Subject Name: ANALOG AND DIGITAL ELECTRONICS

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Year and Sem, Department: II/I,CSE

Unit-I: DIDOE AND APPLICATIONS

Important points / Definitions: (Minimum 15 to 20 points covering complete topics in that unit)

1. The term conductor is applied to any material that will support a generous flow of charge when a voltage source of limited magnitude is applied across its terminals.
2. An insulator is a material that offers a very low level of conductivity under pressure from an applied voltage source.
3. A semiconductor, therefore, is a material that has a conductivity level somewhere between the extremes of an insulator and a conductor
4. An increase in temperature of a semiconductor can result in a substantial increase in the number of free electrons in the material.
5. $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$
6. A semiconductor material that has been subjected to the doping process is called an extrinsic material.
7. This region of uncovered positive and negative ions is called the depletion region due to the depletion of carriers in this region.
8. The process of removing one-half the input signal to establish a dc level is aptly called half-wave rectification.
9. The dc level obtained from a sinusoidal input can be improved 100% using a process called full-wave rectification.
10. The clamping network is one that will "clamp" a signal to a different dc level. The network must have a capacitor, a diode, and a resistive element, but it can also employ an independent dc supply to introduce an additional shift
11. The clippers cicuits have the ability to "clip" off a portion of the input signal without distorting the remaining part of the alternating waveform.
12. In the reverse-bias region we have the transition- or depletion-region capacitance (C_T), while in the forward-bias region we have the diffusion (C_D) or storage capacitance.

Short Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)
Unit-I

1. Define static resistance. **(April/May – 2018)**
2. Write the effect of temperature on diode characteristics. **(April/May – 2018)**
3. List the difference between the filters. **(April/May – 2018)**
4. Define ripple factor **(Nov-2017|)**
5. Draw the diode equivalent circuit .mention the application of pn junction diode.**(March – 2017)**
6. Explain how PN junction diode acts as a rectifier. **(March – 2017)**

7. Explain the necessity of filter circuit after the rectifier circuit.(**March – 2017**)
8. What is meant by depletion.(**March – 2017**)
9. Explain the operation of pn junction biased in reverse direction.(**March – 2017**)
10. Explain the harmonic components in rectifier. (**March – 2017**)
11. Define Peak Inverse Voltage (**March – 2017**)
12. Derive ripple factor of full wave rectifier. (**March – 2017**)
13. Write short note son varactor diode (**Nov-2017**)

Long Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

Unit –I

1. Explain about the Current components in a p-n diode. (**March – 2017**)
2. Sketch the piecewise linear characteristics of a diode. What are the approximate cut in voltages for silicon and germanium? (**March – 2017**)
3. Define diffusion and transition capacitance of p-n junction diode. Prove that diffusion capacitance is proportional to current I. (**March – 2017**)
4. Explain about L section Filters. (**March – 2017**)
5. A full-wave single phase rectifier employs a pi- section filter consisting of two 4 µF capacitances and a 20 H choke.The transformer voltage to the center tap is 300 V rms.The load current is 500 mA. Calculate the dc output voltage and the ripple voltage. The resistance of the choke is 200Ω. (**March – 2017**)
6. Derive the expression for transition capacitance of a diode**. (Nov-2016)**
7. Explain static characteristics of SCR **(Nov-2017).**
8. Qualitatively explain the static V-I characteristics of UJT. Derive the expression for transition capacitance of a diode**. (Nov-2016)**
9. Explain The Working Of Semiconductor Photo Diode**.(April-2018)**
10. Explain the dsign of full wave bridge rectifier(nov-2018)

11. Explain tunnel diode operation with the help of energy band diagrams**.(Nov-2017)**

Fill in the Blanks / Choose the Best: (Minimum 10 to 15 with Answers)

Unit I: p-n Junction Diode

1. The conventional current in a PN junction diode flows: [   ]

    (a) From positive to negative   (b) From negative to positive
    (c) In the direction opposite to the electron flow.   (d) Both (a) and (c) above
2.   The cut in voltage (or knee voltage) of a silicon diode is   [   ]

    (a) 0.2V   (b) 0.6V   (c) 0.8 V   (d) 1.0V
3. When a diode is reverse biased, it is equivalent to   [   ]

    (a) An OFF switch   (b) an ON switch
    (c) A high resistance   (d) none of the above

