QUESTION BANK

PERIOD: MAY 2023 - JULY 2023   **BATCH**: 2022-2023

BRANCH: CSE/MECH   **YEAR/SEM:** I/II

SUB CODE/NAME: BE3251/ Basic Electrical and Electronics Engineering

UNIT-III ANALOG ELECTRONICS
PART A

1. **Name the Four operating regions of transistor. (April/May 2022)**

   Active region: It is defined in which transistor collector junction is biased in reverse direction and emitter junction in forward direction.

   Cutoff region: The region in which the collector and emitter junctions are both reverse-biased

   Saturation region: The region in which both the collector and emitter junctions are forward biased.

   Inverse active region: This region lies between saturation and cutoff. The transistor operates in active region when the emitter junction is forward biased and collector junction is reverse biased. In the active state, collector current is times the base current,
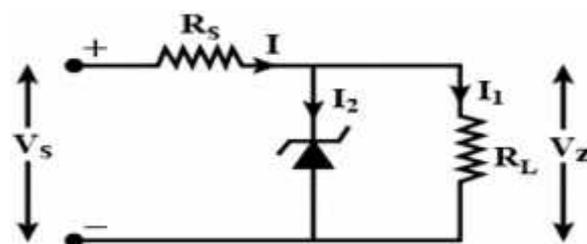
2. **Differentiate the operation of rectifiers and inverters?**

S. No	RECTIFIERS	INVERTERS
1	A rectifier changes current from alternating current (AC) to direct current (DC)	while an inverter converts DC to AC.
2	Rectifiers come in two basic types: half-wave and full-wave	Inverter come in two basic types: Single phase inverter an Three phase inverter

3. **Define Semiconductors. (April/May 2022)**

   Semiconductors are materials having conducting properties lies between conductors and insulators. These materials are separated by a small energy gap (=1ev).Germanium and Silicon are commonly used semiconductors.

4. **Draw the circuit of Zener voltage regulator? (Nov/Dec 2022)**

Zender diode as a voltage regulator

5. JFET is a voltage operated device. Justify?

A JFET is a voltage-controlled device because the current between the drain and the source is controlled by the voltage at the gate with reference to the source (vgs).

6. Define: valence band, conduction band.

The range of energies possessed by valence electrons is called valence band. The range of energies possessed by conduction electrons is called conduction band. The free electrons which are left in the valence band are occupying the conduction band.

7. Define: forbidden energy gap

The energy gap between the valence band and conduction band is defined as forbidden energy gap. For insulators. It is around 6ev, for semiconductors, its value is comparatively low. Germanium has energy gap 0.7 eV and silicon has 1.1 eV. For conductors, since conduction and valence bands are overlapping the energy gap is zero.

8. What is intrinsic semiconductor?

Intrinsic semiconductors are pure form of semiconductors. The conductivity of a semiconductor lies between an insulator and a conductor. As temperature increases, the conductivity of the semiconductor also increases. Semiconductors have negative temperature co-efficient of resistance.

9.   Explain the significance of Base width modulation (Early effect)

It reduces the charges recombination of electrons with holes in the base region; hence the current gain increases with the increase in collector -base voltage. The charge gradient is increased within base hence the current due to minority carriers injected across emitter junction increases.

10. What are the three types of transistor configuration? Among those which is most important?

Common base configuration, Common emitter configuration, Common collector configuration are the three types of transistor configuration. The CE configuration is important because it has high current gain and its Output to input impedance ratio is moderate therefore easy coupling is possible between various transistor stages. It finds excellent usage in audio frequency applications hence used in receivers and transmitters.

11. How a transistor is used as a switch?

A transistor should be operated in saturation and cutoff regions to use it as a switch. While operating   in saturation region, transistor carry heavy current hence considered as ON state. In cutoff it doesn't carry current and it is equivalent to open.

12. Which configuration is known as emitter follower and why it is named so?

CC configuration is known as emitter follower, whatever may be the signal applied at the input, may produce same signal at the output. In other words, the gain of the circuit is unity. So that the

common circuit the so called emitter follower is named as emitter follower (output follows the input).

