SET 2013

PAPER – III

ELECTRONIC SCIENCE

Signature of the Invigilator	Question Booklet No. ....

1. OMR Sheet No.. ....

Subject Code	**14**	**ROLL No.**								

Time Allowed : 150 Minutes	**Max. Marks : 150**

No. of pages in this Booklet : **16**	No. of Questions : **75**

INSTRUCTIONS FOR CANDIDATES

1. Write your Roll No. and the OMR Sheet No. in the spaces provided on top of this page.

2. Fill in the necessary information in the spaces provided on the OMR response sheet.

3. This booklet consists of seventy five (75) compulsory questions each carrying 2 marks.

4. Examine the question booklet carefully and tally the number of pages/questions in the booklet with the information printed above. **Do not accept a damaged or open booklet**. Damaged or faulty booklet may be got replaced within the first **5** minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time given.

5. Each Question has four alternative responses marked (A), (B), (C) and (D) in the OMR sheet. You have to completely darken the circle indicating the most appropriate response against each item as in the illustration.

(A) (B) ● (D)

6. All entries in the OMR response sheet are to be recorded in the original copy only.

7. Use only Blue/Black Ball point pen.

8. Rough Work is to be done on the blank pages provided at the end of this booklet.

9. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Sheet, except in the spaces allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, you will render yourself liable to disqualification.

10. You have to return the Original OMR Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. **You are, however, allowed to carry the test booklet and the duplicate copy of OMR Sheet** on conclusion of examination.

11. Use of any calculator, mobile phone or log table etc. is strictly prohibited.
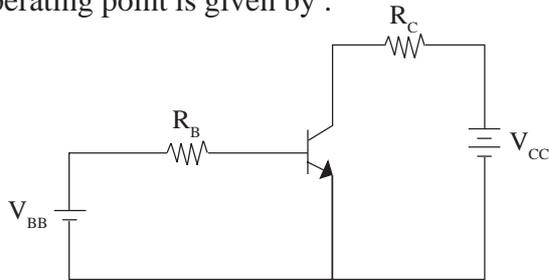
12. **There is no negative marking.** **14-13**

ELECTRONIC SCIENCE
PAPER—III

Note :— This paper contains **seventy five (75)** objective type questions of **two (2)** marks each. **All** questions are compulsory.

1. In the circuit shown, $V_{CC} = 10$ V, $V_{BB} = 2.7$ V, $R_C = 3$ K, $R_B = 100$ K, $V_{BE} = 0.7$ V, $h_{ie} = 100$. The operating point is given by :

   (A) $I_B = 0.027$ mA, $I_C = 2.7$ mA, $V_{CE} = 5.4$ V
   (B) $I_B = 0.027$ mA, $I_C = 2.7$ mA, $V_{CE} = 4.6$ V
   (C) $I_B = 0.02$ mA, $I_C = 2$ mA, $V_{CE} = 4$ V
   (D) $I_B = 0.02$ mA, $I_C = 2$ mA, $V_{CE} = 6$ V

2. The drain of an n-channel MOSFET is shorted to the gate. The threshold voltage V_T of the MOSFET is 1 Volt. If the drain current is 1 mA for $V_{GS} = 2$ V, then I_D for $V_{GS} = 4$ V is :
   (A) 2 mA
   (B) 3 mA
   (C) 4 mA
   (D) 9 mA

3. The biggest advantage of an electron beam lithography system is :
   (A) Low cost
   (B) No mask is required
   (C) Very high throughput
   (D) All of the above

4. Which among the following has the lowest doping level in a BJT ?
   (A) Emitter
   (B) Base
   (C) Collector
   (D) Source

5. A drawn wire of resistance 5 Ω is further drawn so that its diameter becomes one-fifth. Its resistance will now be (volume remaining same) :
   (A) 625 Ω
   (B) 125 Ω
   (C) 25 Ω
   (D) None of the above