4. The resistance of a diode is equal to   [   ]

    (a) Ohmic resistance of the P- and N- semiconductors   (b) Junction resistance
    (c) Reverse resistance   (d) Algebraic sum of (a) and (b) above
5. For a silicon diode, the value of the forward - bias voltage typically   [   ]

    (a) Must be grater than 0.3V   (b) Must be greater than 0.7V
    (c) Depends on the width of the depletion region   (d) Depends on the concentration of majority
    carriers
6. When forward biased, a diode   [   ]

    (a) Blocks current   (b) conducts current
    (c) Has a high resistance   (d) drops a large voltage.
7. A PN junction diode's dynamic conductance is directly proportional to   [   ]

    (a) The applied voltage   (b) the temperature
    (c) The current   (d) the thermal voltage
8. The forward region of a semiconductor diode characteristic curve is where diode appears as [   ]

    (a) Constant current source   (b) a capacitor
    (c) An OFF switch   (d) an ON switch
9. At room temperature of25 °C, the barrier potential for silicon is 0.7 V. lts value at 125° C is[   ]

    (a) 0.5V   (b) 0.3V   (c) 0.9V   (d) 0.7V
10. Junction breakdown of a PN junction occurs   [   ]

    (a) With forward bias   (b) with reverse bias
    (c) Because of manufacturing defect (d) None of these
11. Reverse saturation current in a silicon PN junction diode nearly doubles for every   [   ]

    (a) 2° C rise in temperature   (b) 5° C rise in temperature
    (c) 6° C rise in temperature   (d) 10° C rise in temperature
12. The approximate value of v_0 across the diode shown in Fig below is   [   ]
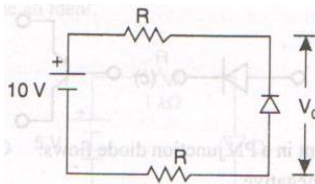
    (a) Zero   (b) 10V   (d) dependent on the value of R

13. The diode D is an ideal in the circuit shown in Fig below. The current, I will be   [   ]
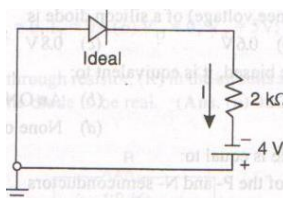
(a) - 2nA   (b) zero   (c) 2 mA   (d) 4mA

14. The transition capacitance of a diode is 1nF and it can withstand a reverse potential of 400V. A capacitance of 2nF which can withstand a reverse potential of 1 kV is obtained by connecting

(a) two 1nF diodes in series   [   ]

(b) six parallel branches with each branches comprising there 1nF diodes in series

(c) two 1nF diodes in series

(d) three parallel branches with each branch comprising 1nF diodes in series

15. A zener diode   [   ]

(a)   has a high forward-voltage rating

(b)   has a sharp breakdown at low reverse voltage

(c)   is useful as an amplifier

(d)   has a negative resistance

ANSWERS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	B	A	D	B	B	C	D	A	B	D	A	C	B	B

Special Purpose Electronic Devices

1.   A tunnel- diode is   [   ]
   (a) a very heavily-doped PN junction diode
   (b) a high resistivity PN junction diode
   (c) a slow switching device
   (d) used with reverse bias

2.   The light-emitting diode (LED)   [   ]
   (a) is usually made from silicon
   (b) uses a reverse-biased junction
   (c) gives a light output which increases with the increase in temperature

(d) depends on the recombination of holes and electrons

3. LED's do not require   [   ]

   (a) heating   (b) warm-up time

   (c) Both (a) and (b) above   (d) non of above

4. The sensitivity of a photodiode depends upon   [   ]

   (a)   light intensity and depletion region width

   (b)   depletion region width and excess carrier life time

   (c)   Excess carrier life time and forward bias current.

   (d)   Forward bias current and light intensity.

5. LEDs are commonly fabricated from gallium compounds like gallium arsenide and gallium phosphide because

   they   [   ]

   (a) Are cheap   (b) are easily available

   (c) Emit more heat   (d) emit more light.

6. A LED is basically a _____ P-N junction.   [   ]

   (a) forward-biased   (b) reverse-biased

   (c) lightly-doped   (d) heavily-doped

7. As compared to a LED display, the distinct advantage of an LCD display is that it requires   [   ]

   (a) No illumination   (b) extremely-bias

   (c) No forward-bias   (d) a solid crystal

8. Before illuminating a P-N junction photodiode, it has to be   [   ]

   (a) Reverse-biased   (b) forward-biased

   (c) Switched ON   (d) switched OFF.

