## SOLID STATE ELECTRONIC DIGITAL ELECTRONIC SOFT CONDENCED MATTER CET 2012

- 1. The material such as conductors ,insulators and semiconductor are distinguished from one another on the basis of,
  - 1. Free electron theory of materials
  - 2. Band theory of solids
  - 3. Kinetic theory of gases
  - 4. Special theory of relativity
- 2. The energy band which are completely filled at absolute zero (0 K) are called
  - 1. Conduction bands
  - 2. Valence bands
  - 3. Forbidden bands
  - 4. Intrinsic bands
- 3. The energy band which are either partially filled or completely empty at 0 K are called
  - 1. Conduction bands
  - 2. Valence bands
  - 3. Forbidden bands
  - 4. Intrinsic bands
- 4. The width of the forbidden band is called
  - 1. Band width
  - 2. Energy Gap
  - 3. Band length
  - 4. Quantum gap
- 5. When the energy gap  $E_g$  is zero, the material is
  - 1. A conductor
  - 2. An inductor
  - 3. A semiconductor
  - 4. A dielectric
- 6. The energy gap for an insulator is of the order of
  - **1**. 1 *eV*
  - 2. 10 eV
  - 3.  $10^2 eV$
  - 4.  $10^{-2} eV$
- 7. The most widely used semiconductor in solid state technology is
  - 1. Silicon
  - 2. Germanium
  - 3. Cuprous oxide
  - 4. Copper
- 8. In insulators
  - 1. Valence band is partially filled with electrons
  - 2. The conduction band is partially filled with electrons
  - 3. The conduction band is filled with electrons and valence band is empty
  - 4. The conduction band is empty and valence band is filled with electrons

- 9. In which of the following the width of the forbidden band is small?
  - 1. Good conductors
  - 2. Semi-conductors
  - 3. Insulators
  - 4. The width of the forbidden band has nothing to do with the conductivity
- 10. Fermi energy level is
  - 1. The minimum energy of electrons at 0 K
  - 2. The maximum energy of electrons at 273 K
  - 3. The maximum energy of electrons at 0 K
  - 4. The minimum energy of electrons at 273 K
- 11. There is no holes current in good conductors, because they
  - 1. Are full of electron gas
  - 2. Have large forbidden gap
  - 3. Have no valence band
  - 4. Have overlapping valence and conduction bands
- 12. When semi-conductor is heated, its resistance
  - 1. Decreases
  - 2. Increases
  - 3. Remains the same
  - 4. May increase or decrease depending upon the semi-conductor
- 13. Holes can exist in
  - 1. Metals
  - 2. Insulators
  - 3. Semi-conductors
  - 4. Transistors
- 14. A piece of copper and germanium are cooled from room temperature to 80 K, the resistance of
  - 1. Each increases
  - 2. Each decreases
  - 3. Copper increases and germanium decreases
  - 4. Copper decreases and germanium increases
- 15. At absolute temperature, a crystal of pure germanium
  - 1. Behaves as perfect conductor
  - 2. Behaves as perfect insulator
  - 3. Contains no electron
  - 4. None of the above
- 16. With rise in temperature, the specific resistance of semi-conductor
  - 1. Increases
  - 2. Decreases
  - 3. Remains unchanged
  - 4. First decreases and then increases

- 17. In an intrinsic semi-conductor
  - 1. Only electrons are responsible for flow of current
  - 2. Both holes and electrons carry current
  - 3. Both holes and electrons carry current with electrons being majority carriers
  - 4. Only holes are responsible for flow of current
- 18. Doping materials are called impurities, because they
  - 1. Decrease the number of charge carriers
  - 2. Change the chemical properties of semi-conductors
  - 3. Make semi-conductors less than 100% pure
  - 4. Alter the crystal structure of pure semi-conductors
- 19. When Arsenic is added as an impurity to silicon, the resulting material is
  - 1. N type conductor
  - 2. N type semi-conductor
  - 3. P type conductor
  - 4. P type semi-conductor
- 20. When Boron is added as an impurity to silicon, the resulting material is
  - 5. N type conductor
  - 6. N type semi-conductor
  - 7. P type conductor
  - 8. P type semi-conductor
- 21. The level formed due to impurity atom, in the forbidden energy gap, very near to the valence band in P type semiconductor is called
  - 1. An acceptor level
  - 2. A donor level
  - 3. Conduction level
  - 4. A forbidden level
- 22. The potential barrier in the depletion layer is due to
  - 1. lons
  - 2. Holes
  - 3. Electrons
  - 4. Forbidden band
- 23. At 0 K temperature, a P type semi-conductor
  - 1. Does not have any charge carriers
  - 2. Has few holes and few free electrons
  - 3. Has few holes but no free electrons
  - 4. Has few electrons but no free holes.
- 24. The conductivity of an intrinsic semi-conductor at absolute zero is
  - 1. Infinite
  - 2. Zero
  - **3**. 10<sup>6</sup> mho
  - 4. 1 mho

