Test Paper : **III**

Test Subject : **ELECTRONIC SCIENCE**

Test Subject Code : **K-3116**

Test Booklet Serial No. : _____

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Paper : **III**

Subject : **ELECTRONIC SCIENCE**

Time : 2 Hours 30 Minutes   Maximum Marks : 150

Number of Pages in this Booklet : **16**   Number of Questions in this Booklet : **75**

ELECTRONIC SCIENCE
Paper – III

Note : This paper contains **seventyfive (75)** objective type questions. **Each** question carries **two (2)** marks. **All** questions are **compulsory**.

1. An intrinsic silicon sample has 1 million free electrons at room temperature. As the temperature is increased

   (A) The number of free electrons increases but the number of holes remains same

   (B) The number of free electrons increases but the number of holes decreases

   (C) The number of free electrons and holes increase by the same amount

   (D) The number of free electrons and holes increases but not by the same amount

2. The action of JFET in its equivalent circuit can be represented by

   (A) Current Controlled Current Source

   (B) Current Controlled Voltage Source

   (C) Voltage Controlled Current Source

   (D) Voltage Controlled Voltage Source

3. In IC technology, dry oxidation as compared to wet oxidation produces

   (A) Superior quality oxide with a higher growth rate

   (B) Inferior quality oxide with a higher growth rate

   (C) Inferior quality oxide with a lower growth rate

   (D) Superior quality oxide with a lower growth rate

4. Consider an LTI system with impulse response $h(t) = e^{-t} u(t)$. An input signal $e^{-t} u(t)$ is applied to the system. The output y(t) is given by

   (A) $e^{-t} u(t)$

   (B) $te^{-t} u(t)$

   (C) u(t)

   (D) $e^{-2t} u(t)$

5. To prevent a DC return between source and load, it is necessary to use

   (A) resistor between source and load

   (B) inductor between source and load

   (C) capacitor between source and load

   (D) either A or B

6. If the poles moves away from real axis in pole-zero plot located in L.H.S. then

   (A) oscillation frequency increases

   (B) oscillation frequency decreases

   (C) oscillation frequency remains constant

   (D) system becomes unstable

7. In which period is the capacitor filter charged in a full wave rectifier ?

   (A) The time during the positive cycle

   (B) The time during which the diodes are not conducting

   (C) The time during which the diode(s) is (are) conducting

   (D) The time during both positive and negative cycle

8. An amplifier using an op-Amp with a slew rate 1v/μ s has a gain of 40 dB. If this amplifier has to faithfully amplify sinusoidal signals from DC to 20 KHz without introducing any slew rate induced distortion, then the input signal level must not exceed

   (A) 795 mv

   (B) 79.5 mv

   (C) 395 mv

   (D) 39.5 mv

9. The _____ circuit overcomes the problem of switching caused by jitter on the inputs.

   (A) astable multivibrator

   (B) bistable multivibrator

   (C) schmitt trigger

   (D) monostable multivibrator

10. A bulb in a staircase has two switches one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by any one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles

    (A) an AND gate

    (B) an OR gate

    (C) a NAND gate

    (D) an XOR gate

11. When an 8 bit serial in/serial out shift register is used for a 20 μ s time delay, the clock frequency is

    (A) 400 kHz

    (B) 40 KHz

    (C) 500 KHz

    (D) 50 KHz

12. A non-linearity aspect is taken care in following A/D converter

    (A) Flash converter

    (B) Counter ramp type

    (C) Successive approximation type

    (D) Dual slope

13. For the 8085 assembly language program given below, the content of the accumulator after the execution of the program is

MVI A, 45H

MOV B, A

STC

CMC

RAR

XRA B

(A) 00 H   (B) 45 H

(C) 67 H   (D) E7 H

14. Number of address lines in a memory chip whose memory capacity is 4Kx8

(A) 11   (B) 12

(C) 13   (D) 14

15. An alternate function of port pin P3.4 in the 8051 is

(A) Timer 0

(B) Timer 1

(C) Interrupt 0

(D) Interrupt 1

16. The following C program segment is executed, the output will be

if (gameOver = = 0)

if (player To Move = = you)

printf ("Your Move \n")

else

printf ("My Move\n");

