

A1 VERSION CODE	ELIGIBILITY EXAMINATION-2025 PAPER-2 Total Number of Questions : 100 Maximum Marks : 200 Subject : ELECTRONIC SCIENCE Subject Code : 31	Serial Number :							
	MENTION YOUR REGISTER NUMBER								
								Paper Code	ELS21125B

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2. This question booklet contains **100** questions and each question will have one statement and four different options / responses & out of which you have to choose one correct answer.
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①	●	③	④	①	②	③	④	①	②	③	④	①	②	③	④

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8. After separating the top sheet (Office copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you.
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DO NOT WRITE HERE

1. Which MOSFET is/are normally ON?
 - (1) Enhancement P-MOSFET
 - (2) Depletion MOSFET
 - (3) Enhancement N-MOSFET
 - (4) Enhancement P and N-MOSFET

2. If N-MOS conducts and has large voltage between source and drain, then it is said to be in

(1) Linear region	(2) Saturation region
(3) Non-saturation region	(4) Cut-off region

3. Write the intrinsic semiconductors in terms of decreasing order of band gaps

(1) GaP, GaAs, Si, Ge	(2) GaAs, GaP, Si, Ge
(3) GaAs, Si, GaP, Ge	(4) GaP, GaAs, Ge, Si

4. When the temperature of either P-type or N-type semiconductor increases, the movement of the position of the fermi energy level is
 - (1) Towards up of energy gap
 - (2) Towards centre of energy gap
 - (3) Towards down of energy gap
 - (4) Temperature does not have any effect

5. Examine carefully Assertion (A) and Reason (R) and choose the correct answer.
 Assertion (A) : High Electron Mobility Transistor (HEMT) is a type of FET.
 Reason (R) : HEMT contains source, drain, body and gate terminals.
 - (1) Both (A) & (R) are correct and (R) is the correct explanation of (A)
 - (2) Both (A) & (R) are correct but (R) is not the correct explanation of (A)
 - (3) (A) is true but (R) is false.
 - (4) (A) is false but (R) is true.

6. Examine carefully Assertion (A) and Reason (R) and choose the correct answer.
 Assertion (A) : Avalanche breakdown is reversible.
 Reason (R) : Avalanche breakdown occurs due to increased electric field breaking covalent bond thereby generating minority carriers.
 - (1) Both (A) & (R) are correct and (R) is the correct explanation of (A).
 - (2) Both (A) & (R) are correct but (R) is not the correct explanation of (A)
 - (3) (A) is true but (R) is false.
 - (4) (A) is false but (R) is true.

7. Match the following and choose the correct answer.

- | List-I | List-II |
|----------|--------------|
| a) GaAs | (i) Infrared |
| b) GaAsP | (ii) Red |
| c) AlGaP | (iii) Green |
| d) SiC | (iv) Blue |
- (1) a – i, b – ii, c – iii, d – iv (2) a – ii, b – i, c – iii, d – iv
(3) a – ii, b – i, c – iv, d – iii (4) a – iii, b – ii, c – iv, d – i

8. Match the following and choose the correct answer.

- | List - I | List - II |
|----------------------|----------------------------|
| a) Indirect band gap | (i) GaAs |
| b) Direct band gap | (ii) Cavity |
| c) Laser diode | (iii) Spontaneous emission |
| d) LED | (iv) Si |
- (1) a – ii, b – i, c – iii, d – iv (2) a – iii, b – iv, c – i, d – ii
(3) a – i, b – iv, c – ii, d – iii (4) a – iv, b – i, c – ii, d – iii

9. The materials used for tunnel diode are

- a) Si
b) ZnTe
c) Ge
d) GaAs
- (1) a and b (2) a and c
(3) a and d (4) c and d

10. Terminal voltage of solar cell cannot exceed the barrier potential of diode, therefore to achieve higher voltage. Which of the following statements is correct?

- (1) They are operated under open circuit condition.
(2) They are operated in forward biased condition.
(3) Array solar cells are used.
(4) Rechargeable cells are used.

11. Why are stick diagrams commonly used by layout designers?

- (1) Because they are always drawn to scale.
(2) Because they are easy to draw without scale.
(3) Because they include detailed transistor parameters.
(4) Because they replace the need for metal wires.

12. What is the role of polysilicon gate in an nMOS transistor structure?
- (1) It acts as the source region
 - (2) It is the thick oxide layer preventing short circuits.
 - (3) It forms the input terminal controlling the channel conductivity.
 - (4) It connects the drain to the output line.
13. In the MOS transistor saturation region, the drain current I_{ds} depends on which of the following?
- (1) $(V_{gs} - V_t)^2$
 - (2) V_{ds} linearly
 - (3) Threshold Voltage V_t
 - (4) Gate capacitance per unit area only

14. Match stick diagram facts with explanation.

List-I

- a) Advantage of stick diagram
- b) Routing track pitch
- c) Transistor role in layout
- d) Required spacing between nMOS & pMOS