6. A two-port network with short circuit admittances Y_{11}, Y_{12}, Y_{21}, Y_{22} is terminated through a resistance R at port 2. The overall Y_{21} of the network is :

   (A) $\dfrac{Y_{21}}{Y_{22} + \dfrac{1}{R}}$

   (B) $Y_{21} + \dfrac{1}{R}$

   (C) $\dfrac{\dfrac{Y_{21}}{R}}{Y_{22} + \dfrac{1}{R}}$

   (D) $\dfrac{Y_{21} + \dfrac{1}{R}}{Y_{22}}$

7. The magnitude of function $F(s) = \dfrac{s^2 - 6s + 8}{s^2 + 6s + 8}$:
   (A) increases with increase in frequency
   (B) decreases with increase in frequency
   (C) has some relation with frequency
   (D) is independent of the frequency

8. A unit impulse input to a linear network has a response R(t) and a unit step input to the same network has a response S(t). The response R(t) :

(A) equals $\dfrac{dS(t)}{dt}$

(B) equals the integral of S(t)

(C) is the reciprocal of S(t)

(D) has no relation with S(t)

9. For a given opamp, CMRR $= 10^5$ and differential gain $= 10^5$. What is the common-mode gain ?

(A) 10^{10}

(B) 2×10^5

(C) 10^5

(D) 1

10. Class-AB operation is used in power amplifiers in order to :

(A) Get maximum efficiency

(B) Remove even harmonics

(C) Overcome cross-over distortion

(D) Reduce collector dissipation

11. A triangular to square wave converter would require :

(A) A sine wave oscillator and a comparator

(B) An integrator and a comparator

(C) A differentiator and a comparator

(D) A sine wave oscillator and a clipper

12. The circuit shown in the figure :
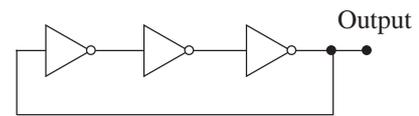
(A) Is an oscillating circuit and the output is a square wave

(B) Is one whose output remains at '1' state

(C) Is one whose output remains at '0' state

(D) Gives a single pulse of 3 times the propagation delay of a single inverter

13. The simplified form of xy + x'z + yz =

(A) xy + yz

(B) x'z + yz

(C) x + y + z

(D) xy + x'z

14. The fastest logic family is :

(A) TTL

(B) CMOS

(C) nMOS

(D) ECL

15. A square wave generator is a :

(A) Bistable multivibrator

(B) Monostable multivibrator

(C) Astable multivibrator

(D) None of these

16. For an N-bit digital input the SAR based ADC completes the conversion in :

(A) N clock cycles

(B) 1 clock cycle

(C) 2 clock cycles

(D) N/2 clock cycles

17. What is the size of Internal ROM in an 8051 microcontroller ?

(A) 8 K bytes

(B) 4 K bytes

(C) 2 K bytes

(D) 16 K bytes

18. Which instruction takes 13T states to execute ?

(A) MVI A, 98H

(B) STA Address

(C) LXI H, Address

(D) SPHL

19. What is the maximum number of instructions in a microprocessor that has an opcode of 6-bits ?

(A) 32

(B) 128

(C) 64

(D) 74

20. Find the contents of BC pair after the execution of the following instructions. Assume that SP is already initialized :

LXI H, 2500H

PCHL

PUSH H

POP B

(A) Remains the same

(B) Equal to the contents of SP

(C) Zero

(D) Equal to the contents of HL

21. Single bit indicators that may be set or cleared to show the results of logical and arithmetic operations are the :

(A) Registers

(B) Flags

(C) Monitors

(D) None of the above

22. Which of the following is the correct usage of conditional operators used in C ?

(A) a > b ? c = 30 : c = 40;

(B) a > b ? c = 30;

(C) max = a > b ? a > c ? a : c : b > c ? b : c

(D) return (a > b) ? (a : b)

