KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

MAIN CAMPUS

SECOND SEMESTER, 2017/2018 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN TELECOMMUNICATIONS AND BACHELOR OF EDUCATION SCIENCE

PHYS 120 BASIC ELECTRONICS

STREAM: PARTIME **TIME: 1.00-3.00P.M**

EXAMINATION SESSION: APRIL 2018 **DATE: 14/04/2018**

QUESTION 1 (30 MARKS)

a) Give the symbols for npn and pnp transistors 2 marks

b) Differentiate between conductors, insulators and semiconductors on the basis of bandgap. 6 marks

c) The circuit shown in **Figure 1.1** is to be designed such that I_{CQ} = 0.9 mA and V_{CEQ} = 2.5 V for the case when R_E = 1 kΩ. Assume V_{BE} (on) = 0.7V and β = 80. Find R_B and R_C. 6 marks

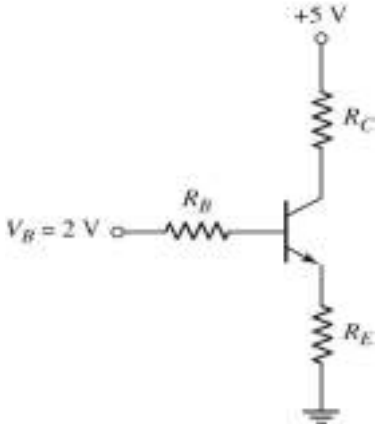
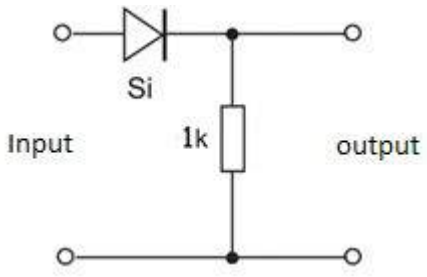


Fig. 1.1

d) Explain the difference between drift and diffusion mechanisms in semiconductors 3 mark

e) Draw the output voltage waveforms for the circuit in figure 1.2 2 marks



f) Discuss the similarities and differences between JFET and MOSFET with regard to their construction and applications. 4 marks

g) **Fig. 1.3 (a)** is a clipper circuits. Sketch on Figure 1.3 (b) the output voltage, V_O if the input signal, V_i is a 12V peak-to-peak square wave. Assume that $V_{th} =$ 0.6V. 3 marks

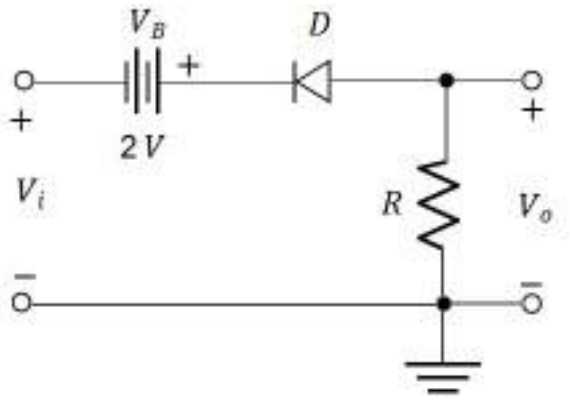
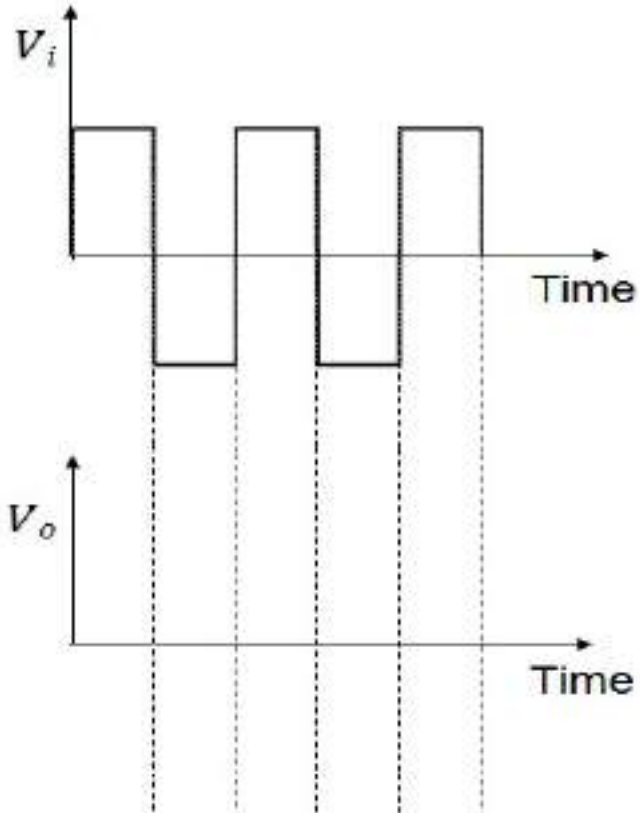
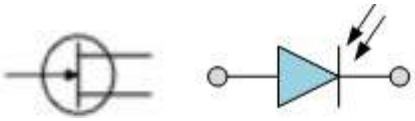


