of holes is far less than the number of Silicon atoms
- b. All of these ✔
- c. In intrinsic Silicon at 300°K there are some free electrons due to thermal generation
- d. In intrinsic Silicon at 300°K both holes and electrons can conduct electricity
- e. In intrinsic Silicon at 300°K the number of holes is equal to the number of free electrons

Correct

Marks for this submission: 2.00/2.00.

Question **2**

Correct

Mark 2.00 out of 2.00

Which of the following is true ?

Select one:

- a. None of these
- b. Arsenic is often used as an N-type dopant in Silicon ✔
- c. Carbon is often used as a P-type dopant in Silicon
- d. Boron is often used as an N-type dopant in Silicon
- e. Phosphorus is often used as a P-type dopant in Silicon

Correct

Marks for this submission: 2.00/2.00.

Question **3**

Correct

Mark 2.00 out of 2.00

Which of the following is true for the depletion region capacitance of a PN junction?

Select one:

- a. None of these
- b. The capacitance decreases as the reverse bias decreases
- c. The capacitance depends on the cube root of the reverse bias for an abrupt step junction
- d. The capacitance depends on the square root of the reverse bias for a linearly graded junction
- e. The amount of charge stored increases as the reverse bias increases ✔

Correct

Marks for this submission: 2.00/2.00.

Question **4**

Correct

Mark 2.00 out of 2.00

When P-type Silicon is brought into contact with N-type Silicon to form a PN Junction :

Select one:

- a. The donor and acceptor atoms near the junction are ionized, leaving behind fixed charge
- b. The separation of charge causes an electric field which opposes the diffusion of carriers
- c. Holes diffuse from the P side to the N side, and electrons diffuse from the N side to the P side
- d. All of these ✔
- e. The area around the junction is depleted of free electrons and holes

Correct

Marks for this submission: 2.00/2.00.

Question **5**

Correct

Mark 2.00 out of 2.00

Which of the following is true for a zener diode used as a voltage reference?

Select one:

- a. The amount the reference voltage varies when the input supply voltage varies is called the load regulation
- b. The input supply voltage used must never be larger than the reverse breakdown voltage of the zener diode
- c. The amount the reference voltage varies when the load current varies is called the line regulation
- d. All of these
- e. Once a zener diode is operating in the reverse breakdown region, the voltage across it only varies slightly ✔

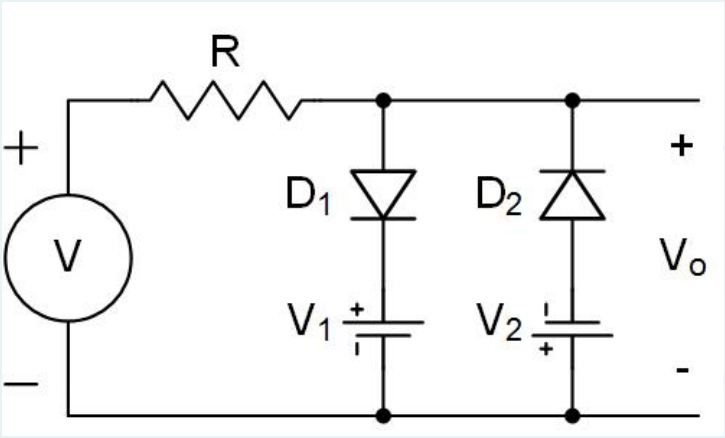
Correct

Marks for this submission: 2.00/2.00.

Question **6**

Correct

Mark 2.00 out of 2.00



Assuming ideal diodes, for the diode circuit shown :

Select one:

- a. The maximum output voltage is -V1
- b. The gain is equal to 1 when V is < +V1 and > -V2 ✔
- c. All of these
- d. The minimum output voltage is +V2
- e. The gain is equal to 1 when V is > +V1, or < -V2

Correct

Marks for this submission: 2.00/2.00.

Question **7**

Correct

Mark 2.00 out of 2.00

In a DC Restorer diode circuit, which of the following is true?

Select one:

- a. All of these
- b. The peak-to-peak output voltage is equal to the peak input voltage
- c. The diode clamps one side of the capacitor to a fixed voltage, such as ground ✔
- d. The average value of the output voltage is always equal to zero
- e. The capacitor charges up to the average value of input voltage

Correct

Marks for this submission: 2.00/2.00.

Question **8**

Correct

Mark 2.00 out of 2.00

Which of the following circuits is part of a typical DC power supply?

Select one:

- a. All of these
- b. A current regulator
- c. A high pass filter
- d. A diode rectifier ✔
- e. A load resistor

Correct

Marks for this submission: 2.00/2.00.

Question **9**

Correct

Mark 2.00 out of 2.00

Compared to the device transconductance for a PMOS FET, the device transconductance for an NMOS FET is :

Select one:

- a. Impossible to determine ✔
- b. None of these
- c. Larger
- d. Smaller
- e. Same

Correct

Marks for this submission: 2.00/2.00.

