CHAPTER - D

SEMICONDUCTORS

Date Planned : __ / __ / __	**Daily Tutorial Sheet - 1**	**Expected Duration : 90 Min**
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1. Depletion layer contains.

(A) Only immobile negative and positive ions

(B) Only free charge carries

(C) Both free carries and immobile ions

(D) None of these

2. A pure semiconductor behaves slightly as a conductor at

(A) Room temperature **(B)** Low temperature

(C) High temperature **(D)** Both (B) and (C)

3. Zener diode is used

(A) As an amplifier **(B)** As a rectifier

(C) As an oscillator **(D)** As a voltage regulator

4. When alumium is added as an impurity to silicon, the resulting material is.

(A) *P*-type semiconductor **(B)** *P*-type conductor

(C) *N*-type semiconductor **(D)** *N*-type conductor

5. Zener breakdown in semiconductor diode occurs when

(A) Forward current exceeds certain value **(B)** Reverse bias exceeds certain value

(C) Forward bias exceeds certain value **(D)** Potential barrier is reduced to zero

6. The conductivity of a semiconductor increases with increase in temperature because :

(A) Number density of free current carries increases

(B) Relaxation time increases

(C) Both number density of carries and relaxation time increase

(D) Number density of current carriers increases, relaxation time decreases but effect of decrease in relaxation time is much less than increase in number density

7. Barrier potential of a *P-N* junction diode does not depend on

(A) Temperature **(B)** Forward bias **(C)** Doping density **(D)** Diode design

8. On adding the *P-N* junction diode in forward bias,

(A) Depletion layer increases **(B)** Resistance increases

(C) Both decreases **(D)** None of these

9. In semiconductor at a room temperature

(A) The valence band is partially empty and the conduction band is partially filled
(B) The valance band is completely filled and the conduction band is partially filled
(C) The valence band is completely filled
(D) The conduction band is completely empty

10. The output of *OR* gate is 1 (one)

(A) If both inputs are zero **(B)** If either or both inputs are one
(C) Only if both inputs are one **(D)** If either input is zero

11. Copper has face centred cubic (*fcc*) lattice with interatomic spacing equal to 2.54Å. The value of lattice constant for this lattice is.

(A) 2.54Å **(B)** 3.59Å **(C)** 1.27Å **(D)** 5.08Å

12. To a germanium crystal equal number of aluminium and indium atoms are added. Then

(A) It remains an intrinsic semiconductor **(B)** It becomes a N-type semiconductor
(C) It becomes a P-type semiconductor **(D)** It becomes an insulator

13. The term liquid crystal refers to a state that is intermediate between

(A) Crystalline solid and amorphous liquid **(B)** Crystalline solid and vapour
(C) Amorphous liquid and its vapour **(D)** A crystal immersed in a liquid

14. Energy gap of a semiconductor is of the order of

(A) 1 *eV* **(B)** 10 *eV* **(C)** 0.1 *eV* **(D)** None of these

15. When germanium is doped with phosphorous what type of semiconductor is produced?

(A) *N*-type **(B)** *P*-type **(C)** Both (A) and (B) **(D)** None of these

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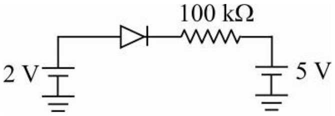
16. Current through the ideal



(A) Zero **(B)** 20 *A* **(C)** 1/20 *A* **(D)** 1/50 *A*

17. When a *P-N* diode is reverse biased, then

(A) No current flows

(B) The depletion region is increased

(C) The depletion region is reduced

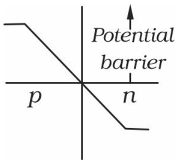
(D) The height of the potential barrier is reduced

18. A transistor is operated in common emitter configuration at constant collector voltage V_C = 1.5 *V* such that a change in the base current from $100\mu A$ to $150\mu A$ produces a change in the collector current from 5 *mA* to 10 *mA*. The current gain β is :

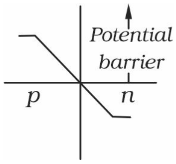
(A) 50 **(B)** 67 **(C)** 75 **(D)** 100

19. In a forward biased p-n junction diode, the potential barriers in the depletion region will be of the from :

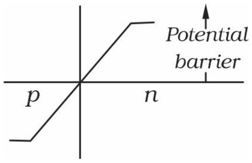
(A)



(B)



(C)



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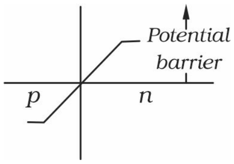
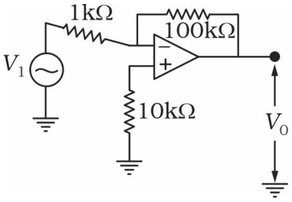
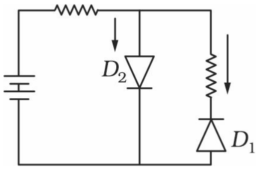


20. The voltage gain of the following amplifier is:



(A) 10 **(B)** 100 **(C)** 1000 **(D)** 9.9

21. In the diode circuit given :



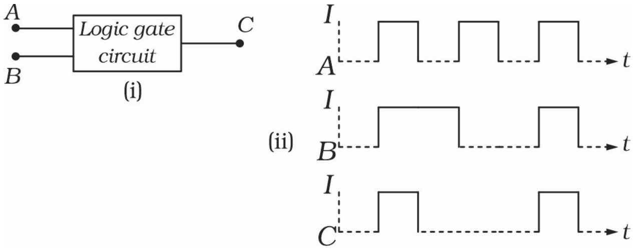
(A) D_1 and D_2 are reverse biased

(B) D_1 and D_2 are forward biased

(C) D_1 is reverse biased and D_2 is forward biased

(D) D_1 and D_2 will not conduct

22. The following figure (i) shows a logic gate circuit with two inputs A and B and output C. The voltage waveforms of A, B and C are as shown in the figure (ii) given below:



The logic circuit gate is:

(A) OR **(B)** AND **(C)** NAND **(D)** NOR

23. In a reverse biased diode when the applied voltage changes by 1 *V*, the current is found to change by $0.5\mu A$. The reverse bias resistance of the diode is :

(A) $2\times10^5\,\Omega$ **(B)** $2\times10^6\,\Omega$ **(C)** 200Ω **(D)** 2Ω

24. The truth table given below is for
(*A* and *B* are the inputs, *Y* is the output)

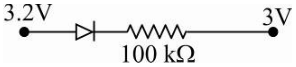
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(A) NOR **(B)** AND
(C) XOR **(D)** NAND

25. A transistor is working in common emitter mode. Its amplification factor $\beta = 80$. If the base current is $250\,\mu A$, what is the current at the collector?