- 25. In semi-conductor crystal, if current flows due to breakage of crystal bonds, then the semi-conductor is called
  - 1. Acceptor
  - 2. Donor
  - 3. Intrinsic semi-conductor
  - 4. Extrinsic semi-conductor
- 26. A semi-conductor is damaged by a strong current, because of
  - 1. Excess of electrons
  - 2. Decreases in electrons
  - 3. Lack of free electrons
  - 4. None of the above
- 27. To obtain electrons as majority charge carriers in a semi-conductor, the impurity mixed is
  - 1. Mono-valent
  - 2. Di-valent
  - 3. Tri-valent
  - 4. Penta-valent
- 28. If  $n_e$  and  $n_h$  are the numbers of electrons and holes in a semi-conductor heavily doped with phosphorus, then
  - 1.  $n_e \gg n_h$
  - 2.  $n_e \ll n_h$
  - 3.  $n_e \leq n_h$
  - 4.  $n_e = n_h$
- 29. The band diagrams of three semi-conductors are given in the following figure. From left to right, they are respectively



- 2. P intrinsic N**3**. Intrinsic -P - N
- 4. Intrinsic -N P
- 30. In a semi-conducting material the mobilities of electrons and holes are  $\mu_{en}$  and  $\mu_n$  respectively. Which of the following is true?
  - 1.  $\mu_e > \mu_n$
  - 2.  $\mu_e < \mu_n$
  - 3.  $\mu_e = \mu_n$
  - 4.  $\mu_e < 0 : \mu_n > 0$

31. Which one of the energy band diagrams in the following figure corresponds to that of a semiconductor?



32. The temperature (T) dependence on resistivity ( $\rho$ ) of a semi-conductor is represented by



- 33. The potential barrier at a P N junction is due to the charges on either side of the junction. These charges are
  - 1. Fixed donor and acceptor ions
  - 2. Minority carriers
  - 3. Majority carriers
  - 4. both minority and majority carriers
- 34. In a semi-conductor diode, the barrier potential offers opposition to only
  - 1. Majority carriers in both regions
  - 2. Minority carriers in both regions
  - 3. Free electrons in N region
  - 4. Holes in the P region
- 35. The reverse biasing in junction diode
  - 1. Decreases the potential barrier
  - 2. Increases the potential barrier
  - 3. Increases the number of minority charge carriers
  - 4. Increases the number of majority charge carriers
- 36. When P N junction diode is in forward biased condition, the flow of current is mainly due to
  - 1. The drift of electrons
  - 2. The diffusion of electrons
  - 3. Both The drift and diffusion of electrons
  - 4. None of the above

- 37. Avalanche breakdown in a semi-conductor diode occurs when
  - 1. Forward current exceeds a certain value
  - 2. Reverse bias exceeds a certain value
  - 3. Forward bias exceeds a certain value
  - 4. The potential barrier is Zero
- 38. Rectifier is used to convert
  - 1. Electrical energy into mechanical energy
  - 2. Heat energy into electrical energy
  - 3. High voltage into low voltage
  - 4. *A*. *C*. into *D*. *C*.
- 39. In half wave rectifier, the RMS value of A.C. component of the wave is
  - 1. Equal to D.C. value
  - 2. More than D.C. value
  - 3. Less than D.C. value
  - 4. Zero
- 40. Two P N junctions can be connected in series by three methods as shown in figure. If the potential difference in the junctions is the same, then the correct connection will be