23. Which of the following are unary operators in C ?

1. !   2. sizeof

3. ~   4. &&

(A) 1, 2

(B) 1, 3

(C) 2, 4

(D) 1, 2, 3

24. What would be the equivalent pointer expression for referring the array element a[i][j][k][l] ?

(A) ((((a + i) + j) + k) + l)

(B) *(*(*(*(a + i) + j) + k) + l)

(C) (((a + i) + j) + k + l)

(D) ((a + i) + j + k + l)

25. A pointer is :

(A) A keyword used to create variables

(B) A variable that stores address of an instruction

(C) A variable that stores address of other variable

(D) All of the above

26. Which of the following statements is correct ?

(A) Electromagnetic waves travel faster in conductors than in dielectrics.

(B) In a good conductor, **E** and **H** are in time phase.

(C) The Poynting vector physically denotes the power density leaving or entering a given volume in a time varying field.

(D) None of these

27. In context of transmission line, consider the following statements :

(i) All r- and x-circles pass through point $(1, 0)$ on the Smith chart.

(ii) Any impedance repeats itself every $\lambda/4$ on the Smith chart.

(iii) An s = 2 circle is the same as $|\Gamma| = 0.5$ circle on the Smith chart.

(iv) The slotted line is used to determine Z_L only.

The correct statements are :

(A) (i), (ii) and (iv)

(B) (iii) and (iv) only

(C) (ii) only

(D) (i) only

28. Two infinite sheets with a charge density ρ_s on each are located at ± 2.0 m. The field E in the region $-1 < x < 1$ is :

(A) Infinity

(B) ρ_s/ϵ_0

(C) Zero

(D) $-\rho_s/\epsilon_0$

29. Electric potential due to a charge at point situated at ∞ is :

(A) ∞

(B) $-\infty$

(C) Zero

(D) 1

30. An analog signal with a bandwidth of 4.2 MHz is to be converted into binary PCM and transmitted over a channel. The peak signal to quantization noise ratio at the receiver output must be at least 53 dB. Assuming no transmission errors and no ISI, the minimum number of quantization steps required is :

(A) 64

(B) 128

(C) 256

(D) 512

31. Consider the signal $\quad 2\pi f_c t \;\; 0 \le t < T.$

The impulse response of the matched filter for this signal is :

(A) $h(t) = \dfrac{A(t-T)}{T} \cos 2\pi f_c(t-T) \;\; 0 \le t < T$

(B) $h(t) = \dfrac{A(T-t)}{T} \cos 2\pi f_c(T-t) \;\; 0 \le t < T$

(C) $h(t) = \dfrac{A(t-T)}{T} \;\; 0 \le t < T$

(D) $h(t) = \dfrac{A(T-t)}{T} \;\; 0 \le t < T$

32. Indicate which of the following pulse modulation system is analog :

(A) Pulse-code modulation

(B) Differential PCM

(C) Pulse width modulation

(D) Delta modulation

33. The relationship $n_1 \sin(\Phi_1) = n_2 \sin(\Phi_2)$ at the interface is known as :

(A) Snell's law

(B) Skew's law

(C) Maxwell's law

(D) None of the above

34. For internal reflection :

(A) the ray should travel from rarer to denser medium

(B) the angle of incidence in the denser medium should be less than the critical angle of that medium

(C) the ray should travel from denser to rarer medium

(D) the angle of incidence in the rarer medium should be greater than the critical angle of that medium

35. A saw-tooth generator is built using a UJT with a constant-current-charged capacitor C of 1 μF driving the emitter. If the voltage V_{BB} is 15 V and capacitor charging current is 1 mA, then the period of the saw-tooth is approximately :

(A) 100 ms

(B) 10 ms

(C) 0.1 ms

(D) 0.01 ms

36. The necessity of cladding for an optical fiber is :

I. To provide proper light guidance inside the core

II. To avoid leakage of light from the fiber

III. To provide gain

Identify the correct statement(s).