(A) $250\,\mu A$ **(B)** $250\times80\,\mu A$ **(C)** $80\,\mu A$ **(D)** $200\times80\,\mu A$

26. The current in the circuit shown in the figure considering ideal diode is :



(A) $2\times10^3\,A$ **(B)** $2\times10^{-3}\,A$ **(C)** $3\times10^{-3}\,A$ **(D)** $3\times10^3\,A$

27. The logic behind *NOR* gate is that it gives

(A) High output when one input is low and other is high
(B) High output when both inputs are low
(C) High output when both inputs are high
(D) None of these

28. What is the voltage gain in a common-emitter amplifier, when input resistance is 4Ω and load resistance is 24Ω? Take $\beta = 0.6$

(A) 3.6 **(B)** 4.8 **(C)** 2.4 **(D)** 1.2

29. In a *N-P-N* transistor circuit the collector current is 9 *mA*. If 90% of the electrons emitted reach the collector, then the emitter current is :

(A) 7 *mA* **(B)** 8 *mA* **(C)** 9 *mA* **(D)** 10 *mA*

30. If collector current is 120 *mA* and base current is 2 *mA* and resistance gain is 3, what is power gain?

(A) 180 **(B)** 10800 **(C)** 1.8 **(D)** 18

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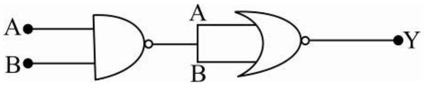
31. In the following circuit, the output *Y* for all possible inputs *A* and *B* is expressed by the truth table.



(A)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(B)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

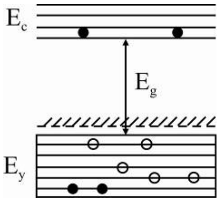
(C)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(D)

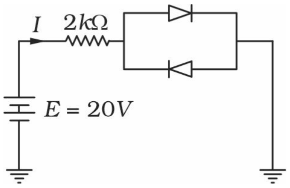
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

32. In the energy band diagram of a material shown below, the open circles and filled circles denote holes and electrons respectively. The material is :



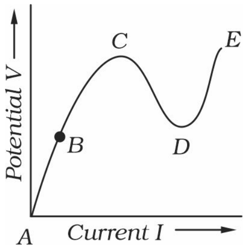
(A) An insulator
(B) A metal
(C) Amn *N*-type semiconductor
(D) A *P*-type semiconductor

33. Assuming the diodes to be of silicon with forward resistance zero, the current I in the following circuit is:



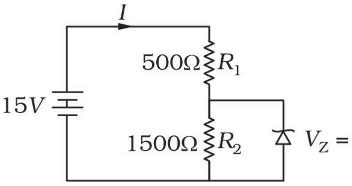
(A) 0
(B) 9.65 mA
(C) 10 mA
(D) 10.36 mA

34. Which part represents the negative dynamic resistance?



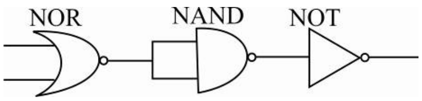
(A) AB **(B)** BC **(C)** CD **(D)** DE

35. In the given circuit the current through the Zener diode is:



(A) 10 mA **(B)** 6.67 mA **(C)** 5mA **(D)** 3.33 mA

36. The circuit



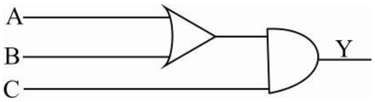
Is equivalent to.

(A) NOR gate **(B)** OR gate **(C)** AND gate **(D)** NAND gate

37. A *P-N* photodiode is made of material with a band gap of 2.0 *eV*. The minimum frequency of the radiation that can be absorbed by the material is nearly

(A) 1×10^{14} *Hz* **(B)** 20×10^{14} *Hz* **(C)** 10×10^{14} *Hz* **(D)** 5×10^{14} *Hz*

38. To get an output $Y = 1$ from the circuit shown, the inputs *A*, *B* and *C* must be respectively

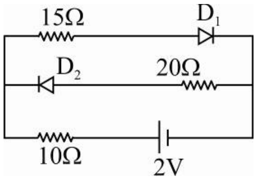


(A) 1, 0, 1 **(B)** 1, 1, 0 **(C)** 0, 1, 0 **(D)** 1, 0, 0

39. A common emitter amplifier gives an output of 3 *V* for an input of 0.01 *V*. If β of the structure is 100 and the input resistance is $1k\Omega$, then the collector resistance is.

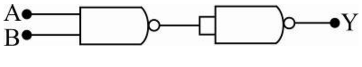
(A) $1\,k\Omega$ **(B)** $3\,k\Omega$ **(C)** $30\,k\Omega$ **(D)** 30Ω **(E)** $6\,k\Omega$

40. The current *I* through 10 ohm resistor in the circuit given below is.



(A) 50 *mA* **(B)** 20 *mA* **(C)** 40 *mA* **(D)** 80 *mA*

41. The combination of the following gates produces



(A) AND gate **(B)** NAND gate **(C)** NOR gate **(D)** OR gate

42. A Zener diode has a contact potential of 1 *V* in the absence of biasing. It undergoes Zener breakdown for an electric field of 10^6 *V/m* at the depletion region of p-n junction. If the width of the depletion given is $2.5\mu m$, what should be the reverse biased potential for the Zener breakdown to occur?