Fig. 1.3 (a)



Figire 1.3 (b)

h) Give the name and role of devices represented by the following two symbols. 4 marks



QUESTION 2 (20 MARKS)

a) Describe how Current-Voltage characteristics of a Zener diode can be determined in the laboratory? 10 marks

b) Discuss potential divide method of biasing clearly proving its superiority over other methods. 10 marks

QUESTION 3 (20 MARKS)

a) The transistor used in circuit (Figure 3.1(a)) has the characteristics shown on the graph (Figure 3.1(b).

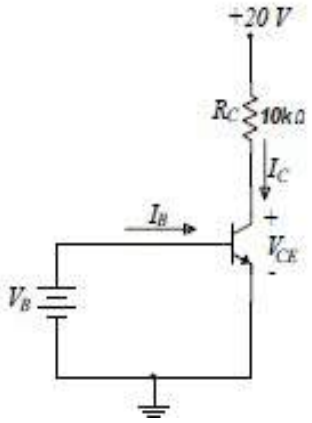


Figure 3 (a)

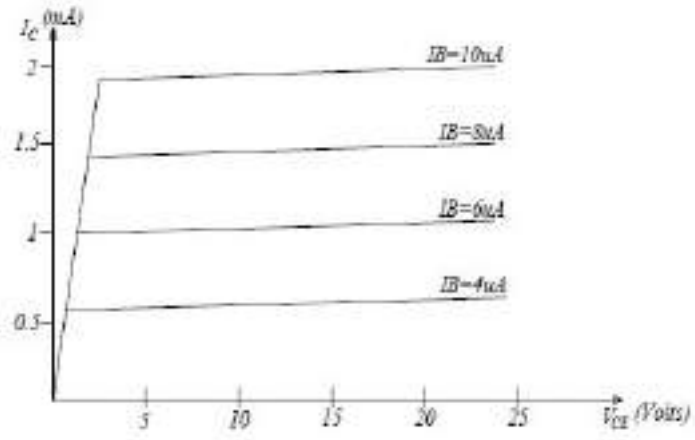


Figure 3 (b)

i. Copy the graph and draw the loadline. 5 marks

ii. On the loadline, locate the Q-point for $I_B=6uA$ 2 marks

iii. Estimate the value of the transistor β. 2 marks

b) Illustrate graphically the three operating modes of BJT. Explain the biasing conditions of the *B-E* junction and *B-C* junction of the BJT for operation in each mode. 8 marks

c) Label parts marked A, B, and C of an npn transistor given below (Figure 3.2). 3 marks

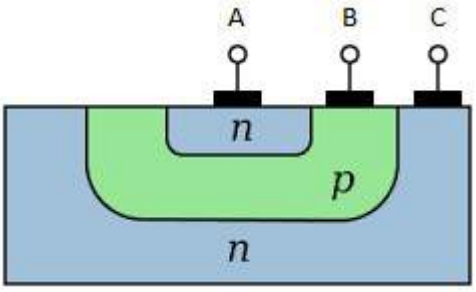


Figure 3.2

QUESTION 4 (20 MARKS)

a) Refer to Figure 4.1 .

i) Show that the gain can be calculated from: $Av = 1 + \frac{Rf}{R_1}$. 4 marks

ii) Determine the voltage gain for the circuit, with Rf = 100KΩ and R1=10 KΩ. 2 marks

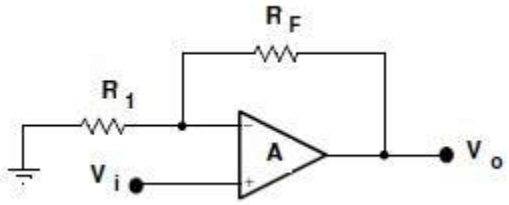


Figure 4.1

b) The circuit of a **Single Stage Common Source N-channel JFET** amplifier using self bias is shown in fig. 4.2. Explain the purpose of each component Used. 7 marks