13. Compare the performance of CE, CB, CC

Parameters	CB	CE	CC
Current gain (A_i)	Low	High	High
Voltage gain (V_i)	High	High	Low
Input resistance (R_i)	Low	Medium	High

14. What is Zener breakdown? (Nov 2015)

When a PN junction is heavily doped the depletion region is very narrow. So under reverse bias condition, the electric field across the depletion layer is very intense. Electric field is voltage per distance and due to narrow depletion region and high reverse voltage, it is intense. Such an intense field is enough to pull the electrons out of the valence bands of the stable atoms. So this is not due to the collision of carriers with atoms. Such a creation of free electrons is called Zener effect which is different that the avalanche effect. These minority carriers constitute very large current and mechanism is called Zener Breakdown.

15. Give the applications of Zener diode (Nov 2015)

⟩ Used as a constant voltage source.

⟩ Used as voltage regulator.

16. Define load regulation and line regulation

Line Regulation: Ratio of change in output voltage for a corresponding change in the input Voltage expressed as a percentage.

Load Regulation: Ratio of change in the output voltage for a certain range of load current Values, expressed as a percentage.

17. **Define Rectifier**:

It is an electronic circuit which converts AC input to pulsating DC. i.e., output of the rectifier is not a pure DC. Normally PN diode is used as rectifying device.

18. Define PIV of a rectifier with an example.

This is the maximum reverse voltage with which a diode can withstand without any damage. PIV of half wave rectifier is V_m, while that of center tapped FWR is $2V_m$.

19. Compare the performance analysis of HWR,FWR(Centre tapped) & bridge rectifier

Performance factors	HWR	FWR (Bridge)	FWR(Center tapped)
Average current	$I_m/$	$2I_m/$	$2I_m/$
Average dc voltage	$E_m/$	$2V_m/$	$2V_m/$

rms load current	$I_m/2$	$I_m/\ 2$	$I_m/\ 2$
Efficiency	0.406	0.812	0.812
TUF	0.287	0.812	0.693
Ripple factor	1.21	0.48	0.48
PIV	V_m	V_m	$2V_m$

20. **Write any two salient points on a p-n junction. (May 2013)**

A junction is formed between a sample of 'P' type semiconductor and a sample of 'N' type semiconductor joined together then this device is called the PN junction.

The formation of PN junction is also called as Diode, because it has two electrodes and for P region named as Anode and the other for 'N' region named as Cathode.

21. **When should a transistor be biased? Name two common biasing circuits. (May 2013)**

For proper operation of transistor, input junction should be forward biased and the output junction should be reverse biased.

Common base and common emitter configuration are the two common biasing circuits.

22. **What is doping? (May 2014)**

Doping means adding an impurity to pure semiconductor to impure its electrical conductivity.

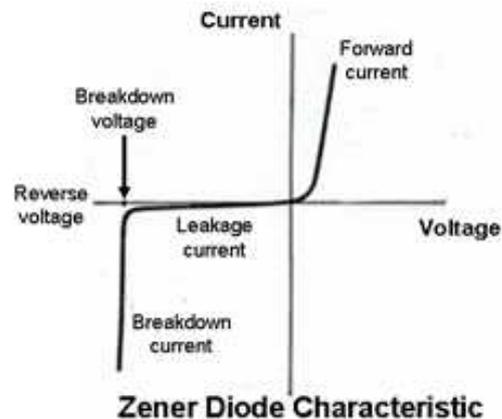23. **Give the other names of depletion region. (May 2014)**

*Potential barrier region.

*Space charge region or charge free region.

24. **What is cut in voltage?**

The forward voltage at which the current through the junction starts increasing rapidly is called knee voltage or cut in voltage.

25. **Draw the characteristics of zener diode. (May 2015).**

Zener Diode Characteristic

26. **Find the values of I_C, I_B, . Transistor values are =0.95, I_E = 1mA. (May 2015).**

I_C = . I_E = 0.95 * 1mA= 0.95 mA

=   /(1-)= 0.95/(1-0.95)= 19.

$I_B = I_C/$ =0.05/ 19= 0.05 mA

27. **List various hybrid parameters of transistor. (May 2016).**

Voltage gain, input resistance, output resistance, output conductance and current gain.