(A) If gameOver is 0 then my move

(B) If gameOver is 1 and player to move is you then My Move

(C) If gameOver is 0 and player To Move is you then your Move

(D) Compilation Error

17. How many times EXAM is printed if following C-code is executed ?

```
int main ( )
{
  int i ;
  for (i = − 5 ; i < 15; i + = 2 )
  {
  if (i < 10)
  continue ;
  else
  break
  print f("EXAM");
  }
}
```

(A) 2 times

(B) 0 times

(C) 8 times

(D) 10 times

18. A constructor is called whenever

(A) An object is declared

(B) An object is used

(C) A class is declared

(D) A class is used

19. A 100 Ω transmission line is to be matched to a $25\,\Omega$ antenna with a piece of transmission line. The operating frequency is 100 MHz. Calculate the length of the line required.

(A) 25 cm   (B) 50 cm

(C) 100 cm   (D) 75 cm

20. The scattering matrix of magic tree is

(A) $\dfrac{1}{\sqrt{2}} \begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & -1 & 1 \\ 1 & -1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$

(B) $\dfrac{1}{2} \begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & -1 & 1 \\ 1 & -1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$

(C) $\dfrac{1}{\sqrt{2}} \begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$

(D) $\dfrac{1}{2} \begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$

21. For a Gunn diode oscillator, the drift velocity of the electron is 10^7 cm/s and the active region length is 10×10^{-4} cm. The natural frequency of oscillation would be

(A) 10 MHz

(B) 1 MHz

(C) 10 GHz

(D) 1 GHz

22. An FM signal with deviation δ is passed through mixer. Its frequency is reduced five fold. The deviation in output of mixer is

(A) 0.2 δ

(B) δ

(C) 2 δ

(D) 5 δ

23. The bandwidth of a FSK signal with MARK frequency of 32 KHz, a SPACE frequency of 24 KHz and a bit rate of 4 kbps is

(A) 4 KHz

(B) 8 KHz

(C) 12 KHz

(D) 16 KHz

24. The Baud

(A) Is always equal to bit transfer rate

(B) Is equal to twice the bandwidth of an ideal channel

(C) Is not equal to the signaling

(D) Is equal to one-half the bandwidth of an ideal channel

25. In SCR angle of conduction can be changed by changing

(A) anode voltage

(B) anode current

(C) gate current

(D) forward current rating

26. One of the salient feature of DC motors is

(A) High starting torque

(B) Low starting torque

(C) Suitable for high speed application

(D) Not suitable for variable speed drivers

27. Fiber optic cable has a loss of 15 dB/km. The attenuation in a cable, 100 ft long is

(A) 9.3 dB

(B) 24 dB

(C) 0.457 dB

(D) 457 dB

28. Two 100 volts d.c. voltmeters having resistance of 10 kΩ and 5 kΩ respectively are connected in series to a 60 V supply. The reading of the two voltmeter will be

(A) 20 V, 40 V

(B) 40 V, 20 V

(C) 30 V, 30 V

(D) 60 V, 60 V

29. The microphone in a mobile/cellphone belongs to the category of following transducers

(A) Piezoelectric

(B) Thermoelectric

(C) Photoelectric

(D) Capacitive

30. How many roots of the given characteristic equation are/is in RHS of S-plane ?

$S^5 + 6S^4 + 3S^3 + 2S^2 + S + 1 = 0$

(A) 0

(B) 2

(C) 3

(D) 4

31. Under high electric fields, in semiconductor with increasing electric field which of the following is/are valid/ correct statement (s) ?