(A) Only statement—I is true

(B) Only statements—I and II are true

(C) All statements are true

(D) None are true

37. The EEG is an instrument for recording the electrical activity of :

(A) Heart

(B) Muscles

(C) Brain

(D) None of these

38. Electromagnetic induction type wattmeter measures :

(A) D.c. power

(B) Active a.c. power

(C) D.c. or a.c. power

(D) Reactive a.c. power

39. For a stable type-1 system having unit input, the steady-state error is :

(A) 0

(B) 1

(C) –1

(D) ∞

40. The characteristic equation of a system is

$$s^3 - s^2 + 27s - 3 = 0,$$

the number of roots in the RHS-plane is :

(A) 1

(B) 2

(C) 3

(D) zero

Q. Nos. 41 to 50 : Assertion – Reason type questions :

The following items consist of two statements, one labelled as the 'Assertion (A)' and the other labelled as the 'Reason (R)'. You are to examine these two statements and decide if the Assertion (A) and the Reason (R) are individually true and if so, whether the Reason is a correct explanation of the Assertion. Select your answers to these items using the codes given below and mark your answer sheet accordingly.

Codes :

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

(B) Both (A) and (R) are true but (R) is *not* the correct explanation of (A).

(C) (A) is true and (R) is false.

(D) (A) is false and (R) is true.

41. Assertion (A) : Silicon is the most preferred material in integrated circuit fabrication industry.

    Reason (R) : It is easy to grow a layer of native Silicon-di-Oxide on Silicon.

42. Assertion (A) : z-matrix for a single series element, 2-port network, cannot be determined.

    Reason (R) : z-parameters are calculated under open-circuit conditions.

43. Assertion (A) : Negative feedback can be employed to desensitize the gain of an amplifier.

    Reason (R) : The gain with negative feedback is less than the gain without feedback.

44. Assertion (A) : K-map is a popular minimisation technique.

    Reason (R) : K-map can be used for a very large number of variables.

45. Assertion (A) : The stack is located in the high memory area of a micro-processor.

    Reason (R) : The stack stores interrupt service subroutine.

46. Assertion (A) : $E = -\nabla V - \dfrac{\partial A}{\partial t}$ is not adequate for time varying fields.

    Reason (R) : $\nabla . B = 0$ holds good for time varying fields.

47. Assertion (A) : Power transistors are more commonly of silicon npn type.

    Reason (R) : The fabrication of npn silicon transistors is easy.

48. Assertion (A) : When gate current is several times higher than the minimum gate current required, a thyristor is said to be hard-fired or over-driven.

    Reason (R) : Hard-firing of a thyristor increases its turn-on time and enhances its di/dt capability.

49. Assertion (A) : AC bridge methods are the best and most usual methods for the precise measurement of self and mutual inductances and capacitances.

    Reason (R) : It is generally more difficult to obtain accuracy with deflection methods.

50. Assertion (A) : Matched filter is an optimal receiver.

    Reason (R) : It maximizes output signal to noise ratio.

51. Depletion capacitance in a p-n junction diode depends upon :
    (i) Applied junction voltage
    (ii) Junction built-in potential
    (iii) Current flowing through the junction
    (iv) Doping profile across the junction
    Identify the correct statements :
    (A) (i) and (ii)
    (B) (i) and (iii)
    (C) (i), (ii) and (iv)
    (D) (ii), (iii) and (iv)

52. The transfer impedances and admittances of a network remain constant when the position of excitation and response are interchanged if the network :
    (i) is linear
    (ii) consists of bilateral elements
    (iii) has high impedance or admittance
    (iv) is resonant
    The correct statements are :
    (A) (i) and (ii)
    (B) (i), (iii) and (iv)
    (C) (ii) and (iv)
    (D) (i), (ii), (iii) and (iv)

53. The input differential stage of the IC-741 op-amp is biased at about 10 µA current. Such a low current of the input stage gives :
    (i) Low power consumption
    (ii) High differential gain
    (iii) Low differential gain
    (iv) High input impedance
    Identify the correct statements :
    (A) (i) and (iii)
    (B) (i), (iii) and (iv)
    (C) (iii) and (iv)
    (D) (i), (ii), (iii) and (iv)

