Ministry of Higher Education

Manzala Higher Institute for Engineering and Technology

First Semester		Date: 14/12/2020
Mid-term Exam		Level: 1
Department : Electronic Eng.		Time allowed: 60 mins.
Total mark : 40		Code: COM113

Course title : Fundamentals of Electronic Engineering

Answer all of the following questions

Q1: (Total mark: 10)

a- Sketch a bridge rectifier circuit. (5 marks)

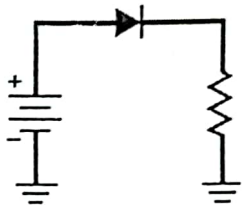
b- Sketch the output signal of a bridge rectifier, if the input sine wave has peak voltage of 10 V, and silicon diodes are used. (What is the output peak voltage?)

(5 marks)

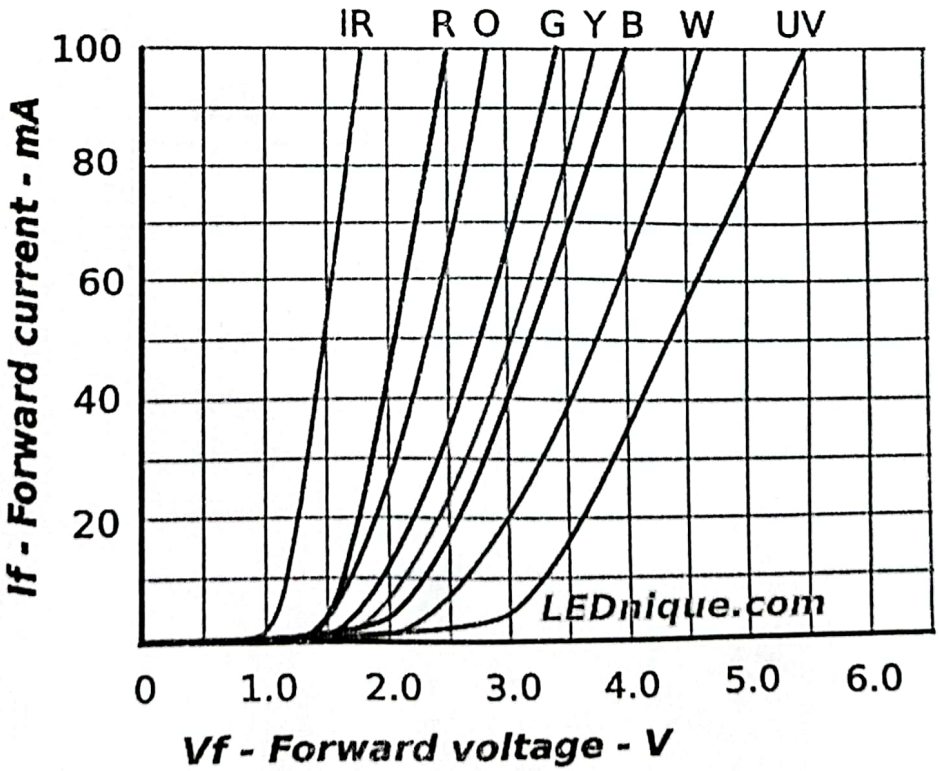
Q2: (Total mark: 10)

a- In the circuit shown, and using the provided curves, find the diode voltage and current graphically using load line analysis. Let V_s = 6V, R = 100 Ω. Assume 'R' (Red LED).

(5 marks)



b- If two white LEDs are connected in series to a 9V battery and a resistor, what is the value of the resistor so that the LEDs current is 40 mA? (5 marks)



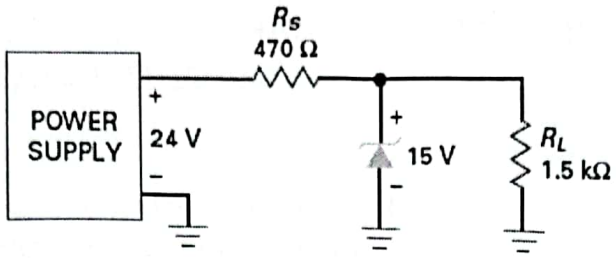
يجب تسليم الرسم مبينا عليه الحل مع ورقة الإجابة.