- (1) a – i, b – ii, c – iii, d – iv
- (3) a – iv, b – i, c – ii, d – iii

List-II

- (i) Used to estimate layout area quickly
- (ii) Sum of wire width and spacing
- (iii) Widgets placed under metal wires
- (iv) Set by well-spacing with extra track

- (2) a – iii, b – iv, c – ii, d – i
- (4) a – ii, b – iii, c – iv, d – i

15. Match ion implantation terms with their meaning.

List-I

- a) Ion implantation
- b) N+ diffusion
- c) Polysilicon gate
- d) Ohmic contact

- (1) a – ii, b – iv, c – i, d – iii
- (3) a – iii, b – i, c – iv, d – ii

List-II

- (i) Adding dopants by shooting ions into silicon
- (ii) Heavily-doped n-type source/drain region
- (iii) Gate material made of poly crystalline silicon
- (iv) Low resistance metal to semiconductor contact.

- (2) a – i, b – ii, c – iii, d – iv
- (4) a – iv, b – iii, c – ii, d – i

16. Match the MOS transistors region with their operations.

List-I

- a) Cut-off region
- b) Linear region
- c) Saturation region
- d) Depletion region

- (1) a – i, b – ii, c – iii, d – iv
- (3) a – i, b – iii, c – ii, d – iv

List-II

- (i) Channel pinches off
- (ii) Channel inverted
- (iii) Channel not inverted
- (iv) Non-conductive dielectric

- (2) a – iii, b – ii, c – i, d – iv
- (4) a – ii, b – i, c – iv, d – iii

17. Arrange the following steps of converting a circuit schematic to a layout in the correct order.

- (i) Place transistors and draw active areas
- (ii) Connect using interconnect layers
- (iii) Design rule check (DRC)
- (iv) Define wells and isolation regions

- (1) i, ii, iii, iv
- (3) iv, ii, i, iii

- (2) i, iii, ii, iv
- (4) iv, i, ii, iii

18. Arrange the steps of IC fabrication in order.

- (i) Expose it to UV light through mask that defines diffusion areas.
- (ii) Grow a thick (~1nm) silicon dioxide layer over the wafer surface.
- (iii) Deposit heavily doped polysilicon.
- (iv) Diffusion or Ion implantation

- (1) i, ii, iii, iv
- (3) ii, i, iv, iii

- (2) iv, iii, ii, i
- (4) i, iv, iii, ii

19. Which is the order of steps of working of CCD?

- (i) Light absorption and charge generation
- (ii) Charge accumulation
- (iii) Charge transfer
- (iv) Signal Read out

- (1) i, iii, ii, iv
- (3) i, ii, iii, iv

- (2) iv, ii, i, iii
- (4) ii, iii, i, iv

20. Which device is an example of a passive type device?

- (1) MOSFET
- (3) Photodiode

- (2) Thin Film Resistor
- (4) LED

21. The two-port parameters used for the analysis of cascaded networks is

- (1) ABCD Parameters
- (3) Y - Parameters

- (2) H - Parameters
- (4) Z - Parameters

22. All poles and zeros of a driving point impedance function of an LC network

- (1) should lie on the $j\omega$ axis
- (3) should lie on the $-ve$ real axis

- (2) should lie on the $+ve$ real axis
- (4) should lie on both sides of $j\omega$ axis

23. The unilateral Laplace transform of the signal $x(t) = u(t + 5)$ is

- (1) e^{+5s}/s
- (3) e^{-5s}/s

- (2) $1/s$
- (4) $5/s$

24. Which of the following statements are correct?

- a) Periodic signals are power signals. b) Periodic signals are energy signals.
c) Deterministic signals are energy signals. d) Deterministic signals are power signals.

Codes

- (1) b and c (2) b and d
(3) a and d (4) a and c

25. In a planar graph theory, which of the following statements are true?

- a) A set of branches that connects all nodes of the network but contains no loop.
b) A set of branches that connects all nodes of the network but contains loop.
c) A given network can have only one distinct tree.
d) A given network can have many distinct trees.

- (1) b and c (2) b and d
(3) a and c (4) a and d

26. List-I gives the sequence and List-II gives the Z-transform. Match List-I with List-II and choose the correct answer.

List-I

a) $x[-n]$

b) $x[n-k]$

c) $k^n x[n]$

d) $nx[n]$

List-II

(i) $-z \frac{d}{dz} X(z)$

(ii) $X\left(\frac{1}{z}\right)$

(iii) $X[z/k]$

(iv) $z^{-4} X(z)$

(1) a – iii, b – iv, c – i, d – ii

(3) a – iv, b – ii, c – i, d – iii

(2) a – ii, b – iv, c – iii, d – i

(4) a – ii, b – iii, c – i, d – iv

27. Match List-I (Discrete-time periodic signal) with List-II (Discrete -Fourier-series coefficients) and choose the correct answer.