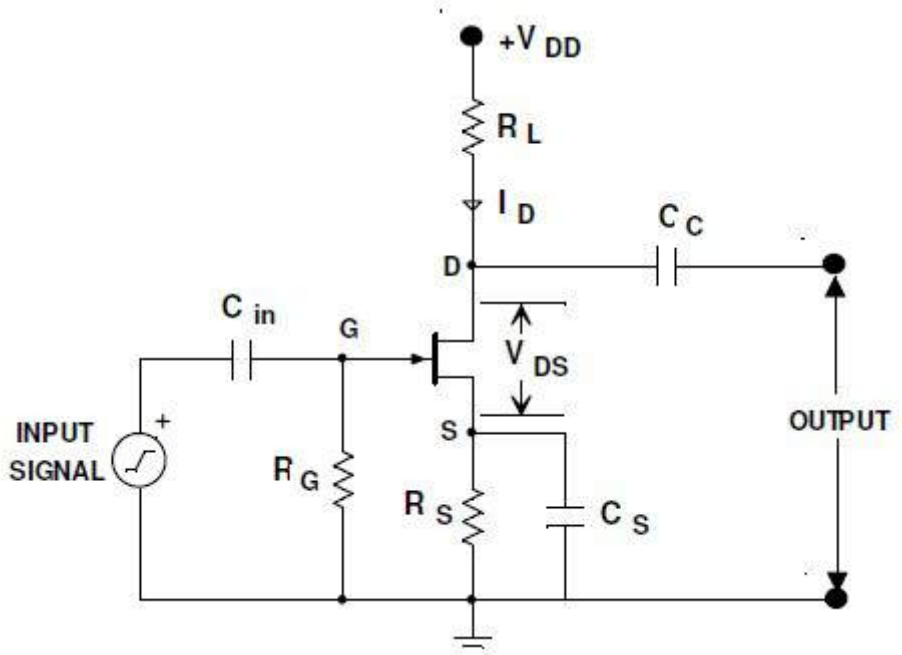


Figure 4.3

c) With suitable diagrams and/or a graph, explain how the gate voltage controls the output. 7 marks

QUESTION 5 (20 MARKS)

a) A Zener diode is connected in a voltage regulator circuit as shown in **Fig. 5.1.** It is given that V_{PS} = 20V, the Zener voltage, V_Z = 10V, R_i = 222 Ω and $P_{Z(max)}$ = 400 mW.

i. Determine the values of I_L, I_Z and I_I if R_L = 380 Ω. 6 marks

ii. Determine the value of R_L that will establish $P_{Z(max)}$ = 400 mW in the diode. 2 marks

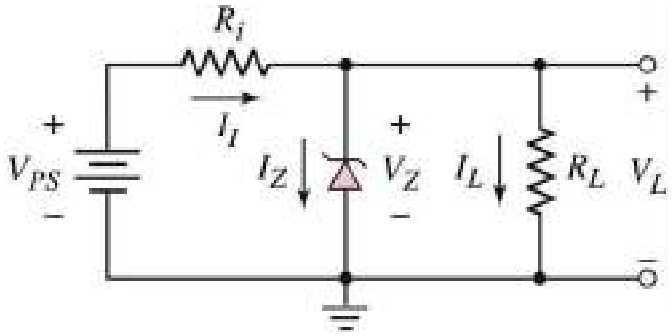


Figure 5.1

b) The following values are given as design data for the *BJT* configuration shown in **Figure 5.2:** V_{CC} = 12V, V_{BB} = 5V, I_C = 15.5 mA, V_{CE} = 5.8V, I_B = 100 μA and V_{BE} (on) = 0.7V.

i. Calculate the values of β, I_E, R_B and R_C 7 marks

ii. Sketch the output load-line 5 marks

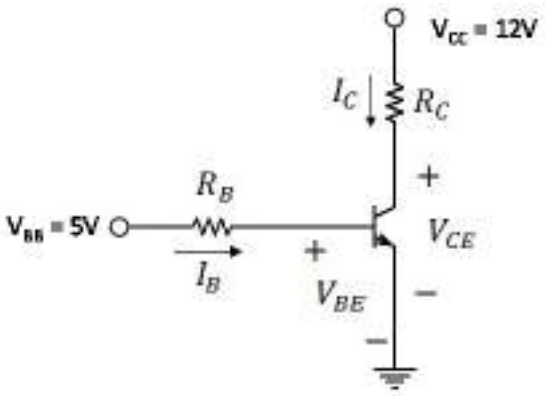


Figure 5.2

KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER, 2018/2019 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN EDUCATION SCIENCE/BSC IN TELECOMMUNICATIONS/BSC COMPUTER SCIENCE

PHYS 120 BASIC ELECTRONICS

STREAM: Y1S2 **TIME: 9.00-11.00 AM**

EXAMINATION SESSION: JAN-APR **DATE: 10/04/2019**

INSTRUCTIONS:

Answer Question 1 and any other THREE

Question 1 (30 marks)

a) List the advantages of semiconductor devices over vacuum based devices. [4]

b) You are given figure 1 below. Copy the diagram and label it to obtain

a) pnp transistor [2]

b) npn transistor [2]

