Subject : Electronics
Paper name : Semiconductor Physics
Paper No : EL/II/EC/02(T)
Semester : 2nd Semester (CBCS)

A. Multiple choice questions [75 (15 from each unit)]

Q. No. 1 – 15 are from Unit 1
Q. No. 16 – 30 are from Unit 2
Q. No. 31 – 45 are from Unit 3
Q. No. 46 – 60 are from Unit 4
Q. No. 61 – 75 are from Unit 5

1. A semiconductor has ……
   a) Almost empty valance band
   b) Almost empty conduction band
   c) Almost full conduction band
   d) Almost full valance band

2. The electrons in the conduction bands are known as….
   a) Bound electrons
   b) Valance electrons
   c) Free electrons
   d) Band electrons

3. In insulator, the energy gap between valence and conduction band is
   a) Very large
   b) Zero
   c) Very small
   d) Less than one

4. In a semiconductor, the energy gap between valence and conduction band is about…..
   a) 50eV
   b) 100eV
   c) 1eV
   d) Zero

5. The energy gap between valence and conduction band in insulator is about…..
   a) 15eV
   b) 1.5eV
   c) Zero
   d) 0.5eV

6. The most commonly used semiconductor is
   a) Germanium
   b) Silicon
   c) Carbon
   d) Sulphur

7. The resistivity of pure germanium under standard condition is about ….
   a) $6X10^4$ Ωcm
   b) 60 Ωcm
   c) $3X10^4$ Ωcm
   d) $6X10^{-4}$ Ωcm

8. The resistivity of pure silicon is about ……
   a) 100 Ωcm
   b) 6000 Ωcm
   c) $3X10^5$ Ωcm
   d) $1.6X10^{-8}$ Ωcm

9. When a semiconductor is heated, its resistance…..
   a) goes up
   b) goes down
   c) remains the same
   d) cannot say

10. The strength of a semiconductor crystal comes from …..
    a) forces between nuclei
    b) forces between proton
    c) electron-pair bonds
    d) forces between neutron

11. When a pentavalent impurity is added to a pure semiconductor, it becomes…
    a) An insulator
    b) An intrinsic semiconductor
    c) P-type semiconductor
    d) N-type semiconductor

12. Addition of pentavalent impurity to a semiconductor creates many ….
    a) Free electron
    b) Holes
    c) Valence electrons
    d) Bound electrons

13. An N-type semiconductor is ….
    a) Positively Charged
    b) Negatively Charged
    c) Electrically neutral
    d) None-of the above

14. Addition of trivalent impurity to a semiconductor creates many
    a) holes
    b) Free electrons
    c) Valence electrons
    d) Bound electrons

15. A hole in a semiconductor is defined as ….
    a) A free electron
    b) the incompetent part of an electron pair bond
    c) a free proton
    d) a free neutron

16. The impurity level in an extrinsic semiconductor is about …. of pure semiconductor.
    a) 10 atoms for 10^8 atoms
    b) 1 atom for 10^8 atoms
    c) 1 atom for 10^4 atoms
    d) 1 atom for 100 atoms

17. A forward biased pn junction has a resistance of the
    a) Order of Ω
    b) Order of KΩ
    c) Order of MΩ
    d) Order of GΩ

18. The battery connection required to a forward biased *pn*-junction are …
    a) +ve terminal to *p* and -ve terminal to *n*
    b) -ve terminal to *p* and +ve terminal to *n*
    c) -ve terminal to *p* and -ve terminal to *n*
    d) +ve terminal to *p* and +ve terminal to *n*

19. In the depletion region of a *pn* junction, there is a shortage of….
    a) Acceptor ions
    b) Holes and electrons
    c) Donor electrons
    d) Fermi-level

20. A reverse biased *pn*-junction has…
    a) Very narrow depletion region
    b) Almost no current
    c) Very low resistance
    d) Large current flow

21. A reverse bias pn-junction has resistance of the
    a) Order of Ω
    b) Order of KΩ
    c) Order of MΩ
    d) Infinity