Note: * indicates conjugate

e indicates even

0 indicates odd

Re and Im indicate real & imaginary

List-I

a) $x^*(n)$

b) $x^*(-n)$

c) $x_e(n)$

d) $x_0(n)$

List-II

(i) $X^*(-k)$

(ii) $\text{Re}[X(k)]$

(iii) $X^*(k)$

(iv) $j\text{Im}[X(k)]$

(1) a – ii, b – iv, c – iii, d – i

(3) a – iii, b – i, c – ii, d – iv

(2) a – i, b – iii, c – iv, d – ii

(4) a – i, b – iii, c – ii, d – iv

28. Arrange the following design procedure for second order low-pass Butterworth filter.

- Determine the value of Ω_c
- Calculate the value of $H(s)$
- Find the order of the filter N
- Find the value of $H_N(s)$
- Determine the value of S_K

(1) a b c d e

(2) c e d a b

(3) d a b e c

(4) c b a e d

29. Assertion (A) : The op-amp voltage follower uses voltage-series feedback

Reason (R) : Input impedance of op-amp voltage follower is less than transistor emitter follower

- Both (A) & (R) are true and (R) is the correct explanation of (A)
- Both (A) & (R) are true but (R) is not the correct explanation of (A)
- (A) is true but (R) is false
- (A) is false but (R) is true

30. The equivalent resistance between terminals X and Y of the circuit shown in fig(10) is _____

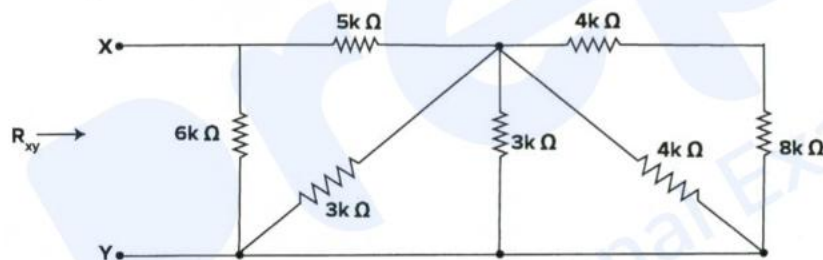


fig. 10

(1) 3 kΩ

(2) 3.8 kΩ

(3) 5 kΩ

(4) 5.4 kΩ

31. For a sustained oscillation, the necessary condition for the gain of the op-amp based RC-phase shift oscillator is _____.

(1) $|A_v| \geq 3$

(2) $|A_v| < 3$

(3) $|A_v| \geq 29$

(4) $|A_v| < 29$

32. Arrange the following oscillators based on increasing number of capacitors used in feedback network:

- Colpitt's Oscillator
- Crystal Oscillator

- Hartley Oscillator
- Phase-shift Oscillator

(1) c, a, b, d

(2) c, b, a, d

(3) a, b, c, d

(4) d, b, a, c

33. In a negative feedback circuit, which of the following statements are true?

- a) Improves circuit frequency response
- b) Circuit noise is increased
- c) Reduces input impedance
- d) Reduces output impedance

(1) a and b

(2) a and d

(3) b and c

(4) c and d

34. Arrange the following amplifiers in decreasing order of output waveform's conduction angle:

- a) Class B
- b) Class A
- c) Class AB
- d) Class C

(1) b, c, d, a

(2) b, c, a, d

(3) d, c, b, a

(4) d, a, c, b

35. Arrange the following components used in regulating power supply from input to output

- a) Inductor
- b) BY127
- c) 2N3055
- d) LM317

(1) a, b, d, c

(2) b, a, c, d

(3) a, b, c, d

(4) b, a, d, c

36. Match the pin numbers of VCO IC 566 with their respective functions.

List - I

List - II

a) 1

(i) Square wave output

b) 3

(ii) Triangular wave output

c) 4

(iii) Modulation input

d) 5

(iv) Ground

(1) a - ii, b - i, c - iv, d - iii

(2) a - iii, b - ii, c - i, d - iv

(3) a - iv, b - i, c - ii, d - iii

(4) a - i, b - iii, c - ii, d - iv

37. Match the following.

List - I

- a) Instrumentation Amplifier
- b) Schmitt trigger
- c) Phase-locked loop
- d) Multivibrators