Question **10**

Correct

Mark 2.00 out of 2.00

What happens to the gate-to-channel voltage in a saturated NMOS FET as you move from source to drain?

Select one:

- a. Impossible to determine
- b. The gate-to-channel voltage decreases ✔
- c. The gate-to-channel voltage increases
- d. None of these
- e. The gate-to-channel voltage doesn't change

Correct

Marks for this submission: 2.00/2.00.

Question **11**

Correct

Mark 2.00 out of 2.00

A hole is really just the absence of an electron, and can be thought of as a negatively charged particle.

Select one:

- True
- False ✔

Correct

Marks for this submission: 2.00/2.00.

Question **12**

Correct

Mark 2.00 out of 2.00

When silicon is doped with donor atoms, this increases the number of electrons.

Select one:

- True ✔
- False

Correct

Marks for this submission: 2.00/2.00.

Question **13**

Correct

Mark 2.00 out of 2.00

The depletion region capacitance decreases nonlinearly as the reverse bias voltage is increased.

Select one:

- True ✔
- False

Correct

Marks for this submission: 2.00/2.00.

Question **14**

Correct

Mark 2.00 out of 2.00

As the forward bias across a PN junction is increased, the potential barrier decreases.

Select one:

- True ✔
- False

Correct

Marks for this submission: 2.00/2.00.

Question **15**

Correct

Mark 2.00 out of 2.00

The size of the ripple voltage at the output of a power supply filter capacitor is inversely proportional to the period of the input sine wave.

Select one:

- True
- False ✔

Correct

Marks for this submission: 2.00/2.00.

Question **16**

Correct

Mark 2.00 out of 2.00

If the reverse bias voltage applied across a diode gets too high and exceeds the breakdown voltage for the diode, then the reverse current flowing through the diode will increase sharply.

Select one:

- True ✔
- False

Correct

Marks for this submission: 2.00/2.00.

Question **17**

Correct

Mark 2.00 out of 2.00

The Exponential diode model provides a good compromise between accuracy and ease of use when analyzing diode circuits.

Select one:

- True
- False ✔

Correct

Marks for this submission: 2.00/2.00.

Question **18**

Correct

Mark 2.00 out of 2.00

In a full-wave rectifier the diodes turn on twice during each period of the input sine wave to recharge the filter capacitor.

Select one:

- (•) True ✔
- ( ) False

Correct

Marks for this submission: 2.00/2.00.

Question **19**

Correct

Mark 2.00 out of 2.00

PMOS FETs use P+ doped source and drain diffusions in a P-type substrate.

Select one:

- ( ) True
- (•) False ✔

Correct

Marks for this submission: 2.00/2.00.

Question **20**

Correct

Mark 2.00 out of 2.00

For a MOSFET in saturation, the amount of charge in the channel at the drain end is approximately zero.

Select one:

- (•) True ✔
- ( ) False

Correct

Marks for this submission: 2.00/2.00.

Question **21**

Correct

Mark 6.00 out of 6.00

If a silicon diffusion is doped with phosphorus at a concentration of 7.9 x 10^16/cm^3, what is the concentration of holes in this piece of silicon per cm^3? Assume ni = 1.5 x 10^10/cm^3 at 300°K

Answer: 2848.10 ✔

Correct

Marks for this submission: 6.00/6.00.

Question **22**

Correct

Mark 6.00 out of 6.00

If a PN junction is doped with boron at a concentration of 1.4 x 10^18/cm^3 and phosphorus at a concentration of 1.9 x 10^17/cm^3, then what is the built-in voltage in millivolts for this junction? Assume ni = 1.5 x 10^10/cm^3 and Vt = kt/q = 26mV at 300°K. Since small changes in the built-in voltage imply large changes in the doping levels, be sure to give your answer to the nearest millivolt!

Answer: 902.36 ✔

Correct

Marks for this submission: 6.00/6.00.

Question **23**

Correct

Mark 6.00 out of 6.00

If the DC bias current, Id, for a forward biased PN junction is equal to 37.0 mA then what is the capacitance of this junction in pF? Assume that the mean transit time for the junction is equal to 106 psec, and that the thermal voltage is equal to Vt = kt/q = 26mV. (Note that 1pF = 1 pico Farad = 1 x 10^-12 F, and 1 psec = 1 pico second = 1 x 10^-12 seconds.)

Answer: 150.85 ✔

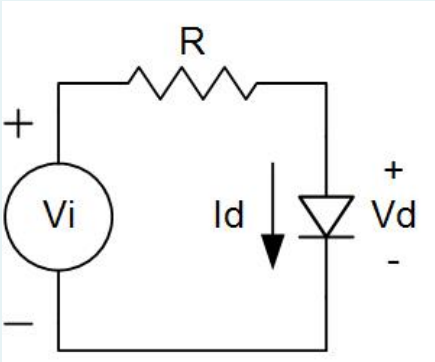
Correct

Marks for this submission: 6.00/6.00.