22. With forward biased to a *pn*-juction, the width of depletion layer….
    a) Decreases
    b) Increases
    c) Remains the same
    d) Constant
23. The leakage current in a pn junction is of the order of..
    a) A
    b) mA
    c) kA
    d) μA

24. In an intrinsic semiconductor, the number of free electrons…
    a) Equal the number of holes
    b) Is greater than the number of holes
    c) Is less than the number of holes
    d) Is twice the number of holes

25. At room temperature, an intrinsic semiconductor has…
    a) Many holes
    b) A few free electrons and holes
    c) Many free electrons only
    d) No holes or free electrons

26. At absolute temperature, an intrinsic semiconductor has…
    a) Many holes
    b) A few electrons and holes
    c) Many free electrons only
    d) No holes or free electrons

27. At room temperature, an intrinsic silicon crystal act approximately as…
    a) A battery
    b) A conductor
    c) An insulator
    d) A piece of copper wire

28. When germanium crystal is doped with phosphorous atoms, it becomes
    a) N-type semiconductor
    b) P-type semiconductor
    c) Photo-transistor
    d) An insulator

29. Conduction electrons have more mobility than holes because they
    a) lighter
    b) experience collision less frequently
    c) have negative charge
    d) Need less energy to move then

30. Theoretical maximum efficiency of full wave Centre-tap transformer rectifier is
    a) 81.57%
    b) 40.8%
    c) 40.6%
    d) 81.2%

31. A tunnel diode is always biased
    a) By DC source
    b) In the middle of resistance region
    c) In the positive-resistance region nearest zero
    d) In the reverse direction

32. A PIN diode is frequently used as
    a) Peak clipper
    b) Voltage regulator
    c) Harmonic generator
    d) Switching diode for frequency up to GHz range

33. A crystal diode is used as
    a) An amplifier
    b) A rectifier
    c) An oscillator
    d) A voltage regulator

34. The ratio of reverse resistance and forward resistance of a germanium crystal diode is about…
    a) 1:1
    b) 100:1
    c) 1000:1
    d) 40000:1

35. If the doping level of a crystal diode is increased, the breakdown voltage..
    a) Remains the same
    b) Is increased
    c) Is decreased
    d) None of the above

36. A zener diode is used as..
    a) An amplifier
    b) A voltage regulator
    c) A rectifier
    d) A multivibrator

37. The ripple factor of a half rectifier is ..
    a) 2
    b) 1.21
    c) 2.5
    d) 0.48

38. The *PIV rating* of each diode in a bridge rectifier is …. that of the equivalent Centre-tap rectifier
    a) One half
    b) The same as
    c) Twice
    d) Four times

39. A 10V power supply would use….. as filter capacitor
    a) Paper capacitor
    b) Mica capacitor
    c) Electrolyte capacitor
    d) Air capacitor

40. The ….. filter circuit result in the best voltage regulation.
    a) Choke input
    b) Capacitor input
    c) Resistance input
    d) Inductor input

41. A half-wave rectifier has an input voltage of 240V r.m.s . If the step down transformer has a turns ratio of 8:1, what is the peak load voltage ? Ignore diode drop.
    a) 27.5V
    b) 86.5V
    c) 30V
    d) 42.5V

42. Zener diode are used primarily as…
    a) Amplifier
    b) Voltage regulator
    c) Rectifier
    d) Oscillator

43. A pn-junction that radiates energy as light instead of heat is called a…
    a) LED
    b) Photo-dode
    c) Photo-cell
    d) Zener diode

44. To display the digit 8 in seven-segment indicator
    a) C must be lighted
    b) G must be lighted
    c) F must be lighted
    d) All must be lighted

45. The device associated with voltage controlled capacitance is
    a) LED
    b) Photo-diode
    c) Varactor diode
    d) Zener diode