(A) 3.5 *V* **(B)** 2.5 *V* **(C)** 1.5 *V* **(D)** 0.5 *V*

43. A *Si* and a *Ge* diode has identical physical dimensions. The band gap in *Si* is larger than that in *Ge*. An identical reverse bias is applied across the diodes.

(A) The reverse current in *Ge* is larger than that in *Si*
(B) The reverse current in *Si* is larger than that in *Ge*
(C) The reverse current is identical in the two diodes
(D) The relative magnitude of the reverse currents cannot be determined from the given data only

44. The number of electrons or holes in a pure semiconductor at a temperature *TK* is given by :

(A) $AT^{3/2}e^{-E_g/2KT}$ **(B)** $AT^{3/2}e^{-E_g/KT}$ **(C)** $AT^{3/2}e^{-\frac{-E_g}{KT}}$ **(D)** $AT^{3/2}e^{-\frac{E_g}{3KT}}$

45. The number of NAND gates required to form an AND gate is :

(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

JEE Main (Archive)

1. The difference in the variation of resistance with temperature in a metal and a semiconductor arises essentially due to the difference in the : **[2003]**

(A) crystal structure
(B) variation of the number of charge carries with temperature
(C) type of bonding
(D) variation for scattering mechanism with temperature

2. In the middle of depletion layer of a reverse-biased p-n junction, the: **[2003]**

(A) electric field is zero **(B)** potential is maximum
(C) electric field is maximum **(D)** potential is zero

3. When npn transistor is used as amplifier : **[2004]**

(A) electrons move from base to collector **(B)** holes move from emitter to base
(C) electrons move from collector to base **(D)** electrons move from base to emitter

4. For a transistor amplifier in common emitter configuration having load impedance of $1\,\text{k}\Omega$ $(h_{fe} = 50$ and $h_{ce} = 25)$ the current gain is: **[2004]**

(A) -5.2 **(B)** -15.7 **(C)** -24.8 **(D)** -48.78

5. A piece of copper and another of germanium are cooled from room temperature to 77 K, the resistance of: **[2004]**

(A) each of them increases
(B) each of them decreases
(C) copper decreases and germanium increases
(D) copper increased and germanium decreases

6. The manifestation of band structure in solids is due to: **[2004]**

(A) Heisenberg's uncertainty principle **(B)** Pauli's exclusion principle
(C) Bohr's correspondence principle **(D)** Boltzmann's law

7. When p-n junction diode is forward biased: **[2004]**

(A) the depletion region is reduced and barrier height is increased
(B) the depletion region is widened and barrier height is reduced
(C) both the depletion region and barrier height reduced
(D) both the depletion region and barrier height increased

8. The thermistors are usually made of : **[2004]**

(A) metals with low temperature coefficient of resistivity
(B) metals with high temperature coefficient of resistivity
(C) metal oxides with high temperature coefficient of resistivity
(D) semiconducting materials having low temperature coefficient of resistivity

9. The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than 2480 nm is incident on it. The band gap in (eV) for the semiconductor is : **[2005]**

(A) 1.1 eV **(B)** 2.5 eV **(C)** 0.5 eV **(D)** 0.7 eV

10. In a full wave rectifier circuit operating from 50 Hz mains frequency, the fundamental frequency in the ripple would be: **[2005]**

(A) 50 Hz **(B)** 25 Hz **(C)** 100 Hz **(D)** 70.7 Hz

11. In a common base amplifier, the phase difference between the input signal voltage and output voltage is:

(A) $\frac{\pi}{4}$ **(B)** π **(C)** 0 **(D)** $\frac{\pi}{2}$ **[2005]**

12. A solid which is transparent to visible light and whose conductivity increases with temperature is formed by : **[2006]**

(A) Metallic binding **(B)** Ionic binding

(C) Covalent binding **(D)** Van der Waals binding

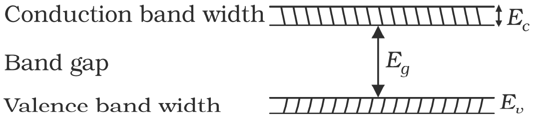
13. If the ratio of the concentration of electrons that of holes in a semiconductor is 7/5 and the ratio of currents is 7/4 then what is the ratio of their drift velocities? **[2006]**

(A) $\frac{4}{7}$ **(B)** $\frac{5}{8}$ **(C)** $\frac{4}{5}$ **(D)** $\frac{5}{4}$

14. In a common base mode of a transistor, the collector current is 5.488 mA for an emitter current of 5.60 mA. The value of the base current amplification factor (β) will be: **[2006]**

(A) 48 **(B)** 49 **(C)** 50 **(D)** 51

15. If the lattice constant of this semiconductor is decreased, then which of the following is correct? **[2006]**

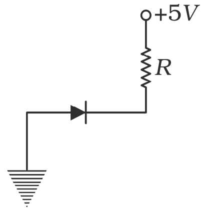


(A) All E_c, E_g, E_v decrease **(B)** All E_c, E_g, E_v increase

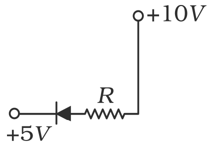
(C) E_c, and E_v increase but E_g decreases **(D)** E_c, and E_v, decrease E_g increases

16. In the following, which one of the diodes is reverse biased ? **[2006]**

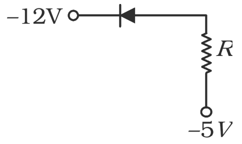
(A)



(B)



(C)



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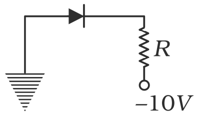
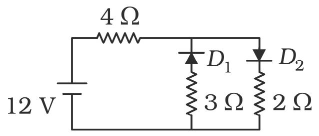