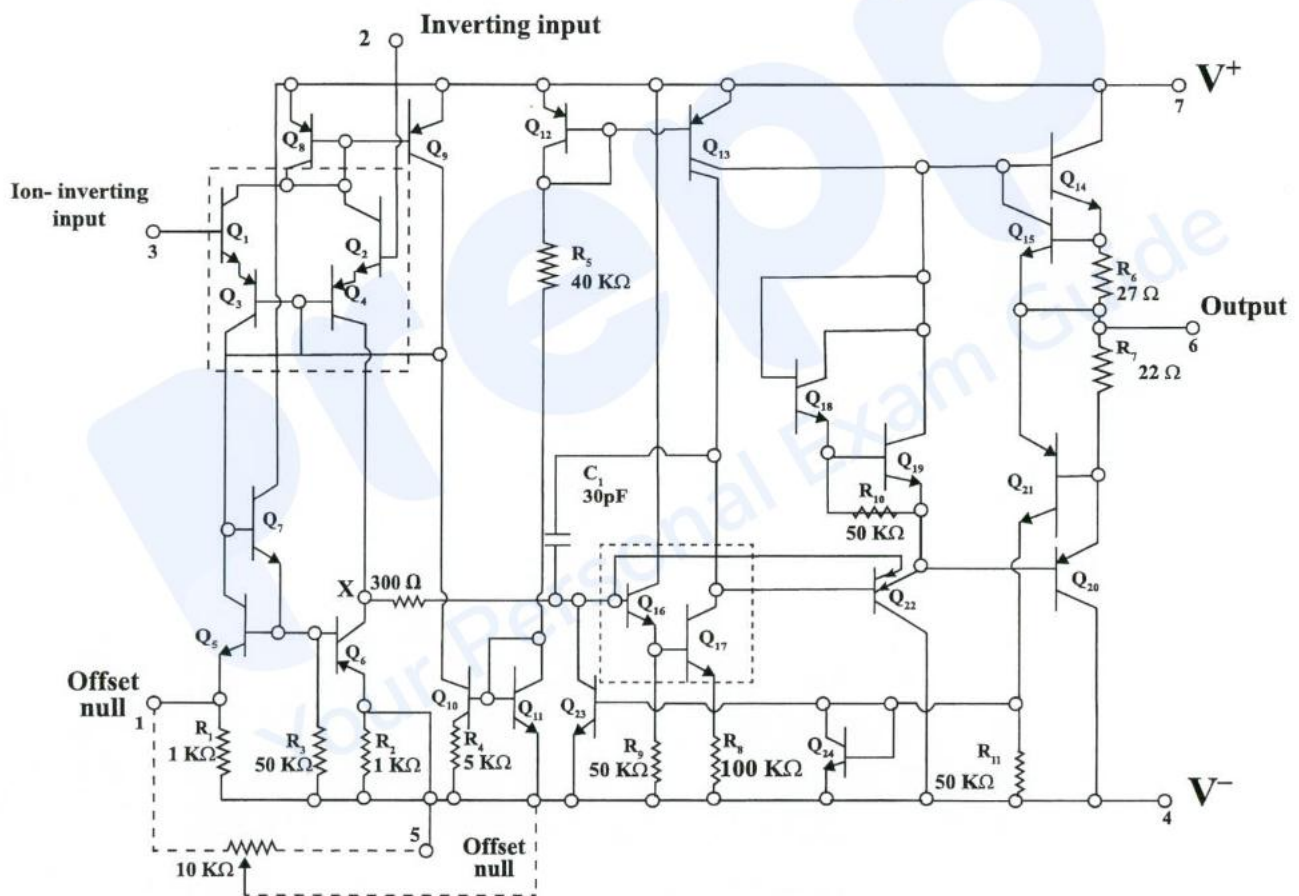
- (1) a - ii, b - iv, c - i, d - iii
- (3) a - i, b - iv, c - iii, d - ii

List - II

- (i) Error amplifier
- (ii) High CMRR
- (iii) Triggering
- (iv) Wave shaping

- (2) a - iv, b - iii, c - i, d - ii
- (4) a - iii, b - ii, c - iv, d - i

* From the given below schematic 741 op-amp, answer the following questions from Q. 38 - 42



Schematic circuit diagram for 741 op-amp

38. From the diagram of 741 op-amp, which of the following transistors are used to increase the input impedance?

- (1) Q_1, Q_2
- (2) Q_5, Q_6
- (3) Q_{10}, Q_{11}
- (4) Q_8, Q_9

39. Transistors Q_{14} and Q_{20} are configured in which of the following class of amplifiers?
- (1) Class A (2) Class C
(3) Complimentary Class B (4) Class AB
40. Transistor Q_{24} 's main function is
- (1) To amplify current (2) Bias for transistor Q_{21}
(3) Level shifter (4) Temperature compensating diode
41. The function of transistors Q_{12} and Q_{13} is
- (1) Current mirror (2) Voltage stabiliser
(3) Emitter follower (4) Offset null
42. The block of transistors Q_{16} and Q_{17} is responsible for
- (1) Increasing the bandwidth (2) Stabilisation of the feedback
(3) Voltage amplification (4) Low output impedance
43. Which of the following Boolean expression is equivalent to the exclusive NOR of A and B?
- (1) $AB' + A'B$ (2) $(A + B)'$
(3) $(A + B')(A' + B)$ (4) $(A + B)(A' + B')$
44. The output of a D-flipflop is delayed from the clock input due to
- (1) Setup time only
(2) Propagation delay
(3) Hold time only
(4) Race around condition
45. Which of the following state assignment techniques leads to faster clock speed in FSMs implemented on FPGAs?
- (1) Binary (2) One-hot
(3) Gray (4) Random
46. Which of the following are true for CMOS logic?
- (i) Low static power dissipation
(ii) High noise margin
(iii) High speed in comparison to TTL
(iv) Uses PMOS and NMOS transistors
- (1) i, ii (2) ii, iii, iv
(3) i, ii, iv (4) iii, iv