46. In a transistor,
    a) $I_C = I_E + I_B$
    b) $I_B = I_C + I_E$
    c) $I_E = I_C - I_B$
    d) $I_E = I_C + I_B$

47. The relation between β and α is

a) $\beta = \frac{1}{1-\alpha}$

b) $\beta = \frac{1-\alpha}{\alpha}$

c) $\beta = \frac{\alpha}{1-\alpha}$

d) $\beta = \frac{\alpha}{1+\alpha}$

48. Thermal runaway occurs when.....
a) collector is reverse biased
b) transistor is not biased
c) emitter is forward biased
d) junction capacitance is high

49. In an NPN transistor, the emitter to collector carrier is
a) electrons
b) electrically neutral
c) holes
d) both electron and holes.

50. In most transistor, which region is physically largest
a) emitter
b) collector
c) base
d) emitter and collector

51. The current amplification factor alpha dc (α_{dc}) is given by
a) I_C/I_E
b) I_C/I_B
c) I_B/I_E
d) I_B/I_C

52. The collector of a transistor is ……. doped
a) heavily
b) moderately
c) Lightly
d) most heavily

53. In a transistor, the base current is about …….. of emitter current
    a) 25%
    b) 20%
    c) 35 %
    d) 5%

54. In a transistor i_C = 20 mA and i_B = 0.1 mA. The β of the transistor is
    a) 150
    b) 100
    c) 200
    d) 50

55. The number of depletion layers in a transistor is ……
    a) four
    b) three
    c) one
    d) two

56. I_{CEO} = (…….)I_{CBO}
    a) β
    b) $1 + \alpha$
    c) $1 + \beta$
    d) $1 - \beta$

57. The arrow in the symbol of a transistor indicates the direction of …….
    a) electron current in the emitter
    b) electron current in the collector
    c) hole current in the emitter
    d) donor ion current

58. In a transistor, collector current is controlled by ……..
    a) collector voltage
    b) base current
    c) collector resistance
    d) emitter current

59. The leakage current in a semiconductor diode is due to..
    a) minority carrier
    b) majority carrier
    c) junction capacitance
    d) junction breakdown

60. A transistor has …….
    a) one pn junction
    b) two junctions
    c) three pn junctions
    d) four pn junctions

61. In determining the load line, for $I_C = 0$, we have
    a) $V_{CE} = V_{CB}$
    b) $V_{CE} = 0$
    c) $V_{CC} = 0$
    d) $V_{CE} = V_{CC}$

62. The d.c. load line of a transistor circuit
    a) has a negative slope
    b) is a curved line
    c) gives graphic relation between I_C and I_B
    d) does not contain the Q-point

63. A transistor amplifier has high output impedance because
    a) emitter is heavily doped
    b) collector has reverse bias
    c) collector is wider than emitter or base
    d) base is lightly doped

64. In a transistor, Signal is transferred from a …….. circuit
    a) high resistance to low resistance
    b) low resistance to high resistance
    c) high resistance to high resistance
    d) low resistance to low resistance

65. Which one of the following is transistor amplifier according to frequency range of operation
    a) Wide band amplifier.
    b) Voltage amplifier
    c) Radio frequency amplifier
    d) Transformer coupled amplifier

66. The slope of load line depends only on
    a) collector current
    b) base current
    c) collector voltage
    d) load resistance

67. The intersection of *dc* load line with the base current is
    a) Saturation point
    b) Cut off point
    c) Operating point
    d) Check point

68. In a class-A amplifier, conduction extends over 360^0 because Q-point is
    a) located in load line
    b) located near saturation point
    c) centred on load line
    d) located at or near cut-off point

69. The operating point …… on the a.c. load line
    a) Also line
    b) Does not lie
    c) May or may not lie
    d) Data insufficient

70. A transistor amplifier has high output impedance because
    a) emitter is heavily doped
    b) collector has reverse bias
    c) collector is wider than emitter or base
    d) base is lightly doped