PART-B

1. Explain the Constructional details and different modes of operation of MOSFET **(13 Marks) (A/M 2022)**

2. Describe the working of a PN junction diode with neat diagrams. Also explain its V-I characteristics. **(13 Marks) (May 2014) ,(May 2015) & (Nov 2015) & (April/May 2022)**

3. Explain Bridge rectifier with suitable circuit diagram and derive its ripple factor **(13 marks) (Nov/Dec 2022)**

4. Explain the operation of BJT in common emitter mode with its characteristics. **(Nov/Dec 2022)**

5. Explain Half wave rectifier with suitable circuit diagram and derive its efficiency, ripple factor, TUF and PIV. **(Nov 2015) & (May 2016).**

6. Describe the working of a zener diode with neat diagrams. Also explain its V-I characteristics. **(13 Marks)** Explain the Constructional details and operation of IGBT **(13 Marks)**

7. Explain the Constructional details and operation of SCR **(13 Marks)**

8. Explain the mechanism of avalanche breakdown and zener breakdown. **(May 2016).**

9. Explain the working of the CB configuration BJT. Draw its input and output characteristics. **(May 2014) & (May 2015).**

10. Explain the Constructional details and operation of JFET **(13 Marks)**

Unit – IV DIGITAL ELECTRONICS

PART-A

1. Encode the word DATE in ASCII code.

ANS:D - 100 0100 A - 100 0001 T - 101 0100 E - 100 0101

2. Encode (1236) $_{10}$ in Excess – 3 code

ANS (0101 0110 0111 1010) $_2$

3. Divide 110110 by   101 (Binary)

ANS: 101.1
          101) 110110
                 101
                  111
                  101
                 1000
                  101
                  100

4. Convert the following decimal numbers to octal (a) 79 (b) 0.925

ANS   (a)   8 | 79

             8 | 8 – 7   = $(107)_8$

                 1 - 0

       (b)   0.925 * 8 = 7.400

            0.400 * 8 = 3.200

            0.200 * 8 = 1.600

               = $(0.731)_8$

5. Convert the following Hexadecimal to Decimal (a) 4C5 (b) 0.9E8

ANS: (a)   = $4 * 16^2 + 12 * 16^1 + 5 * 16^0$

                = $(1217)_{10}$

         (b)   = $9 * 16^{-1} + 14 * 16^{-2} + 8 * 16^{-3}$

                = $(1.18164)_{10}$

6. Perform the following Arithmetic operation

ANS: 1011.101

          101.011 (-)

          110.010

7. What are non – weighted Code and Weighted Code?

Non weighted: The Code in which the bit position does not have any specified value.

Example: Excess-3 code, Gray code

Weighted code: The code in which each and every bit position has a specified value or weight

 Example: 8421, 5211 and 2421

8. Convert $(1259)_{10}$ into Hexadecimal

    ANS:16 | 1259

        16 | 78 – 11

          3 – 14

         = $(3EB)_1$

9. Convert $(11101)_{gray}$ to Binary code

    ANS: Binary Equivalent = $(10110)_2$

10. What are the advantages of encoding a decimal number in BCD as compared with straight numbers?

The advantages of encoding a decimal number in BCD is that there is easier conversion between decimal and binary system .Moreover arithmetic operations are done in binary numbers in computers. Therefore encoding a decimal number in BCD is more advantageous.

11. What are Universal Gates? Why are they called so? What are their advantages? (May 2015) &(Nov 2015)

Universal gates are NAND and NOR, they are called so because using these codes any logical gate or logical expression can be derived.

12. Add the decimals 57 & 68 using 8421 BCD code.

$$
\begin{array}{ll}
57+ & 0101 \quad 0111 + \\
68 & \underline{\quad 0110 \quad 1000} \\
& \underline{1011 \quad 1111} \\
\text{Add 6 to both} & \underline{0110 \quad 0110} \\
\text{Groups} & \underline{1\,0010 \quad 0101}
\end{array}
$$

13. Convert 0.875_{10} to quandary (Base 5)

	Integer		Fraction		Coefficient
0.875×5 =	4	+	0.375		a_{-1} = 4
0.375×5 =	1	+	0.875		a_{-2} = 1
0.875×5 =	4	+	0.375		a_{-3} = 4
0.375×5 =	1	+	0.875		a_{-2} = 1

Answer: $0.875_{10} = (0.a_{-1}a_{-2}a_{-3}\,a_{-4})_5 = (0.4141)_5$

14. Add the decimals 67 & 78 using excess3 code

$$
\begin{array}{ll}
67 + & 1001 \quad 1010 \\
78 & \underline{1010 \quad 1011} \\
& \underline{1\,0100 \quad 0101}
\end{array}
$$

15. The arithmetic operation $(23+44+14+32)_r = 223_r$ is correct in at least one Number system. Find r.

$2r+3+4r+4+r+4+3r+2 = 2r^2+2r+3$

$10r+13 = 2r^2+2r+3$; $2r^2 – 8r -10 =0$

$r = (+8\sqrt{\,64 +80})/4 = 5,-1$

Answer: r =5

16. Express the number $(25)_{10}$ in Gray code.

$$
\begin{array}{lll}
2 & |\underline{25\quad} & \\
2 & |\underline{12\,} & 1 \\
2 & |\underline{6\,} & 0 \\
2 & |\underline{3\,} & 0 \\
& 1 & 1
\end{array}
$$

The equivalent binary is $(11001)_2$. Now the binary number (11001) is converted into Gray code.