9. A LED emits visible light when its _____   [   ]

   (a) P-N junction is reverse-biased   (b) depletion region widens

   (c) Holes and electrons recombine   (d) P-N junction becomes hot.

10. In LED, light is emitted because   [   ]

    (a) Recombination of charge carriers takes place

    (b) Diode gets heated up

    (c) Light falling on the diode gets amplified

    (d) Light gets reflected due to lens action.

11. GaAs, LEDs emit radiation in the   [   ]

    (a) Ultraviolet region   (b) violet - blue green range of the visible region

    (c) Visible region   (d) infra-red region

ANSWERS

1	2	3	4	5	6	7	8	9	10	11
A	D	C	A	D	A	B	A	C	A	D

Rectifiers and Filters

1. In a half - wave rectifier, the load current flows for   [   ]

    (a) Complete cycle of the input signal
    (b) Less than half-cycle of the input signal,
    (c) More than half-cycle but less than complete cycle of the input signal.
    (d) Only for the positive half-cycle of the input signal.

2. In a full-wave rectifier, the current in each of the diodes flows for   [   ]

    (a) Complete cycle of the input signal.   (b) Half cycle of the input signal.
    (c) Less than half of the input signal.   (d) None of the above.

3. The ripple factor of a bridge rectifier is   [   ]

    (a) 0.482   (b) 0.812   (c) 1.11   (d) 1.21

4. A bridge rectifier is preferable to an ordinary two-diode full-wave rectifier because   [   ]

    (a) It needs much smaller transformer for the same output.
    (b) It uses four diodes.
    (c) Its transformer does not require center-tap.
    (d) None of the above.

5. The basic purpose of a filter is to   [   ]

    (a) Minimize variations in a.c. input signal.
    (b) Suppress harmonics in rectified output.
    (c) Remove ripples from the rectified output.
    (d) Stabilize d.c. output voltage.

6. The use of a capacitor filter in a rectifier circuit gives satisfactory performance only when the load

    (a) Current is high   (b) current is low   [   ]
    (c) Voltage is high   (d) voltage is low

7. A half-wave rectifier is equivalent to a   [   ]

    (a) a clamper circuit   (b) a clipper circuit
    (c) a clamper circuit with negative bias (d) a clamper circuit with positive bias

8. Bridge rectifiers are preferred because   [   ]

    (a) they require small transformer
    (b) they have less peak-inverse voltage
    (c) they need small transformer and also have less peak-inverse voltage
    (d) They have low ripple factor.

9. If V_m is the peak value of an applied voltage in a half-wave rectifier with a large capacitor across the load, then the peak-inverse voltage will be   [   ]

(a) $\frac{V_m}{2}$ (b) V_m (c) $\sqrt{2}V_m$ (d) $2V_m$

10. A voltage of $200cos100t$ is applied to a half-wave rectifier with a load resistance of 5K. The rectifier is represent by an ideal diode in series with a resistance of 1 K. The maximum value of current, d.c. component of current and r.m.s. value of current will be respectively   [   ]

(a) 33.33 mA, 10.61 mA and 16.67mA   (b) 22.22 mA, 8.61 mA and 12.38 mA

(c) 28.33 mA, 14.61 mA and 13.33 mA   (d) 40 mA, 20 mA and 25 mA

11. The basic reason why a full-wave rectifier has a twice the efficiency of a half-wave rectifier is that

     (a) it makes use of transformer   [   ]

     (b) its ripple factor is much less

     (c) it utilizes both half-cycle of the input

     (d) its output frequency is double the line frequency.

12. The output of a half-wave rectifier is suitable only for   [   ]

(a) running car radios   (b) running a.c. motors

(c) charging batteries   (d) running tape recorders.