71. In a class-A amplifier, conduction extends over 360^0 because Q-point is
    a) located in load line
    b) located near saturation point
    c) centred on load line
    d) located at or near cut-off point

72. The output signal of class-B Amplifier is
    a) 180^0
    b) 360^0
    c) below 180^0
    d) between $180^0$and 360^0

73. The purpose of capacitors in a transistor amplifier is to ……
    a) Protect the transistor
    b) Cool the transistor
    c) Couple or bypass a.c. component
    d) Provide biasing

74. The slope of a.c. load line is …… that of d.c. load line
    a) The same as
    b) More than
    c) Less than
    d) Below

75. The phase difference between the output and input voltages of a CE amplifier is ……..
    a) 180^o
    b) 0^o
    c) 90^o
    d) 270^o

B. Fill up the blanks [15 (5 from each unit)]

Q. No. 1 – 5 are from Unit 1
Q. No. 6 – 10 are from Unit 2
Q. No. 11 – 15 are from Unit 3
Q. No. 16 – 20 are from Unit 3
Q. No. 21 – 25 are from Unit 3

1. When an electron jumps from higher orbit to lower orbit, it_____ energy
2. The electrons in the third orbit of an atom have_____energy than the electrons in the second orbit.
3. A semiconductor is formed by _____ Bonds.
4. A semiconductor has _____ temperature coefficient of resistance.
5. A semiconductor has generally _____ valence electrons
6. As the doping to a pure semiconductor increases, the bulk resistance of the semiconductor_____.
7. The random motion of holes and free electrons due to thermal agitation is called_____.
8. The barrier voltage at a *pn* junction for germanium is about_____.
9. When the temperature of an extrinsic semiconductor is increased, the pronounced effect is on_____.
10. The ripple factor of bridge rectifier is _____.
11. A zener diode is always connected in _____.
12. A photo-diode is normally _____ biased
13. A crystal diode is used as _____.
14. If the temperature of the crystal diode is increases, the leakage current_____.
15. The maximum efficiency of a half wave rectifier is_____.

16. The base of a transistor is …….. doped
17. $I_C = \beta I_B +$ ……
18. In a npn transistor, ……. are the minority carriers
19. A transistor is a …… operated device
20. Most of the majority carriers from the emitter pass through the base region to …….
21. The operating point is also called the …….
22. Bandwidth is the frequency range, over which the gain is equal to or greater than the _____% of maximum gain
23. It is generally desired that a transistor should have …….. input impedance
24. An ideal value of stability factor is ……..
25. In practice, the voltage gain of an amplifier is expressed in ……..

Key Answers

A. Multiple choice questions :

1. b)
2. c)
3. a)
4. c)
5. a)
6. b)
7. d)
8. c)
9. d)
10. a)
11. b)
12. c)
13. b)
14. a)
15. b)
16. b)
17. a)
18. a)
19. b)
20. b)
21. c)
22. a)
23. d)

24. a)
25. d)
26. c)
27. a)
28. d)
29. d)
30. d)
31. a)
32. d)
33. b)
34. d)
35. c)
36. b)
37. b)
38. a)
39. c)
40. a)
41. d)
42. b)
43. a)
44. d)
45. c)
46. d)
47. c)
48. b)
49. a)
50. b)
51. a)
52. b)
53. d)
54. c)
55. d)
56. c)
57. c)
58. b)
59. a)
60. b)
61. d)
62. a)
63. a)

64. b)
65. a)
66. d)
67. c)
68. c
69. a)
70. a)
71. c)
72. a)
73. c)
74. b)
75. a)

B. Fill up the blanks :

1. Emits
2. More
3. Covalent
4. Negative
5. 4
6. Decrease
7. Diffusion
8. 0.3V
9. Minority Carrier
10. 0.482
11. Reverse
12. Reverse
13. A rectifier
14. Increase
15. 40.6%
16. lightly
17. I_{CEO}
18. holes
19. current
20. Collector region
21. Quiescent point
22. 70.7
23. High
24. 1
25. Db (Decibel)