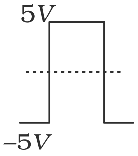
17. The circuit has two oppositely connected ideal diodes in parallel. What is the current following in the circuit ? **[2006]**

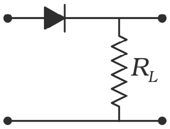


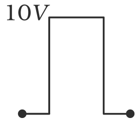
(A) 1.33 A **(B)** 1.71 A **(C)** 2.00 A **(D)** 2.31 A

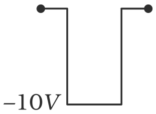
18. If in a p-n junction diode, a square input signal of 10 V is applied as shown **[2007]**

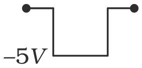
Then the output signal across R_L will be

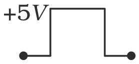




(A) 

(B) 

(C) 

(D) 

19. Carbon, silicon and germanium have four valence electrons each. At room temperature which one of the following statements is most appropriate? **[2007]**

(A) The number of free conduction electrons is significant in C but small in Si and Ge.

(B) The number of free conduction electrons is negligible small in all the three.

(C) The number of free electrons for conduction is significant in all the three.

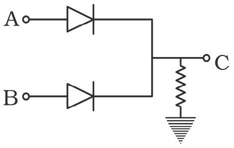
(D) The number of free electrons for conduction is significant only in Si and Ge but small in C.

20. A working transistor with its three legs marked P, Q and R is tested using a multimeter. No conduction is found between P and Q. By connecting the common (negative) terminal of the multimeter to R and the other (positive) terminal to P or Q, some resistance is seen on the multimeter. Which of the following is true for the transistor? **[2008]**

(A) It is an npn transistor with R as base **(B)** It is a pnp transistor with R as collector

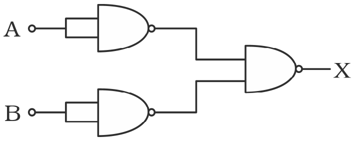
(C) It is a pnp transistor with R as emitter **(D)** It is an npn transistor with R as collector

21. In the circuit below, A and B represent two inputs and C represents the output. The circuit represents :



(A) NOR gate **(B)** AND gate **(C)** NAND gate **(D)** OR gate **[2008]**

22. The combination of gates shown below yields : **[2010]**

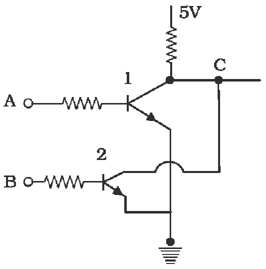


(A) OR gate **(B)** NOT gate **(C)** XOR gate **(D)** NAND gate

23. The output of an OR gate is connected to both the inputs of a NAND gate. The combination will serve as a: **[2012]**

(A) AND gate **(B)** OR gate **(C)** NOT gate **(D)** NOR gate

24. Consider two npn transistors as shown in figure. If 0 volts corresponds to false and 5 volts correspond to true then the output at C correspond to true then the output at C corresponds to: **[2013]**

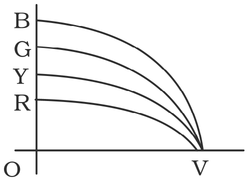


(A) A NAND B **(B)** A OR B

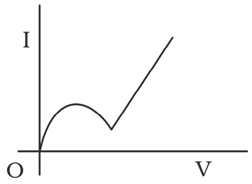
(C) A and B **(D)** A NOR B

25. The I – V characteristic of an LED is: **[2013]**

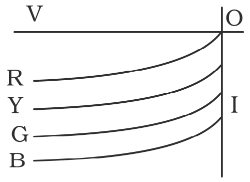
(A)



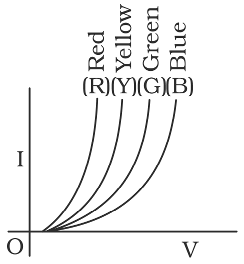
(B)



(C)



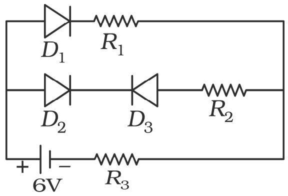
(D)



26. A diode detector is used to detect an amplitude modulated wave of 60% modulation by using a condenser of capacity 250 pico farad in parallel with a load resistance 100 kilo ohm. Find the maximum modulated frequency which could be detected by it. **[2013]**

(A) 10.62 kHz **(B)** 5.31 MHz **(C)** 5.31 kHz **(D)** 10.62 MHz

27. Figure shows a circuit in which three identical diode are used. Each diode has forward resistance of $20\ \Omega$ and infinite backward resistance. Resistors $R_1 = R_2 = R_3 = 50\ \Omega$. Battery voltage is 6 V. The current through R_3 is : **[2013]**

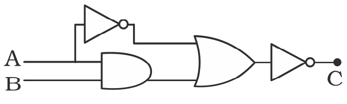


(A) 50 mA **(B)** 100 mA **(C)** 60 mA **(D)** 25 mA

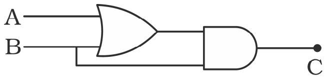
28. Which of the following circuits correctly represents the following truth table ? **[2013]**

A	B	C
0	0	0
0	1	0
1	0	1
1	1	0

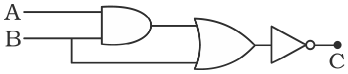
(A)



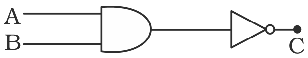
(B)



(C)



(D)



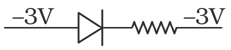
29. The forward biased diode connection is: **[2014]**

(A)

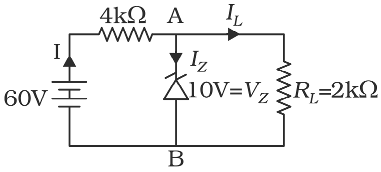
(B)

(C)

(D)



30. A Zener diode is connected to a battery and a load as shown below. The currents I, I_Z and I_L are respectively: **[2014]**



(A) 15 mA, 5 mA 10 mA **(B)** 15 mA, 7.5 mA, 7.5 mA

(C) 12.5 mA, 7.5 mA, 5 mA **(D)** 12.5 mA, 5 mA, 7.5 mA

31. In an unbiased n-p junction electrons diffuse from n-region to p-region because: **[2015]**

(A) electrons travel across the junction due to potential difference

(B) electron concentration in n-region is more as compared to that in p-region

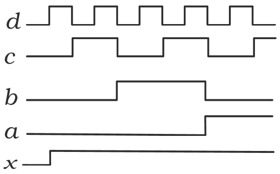
(C) holes in p-region attract them.