Question **24**

Correct

Mark 6.00 out of 6.00



What is the DC bias current, Id, in milliamps for the diode circuit shown? Use the constant voltage model for the diode, and assume that Vd = 638mV. Use Vi = 5.2V and R = 6.7kΩ.

Answer: 0.68 ✔

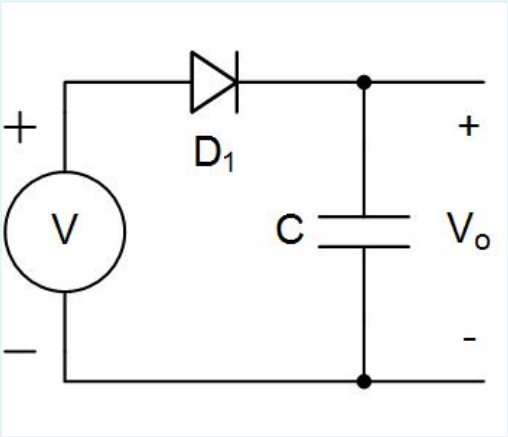
Correct

Marks for this submission: 6.00/6.00.

Question **25**

Correct

Mark 6.00 out of 6.00



For the diode circuit shown, what will the output voltage, Vo, be in volts if the input voltage, V, is a sine wave with an amplitude equal to 4.5V ? Assume that when the diode is turned on the voltage across it will be 0.7V.

Answer: 3.8 ✔

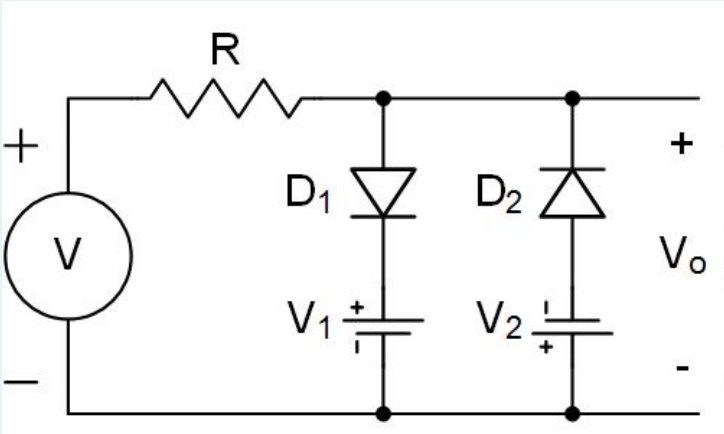
Correct

Marks for this submission: 6.00/6.00.

Question **26**

Correct

Mark 6.00 out of 6.00



For the diode circuit shown, what will the output voltage, Vo, be in volts if the input voltage, V, is equal to 14V ? Assume that when a diode is turned on the voltage across it will be 0.7V, and for the batteries use V1 = 6.0V and V2 = 6.1V. Also use R = 4.9kΩ.

Answer: 6.7 ✔

Correct

Marks for this submission: 6.00/6.00.

Question **27**

Correct

Mark 3.00 out of 6.00

A full-wave diode rectifier circuit is driven by a 60Hz sine wave with a peak value of 13V. If the load resistance this circuit drives is 6.7kΩ and the ripple voltage at the output is 0.10 Vpeak-to-peak, then during what percent of each cycle does the diode conduct?

Answer: 3.95 ✔

Correct

Marks for this submission: 6.00/6.00. Accounting for previous tries, this gives **3.00/6.00**.

Question **28**

Correct

Mark 6.00 out of 6.00

If a MOSFET with W = 65.8 µm and L = 1.2 µm is biased in saturation, what is the gate-to-source capacitance, Cgs, in femtofarads? Assume the gate dielectric is silicon dioxide with tox = 68.0 angstroms.

Answer: 267.31 ✔

Correct

Marks for this submission: 6.00/6.00.

Question **29**

Correct

Mark 6.00 out of 6.00

If an NMOS FET with W = 30.0 µm and L = 0.4 µm is biased in triode with Vgs = 1.3 and Vds = 0V, what is the on-resistance of this MOS switch in Ohms? Use: VTN = 0.5V, k'n = 100µA/V^2

Answer: 166.67 ✔

Correct

Marks for this submission: 6.00/6.00.

Question **30**

Correct

Mark 6.00 out of 6.00

If a NMOS FET with W/L = 13.3 has Vgs = 0.78 and Vds = 1.87, what is the drain current in microamps? Use: VTN = 0.5V, k'n = 100µA/V^2, λ = 0

Answer: 52.14 ✔

Correct

Marks for this submission: 6.00/6.00.

Question **31**

Correct

Mark 6.00 out of 6.00

A half-wave diode rectifier circuit is driven by a 60Hz sine wave with a peak value of 11V. If the load resistance this circuit drives is 1.6kΩ and the maximum ripple voltage allowed at the output is 0.28 Vpeak-to-peak, then what must the minimum value be for the filter capacitor in microFarads?

Answer: 409.23 ✔

Correct

Marks for this submission: 6.00/6.00.

◄ Midterm Exam I (Make up exam for documented timing conflicts)

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