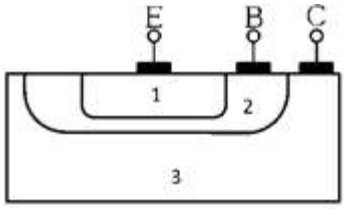


Figure 1

c) What is the source of the leakage current in a transistor? [1]

d) Give two examples for each of the following:

i) donor impurity. [2]

ii) acceptor impurity. [2]

e) Determine the diode current at 20°C for a silicon diode with I_s =0.1 Aat a reverse-bias potential of 10 V. Take: Fundamental charge q = 1.6x10^{-19} C; Boltzmann's constant K_B = 1.38 x 10^{-23} J/K. [4]

f) Determine α_{DC} if I_E 2.8 mA and I_B =20μA. [3]

g) Justify the following statements:

a) "semiconductor devices can serve as source of power". [2]

b) "Semiconductor based devices saves energy" [2]

h) In Figure 2, V_{in} = 12 Volts.

i. Give the name of the circuit. [1]

ii. Explain the operation of the circuit. [3]

iii. Find voltage across AB. [2]

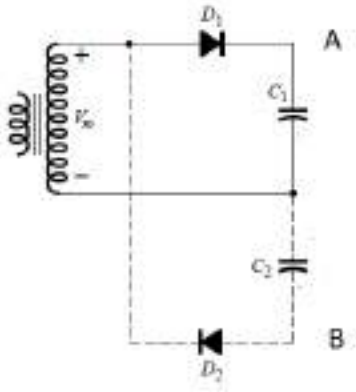


Figure 2

Question 2 (20 marks)

a) Draw the 2D structure illustrating boding Ge and explain why it is an insulator at 0K. [5]

b) Describe the difference between *n*-type and *p*-type semiconductor materials. [6]

a) Draw a voltage regular circuit and explain its operation. [6]

b) Determine *ID*, and *Vo* for the circuit of Fig. 3. Take the threshold of silicon to be 0.6 V. [3]

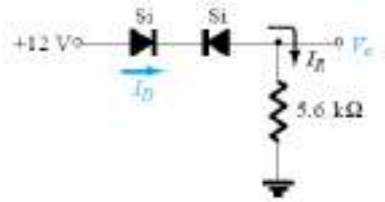


Figure 3

Question 3 (20 marks)

a) Using the characteristics of Fig. 4: Find

i. The value of $I_C$corresponding to V_{BE}=750 mV and V_{CE}= 5 V. [2]

ii. The value of $V_{CE}$and V_{BE}corresponding to I_C=3 mA and I_B=30μA. [2]

iii. The dc beta at an operating pointof V_{CE}= 8 V and IC =2 mA. [3]

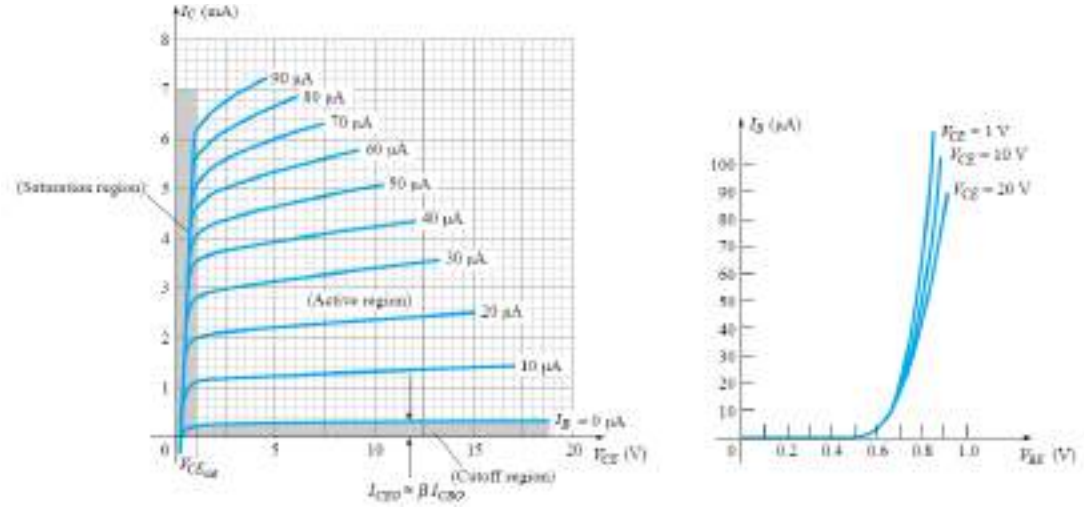


Figure 4

b) Explain the desired bias condition for the three labelled operating points in Figure 4. [6]

c) Determine the Q point for the circuit below (Figure 5): [7]