13. The ripple factor of a bridge rectifier is   [   ]

(a) 0.406   (b) 0.812   (c) 1.21 (d) 1.11

14. The ripple factor of a power supply is given by (symbols have the usual meaning).   [   ]

(a) $\frac{P_{dc}}{P_{ac}}$ (b) $\sqrt{\left(\frac{I_{rms}}{I_{dc}}\right)^2 - 1}$ (c) $\sqrt{\left(\frac{I_{dc}}{I_{rms}}\right)^2 - 1}$ (d) $\frac{I_{dc}}{I_{rms}}$

15. The PIV of a half-wave rectifier circuit with a shunt capacitor filter is   [   ]

(a) $2V_m$ (b) V_m (c) $\frac{V_m}{2}$ (d) $3V_m$

16. The primary function of a rectifier filter is to   [   ]

     (a) minimise a.c. input variations

     (b) suppress odd harmonics in the rectifier output

     (c) stabilise d.c, level of the output voltage

     (d) remove ripples from the rectified output

17. In a rectifier, larger the value of shunt capacitor filter   [   ]

     a.   larger the peak-to-peak value of ripple voltage

     b.   larger the peak current in the rectifying diode

     c.   longer the time that current pulse flows through the diode

     d.   Smaller the d.c. voltage across the load.

18. In a LC filter, the ripple factor   [   ]

(a) Increases with the load current   (b) increases with the load resistance

(c) Remains constant with the load current   (d) has the lowest value.

19. The main reason why a bleeder resistor is used in a d.c. power supply is that it   [   ]

   (a) Keeps the supply ON   (b) improves voltage regulation

   (c) Improves filtering action   (d) both (b) and (c).

20. Which rectifier requires four diodes?   [   ]

   (a) half-wave voltage doubler   (b) full-wave voltage doubler

   (c) full-wave bridge circuit   (d) voltage quadrupler.

21. If, by mistake, a.c source in a bridge rectifier, is connected across the d.c. terminals, it will burn out and

   hence short _____ diodes.   [   ]

   (a) one   (b) two   (c) three   (d) four

22. The d.c. output polarity from a half-wave rectifier can be reversed by reversing   [   ]

   (a) The diode   (b) transformer primary

   (c) Transformer secondary   (d) both (b) and (c).

23. In a half-wave rectifier if a resistance equal to load resistance is connected in parallel with the diode, then

   (a) Output voltage would be halved   (b) output voltage would be doubled   [   ]

   (c) Circuit will stop rectifying   (d) output voltage will remain unchanged,

24. If the input supply frequency is 50 Hz, the output ripple frequency of a bridge rectifier is _____ Hz.

   (a) 100   (b) 75   (c) 50   (d) 25.   [   ]

ANSWERS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
D	B	A	A	C	B	B	C	B	A	C	B	C	B	A	D	B	C	D	B	D	A	C	A

CLIPPERS &CLAMPERS

1. The circuit which converts sinusoidal wave form into square under some special condition is [   ]

 a) Dc restorer   b) Double ended clamper   c) Attenuator   d) Clamper

2. zener diode has ---------- temperature coefficient   [   ]

 a) some times positive and sometimes negative   b) Only NEGITIVE

 c) Both positive and negative   d) Only positive

3. the semiconductor diode current equation is given by   [   ]

a) $I=(1-e^{V/\eta Vt})$ b) $I=I_o(e^{1/\eta Vt}-1)$ c) $I=I_o(e^{V/\eta Vt}-1)$ d) $I=I_o(1-e^{1/\eta Vt})$

4. a comparator is a basic building block in a system used to analyze the -------- distribution of noise

generated in active device   [   ]

a) Both frequency and phase   b) Amplitude   c) Phase   d) Frequency

5.The breakdown occurring due to direct rupture of bonds because of existence of strong electric field is

a)avalanche breakdown   b) Zener breakdown   c) Forward breakdown   d)none[   ]

6.The circuit which converts sinusoidal wave form into square under some special condition is [   ]

  a) Dc restorer   b) Double ended clamper   c) Attenuator   d)none

7.Under steady state the output is given by, when the circuit and input are as shown in the figure[   ]

  a) $V_o = V_i .V_m$ b) $V_o = V_i + V_m$ c) $V_o = V_i - V_m$ d) $V_o = V_i / V_m$

8.the application of voltage comparartor   [   ]

a)   ohm meter b)   voltmeter c)ammeter d)   phasemeter

9.time constant or RLciruit   [   ]

  a) R/L   b)R+L   c) RL   d) L/R

10the disadvantage of shunt clipper   [   ]

  a) Round shaped edges of input waveform   b) No transmission of signal

  c) Transmits same signal   d) Doubles amplitude of input waveform

  11.the negative clamper is also called   [   ]

  a) Positive peak clamper   b) Negative peak clamper c) Positive peak clipper d) Negative peak clipper

ANSWERS:

1	2	3	4	5	6	7	8	9	10	11
D	B	C	B	B	D	C	D	D	A	A