47. Which of the following are the advantages of FPGAs?

- (i) Reconfigurability
- (ii) Faster than ASICs in all cases
- (iii) Economic in mass production
- (iv) Prototyping ease

(1) i, iii and iv

(2) i and iv

(3) ii, iii and iv

(4) i, ii, iii and iv

48. Find the correct sequence of data transfer in Demultiplexer.

- a) Data input activated
- b) Signal routed to one output
- c) Other outputs remain inactive
- d) Control line selects output

(1) a, d, b, c

(2) d, a, c, b

(3) a, b, d, c

(4) d, a, b, c

49. Arrange the design steps of a finite state machine (FSM)

- a) Write state transition table
- b) Assign binary codes to states
- c) Identify number of states
- d) Draw state diagram

(1) c, d, b, a

(2) a, b, c, d

(3) c, d, a, b

(4) c, a, d, b

50. Match the following.

List - I

- a) Ripple counter
- b) Synchronous counter
- c) Shift register
- d) Johnson counter

List - II

- (i) Bits move serially on each clock
- (ii) Feedback of inverted last bit
- (iii) All flip-flops clocked simultaneously
- (iv) Clock triggers each flip-flop one after another

(1) a - iv, b - iii, c - i, d - ii

(2) a - i, b - iii, c - iv, d - ii

(3) a - iii, b - ii, c - i, d - iv

(4) a - ii, b - i, c - iii, d - iv

51. Match the following.

List - I

- a) Successive approximation ADC
- b) Flash ADC
- c) Dual slope ADC
- d) Sigma-delta ADC

- (1) a – iii, b – i, c – iv, d – ii
- (2) a – ii, b – iii, c – iv, d – i
- (3) a – iv, b – ii, c – iii, d – i
- (4) a – iii, b – iv, c – i, d – ii

List - II

- (i) Integrates inputs and compares against reference
- (ii) Over sampling and noise shaping
- (iii) Uses binary search algorithm
- (iv) One comparator per bit

52. Match the following.

List - I

- a) Verilog
- b) VHDL
- c) Module
- d) Entity

- (1) a – iii, b – iv, c – i, d – ii
- (2) a – iv, b – iii, c – i, d – ii
- (3) a – iii, b – iv, c – ii, d – i
- (4) a – iv, b – iii, c – ii, d – i

List - II

- (i) Basic design block in Verilog
- (ii) Basic design block in VHDL
- (iii) HDL used in industry (C-like syntax)
- (iv) HDL with pascal-like syntax

53. In 8051 microcontroller, which of the following registers are 16 bits wide?

- a) PC
- b) DPTR
- c) Timer 0
- d) SCON

Codes:

- (1) a, b
- (2) a, b, c
- (3) b, c
- (4) a, b, d

54. Which of the following port pins of port 3 of 8051 microcontroller are used for interrupt handling purpose?

- a) P3.0
- b) P3.1
- c) P3.2
- d) P3.3

Codes:

- (1) a, b, c
- (2) a, b
- (3) b, c, d
- (4) c, d

55. Sequence the steps to read data from a keypad interfaced to 8051
- Detect pressed key
 - Output pattern to rows
 - Debounce input
 - Read columns
- (1) b, d, c, a
 - (2) b, d, a, c
 - (3) d, b, c, a
 - (4) d, b, a, c
56. If the direction flag is set, the MOVSB instruction copies a byte from
- (1) DS:SI to ES:DI and increments SI & DI
 - (2) DS:SI to ES:DI and decrements SI & DI
 - (3) ES:SI to DS:DI and increments SI & DI
 - (4) ES:SI to DS:DI and decrements SI & DI
57. Arrange the following activities to properly run the TYPE-4 Interrupt in 8086 Microprocessor.
- Pushes the CS and IP value on stack for next instruction
 - Pushes the flag register on the stack
 - Reset TF and IF
 - Get IP and CS value for start of interrupt service procedure
- Codes:
- (1) a, b, d, c
 - (2) c, b, a, d
 - (3) b, c, a, d
 - (4) d, c, b, a
58. Match the following.
- | List - I | List - II |
|----------------------|---|
| a) MOV Ax, [Bx] | (i) Direct Addressing Mode |
| b) MOV Ax, [1234 H] | (ii) Based Indexed Addressing Mode |
| c) MOV Ax, 1234 H | (iii) Register Indirect Addressing Mode |
| d) MOV Ax, [Bx + SI] | (iv) Immediate Addressing Mode |
- (1) a - iii, b - ii, c - iv, d - i
 - (2) a - ii, b - iv, c - i, d - iii
 - (3) a - iv, b - i, c - ii, d - iii
 - (4) a - iii, b - i, c - iv, d - ii
59. With reference to 8051 microcontroller, match List-I with List-II based on working.
- | List - I | List - II |
|----------|-----------------------------------|
| a) SBUF | (i) Timer Operation |
| b) IP | (ii) Arithmetic & Logic Operation |
| c) ACC | (iii) Interrupt Operation |
| d) TMOD | (iv) Serial Data Transfer |
- Codes:
- (1) a - iv, b - iii, c - ii, d - i
 - (2) a - iii, b - iv, c - i, d - ii
 - (3) a - i, b - ii, c - iii, d - iv
 - (4) a - iv, b - i, c - iii, d - ii