(1)

Q3: In the circuit shown, **(Total mark: 10)**

a- What is the load voltage? **(5 marks)**

b- What is the load voltage if the source voltage was changed to 9 V? **(5 marks)**



Q4: **(Total mark: 10)**

a- A transistor has an emitter current of 10 mA and a collector current of 9.9 mA. Find:

i. the base current? **(2 marks)**

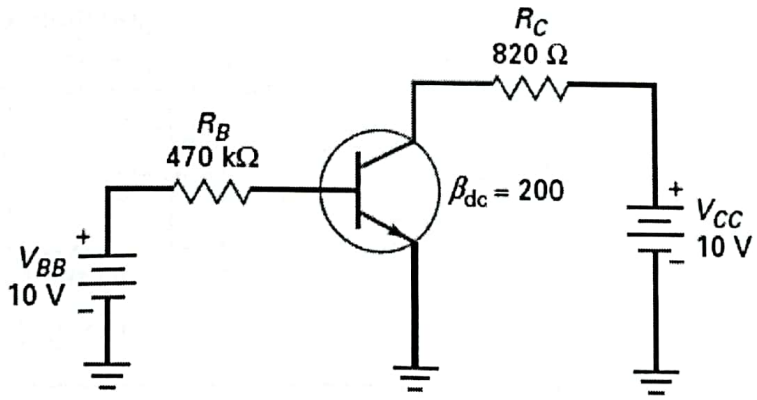
ii. the current gain? **(2 marks)**

b- In the circuit shown,

i. What is the base current? **(2 marks)**

ii. What is the collector current? **(2 marks)**

iii. What is the collector voltage? **(2 marks)**



أسس هندسة الإلكترونية

Ministry of Higher Education		
Manzala Higher Institute for Engineering and Technology		
First semester : 2021/2022		Date: 5/12/2021
Midterm Exam		Level: 1
Department: Electronic Engineering.		Time allowed: 60 min.
Total Marks: 40		Code: COM113
Course title: Fundamentals of Electronic Engineering		Examiner: Dr. Mohamed Abdel Rahman
Student Name:		

Question (1): (15 marks)

a) **Multiple Choice Questions** (3 marks)

1) The varactor is usually.....

a. forward biased b. reverse biased c. operated in the breakdown d. unbiased

2) What is the barrier potential of a silicon diode at room temperature?

a. 0.3 V b. 0.7 V c. 1 V d. 2 mV per degree Celsius

3) When comparing the energy gap of germanium and silicon atoms, a silicon atom's energy gap is

a. about the same b. lower c. higher d. unpredictable

4) If the load resistance increases in a zener regulator, the zener current.....

a. decreases b. stays the same c. increases d. equals the source voltage divided by the series resistance.

5) The width of a diode's depletion layer will decrease when the diode is

a. forward biased b. first formed c. reverse biased d. not conducting

6) A reverse voltage of 10 V is across a diode. What is the voltage across the depletion layer?

a. 0 V b. 0.7 V c. 10 V d. none of the above

7) Which of the following describes an n-type semiconductor?

a. neutral b. positively charged c. negatively charged d. has many holes

b) **Determine** the position for Fermi level with respect to the valence band energy in p-type GaAs at T=300k. (2 marks)

Given : $N_D = 4 \times 10^{15}\ cm^{-3}$ $N_A = 5 \times 10^{16}\ cm^{-3}$ $N_V = 7 \times 10^{18}\ cm^{-3}$

Hint: You may use the following relations:

$E_C - E_F = kT \ln(N_C/N_D)$.....[ev] . $E_F - E_V = kT \ln(N_V/N_A)$.....[ev],

where N_C, N_V ...Effective density of states in conduction and valence bands respectively.