- 2. In circuit (2) and (3) 2 is a circuit (1) and (3)
- 3. In circuit (1) and (3)
- 4. Only in circuit (1)
- 41. Transistors are essentially
  - 1. Power driven devices
  - 2. Current driven devices
  - 3. Voltage driven devices
  - 4. Resistance driven devices
- 42. Choose the correct statement, in case of a transistor
  - 1. The emitter-base junction is forward biased while base-collector junction is reverse biased
  - 2. Resistance of emitter-base junction is very high while that of base-collector junction is very low
  - 3. The base is made very thin and highly doped
  - 4. Both the emitter and collector are equally doped
- 43. In a transistor
  - 1. Emitter is highly doped than collector
  - 2. Collector is highly doped than emitter
  - 3. Both are equally doped
  - 4. None of the above

- 44. One way in which the operation of a NPN transistor differs than that of PNP
  - 1. The emitter junction is reverse biased in NPN
  - 2. The emitter junction injects minority carriers into the base region of the PNP
  - 3. The emitter injects holes into the base region of *PNP* and electrons into the base region of *NPN*
  - 4. The emitter injects holes into the base region of NPN
- 45. NPN transistors are preferred to PNP transistors because they have
  - 1. Low cost
  - 2. Low dissipation energy
  - 3. Capable of handling large power
  - 4. Electrons have high mobility than holes and hence high mobility energy
- 46. To use a transistor as an amplifier
  - 1. Both junctions are forward biased
  - 2. Both junctions are reverse biased
  - 3. The emitter-base junction is forward biased and the collector-base junction is reverse biased
  - 4. No biasing voltages are required
- 47. The difference in the working of an amplifier and step-up transformer is
  - 1. Amplifier increases power which is not possible with transformer
  - 2. Amplifier decreases power whereas the transformer increases power
  - 3. Amplifier keeps the power constant whereas the transformer decreases power
  - 4. Amplifier keeps the power constant whereas the transformer increases power
- 48. The power gain is highest when transistor used in
  - 1. CB configuration
  - 2. CE configuration
  - 3. CC configuration
  - 4. Equal in all cases
- 49. Which of the following configurations has the highest voltage gain?
  - 1. CB configuration
  - 2. CC configuration
  - 3. CE configuration
  - 4. None of the above
- 50. In the case of forward biasing of P N junction, which one of the figures correctly depicts the direction of the flow of carrier?



- 51. The part of the transistor which is heavily doped to produce large number of majority carriers is
  - 1. Emitter
  - 2. Base
  - 3. Collector
  - 4. Any of the above depending upon the nature of the transistor
- 52. In the half-wave rectifier circuit shown in figure which one of the following wave form is true for  $V_{cd}$ , the output across *CD*?



53. The correct curve between potential (V) and distance (d) near P - N junction is



54. The input signal of a full-wave rectifier is sinusoidal then output signal will be



- 55. An electronic oscillator is
  - 1. Just like an alternator
  - 2. An amplifier with feedback
  - 3. Nothing but an amplifier
  - 4. A converter of A. C. to D. C. energy
- 56. For sustaining oscillations in an oscillator
  - 1. Feedback factor should be unity
    - 2. Feedback factor should be negative
    - 3. Phase shift should be  $0^0$
    - 4. Both (1) and (2)
- 57. An frequency oscillator in a device which converts D.C. energy into
  - 1. D.C. of high voltage
  - 2. D. C. of low voltage
  - 3. A.C. energy
  - 4. None of the above
- 58. Which of the following statements is true?
  - 1. Like an amplifier, an oscillator needs an input signal with proper phase
  - 2. An electronic oscillator needs an active device and an A.C. source
  - 3. Oscillators are used to produce high frequency un-damped waves for radio transmission
  - 4. Feedback is used in an oscillator to initiate oscillations
- 59. A logic gate is an electronic circuit which
  - 1. Makes logic decisions
  - 2. Allows electron flow only in one direction
  - 3. Allows hole flow only in one direction
  - 4. Alternates between 0 and 1 values
- 60. The arrangement shown in figure performs the logic function of



- 1. AND gate
- 2. NAND gate
- 3. OR gate
- 4. XOR gate
- 61. Which one of the following combinations of gates represents the AND gate?