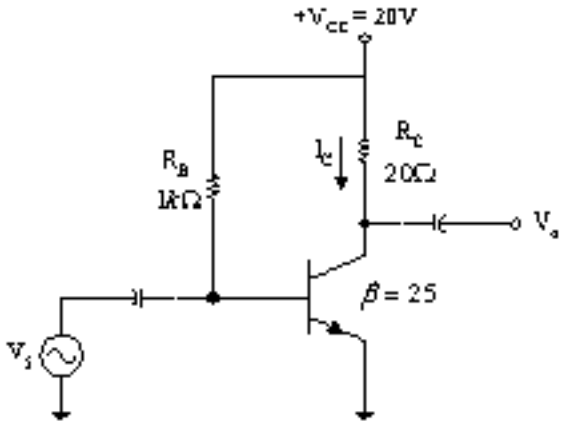


Figure 5

Question 4 (20 marks)

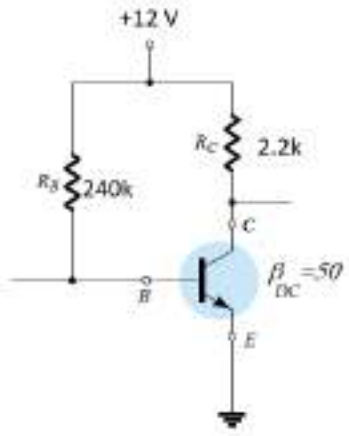
a) Define the Q point of of a transistor circuit. [2]

b) Explain factors which affect the Q point of a transistor circuit. [4]

c) A Fixed Bias circuit is presented in Figure 6.

i. Show that the bias method is unstable. [5]

ii. Draw its load line and mark the Q-point. (Take VBE=7 V). [9]



Question 5 (20 marks)

a) Draw a well-biased circuit -nchannel JFET and sketch the transfer curve defined by I_{DSS}=12 mA and V_P= 6 V. [8]

b) Use transistor equations to draw similarities between JFET and BJT [6]

c) Derive the voltage gain of an amplifier with feedback. [6]

KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

MAIN CAMPUS

FIRST SEMESTER, 2017/2018 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN TELECOMMUNICATION/ BACHELOR OF EDUCATION SCIENCE/ BACHELOR OF SCIENCE IN COMPUTER SCIENCE BACHELOR OF SCIENCE IN COMPUTER FORENSIC

PHYS 120: BASIC ELECTRONICS

STREAM: Y1S2 **TIME: 9.00-11.00 AM**

EXAMINATION SESSION: DECEMBER **DATE: 8/12/2017**

VENUE: AUDIT **COPIES: 200**

Instructions:

*Answer **Question One** and any other **Two***

a) Draw typical band structures illustrating the band gap of:

i.	a metal,	1 point
ii.	an insulator	1 point
iii.	a semiconductor	1 point

b) Describe the working of a photodiode 3 points

c) Draw the symbols of the following:

i.	zener diode	1 points
ii.	npn transistor	1 points
iii.	pchannel –JFET	1 points

d) Distinguish between a valence electron and a conduction electron 2 points

e) Explain how BJT can be used as an amplifier. 3 points

f) Why CE configuration is most popular in amplifier circuits? 1 point

g) Draw the current – voltage characteristic of a Si diode for two temperatures (T2>T1) in common coordinate system. Explain the nature of the graph. 6 points

h) Figure 1.1 shows a battery less radio.

Radios require DC bias. Explain how the conversion from AC to DC is done (with clear diagram(s)). 5 points

Figure 1.1

j) i. Give a circuit representing voltage divider bias 3 points

ii. State one advantage and disadvantage of voltage diver circuit. 2 points

Question 2 (20 marks)

a) Consider the circuit in Figure 2 1 point

i. State the name of the circuit. 1 point

ii. Find the peak secondary voltage 2 pints

iii. Sketch the voltage waveform across R_L. 2 points

iv. Calculate the output DC voltage 3 points

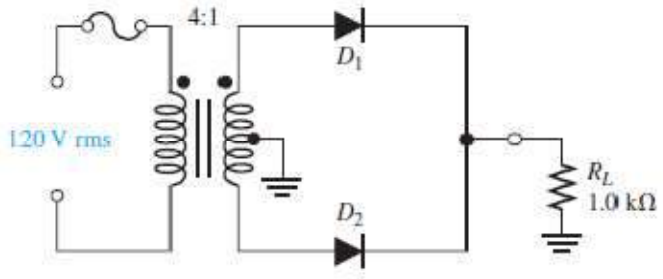


Figure 2-1

b) Discuss FOUR applications of diodes. 12 points

Question 3 (20 marks)

a) State the purpose of dc biasing circuits. 2 points
b) Explain what it means by a transistor operating in:
   i. Cutoff 2 points
   ii. Saturation 2 points
c) As a basic electronics student, explain why a radio receiver operating on low battery is likely to produce a distorted output. 3 points
d) In Figure 3.1, R_B = 100k and β = 100.
   i. Show that saturation current and cutoff voltages are as indicated on the graph. 4 points
   ii. Copy the graph and mark the Q point. 7 points