N_D, N_A...Donor and acceptor concentration for n and p-types respectively.

k....is the Boltzmann'constant 8.62×10^{-5} [eV/k] and T...is the room temperature at 300 k.

c) Aided with the configurations, sketch a center-tapped transformer full wave rectifier circuit. (2 marks)

d) Compare between the half wave rectifier (HWR), center-tapped FWR and bridge FWR with respect to the following parameters: (5 marks)

No.	Parameters	HWR	Center-tapped FWR	Bridge FWR
1	DC output power (P_{DC})			
2	AC output power (P_{AC})			
3	Rectification efficiency (η)			
4	Ripple factor (γ)			
5	Max. load current (I_m)			

e) A Full wave rectifier (FWR) is operated from 50 Hz supply with $E_{s(rms)} = 120\,\text{V}$. It is connected to a load drawing $I_{DC} = 60\,\text{mA}$ and using $C = 100\,\mu\text{F}$ filter capacitor. Calculate the dc output voltage and the root mean square value (rms) of the ripple voltage V_{rms}. Also calculate the ripple factor γ. (3 marks)

Question (2): (8 marks)

Aided with the provided I-V characteristics of the diode and the circuit shown in Fig. 1, find the diode current and voltage graphically using load line analysis for the following two cases:

a) $V_s = 1\,\text{V}$ and $R = 20\,\Omega$.

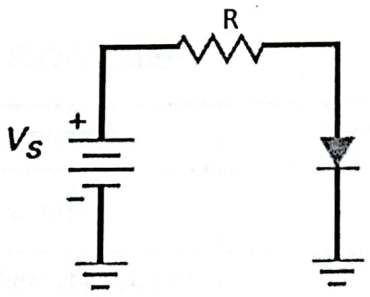


Fig. (1a)

b) $V_s = 2\,\text{V}$ and $R = 40\,\Omega$.

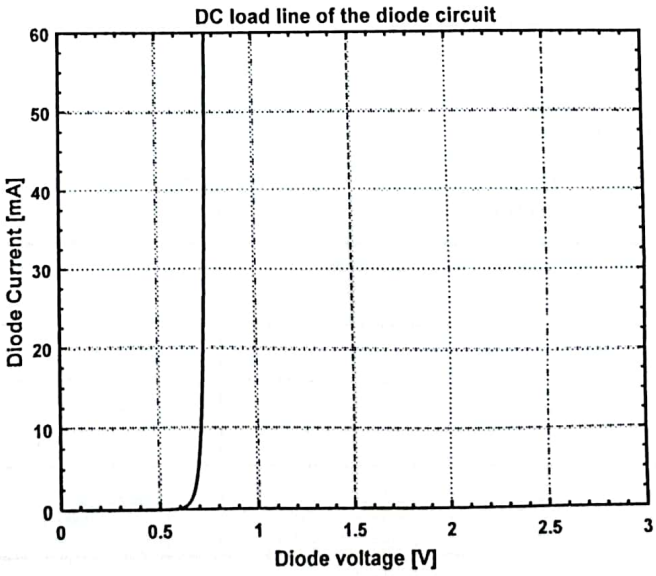


Fig. (1b)

Question (3): (10 mark)

a) Draw the zener diode I-V characteristics and label each region. (4 marks)

b) A stabilized power supply having $V_Z = 5$ V is required to be produced from a **15V DC** power supply input source as shown in Fig. 2. The maximum power rating P_Z of the zener diode is **2 W**. Using the zener regulator circuit in Fig. 2, calculate the following:

(6 marks)

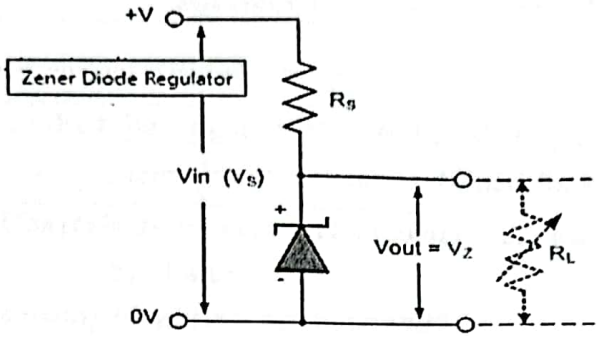


Fig. 2

i) The maximum current flowing through the zener diode.

ii) The minimum value of the series resistor, R_S.

iii) The load current I_L if a load resistor of $R_L = 1\,k\Omega$ is connected across the zener diode.

iv) The zener current I_Z at full load.

Question (4): (7 marks)

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