i) The mobility of the charge carriers decreases

ii) The mobility of the charge carriers increases

iii) The drift velocity of charge carriers saturates

iv) The drift velocity of charge carriers increases

(A) i only

(B) ii only

(C) i and iv

(D) i and iii

32. Following is/are valid for RLC resonant circuit

  i) Current is minimum/maximum at resonance

  ii) Capacitive impedance dominates at lower frequencies

  iii) Inductive impedance dominates at high frequencies

  iv) At resonance $X_L = X_C$

(A) i, ii, iii, and iv

(B) i and iii

(C) i and iv

(D) iii and iv

33. Which of the following is/are true w.r.t. transistor configuration ?

  i) Common base has lowest current gain

  ii) Common emitter has lowest input impedance

  iii) Common collector has highest current gain

  iv) Emitter follower has high input impedance

(A) i, iii and iv

(B) i, ii and iv

(C) iii and iv

(D) i and iv

34. Which of the following is/are correct w.r.t. ring counter ?

  i) Satisfies the truth table

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

  ii) Satisfies the truth table

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

  iii) Ring counter can be constructed by simply connecting output of shift register as an input of first stage

  iv) Satisfies the truth table

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

(A) i, ii, iii and iv

(B) i and ii

(C) ii and iv

(D) iii and iv

35. With reference to 16K×8 asynchronous SRAM with memory cells arranged in array of 128 rows and 128 columns

  i) There will be 8-line to 128 line row and column address decoders

  ii) There will be 7 lines to 128 line row and column address decoders

  iii) There will be 1,31,072 cells

  iv) There will be 1,14,688 cells

Which of the statement/s is/are correct ?

(A) i and iv

(B) ii and iv

(C) ii and iii

(D) iii only

36. Which of the following is/are true w.r.t. to class ?

  i) its protected section can be accessed by derived class

  ii) private members cannot be accessed by public member functions

  iii) private members are not inheritable

  iv) value can be assigned to public data members in a main program

(A) i and ii

(B) iii and iv

(C) i and iv

(D) i, iii and iv

37. Which of the following statement regarding waveguides is/are incorrect ?

  i) At waveguide can be coupled to a coaxial cable

  ii) At frequencies below the cut-off value wave progress across the waveguide after total reflections

  iii) Waveguides are usually air filled hollow conducting metallic tubes for transmitting VHF and microwaves

  iv) Waveguides can handle large power of VHF and microwaves

(A) i only

(B) i, ii and iii

(C) ii and iv

(D) ii only

38. Consider the following :

  i) Binary FSK

  ii) Non-coherant detection

  iii) Two frequencies selected are 1300 to 2100 Hz

  iv) Binary QPSK

Which of the above technique/s is/are used by MODEM ?

(A) i and ii

(B) i, ii and iii

(C) i only

(D) iii and iv

Paper III   ⑧   **K-3116**

39. Consider the following for laser diode

   i) low band gap

   ii) direct band gap

   iii) elemental semiconductor

   iv) compound semiconductor

Which of the above is/are correct ?

(A) i and iii

(B) ii and iii

(C) i, ii and iv

(D) iv only

40. Consider the following

   i) High precision

   ii) High Hysteresis

   iii) High rise time

   iv) High dead band

Which of the above is/are valid/correct characteristics of transducer ?

(A) ii, iii

(B) i only

(C) i and iv

(D) iii only

Q.No. (s) 41 to 50 :

The following items consist of two statements, one labeled the **"Assertion (A)"** and other **"Reason (R)"**. You are to examine these two statements carefully and decide if the **Assertion (A)** and the **Reason (R)** an individually true and if so, whether the Reason is a correct explanation of the Assertion. Select your answer to these items using the codes given below and mark your answer accordingly :

(A) Both (A) and (R) are true and (R) is correct explanation of (A)

(B) Both (A) and (R) are true, but (R) is not correct explanation of (A)

(C) (A) is true but (R) is false

(D) (A) is false but (R) is true

41. Assertion (A) : $\in_r$ can be determined experimentally by measuring the capacitance of a parallel plate capacitor with and without the dielectric

Reason (R) : Capacitance of a parallel plate

Capacitor $= \dfrac{\in_o \in_r A}{d}$.