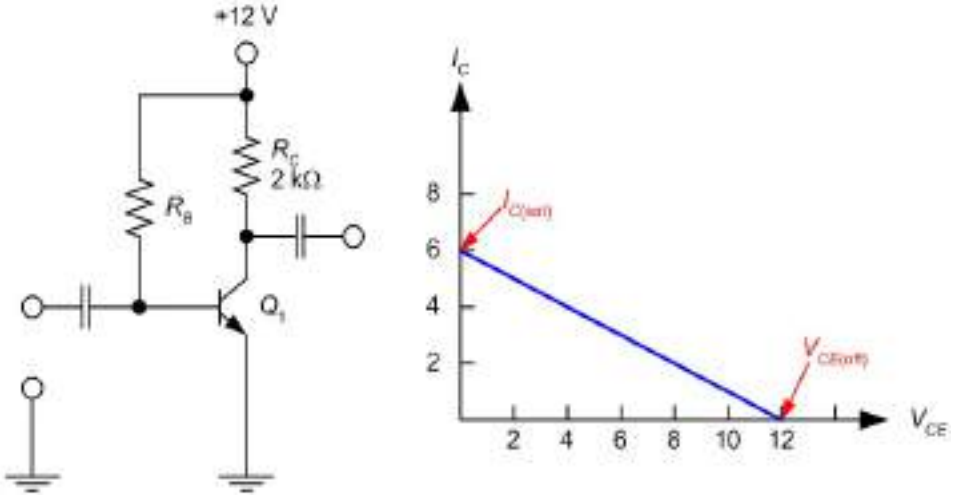


Figure 3.1

Question 4 (20 marks)

a) Using a circuit accompanied with a mathematical proof, show how an op-AMP can be used as:
   a. An integrator 4 points
   b. An ADDER 4 points
b) Discuss the role of dopants in a semiconductor. 3 points
c) Explain THREE methods of fabricating pn junctions. 9 points

Question 5 (20 marks)

a) Electronics plays key role in modern computers. Identify SIX functions or parts of the computer which require electronic parts. You must state the role of the part/function you identify. 12 points

b) Draw a well-labeled circuit representing voltage divider bias. 4 points

c) Briefly describe the principle working of a solar cell. 4 points

KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER, 2017/2018 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION (SCIENCE)

TLCM AND PHYSICS

PHYS 120 BASIC ELECTRONICS

STREAM: Y1Y2 **TIME: 9.00-11.00A.M**

EXAMINATION SESSION: APRIL 2018 **DATE: 13/04/2018**

Answer Question1 and any other two.

a) When a transistor is used as a switch, it is stable in which two distinct regions? [2marks]

b) Figure 1 is a voltage regulator.

i). Which element dictates the maximum level of source voltage? [1mark]

ii). Assume the input is 30 volts DC. Estimate the output. [2marks]

iii). Explain the opration of the circuit. [4marks]

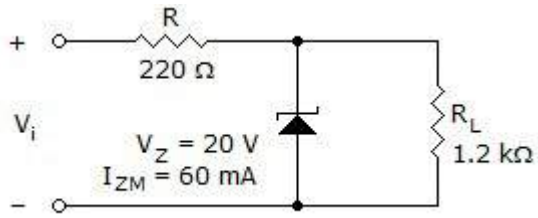


Figure 1

c) Name any two common semiconductors. [2marks]

d) What is the common application common collector configuration? [1mark]

e) For Figure 2,

i) Give the name of the circuit [1mark]

ii) Determine the voltages in each capacitor. [6marks]

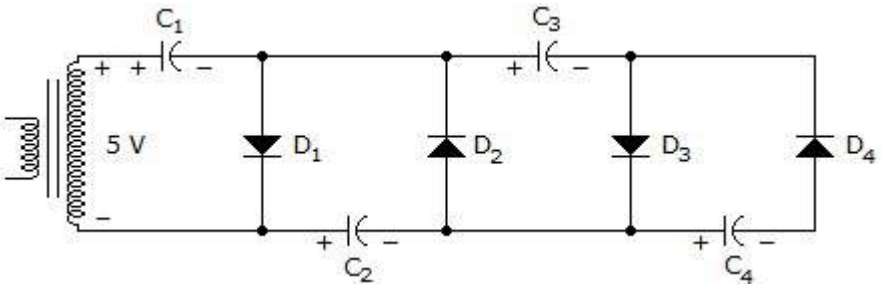


Figure 2

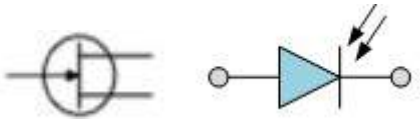
f) Using a diagram, explain the operation of N channel JFET. [6marks]

g) Explain how a p type semiconductor can be achieved. [5marks]