(D) only electrons move from n to p region and not the vice-versa

32. For a common emitter configuration, if α and β have their usual meanings, the incorrect relationship between α and β is : **[2016]**

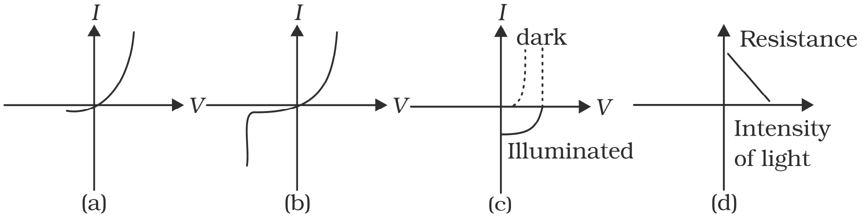
(A) $\alpha = \dfrac{\beta}{1-\beta}$ **(B)** $\alpha = \dfrac{\beta}{1+\beta}$ **(C)** $\alpha = \dfrac{\beta^2}{1+\beta^2}$ **(D)** $\dfrac{1}{\alpha} = \dfrac{1}{\beta} + 1$

33. If *a*, *b*, *c*, *d* are inputs to a gate and *x* is its output, then, as per the following time graph, the gate is : **[2016]**



(A) AND **(B)** OR **(C)** NAND **(D)** NOT

34. Identify the semiconductor devices whose characteristics are given below, in the order (1), (2), (3), (4) :



[2016]

(A) Zener diode, Simple diode, Light dependent resistance, Solar cell

(B) Solar cell, Light dependent resistance, Zener diode, Simple diode

(C) Zener diode, Solar cell, Simple diode, Light dependent resistance

(D) Simple diode, Zener diode, Solar cell, Light dependent resistance

35. For LED's to emit light in visible region of electromagnetic light, it should have energy band gap in the range of **[2016]**

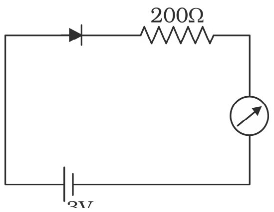
(A) 0.1 eV to 0.4 eV **(B)** 0.5 eV to 0.8 eV

(C) 0.9 eV to 0.8 eV **(D)** 1.7 eV to 3.0 eV

36. In a common emitter amplifier circuit using a n-p-n transistor, the phase difference between the input and the output voltages will be: **[2017]**

(A) 180° **(B)** 45° **(C)** 90° **(D)** 135°

37. The reading of the ammeter for a silicon diode in the given circuit is : **[2018]**



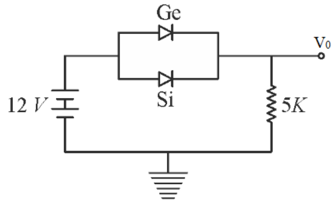
(A) 13.5 mA

(B) 0

(C) 15 mA

(D) 11.5 mA

38. Ge and Si diodes starts conducting at 0.3 V and 0.7 V respectively. In the following figure if Ge diode connection are reversed, the value of V_0 changes by : (assume that the Ge diode has large breakdown voltage) : **[2019]**



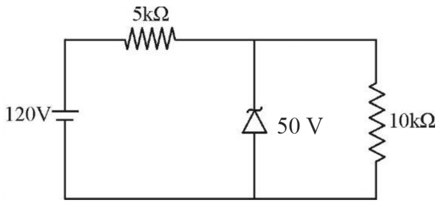
(A) 0.8 V **(B)** 0.6 V

(C) 0.4 V **(D)** 0.2 V

39. Mobility of electrons in a semiconductor is defined as the ratio of their drift velocity to the applied electric field. If, for an n-type semiconductor, the density of electrons is $10^{19}\ m^{-3}$ and their mobility is $1.6\ m^2/(V.s)$ then the resistivity of the semiconductor (since it is an n-type semiconductor contribution of holes is ignored) is close to: **[2019]**

(A) $2\,\Omega m$ **(B)** $4\,\Omega m$ **(C)** $0.2\,\Omega m$ **(D)** $0.4\,\Omega m$

40. For the circuit shown below, the current through the Zener diode is : **[2019]**



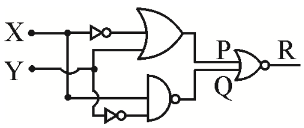
(A) 9mA

(B) Zero

(C) 5mA

(D) 14mA

41. To get output '1' at R, for the given logic gate circuit the input values must be: **[2019]**



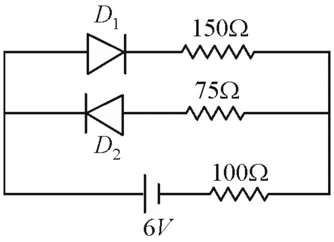
(A) X = 1, Y = 0

(B) X = 0, Y = 0

(C) X = 0, Y = 1

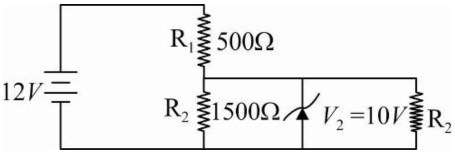
(D) X = 1, Y = 1

42. The circuit shown below contains two ideal diodes, each with a forward resistance of 50Ω. If the battery voltage is $6V$, the current through the 100Ω resistance (in Amperes) is: **[2019]**