42. Assertion (A) : When a square periodic wave is applied to an RC circuit, the voltage across capacitor is observed to be a triangular periodic wave.

Reason (R) : The RC circuit works as integrator and its time constant is much larger than time period of input wave.

43. Assertion (A) : Op-Amp has infinite gain.

Reason (R) : The output stage of Op-Amp provides high voltage gain.

44. Assertion (A) : Divide – 64 counter is a Mod – 64 counter and divides the input frequency by 64.

Reason (R) : A Mod – 64 counter can be obtained by cascading Mod-16 and Mod – 4 counters.

45. Assertion (A) : 8086 is having two interrupt pins.

Reason (R) : 8086 can handle 256 interrupts.

46. Assertion (A) : Integer may be a random number.

Reason (R) : rand ( ) function returns type of data depends on type of the value passed to the function.

47. Assertion (A) : TE_{10} mode is the dominant mode in a rectangular wave guide.

Reason (R) : TE_{10} mode has the lowest cut-off frequency for which the wavelength is double the broadwall dimension.

48. Assertion (A) : In a amplitude modulation systems the value of modulation index should be around 1.

Reason (R) : The power carried in the intelligence carrying side bands decreases with modulation index.

49. Assertion (A) : Typical value of thermal resistance from source to sink of an SCR is about 0.3°c/w.

Reason (R) : Heat sinks of thyristors are generally made of aluminium.

50. Assertion (A) : A semiconductor strain gauge is more accurate than a resistance strain gauge.

Reason (R) : The gauge factor of a semiconductor strain gauge is about 100 where as the gauge factor of a resistance strain gauge is only about 2.

51. Consider the following diodes

i) Si, ii) Ge iii) Ga As

Arrange these diodes in the order of their increasing reverse saturation current.

(A) i, ii, iii

(B) iii, ii, i

(C) i, iii, ii

(D) iii, i, ii

52. Arrange the following filters in the increasing order of magnitude of stop band.

i) Low pass filter with f_H = 100 Hz

ii) Notch filter with f_C = 100 Hz

iii) High pass filter with f_L = 100 Hz

(A) ii, i, iii

(B) i, ii, iii

(C) iii, i, ii

(D) iii, ii, i

53. Components in a voltage regulator IC's are

i) error amplifier

ii) current sense resistor

iii) voltage follower

Arrange them from input to output.

(A) i, ii, iii

(B) i, iii, ii

(C) ii, i, iii

(D) ii, iii, i

54. Arrange the following IC's w.r.t. number of function modules in increasing order.

   i) 7406   ii) 7490

  iii) 7411   iv) 7447

(A) iv, ii, iii, i

(B) i, iii, ii, iv

(C) i, ii, iii, iv

(D) ii, iii, iv, i

55. Arrange the following IC's in increasing order of number of modes of operation.

   i) 8253   ii) 8086

  ii) 8085   iv) 8255

(A) i, iv, ii, iii

(B) iii, ii, i, iv

(C) iii, ii, iv, i

(D) i, iv, iii, ii

56. Arrange the following operators of 'C' programming language from highest to lowest priority.

   i) ,   ii) ++

  iii) %   iv) <<

(A) iii, iv, ii, i

(B) ii, iii, iv, i

(C) iii, ii, iv, i

(D) ii, iv, iii, i

57. Consider the following antennas

   i) Dipole   ii) Parabolic

  iii) Array

Arrange them in the increasing order of directivity.