QUESTION 2 (20 MARKS)

a) Explain the importance of Q point in a transistor circuit. [2marks]

b) Give the name and role of devices represented by the following two symbols. [4marks]



c) Refer to this Figure 4. Assuming $V_{BE} = 0.6V$,

i). Determine V_{CE} [8marks]

ii). draw the landline and locate the Q point [6marks]

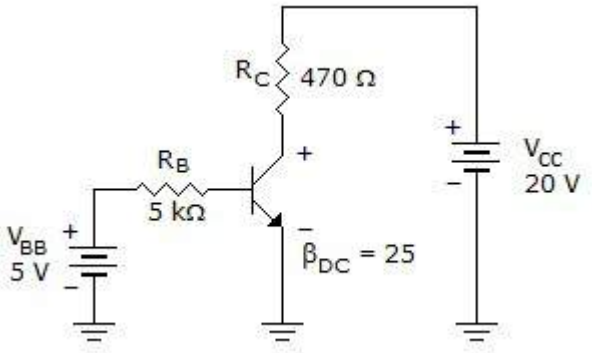


Figure 4

QUESTION 3 (20 MARKS)

a) Refer to figure 5.

i). Name the device [1mark]

ii). Explain the formation of Depletion layer [3marks]

iii). Explain the role of depletion layer in this device [3marks]

iv). Explain the operation of the device. [7marks]

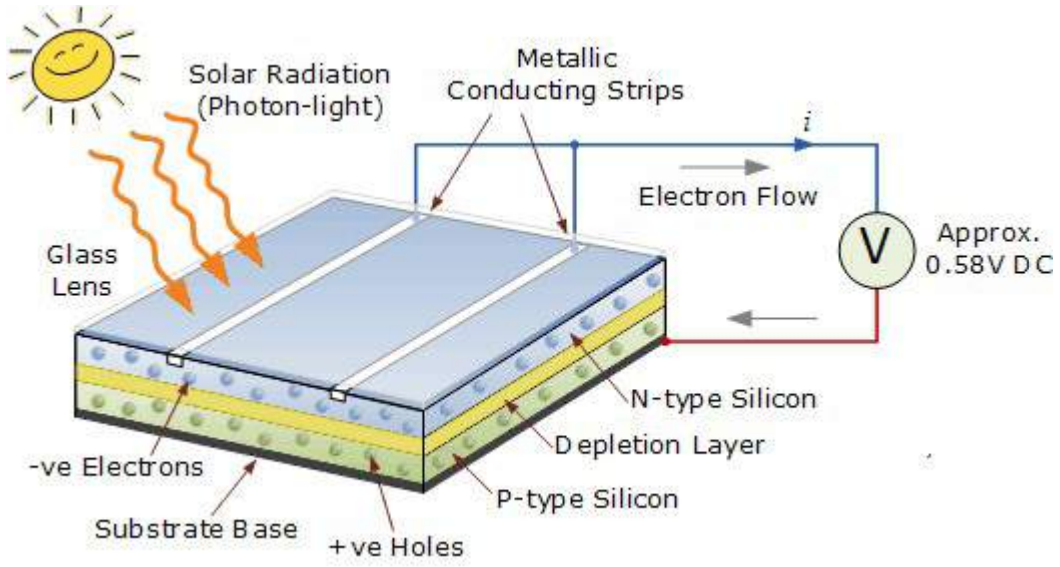


Figure 5

b) Compare FET and BJT [6marks]

QUESTION 4 (20 MARKS)

a) Figure 3 is a circuit for lighting an LED.

i) Explain the circuit operation. [3marks]

ii) Compute the maximum current through the LED. Assume the transistor has VBE =0.6V and gain = 90. [5marks]

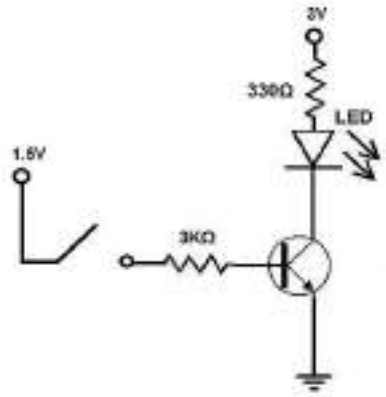


Figure 3

b) Discuss the FOUR operating modes of a transistor. [12marks]

QUESTION 5 (20 MARKS)

a) Give any 3 characteristics of an OP AMP [3marks]

b) Using a suitable circuit, show how an op amp can be used as an integrator [7marks]

c) Discuss 4 advantages of negative feedback in amplifiers. [10marks]

KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS
MAIN CAMPUS

THIRD SEMESTER, 2016/2017 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN TELECOMMUNICATIONS/ BACHELOR OF SCIENCE IN EDUCATION/ BACHELOR OF SCIENCE IN COMPUTER SCIENCE