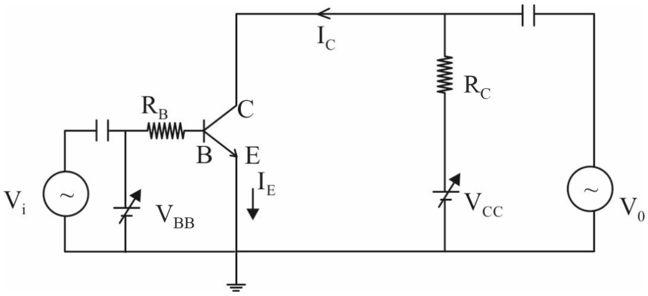
(A) 0.036 **(B)** 0.030 **(C)** 0.027 **(D)** 0.020

43. In the given circuit the current through Zener Diode is close to: **[2019]**



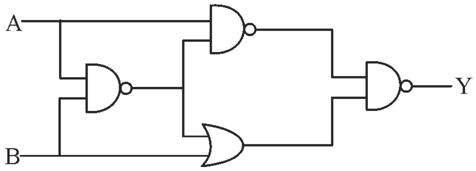
(A) $4.0 mA$ **(B)** $6.7 mA$ **(C)** $0.0 mA$ **(D)** $6.0 mA$

44. In the figure, given that V_{BB} supply can vary from 0 to 5.0 V, $V_{CC} = 5V$, $\beta_{dc} = 200$, $R_B = 100\,k\Omega$, $R_C = 1k\Omega$ and $V_{BE} = 1.0V$, The minimum base current and the input voltage at which the transistor will go to saturation, will be, respectively: **[2019]**



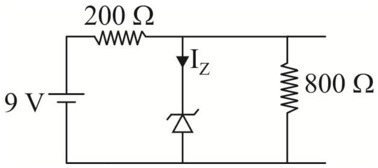
(A) $25\mu A$ and $2.8V$ **(B)** $20\mu A$ and $2.8V$ **(C)** $25\mu A$ and $3.5V$ **(D)** $20\mu A$ and $3.5V$

45. The output of the given logic circuit is: **[2019]**



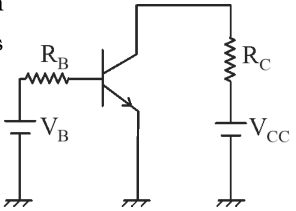
(A) $\bar{A}B$ **(B)** $A\bar{B}+\bar{A}B$ **(C)** $AB+\overline{AB}$ **(D)** $A\bar{B}$

46. The reverse breakdown voltage of a Zener diode is 5.6 V in the given circuit. The current I_Z through the Zener is : **[2019]**



(A) 17 mA **(B)** 7 mA
(C) 15 mA **(D)** 10 mA

47. A common emitter amplifier circuit, built using an npn transistor, is shown in the figure. Its dc current gain is 250, $R_C = 1k\Omega$ and $V_{CC} = 10V$. What is the minimum base current for V_{CE} to reach saturation? **[2019]**

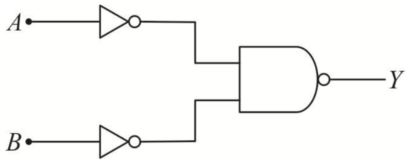


(A) 40 μA **(B)** 7 μA
(C) 100 μA **(D)** 10 μA

48. An NPN transistor is used in common emitter configuration as an amplifier with $1\,k\Omega$ load resistance. Signal voltage of 10 mV is applied across the base-emitter. This produces a 3 mA change in the collector current and $15\,\mu A$ change in the base current of the amplifier. The input resistance and voltage gain are:

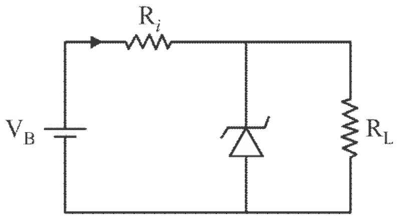
(A) $0.67\,k\Omega$, 200 **(B)** $0.33\,k\Omega$, 300 **(C)** $0.67\,k\Omega$, 300 **(D)** $0.33\,k\Omega$, 1.5 **[2019]**

49. The logic gate equivalent to the given logic circuit is: **[2019]**



(A) NAND **(B)** AND **(C)** NOR **(D)** OR

50. The figure represents a voltage regulator circuit using a Zener diode. The breakdown voltage of the Zener diode is 6 V and the load resistance is, $R_L = 4\ k\Omega$. The series resistance of the circuit is $R_i = 1\ k\Omega$. If the battery voltage V_B varies from 8 V to 16 V, what are the minimum and maximum values of the current through Zener diode? **[2019]**



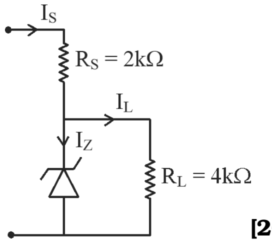
(A) 1 mA; 8.5 mA **(B)** 0.5 mA; 8.5 mA

(C) 1.5 mA; 8.5 mA **(D)** 0.5 mA; 6 mA

51. An npn transistor operates as a common emitter amplifier, with a power gain of 60 *dB*. The intput circuit resistance is 100Ω and the output load resistance is $10\,k\Omega$. The common emitter current gain β is:

(A) 10^4 **(B)** 60 **(C)** 10^2 **(D)** 6×10^2 **[2019]**

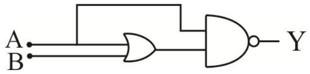
52. Figure shows a *DC* voltage regulator circuit, with a Zener diode of breakdown voltage = 6*V*. If the unregulated input voltage varies between 10 *V* to 16 *V*, then what is the maximum Zener current? **[2019]**