(A) i, ii, iii

(B) ii, i, iii

(C) ii, iii, i

(D) i, iii, ii

58. Arrange the following codes in increasing order of probability of occurrence.

   i) $S_0 = \{00, 110, 011\}$

   ii) $S_1 = \{1, 10, 01\}$

  iii) $S_3 = \{0, 0, 0\}$

(A) i, iii, ii

(B) i, ii, iii

(C) ii, i, iii

(D) ii, iii, i

59. Arrange the transmission window of optical fibre in the increasing order of attenuation in dB/km.

   i) 850 nm   ii) 1310 nm

  iii) 1400 nm   iv) 1550 nm

(A) iv, ii, i, iii

(B) i, ii, iii, iv

(C) iv, iii, ii, i

(D) ii, i, iii, iv

60. In a CRT arrange the following components in increasing order of their placement

   i) Filament

   ii) Horizontal plates

  iii) Focussing anode

  iv) Vertical plates

(A) i, ii, iii, iv

(B) i, iv, ii, iii

(C) ii, iii, i, iv

(D) i, iii, iv, ii

61. Match **List – I** with **List – II** and select the correct answer using codes given below from Q. **61** to Q. **70**.

List – I	List – II
a) Silicon	1) Acceptor impurity
b) Antimony	2) Atomic number 14
c) Gallium	3) Donar impurity
d) Germanium	4) Atomic number 32

Codes :

	a	b	c	d
(A)	1	3	4	2
(B)	3	2	1	4
(C)	2	3	1	4
(D)	2	3	4	1

62.

List – I	List – II
a) $Z_l = Z_i$	1) Thevenin's theorem
b) $I_{SC} \| Z_0$	2) KCL
c) Voltage source in series with impedance	3) Norton's theorem
d) $\sum I = 0$	4) Maximum power transfer theorem

Codes :

	a	b	c	d
(A)	4	3	1	2
(B)	4	3	2	1
(C)	4	1	3	2
(D)	2	3	1	4

63.

List – I	List – II
a) Astable multivibrator	1) Two stable states
b) Bistable multivibrator	2) Free running oscillator
c) Monostable multivibrator	3) One-stable state
d) Schmitt trigger	4) Square wave generator

Codes :

	a	b	c	d
(A)	1	3	2	4
(B)	2	1	3	4
(C)	2	1	4	3
(D)	4	1	2	3

64.

List – I	List – II
a) Sequential memory	1) Encoder
b) Converts decimal number to binary	2) Multiplexer
c) Data selector	3) Demultiplexer
d) Routes single input to many	4) Shift register

Codes :

	a	b	c	d
(A)	4	3	1	2
(B)	4	2	1	3
(C)	4	2	3	1
(D)	4	1	2	3

65.

List – I	List – II
a) CMA	1) Level and edge sensitive
b) $\overline{BHE}$	2) Implicit
c) TRAP	3) Co-processor
d) MX/MN	4) Odd memory bank

Codes :

	a	b	c	d
(A)	2	1	4	3
(B)	1	3	2	4
(C)	2	4	1	3
(D)	3	4	1	2

66.

List – I	List – II
a) malloc ( )	1) no argument
b) calloc ( )	2) single arguments
c) getch ( )	3) array as an arguments
d) strlen ( )	4) two arguments

Codes :

	a	b	c	d
(A)	4	2	1	3
(B)	4	2	3	1
(C)	2	4	1	3
(D)	1	4	2	3

67.

List – I	List – II
a) SSB modulation	1) Wave guides
b) $\Delta . \overline{B} = 0$	2) Transmission line
c) Model dispersion	3) PLL
d) VSWR	4) Absence of magnetic monopoles

Codes :

	a	b	c	d
(A)	3	1	4	2
(B)	2	4	1	3
(C)	2	4	3	1
(D)	3	4	1	2

68.

List – I	List – II
a) Sample and Hold	1) Differential quantisation
b) Delta modulation	2) Non-uniform quantisation
c) Comparator	3) Sampling
d) Compander	4) Analog to digital conversion

Codes :

	a	b	c	d
(A)	3	1	2	4
(B)	4	1	2	3
(C)	4	2	3	1
(D)	3	1	4	2

69.