PHYS 120: BASIC ELECTRONICS

STREAM: Y1S2 **TIME: 9.00-11.00AM**

EXAMINATION SESSION: AUGUST **DATE: 1/08/2017**

INSTRUCTIONS

- Instructions to candidates: Answer **QUESTION ONE** and any other **TWO** questions

Answer Question 1 and any other two

Question 1 (30 marks)

a)	Define a valence electron	1 mark
b)	Discuss electron energy levels.	5 marks
c)	Draw the symbols of npn and pnp transistor	2 marks
d)	Distinguish between intrinsic and extrinsic semiconductors	2 marks
e)	Describe how doping leads to the formation *n*-type semiconductor	6 marks
f)	For Figure 1.1,	
	a. Give the name of the circuit	1 mark
	b. Explain its operation.	5 marks
	c. Calculate the output voltage	3 marks

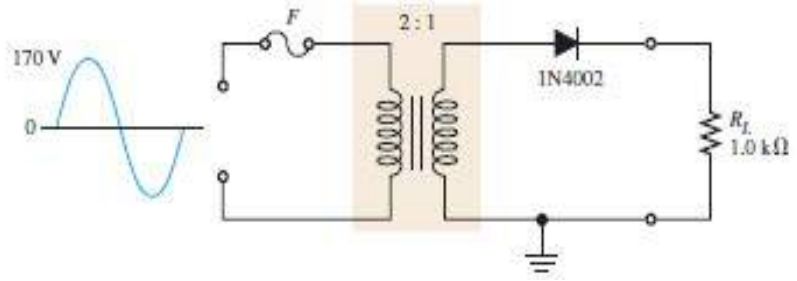


Figure 1.1

g) Explain the role of all the components in the Figure. 1.2. 5 marks

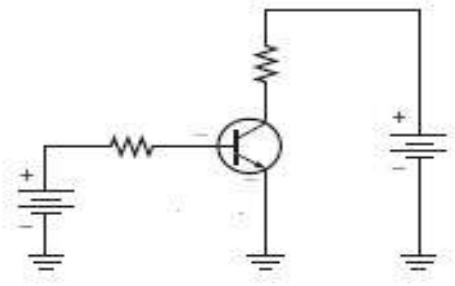


Figure 1.2

Question Two (20 marks)

a) Using a suitable diagram, discuss bonding in semiconductors. 7 marks
b) Why does a semiconductor have fewer free electrons than a conductor? 4 marks
c) Describe experimentally how the diode characteristics can be determined. 9 marks

Question Three (20 marks)

a) Discuss ANY THREE similarities between BJT and FET 6 marks
b) Determine the dc current gain β_{DC} and the emitter current I_E for a transistor where $I_B = 50$ μA and $I_C = 3.65$ mA. 4 marks
c) Determine I_B, I_C, I_E, V_{BE}, and V_{CE} in the circuit of Figure 3.1. The transistor has a $\beta_{DC} = 150$.

10 marks

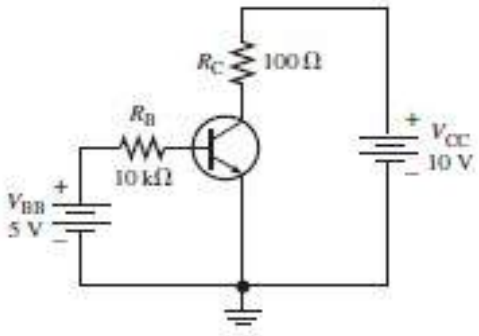


Figure 3.1

Question Four (20 marks)

a) Discuss any two biasing methods 10 marks
b) Highlight ANY 3 faults that can befall a transistor circuit 3 marks
c) Figure 4.1 is a basic transistor bias circuit with all voltages referenced to ground. $\beta_{DC} = 200$. Confirm that the values displayed on meters are correct. 7 marks

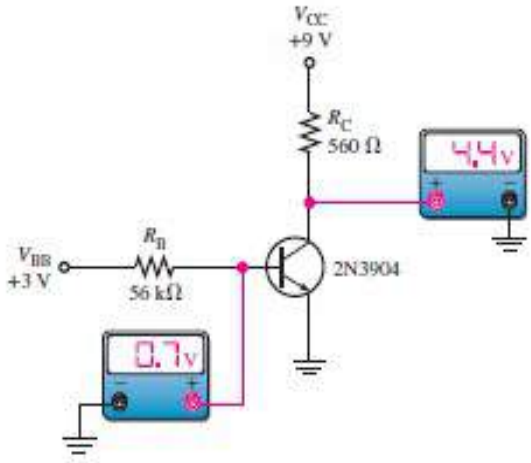


Figure 4.1

Question Five (20 marks)

a) Discuss FOUR applications semiconductors 12 marks

b) Explain the operation modes of a transistor 8 marks