60. $\overline{BHE}$ of 8086 microprocessor signal is used to interface
- (1) Even bank memory
 - (2) Odd bank memory
 - (3) DMA controller
 - (4) Input/Output devices
61. If $\vec{n}$ is the polarisation vector and $\vec{k}$ is the direction of propagation of a plane electromagnetic wave, then which of the following is valid?
- (1) $\vec{n} = \vec{k}$
 - (2) $\vec{n} = -\vec{k}$
 - (3) $\vec{n} \cdot \vec{k} = 0$
 - (4) $\vec{n} \times \vec{k} = 0$
62. When Ohm's law is applied to electromagnetic phenomenon, which of the following is correct?
- (1) $V = IR$
 - (2) $\vec{\sigma} = \vec{J} \vec{E}$
 - (3) $\vec{E} = \vec{J} \vec{\sigma}$
 - (4) $\vec{J} = \vec{\sigma} \vec{E}$
63. The depth of penetration of a wave in lossy dielectric increases with increasing _____.
- (1) Conductivity
 - (2) Permeability
 - (3) Wavelength
 - (4) Permittivity
64. In a VSWR measurement, a square law detector is used to detect the signal level. The voltmeter reads maximum and minimum as 64 mV and 16 mV respectively. The VSWR of the system will be
- (1) 2
 - (2) 4
 - (3) 8
 - (4) 16
65. Consider the following statements with respect to a duplexer used in a radar system.
- a) To protect the receiver when high power signal is transmitted
 - b) To enable the use of a common antenna for transmission and reception
 - c) To allow the antenna to only receive when the signal is arriving
 - d) To avoid interference in both transmitted and received signals and noise in the radar system.
- Which of the above statements are correct?
- (1) a and b are correct
 - (2) c and d are correct
 - (3) a and d are correct
 - (4) b and d are correct
66. Consider the following statements with regard to the concept of poynting theorem.
- a) It refers to the rate of energy transfer per unit volume from a region of space.
 - b) Poynting vector describing the magnitude and direction of flow of energy in electromagnetic wave.
 - c) The maximum value of the poynting vector will be infinite.
 - d) Direction of poynting vector is mutually perpendicular to electromagnetic field components.
- Which of the above statements are correct?
- (1) a, b, c and d are correct
 - (2) b, c and d are correct
 - (3) a, b and d are correct
 - (4) a only is correct

67. The correct sequence of the assembled parts in Klystron Amplifier amongst the following is

- a) Anode
- b) Catcher cavity
- c) Cathode
- d) Buncher cavity

(1) b, a, c and d

(2) a, b, c and d

(3) c, d, b and a

(4) c, a, b and d

68. Match List-I with List-II and select the correct matching.

List - I

List - II

a) Reflex Klystron

(i) Has negative resistance characteristics

b) Tunnel diode

(ii) Used as a detector

c) PIN diode

(iii) Used as local oscillator for microwave frequency

d) Crystal diode

(iv) Used for microwave switching applications

(1) a - iii, b - i, c - iv, d - ii

(2) a - i, b - iii, c - ii, d - iv

(3) a - iii, b - iv, c - i, d - ii

(4) a - iv, b - ii, c - iii, d - i

69. Examine carefully Assertion (A) and Reason (R) and choose the correct answer

Assertion (A) : Helix structure in TWT plays as a delay line.

Reason (R) : Helix structure in TWT increases the RF signal at a speed of light

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

(2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

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

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

70. Examine carefully Assertion (A) and Reason (R) and choose the correct answer.

Assertion (A) : The solution of Poisson's equation is the same as the solution of Laplace's equation.

Reason (R) : Laplace equation is a special case of Poisson's equation for source free regions.

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

(2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

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

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

71. Match List - I with List - II.

List - I

List - II

- | | |
|-------------------------|-------------------------------------|
| a) Intrinsic Material | (i) Wavelength division multiplexer |
| b) Corrugated Structure | (ii) Photodiode |
| c) Cylindrical Lense | (iii) Distributed feedback laser |
| d) Dispersive Material | (iv) Edge emitting LED |

(1) a - iii, b - ii, c - i, d - iv

(2) a - i, b - ii, c - iii, d - iv

(3) a - ii, b - iii, c - iv, d - i

(4) a - iv, b - iii, c - ii, d - i

72. The bit rate of digital communication system is R kbps. The modulation used is 32 QAM. The maximum bandwidth required for ISI-free transmission is