(1): The LSB Gray digit is same as LSB binary

(2): Going from left to right add each adjacent pair of binary digit to get the next Gray code digit .

Discard carries. Therefore the corresponding Gray code for (11001) is 10101

17. What is register in digital system? (May 2016).

Registers are data storage devices that are more sophisticated than latches. A register is a group of binary cells suitable for holding binary information. A group of cascaded flip flop used to store related bits of information is known as register.

18. Describe the importance of EBCDIC code.

The extended Binary coded Decimal interchange code is an eight-bit code.This code is commonly used in Data transfer & computer interface applications. In this case, the decimal digits are represented by the 8421 BCD code proceeded by 1111.

19. Perform (11011-100101) using 2's complement method

11011 -Ψminuend

100101 -Ψsubtrahend

 |

2's complement of subtrahend = 011011

 011011

 011011

 |

110110

 |

Since there is no carry, take 2"s complement of resultant sum. Ans: -001010

20. State Demorgan's theorem: (May 2016).

Demorgan's theorem 1:

The complement of product of any number of variables is equivalent to sum of the individual complements.

Demorgan's theorem 2:

The complement of sum of any number of variables is equivalent to product of individual Complements.

21. Find the following binary difference: 1011010-0101110. (May 2013)

1011010

0101110

 1010100

22. An active high S-R latch has a '1' on the S-input and '0' on the 'R' input. What state is the latch in? (May/June 2013)

It is in set state.

23. Define flip flop. What is the different type of flip flops? (May 2014) &(Nov 2015)

Flip flop is a sequential logic circuit which store one bit binary data. the output of the flip flop depends on the present input and previous output.

(1)RS flip flop. (2)JK flip flop.

(3)D flip flop.   (4) T flip flop.

24. Mention the types of Analog to digital converter? (May 2014)

(1)Successive approximation method

(2)Flash type converter (3)Dual slope A/D converter.

25. Convert $(634)_8$ to binary. (May 2015)

　　　6　　3　　　4

　　110　011　　100

　　$(634)_8 = (110011100)_2$.

PART-B

1. Explain with a neat sketch the working of a successive approximation ADC. **(Nov 2015)**

2. List various types of logic gates with its logic symbol and truth table. List also universal gates **(May 2016).**

3. With neat logic & timing diagrams explain the operation of a 4 – bit SISO   Shift register..

4. What is a combinational circuit? Explain the operation of Half and Full Adder circuit and Implement the sum and carry using NAND gate. **(May 2013)**

5.(i) Reduce the following expressions using Boolean Algebra. **(May 2013)**

Y=A'B'C'+A'B'C+AB'C'+ABC.

Y=[(A+B)'+C']'.

Y= (A+B) (A'+C) (B+D) **(May 2016).**

(ii)Realize the given expression using only NAND gates and Inverters. **(May2013)**

Y=ABC+A'B'C'.

(iii) Design a Full Adder, construct the truth table, simplify the output equations and draw the Logic Diagram. **(May 2016).**

6. (i) Draw the logic diagram for a four bit parallel input parallel output register. Indicate inputs, outputs and a negative edge triggered clock. **(May 2013).**

(ii) Draw a simple Ring Counter and briefly describe its counting action. **(May 2013).**

7. With necessary diagrams explain the functioning of any one type of ADC and DAC. **(May2014).**

 (ii) Convert 95.0625_{10} to binary. **(May 2013).**

8. Write short notes on: **(May 2014)& (Nov 2015)**

(i) RS-flip flop.   (ii) JK-flip flop.   (iii) D-flip flop.   (iv) T-flip flop.

9. 16. Draw and explain the operations of the following flip flops**(May 2015)**

(i) RS flip flop using NOR gate (ii) D flip flop using NAND gate (iii) JK flip flops using NAND gate.

10. With necessary diagrams describe the operation of a 4 – bit binary, ripple counter. **(May 2015).**