(A) 7.5 mA **(B)** 2.5 mA

(C) 1.5 mA **(D)** 3.5 mA

53. The truth table for the circuit given in the fig. is: **[2019]**



(A)

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	1

(B)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

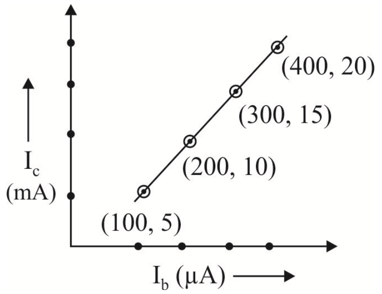
(C)

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	0

(D)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	1

54. The transfer characteristic curve of a transistor, having input and output resistance 100Ω *and* $100\ k\Omega$ respectively, is shown in the figure. The Voltage and Power gain, are respectively: **[2019]**



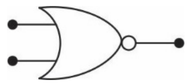
(A) $2.5 \times 10^4, 2.5 \times 10^6$

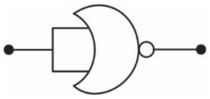
(B) $5 \times 10^4, 2.5 \times 10^6$

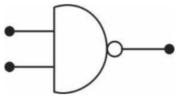
(C) $5 \times 10^4, 5 \times 10^5$

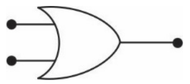
(D) $5 \times 10^4, 5 \times 10^6$

55. Which of the following gives a reversible operation? **[2020]**

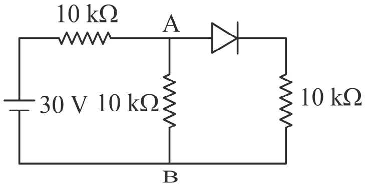
(A) 

(B) 

(C) 

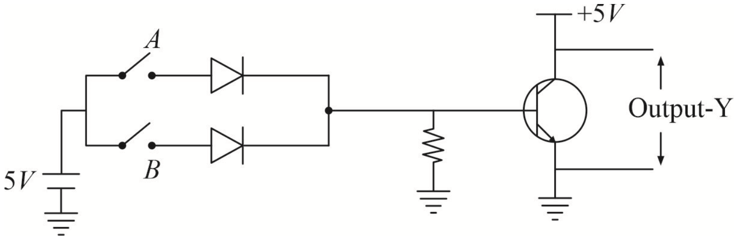
(D) 

56. In the figure, potential difference between A and B is: **[2020]**



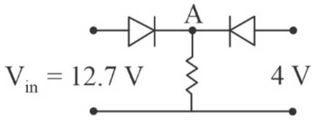
(A) 5 V **(B)** 15 V **(C)** 10 V **(D)** zero

57. Boolean relation at the output stage-Y for the following circuit is : **[2020]**

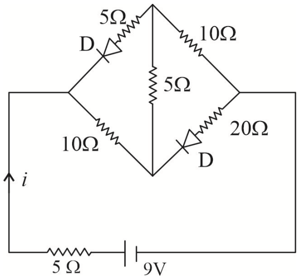


(A) $\bar{A}+\bar{B}$ **(B)** $\bar{A}\cdot\bar{B}$ **(C)** $A\cdot B$ **(C)** $A+B$

58. Both the diodes used in the circuit shown are assumed to be ideal and have negligible resistance when these are forward biased. Built in potential in each diode is 0.7 V. For the input voltages shown in the figure, the voltage (n Volts) at point A is ______. **[2020]**

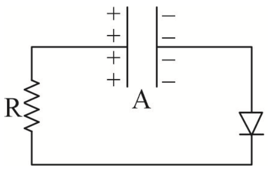


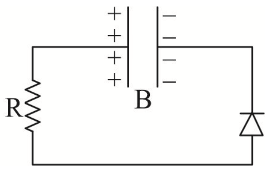
59. The current i in the network is : **[2020]**



(A) $0.3A$ **(B)** $0.6A$ **(C)** $0A$ **(D)** $0.2A$

60. Two identical capacitors A and B, charged to the same potential $5V$ are connected in two different circuits as shown below at time $t = 0$. If the charge on capacitors A and B at time $t = CR$ is Q_A and Q_B espectively, then (Here e is the base of natural logarithm) **[2020**





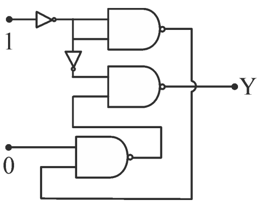
(A) $Q_A = VC,\ Q_B = \frac{VC}{e}$

(B) $Q_A = VC, Q_B = CV$

(C) $Q_A = \frac{VC}{e}, Q_B = \frac{CV}{2}$

(D) $Q_A = \frac{CV}{2}, Q_B = \frac{VC}{e}$

61. In the given circuit, value of Y is: **[2020]**



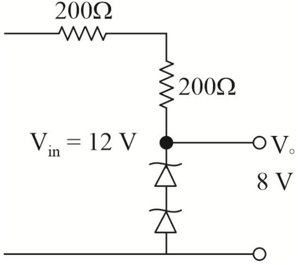
(A) Will not execute

(B) 1

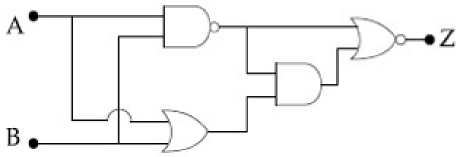
(C) 0

(D) toggles between 0 and 1

62. The circuit shown below is working as a $8V$ dc regulated voltage source. When $12V$ is used as input, the power dissipated (in mW) in each diode is; (considering both Zener diodes are identical) ______. **[2020]**



63. In the following digital circuit, what will be the output at 'Z', when the input (A, B) are $(1,0), (0,0), (1,1), (0,1)$: **[2020]**



(A) 0,0,1,0 **(B)** 1,0,1,1 **(C)** 1,1,0,1 **(D)** 0,1,0,0

64. When a diode is forward biased, it has a voltage drop of 0.5 V. The safe limit of current through the diode is 10 mA. If a battery of emf 1.5 V is used in the circuit, the value of minimum resistance to be connected in series with the diode so that the current does not exceed the safe limit is: **[2020]**

(A) 50 Ω **(B)** 100 Ω **(C)** 300 Ω **(D)** 200 Ω

65. Which of the following will NOT be observed when a multimeter (operating in resistance measuring mode) probes connected across a component, are just reversed? **[2020]**

(A) Multimeter shows NO deflection in both cases i.e. before and after reversing the probes if the chosen component is metal wire.