(1) $\frac{R}{10}$ Hz

(2) $\frac{R}{10}$ kHz

(3) $\frac{R}{5}$ Hz

(4) $\frac{R}{5}$ kHz

73. Arrange the key components from input to output in IOT in chronological sequence.

a) Wi-Fi connectivity

b) User interface

c) Sensors

d) Data processing

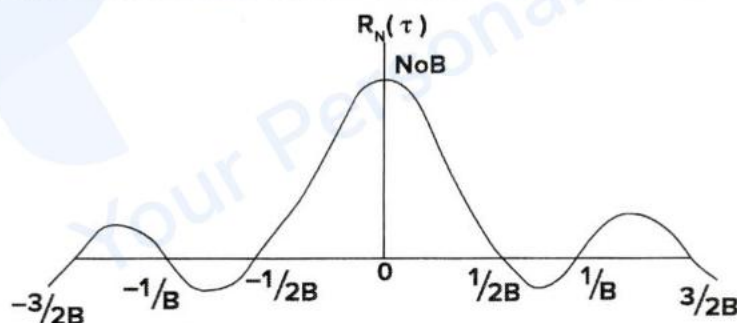
(1) a, c, b and d

(2) d, c, b and a

(3) c, a, d and b

(4) b, c, d and a

74. Autocorrelation function of one of the characteristics of white noise is shown below.



Identify this figure from the options given below.

(1) White noise

(2) Ideal low-pass filtered white noise

(3) Narrowband noise

(4) Ideal bandpass filtered white noise

75. If X is a random variable with mean μ and variance σ^2 , and if Z is defined as $Z = X - \left[\frac{(x-\mu)}{\sigma} \right]$, then E(z) is given by

(1) 0

(2) $\mu - \sigma$

(3) μ

(4) $\mu + \sigma$

76. Match the following and choose the correct code.

List - I

- a) BPSK
- b) PCM
- c) QPSK
- d) FSK

List - II

- (i) uses two carrier signals with same frequency but 90 degree out of phase
- (ii) uses four phase angles to represent two bits per symbol
- (iii) is phase modulation scheme that uses two phase angles to represent one bit per symbol
- (iv) where amplitude of the signal is sampled and then converted into binary code.
- (v) where digital data is encoded on to a carrier signal by varying its frequency.

(1) a – iii, b – iv, c – ii, d – v

(2) a – i, b – ii, c – iv, d – iii

(3) a – iv, b – ii, c – v, d – iii

(4) a – v, b – iv, c – iii, d – i

77. If a fiber has an attenuation coefficient 0.2 dB/km and the fiber length is 10 km, then the total attenuation would be

(1) 0.5 dB

(2) 1 dB

(3) 1.5 dB

(4) 2 dB

78. The core elements in RS-232 modem consist which of the following?

a) UART

b) Uses fibre optical cable

c) Handshaking circuit

d) Works on current loop mode

Codes:

(1) a and c

(2) b and d

(3) a and d

(4) a, b and c

79. Consider the following statements:

a) Intrinsic region is undoped, inserted between p^+ and n^+ .

b) PIN diode has a controlled depletion layer width

c) Intrinsic region is doped, inserted between p^+ and n^+ .

d) Intrinsic region is depleted of free charge carriers.

Which of the statements are true for PIN photodiode?

(1) b, c and d

(2) a, b and d

(3) a, c and d

(4) b and d

80. A source produces four symbols with probability $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$ and $\frac{1}{8}$. For this source, a practical coding scheme has an average code word length of 2 bits/symbol. The efficiency of the code is
- (1) 1 (2) $\frac{1}{4}$
(3) $\frac{3}{8}$ (4) $\frac{7}{8}$
81. If the $\frac{dv}{dt}$ protection of a SCR is inadequate, what could happen?
- (1) The SCR may fail to turn ON
(2) The SCR may turn ON unintentionally due to rapid voltage changes.
(3) The SCR will conduct more current than its rating
(4) The SCR will enter thermal shutdown
82. Examine carefully Assertion (A) and Reason (R) and choose the correct answer.
Assertion (A): P-MOSFET is normally used in power rails in electronic device
Reason (R): P-MOSFET has low R_{ds} - on as compared to N-MOSFET
- (1) Both (A) and (R) are true and (R) is the correct explanation of (A)
(2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
(3) (A) is true but (R) is false
(4) (A) is false but (R) is true
83. What is the role of an integrator in a PI controller?
- (1) To eliminate steady state error
(2) To minimize overshoot
(3) To increase system stability
(4) To amplify the error signal
84. Choose the correct components found in boost converter based on switching principle
- a) NAND Gate
b) Inductor
c) MOSFET
d) Silicon P-N junction diode
- (1) a and c (2) b and c
(3) b, c and d (4) a, b and d

85. Which type of control system has its output dependent only on the current input and not on past inputs or outputs?

- | | |
|---------------------------------|-----------------------------------|
| (1) Linear control system | (2) Non-linear control system |
| (3) Time-variant control system | (4) Time-invariant control system |

86. Which of the following are the methods of controlling the speed of a DC motor?

- a) Varying the armature voltage
- b) Changing the field flux
- c) Using a TRIAC to control power
- d) Using a mechanical governor

- | | |
|----------------|-------------|
| (1) a, b, c, d | (2) a, b, c |
| (3) a, b | (4) c |

87. Sequence the steps in the operation of a PID controller to improve system stability

- a) Apply proportional control based on the error signal
- b) Integrate the error to eliminate steady state error
- c) The controller adjusts the system's output accordingly
- d) Differentiate the error to predict future trends and respond quickly

- | | |
|----------------|----------------|
| (1) a, b, c, d | (2) a, d, b, c |
| (3) d, a, b, c | (4) a, b, d, c |

88. Consider the following statements with regard to TDMA [Time Division Multiple Access]

- a) TDMA is more rigid
- b) It is efficient in handling large number of users due to dynamic allocation.
- c) More susceptible to interfere in crowded channel environment
- d) It requires guard intervals to avoid overlapping

Which of the above statements is/are true to TDMA?