- 62. NAND gate is a combination of
  - 1. AND gate and NOT gate
  - 2. AND gate and OR gate
  - 3. NOT gate and OR gate
  - 4. NOT gate and NOT gate

- 63. NOR gate is a combination of
  - 1. OR gate and NOT gate
  - 2. OR gate and AND gate
  - 3. OR gate and OR gate
  - 4. None of the above
- 64. Digital circuits can be made by respective use of
  - 1. AND gate
  - 2. OR gate
  - 3. NOT gate
  - 4. NAND gate
- 65. the following symbol represents



- 1. NAND gate
- 2. OR gate
- 3. AND gate
- 4. NOR gate
- 66. Which of the following semi-conductor diodes is reverse biased?



67. Which of the following semi-conductor diodes is forward biased?



- 68. Two inputs of NAND gates are shorted. This gate is equivalent to
  - 1. OR gate
  - 2. AND gate
  - 3. *NOT* gate
  - 4. NOR gate
- 69. The correct symbol for Zener diode is



70. With the usual notations, the relation between current gain  $\alpha$  and  $\beta$  is

1. 
$$\beta = \frac{\alpha}{1 - \alpha}$$
  
2.  $\beta = \alpha$   
3.  $\beta = \frac{1 - \alpha}{\alpha}$   
4.  $\beta = \frac{\alpha}{1 + \alpha}$ 

- 71. Which of the following relation is true
  - 1.  $\alpha > \beta$
  - 2.  $\beta > \alpha$
  - 3.  $\alpha = \beta$
  - 4.  $\alpha = 1/\beta$
- 72. For a transistor, the value of  $\alpha = 0.9$ . The Value of  $\beta$  is
  - 1.1
  - 2. 0.09
  - 3. 0.9
  - 4.9
- 73. In the figure the potential difference between A and B is
  - 1.0V
  - 2.5V
  - 3. 10 V
  - 4. 15 V



- 1.  $5 \times 10^{-6}$  volt
- 2.  $2.5 \times 10^{-4}$  volt
- **3**. 1.25 *volt*
- 4. 125 volt

75. For transistor  $I_c = 25 \ mA$  and  $I_b = 1 \ mA$ . What is the value of  $\alpha$  ?

- 1.  $^{25}/_{26}$
- 2. <sup>26</sup>/<sub>25</sub>
- 3.  $\frac{24}{25}$
- 4.  $\frac{25}{24}$
- 76. The ration of forward biased to reversed biased resistance for P N junction diode is
  - 1.  $10^{-1}$  : 1
  - 2.  $10^{-2}$  : 1
  - **3**.  $10^{-3}$  : 1
  - 4.  $10^{-4}$  : 1
- 77. Let  $I_e$ ,  $I_c$  and  $I_b$  represent emitter, collector and base current of a transistor respectively , then 1.  $I_c > I_e$ 
  - 2.  $I_b > I_c$
  - 3.  $I_b > I_e$
  - 4.  $I_e > I_c$
- 78. In the case of constants  $\alpha$  and  $\beta$  of a transistor
  - 1.  $\alpha\beta = 1$
  - 2.  $\beta > 1, \alpha < 1$
  - 3.  $\alpha = \beta$
  - 4.  $\beta < 1, \alpha > 1$



- 79. A potential barrier of 0.05 *V* exists across a P N junction. If the depletion region is  $5 \times 10^{-7} m$  wide, the intensity of the electric field in this region is
  - 1.  $1.0 \times 10^6 V/m$
  - 2.  $1.0 \times 10^5 V/m$
  - 3. 2.0 × 10<sup>5</sup> V/m
  - 4. 2.0 × 10<sup>6</sup> V/m

80. Consider the following statements A and B and identify the correct answers.

a. A Zener diode is always connected in reverse bias.

- b. The potential barrier of a P N junction lies between 0.1 V to 0.3 V approximately.
- 1. A and B both are correct
- 2. A and B both are wrong
- 3. A is correct, but B is wrong
- 4. A is wrong, but B is correct
- 81. The peak voltage in the output of half-wave diode rectifier fed with a sinusoidal signal without filter is 10 V. The D.C. component of the output voltage is
  - 1.  $\frac{10}{\sqrt{2}} V$
  - 2.  $\frac{10}{\pi} V$
  - 3. 10 V
  - 4.  $\frac{20}{\pi} V$