List – I	List – II
a) 3φ fully controlled bridge converter	1) $\dfrac{2\sqrt{2}}{\pi} V \cos\alpha$
b) 3φ half wave converter with continuous load current	2) $V_{dc(max)} = \dfrac{2V_m}{\pi}$
c) single phase half wave rectifier	3) $\dfrac{3\sqrt{3}V_m}{2\pi}$
d) single phase fully controlled bridge converter	4) $\dfrac{V_m}{\pi}$

Codes :

	a	b	c	d
(A)	2	3	4	1
(B)	2	3	1	4
(C)	3	2	1	4
(D)	3	2	4	1

70.

List – I	List – II
a) DVM	1) Flash converter
b) CRO	2) SAR
c) DSO	3) Broadband detector
d) Spectro photometer	4) Deflection

Codes :

	a	b	c	d
(A)	2	4	3	1
(B)	2	4	1	3
(C)	4	2	1	3
(D)	4	2	3	1

Q. 71 – 75

Read the following passage and answer the questions from **71-75**.

If all the messages of the source are equiprobable, then the minimum number of bits required to encode a message is equal to the source entropy $\log_2 (1/P)$, where P is the message probability. For an arbitrary distribution of non-equiprobable messages, the average number of binary digits per message required for encoding is *H(m)* (in bits).

The source encoding theorem says that to encode a source with entropy *H(m)*, a minimum of *H(m)* binary digits per message need to be transmitted. Therefore, the average word length of an optimum code is *H(m)*. To attain this length, we have to encode a sequence of N messages $(N \rightarrow \infty)$ at a time. If we wish to encode each message directly without using longer sequences, then, in general, the average length of the code word per message will be greater than H(m). It is preferable to encode messages directly, even if the price has to be paid in terms of increased word length. The optimum source code, referred to as the Huffman code, is arrived at by the following sequence of steps.

The messages are arranged in order of descending probability. The last two messages are added into one message with their probabilities added together. These messages are then arranged in order of descending probability. The last two messages are again added and then rearranged in order of descending probability. This is done till the number of messages is reduced to two. These two messages are assigned 0 and 1 as their first digits in the code sequence. We now go back and assign numbers 0 and 1 to the second digit for the two messages that were added in the previous step. We keep proceeding like this till the first column is reached. The code obtained is referred to as the *optimum* code or the *Huffman* code or the compact code.

71. Huffman coding technique is adopted for constructing the source code with _____ redundancy

(A) maximum

(B) constant

(C) minimum

(D) unpredictable

72. A source deliver symbols X_1, X_2, X_3 and X_4 with probabilities $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$ and $\frac{1}{8}$ rspectively. The entropy of the system is

(A) 1.75 bits per symbol

(B) 1.75 bits per second

(C) 1.75 symbols per second

(D) 1.75 symbols per bit

73. A ternary source produces alphabets A, B and C with probabilities $P_A = P_B = P_C$.

Which one of the following gives the correct values for the maximum value of the entropy of the source and the corresponding value of P and the range of P ?

(A) 1.0, 0.5, (0, 1)

(B) 3.0, 0.67, (0, 0.5)

(C) 2.0, 4.2, (0, 0.3)

(D) 1.58, 0.33, (0, 0.5)

74. To permit selection of 1 out of 16 equiprobable events, the number of bits required is

(A) 2   (B) $\log_{10} 16$

(C) 4   (D) 8

75. The entropy of a digital source is 2.7 bits/symbol. It is producing 100 symbols per second. The source is likely to be

(A) An octal source

(B) A binary source

(C) A quaternary source

(D) A hexadecimal source

ಚಿತ್ತು ಬರಹಕ್ಕಾಗಿ ಸ್ಥಳ
Space for Rough Work