Codes:

- | | |
|----------------|-------------|
| (1) b, c and d | (2) b and d |
| (3) a, b and c | (4) b only |

89. Match the following SCR triggering methods:

List - A

- a) Gate triggering
- b) Anode-Cathode Voltage
- c) Latching current
- d) $\frac{dv}{dt}$ triggering

List - B

- (i) Forward voltage
- (ii) Sudden breakdown
- (iii) Gate current
- (iv) Voltage across SCR

Codes:

- | | |
|------------------------------------|------------------------------------|
| (1) a - ii, b - i, c - iv d - iii | (2) a - iv, b - i, c - ii, d - iii |
| (3) a - iii, b - iv, c - i, d - ii | (4) a - i, b - ii, c - iii, d - iv |

90. Match the following.

List - I

- a) DC motor
- b) Induction motor
- c) Stepper motor
- d) Synchronous motor

- (1) a – iii, b – i, c – iv d – ii
- (3) a – iii, b – iv, c – i, d – ii

List - II

- (i) used in precision control applications
- (ii) used in applications requiring constant speed
- (iii) used in fans and pumps
- (iv) used in high-efficiency application

- (2) a – i, b – ii, c – iv, d – iii
- (4) a – iv, b – i, c – ii, d – iii

91. Which of the following is a passive transducer?

- (1) LVDT
- (3) Thermistor

- (2) Thermocouple
- (4) Piezoelectric

92. Which of the following sensors gives high response for a given input?

- (1) PTC thermometer
- (3) Thermocouple device

- (2) Piezoelectric device
- (4) Strain gauge

93. Monopolar needle electrodes have a coating of which material over the stainless steel wires and which are bare only at the tips?

- (1) Carbon
- (3) Sodium

- (2) Calcium
- (4) Teflon

94. EEG frequency range for delta waves is

- (1) 0.5 to 4 Hz
- (3) 8 to 13 Hz

- (2) 4 to 7 Hz
- (4) 13 to 30 Hz

95. Arrange the components in a spectrum analyzer in the order of their placement from input to output.

- a) Band-pass filter
- c) Memory unit

- b) Signal conditioner
- d) Frequency selector

- (1) c, d, b, a
- (3) c, b, d, a

- (2) d, a, c, b
- (4) b, d, a, c

96. Arrange the following measuring devices in the increasing order of input impedance

- a) Megger
- b) Simpson analog multimeter
- c) Precision 3 ½ digit DMM
- d) 1000A ammeter

- (1) d, a, b, c
- (3) d, b, c, a

- (2) a, d, b, c
- (4) a, b, d, c

97. Match List - I with List - II for their appropriate application and choose the correct option.

List - I

- a) Spectrum analyser
- b) Analog oscilloscope
- c) LVDT
- d) Potentiometer

- (1) a – ii, b – iii, c – i, d – iv
- (3) a – iv, b – iii, c – ii, d – i

List - II

- (i) Displacement
- (ii) Bandwidth
- (iii) Voltage variation
- (iv) Rise time

- (2) a – ii, b – iv, c – i, d – iii
- (4) a – iii, b – ii, c – i, d – iv

98. Match List - I with List - II and choose the correct answer.

List - I

- a) Load cell
- b) High temperature measurement
- c) Pressure measurement
- d) Flow measurement

- (1) a – ii, b – i, c – iv, d – iii
- (3) a – iii, b – i, c – ii, d – iv

List - II

- (i) PTC
- (ii) PZT
- (iii) Strain gauge
- (iv) Turbine wheel

- (2) a – iv, b – i, c – ii, d – iii
- (4) a – i, b – iii, c – ii, d – iv

99. Examine carefully Assertion (A) and Reason (R) and choose the correct answer.

Assertion (A): Common DMMs can be used for measuring insulation resistance of poor conductors

Reason (R): Common DMMs do not have high input impedance

- (1) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
- (3) (A) is true but (R) is false
- (4) (A) is false but (R) is true

100. Examine carefully Assertion (A) and Reason (R) and choose the correct answer.

Assertion (A): In a DSO, we do not require high speed display like CRT

Reason (R): DSO displays the waveform stored in memory register

- (1) Both (A) and (R) are true and (R) is the correct explanation of (A)
- (2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
- (3) (A) is true but (R) is false
- (4) (A) is false but (R) is true

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