(B) Multimeter shows NO defection in both cases i.e. before and after reversing the probes if the chosen component is capacitor.

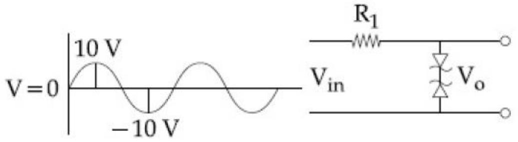
(C) Multimeter shows a deflection, accompanied by a splash of light out of connected component in one direction and NO deflection on reversing the probes if the chosen component is LED.

(D) Multimeter shows an equal deflection in both cases i.e. before and after reversing the probes if the chosen component is resistor.

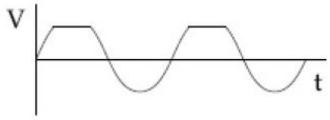
66. If a semiconductor photodiode can detect a photon with a maximum wavelength of 400 nm, then its band gap energy is: Planck's constant $h = 6.63 \times 10^{-34}\ J.s.$ Speed of light $c = 3 \times 10^{8}\ m/s$ **[2020]**

(A) 3.1 eV **(B)** 2.0 eV **(C)** 1.1 eV **(D)** 1.5 eV

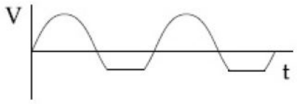
67. Take the breakdown voltage of the Zener diode used in the given circuit as 6V. For the input voltage shown in figure below, the time variation of the output voltage is : (Graphs drawn are schematic and not to scale) **[2020]**



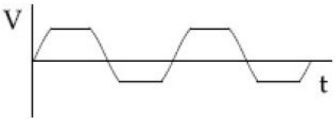
(A)



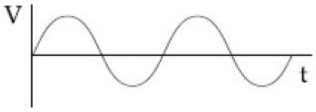
(B)



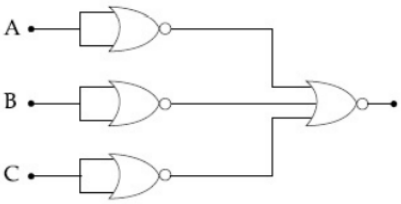
(C)



(D)

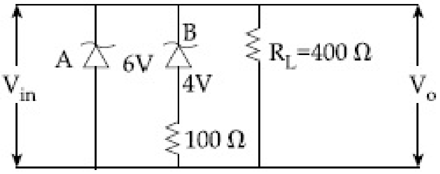


68. Identify the operation performed by the circuit given below : **[2020]**

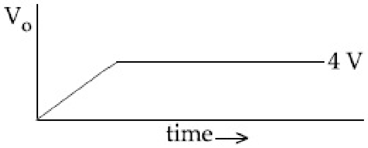


(A) OR **(B)** AND **(C)** NAND **(D)** NOT

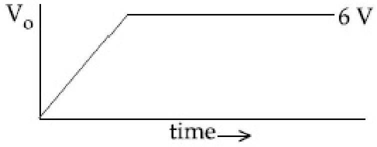
69. Two Zener diodes (A and B) having breakdown voltages of 6 V and 4 V respectively, are connected as shown in the circuit below. The output voltage V_0 variation with input voltage linearly increasing with time, is given by: (V_{input} = 0 V at t = 0) (figures are qualitative) **[2020]**



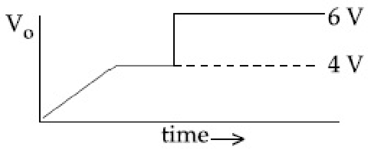
(A)



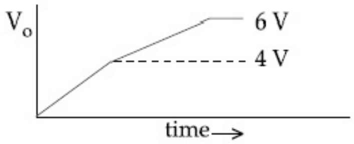
(B)



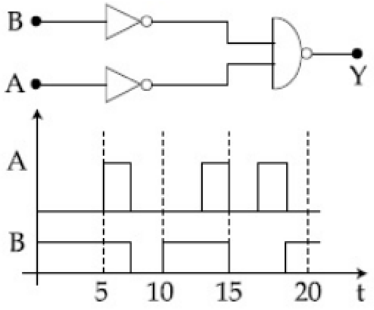
(C)



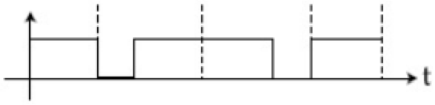
(D)



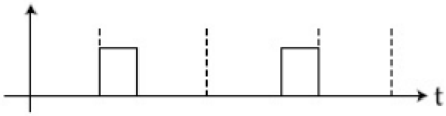
70. Identify the correct output signal Y in the given combination of gates (as shown) for the given inputs A and B. **[2020]**



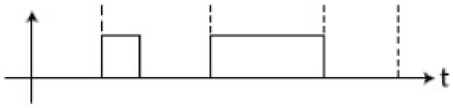
(A)



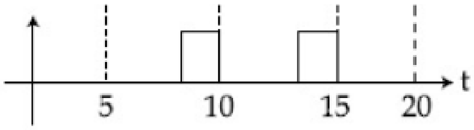
(B)



(C)



(D)



71. The output characteristics of a transistor is shown in the figure. When V_{CE} is 10V and $I_C = 4.0 mA$, then value of β_{ac} is___________. **[2020]**