## 82. If the forward voltage in a diode is increased, the width of the depletion region

- 1. Increases
- 2. Decreases
- 3. Fluctuates
- 4. No change
- 83. The voltage gain in the following amplifier (Fig 1) is
  - 1.10
  - 2.100
  - 3. 1000
  - 4. 9.9
- 84. Zener diode is used for
  - 1. Amplification
  - 2. Rectification
  - 3. Stabilization
  - 4. Producing oscillations in an oscillator
- 85. A transistor oscillator using a resonant circuit with an inductor L (of negligible resistance) and a capacitor C in series produce oscillations of frequency f. if L is doubled and C is changed to 4C, the frequency will be

1. 
$$\frac{f}{2}$$
  
2.  $\frac{f}{4}$   
3. 8f  
4.  $\frac{f}{2\sqrt{2}}$ 



## Soft Condensed Matter

- O 1) Colloidal solution : Size of dispersion particles in the range 1 to 100nm
- O 2) Emulsions are the colloidal solutions: Both dispersed phase and dispersion medium are liquids.
- O E.g. Milk, vanishing creams butter, cold creams, liver oil, grease
- **O** 3) Applications of emulsions
- O Food, cleaning action of soap, medicine, emulsion paints, cosmetics
- **O** 4) Gels are the colloidal solutions: dispersed phase and dispersion medium are liquid and solid. **Weeping or Syneresis:** The shrinking of gel by loosing water
- O E.g. Elastic gels: gelatin, agar-agar, startch, fibrin
- **O** 5) Foams are the colloidal solutions: dispersed phase and dispersion medium are gas in a liquid or solid. **Stabilizers**: Used to prevent coalescence of gas bubbles by lowering interfacial tension.
- O E.g. shaving creams, whipped cream, ice cream, egg white, beer form (Air)
- O <u>Liquid foam:</u> Fire-extinguisher, during froth floatation <u>Solid Foam</u>: Baker's bread, sponge rubber,
- O foamble polymers: Polyurethanes, polystyrene, silicones, PVC, rubber
- O Applications: <u>foam rubbers</u> are used for making pillows, mattresses, cushions, automotive pads
- O Polyurethanes are used for leather substitute
- O Light weight silicone foams for aero-plane and missiles
- O 6) A nematic liquid crystalline phase has orientational order .
- **O** 7) As the temperature increases, the pitch of a cholesteric liquid crystal increases.
- **O** 8) A liquid crystal film in the smectic A phase exhibits fan texture.
- **O** 9) A mesophase state when heated follows solid-smectic –nematic –liquid.
- **O** 10) The twisted nematic used in LCD.
- **O** 11) The lyotropic phase is sensitive to concentration and temperature.
- O 12) A liquid crystal to be useful in displays should have high dielectric anisotropy
- **O** 13) The substance added in a small amount to stabilize on emulsion is called emulsifier.
- O 14) Water in oil is emulsion
- **O** 15) The cleaning action of soaps and detergents is emulsions.
- O 16) An emulsifying agent of milk is water
- **O** 17) When elastic gel is placed in water it absorbs definite number of water molecules and volume increases. The process is called imbibition.
- **O** 18) Flame produced during the combustion of petroleum is effectively controlled by using liquid foam produced by dispersing CO<sub>2</sub> in soap solution

- 86. A mesogen is a .....
  - 1. Crystalline Solid
  - 2. Amorphous Solid
  - 3. Liquid crystal
  - 4. Metal
- 87. Lehman coined the name
  - 1. Liquid crystal
  - 2. Crystal
  - 3. Amorphous Solid
  - 4. Lyotropic liquid crystal
- 88. The liquid crystalline phase of substance is called
  - 1. Metaphase
  - 2. Mesophase
  - 3. Lithophase
  - 4. Semi-phase
- 89. A liquid crystal has
  - 1. Ability to flow
  - 2. Low viscosity
  - 3. Optical anisotropy
  - 4. All these
- 90. Thread like phase in liquid crystal is known as
  - 1. Nematic phase
  - 2. Cholestric phase
  - 3. Smectic phase
  - 4. All phases
- 91. The liquid crystals found in living system are....
  - 1. Thermotropic
  - 2. Lyotropic
  - 3. Both (1) and (2)
  - 4. Neither (1) and (2)
- 92. Liquid crystals used in a liquid crystal thermometer are.....
  - 1. Nematic
  - 2. Smectic
  - 3. Cholestric
  - 4. Lyotropic