54. On the basis of De Morgan's law, it can be concluded that :
    (i) The complement of the product is the sum of the complements
    (ii) The complement of the sum is the product of the complements
    The correct statements are :
    (A) Both (i) and (ii)
    (B) Neither (i) nor (ii)
    (C) Only (i)
    (D) Only (ii)

55. The **fputs** function :
    (i) writes characters to a file
    (ii) takes 2 parameters
    (iii) returns a character
    (iv) requires a file pointer
    Identify the correct statement(s) :
    (A) all are true
    (B) all are false
    (C) only (i) and (ii) are true
    (D) only (i), (ii) and (iv) are true

56. A uniform plane wave propagating in x-direction has :
    (i) Only x-components of E and H.
    (ii) No x-components of E and H.
    (iii) E and H are always perpendicular to each other.
    (iv) E and H are always parallel to each other.
    Which of the above statement(s) is/are correct ?
    (A) (i) and (iii) only
    (B) (iii) only
    (C) (ii) and (iii) only
    (D) (ii) and (iv) only

57. Consider the statements :

(i) The cathode of a CRO is usually coated with copper oxide.

(ii) In a CRO mostly we use electromagnetic deflection.

(iii) In a CRO, higher the bandwidth, higher will be anode voltage.

The correct statement(s) is/are :

(A) (i) and (ii)

(B) (ii) and (iii)

(C) (i) and (iii)

(D) (iii) only

58. Signal transmitted into a band-limited noisy channel may suffer with following effects :

(i) attenuation

(ii) interference

(iii) additive noise

(iv) amplification

The correct statement(s) is/are :

(A) (i) and (ii) only

(B) (ii), (iii) and (iv) only

(C) (i), (ii) and (iii) only

(D) All of these

59. Consider the statements :

(i) Quantization noise increases with the step size.

(ii) Quantization noise is not controllable.

(iii) Channel noise is more severe than quantization noise.

The correct statement(s) is/are :

(A) (i) and (ii) only

(B) (i) and (iii) only

(C) (ii) only

(D) (iii) only

60. Which among the following is NOT a step in IC fabrication ?

(i) Metallization

(ii) Etching

(iii) Hydration

The correct statement(s) is/are :

(A) (i) and (ii)

(B) (ii) and (iii)

(C) (i) and (iii)

(D) (iii) only

61. Match the items in List-I with the items in List-II and then select the correct answer using the codes given below the lists :

	List-I		List-II
a.	Drift Current	1.	Law of conservation
b.	Einstein's Equation	2.	Electric field
c.	Diffusion Current	3.	Thermal voltage
d.	Continuity Equation	4.	Concentration gradient

Codes :

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

62. Match the topological duals from the given lists :

	List-I		List-II
a.	loop	1.	link
b.	twig	2.	node
c.	mesh	3.	cut set
d.	B_f	4.	Q_f

Codes :

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

63. Match the items in List-I with the items in List-II and then select the correct answers using the codes given below the lists :

List-I	*List-II*
Types of feedback	*Input resistance*
a. Voltage-Series	1. Increases
b. Voltage-Shunt	2. Decreases
c. Current-Series	3. Decreases
d. Current-Shunt	4. Increases

Codes :

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

64. Match List-I with List-II :

List-I	*List-II*
a. Astable multi-vibrator	1. SR latch
b. Bistable multi-vibrator	2. Ring oscillator
c. Monostable multi-vibrator	3. Square wave generator
d. NOT gates	4. Pulse generator

Codes :

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

65. Match List-I with List-II and select the correct answer using the codes given below :

List-I	*List-II*
a. 8279	1. Programmable Peripheral Interface
b. 8237	2. Interrupt Controller
c. 8255	3. Keyboard Display Controller
d. 8259	4. DMA Controller

Codes :

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

66. In the context of C programming language, match the items in List-I with the items in List-II and then select the correct answer using the codes given below the lists :

