


Ministry of Higher Education		
Higher Institute for Engineering and Technology at Manzala		
First semester : 2022/2023		Date: 26/11/2022
Mid-term Exam		Level: 1
Department: Electronic Engineering.		Time allowed: 60 min.
Total Marks: 25		Code: COM113
Course title: Fundamentals of Electronic Engineering		Examiner: Dr. Mohamed Abdel Rahman
رقم المسلسل:		اسم الطالب:

Question (1): (Multiple Choice Question)

[5 marks]

- Forward voltage drop of an LED is greater than.....
 - 0.5V
 - 1.2V
 - 2 V
 - 5V
- What is the barrier potential of a silicon diode at room temperature?
 - 0.3 V
 - 0.7 V
 - 1 V
 - 2 mV per degree Celsius
- When comparing the energy gap of germanium and silicon atoms, a silicon atom's energy gap is
 - about the same
 - lower
 - higher
 - unpredictable
- In photodiode, when there is no incident light, the reverse current is almost negligible and is called.....
 - zener current
 - dark current
 - photo current
 - none of the above
- The width of a diode's depletion layer will decrease when the diode is.....
 - forward biased
 - first formed
 - reverse biased
 - not conducting
- A reverse voltage of 10 V is across a diode. What is the voltage across the depletion layer?
 - 0 V
 - 0.7 V
 - 10 V
 - none of the above
- Which of the following describes an n-type semiconductor?
 - neutral
 - positively charged
 - negatively charged
 - has many holes
- For a PN junction diode, the current in reverse bias may be
 - few miliamperes
 - between 0.2 A and 15 A
 - few amperes
 - few micro or nano-amperes
- The varactor is usually.....
 - forward biased
 - reverse biased
 - operated in the breakdown
 - unbiased
- The depletion layer across a p^+ -n junction lies
 - mostly in the p^+ -region
 - mostly in the n-region
 - equally in both the p^+ and n-region
 - entirely in the p^+ -region
- The junction capacitance of a p-n junction depends on
 - doping concentration only
 - applied voltage only
 - both doping concentration and applied voltage
 - barrier potential only

P.T.O

Question (2):

[10 marks]

a) Aluminum is alloyed into n-type Si sample ($N_D = 5 \times 10^{16} \text{ cm}^{-3}$), forming an abrupt junction of circular cross section with a diameter of 0.02 inch. Assume that the acceptor concentration in the alloyed region is $N_A = 4 \times 10^{18} \text{ cm}^{-3}$. Consider $n_i = 1.5 \times 10^{10} \text{ cm}^{-3}$ for silicon at room temperature. Determine the following: [5 marks]

- The value of V_o , x_{n0} , x_{p0} , Q^+ and E_{\max}
- Sketch the electric field intensity E and charge density ρ distributions across the junction. [5 marks]

b) Write down the parameters of both LED and photo diode according to the following table [5 marks]

No.	Parameters	Light emitting diode (LED)	Photo diode
1	function		
2	Schematic symbol		
3	Bias for normal operation		
4	Applications (at least two)		

Question (3):

[5 marks]

For the PN-junction of the silicon diode at room temperature connected in series with DC source 1V and resistor $R = 20\ \Omega$, shown in Fig.1. Write a matlab program in table (1) to compute the diode current and voltage across it resulting from the intersection between the I-V characteristics of the diode and the DC load line. Assume $I_{sat} = 4 \times 10^{-15}$ Amp.

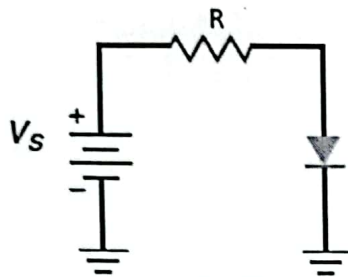


Fig. (1)

Table-1

Question (4):

[5 marks]

- Draw the zener diode I-V characteristics and label each region.
- A stabilized power supply having $V_Z = 8\text{ V}$ is required to be produced from a 18 V DC power supply input source as shown in Fig.2. The maximum power rating P_Z of the zener diode is 2W. Using the zener regulator circuit, calculate the following:

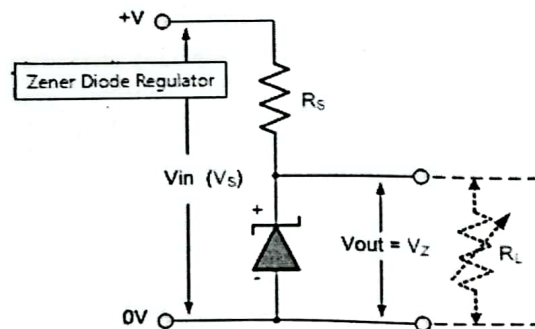


Fig. 2

- The maximum current flowing through the zener diode.
- The minimum value of the series resistor, R_S .
- The load current I_L if a load resistor of $R_L = 100\ \Omega$ is connected across the zener diode.
- The zener current I_Z at full load.