List-I	*List-II*
Data Type	*Size*
a. Integer	1. 4 Bytes
b. Character	2. 1 Byte
c. Double	3. 2 Bytes
d. Float	4. 8 Bytes

Codes :

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

67. For an open/shorted transmission line of length l is specified in List-I and equivalent circuits are given in List-II. Match the items in List-I with the items in List-II and then select the correct answer using the codes given below the lists :

List-I	*List-II*
Transmission Line	*Equivalent circuit*
a. Open line of length $l < \lambda/4$	1. Inductor
b. Shorted line of length $l = \lambda/4$	2. Series resonant circuit
c. Shorted line of length $l = \lambda/2$	3. Capacitor
d. Open line of length $\dfrac{\lambda}{4} < \ell < \dfrac{\lambda}{2}$	4. Parallel-resonant circuit

Codes :

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

68. Match List-I with List-II :

List-I	*List-II*
(Type of instrument)	*(Application)*
a. Dynamometer type	1. AC measurement alone
b. Electrostatic	2. Voltage measurement
c. Rectifier type	3. Transfer instrument
d. Induction type measurement	4. Power and energy

Codes :

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

69. Match List-I with List-II :

List-I	*List-II*
(Type of amplifier)	*(Input Impedance)*
a. Voltage	1. High
b. Current	2. Low
c. Transconductance	3. High
d. Transresistance	4. Low

Codes :

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

70. Match List-I with List-II :

List-I	*List-II*
(Radar Bands)	*(Frequency Range)*
a. C	1. 4-8 GHz
b. Ku	2. 8-12 GHz
c. K	3. 12-18 GHz
d. X	4. 18-24 GHz

Codes :

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

Read the following text and answer Q. 71-75 :

CMOS refers to the device technology for designing and fabricating integrated circuits that employ logic using both n- and p-channel MOSFETs. CMOS is the other major technology utilized in manufacturing digital ICs aside from TTL, and is now widely used in microprocessors, memories, and digital ASICs.

The input to a CMOS circuit is generally to the gate of the input MOS transistor, which exhibits a very high resistance. This high gate resistance is due to the fact that the gate of a MOS transistor is isolated from its channel by an oxide layer, which is a dielectric. As such, the current flowing through a CMOS input is virtually zero, and the device is operated mainly by the voltage applied to the gate, which controls the conductivity of the device channel.

The low input currents required by a CMOS circuit results in lower power consumption, which is the major advantage of CMOS over TTL. In fact, power consumption in a CMOS circuit occurs only when it is switching between logic levels. This power dissipation during a switching action is known as 'dynamic power'. In a typical CMOS IC, output switching may take about a hundred picoseconds, and may occur every 10 nanoseconds or 100 millions times per second. Switching an output from one logic level to another requires the charging and discharging of various load capacitances, which dissipates power that is proportional to these capacitances and the frequency of switching.

71. CMOS stands for :
    (A) Complex Metal Oxide Semiconductor
    (B) Complementary Metal Oxide Semiconductor
    (C) Complementary Metal On Semiconductor
    (D) Complex Metal Oxide Semiconductor

72. TTL stands for :
    (A) Ternary Transistor Logic
    (B) Transistor Ternary Logic
    (C) Transistor Transistor Logic
    (D) Total Transistor Logic

73. ASIC stands for :
    (A) Application Specific Integrated Circuit
    (B) Analog Specific Integrated Circuit
    (C) Analog Semiconductor Integrated Circuit
    (D) Application Semiconductor Integrated Circuit

74. Which of the following is NOT a digital IC ?
    (A) Microprocessor
    (B) Opamp
    (C) Microcontroller
    (D) RAM

75. Which one of the following is the most appropriate reason for the very low power consumption in static CMOS digital circuits ?
    (A) Small size of the transistors
    (B) No static power dissipation
    (C) No dynamic power consumption
    (D) None of the above

ROUGH WORK

ROUGH WORK

ROUGH WORK

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