Paper - II

Electronic Science

Booklet Code

A

Test Booklet No.

SUBJECT CODE : 1 4

Roll No. : | | | | | | | | | | | |

(Figures as per admission card)

Roll No. (in words) : _____

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OMR Sheet No. : | | | | | | | |

Name and Signature of Invigilator/s

Signature : _____

Name : _____

Time : 2 Hours | Maximum Marks : 200

Number of Pages in this Booklet : 24 | **Number of Questions in this Booklet : 100**

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. This paper consists of hundred (100) multiple-choice type of questions.
3. At the commencement of examination, the test booklet will be given to you. In the first 5 minutes, you are requested **To Open the Booklet and Compulsorily Examine it as Below:**
   (i) To have access to the Test Booklet, tear off the paper seal on the edge of the cover page. Do not accept a booklet without sticker seal or open booklet.
   (ii) Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Test Booklet will be replaced nor any extra time will be given.
   (iii) After the verification is over, the Test Booklet Number should be entered in the OMR Sheet and the OMR Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example : Ⓐ Ⓑ ● Ⓓ
   where (C) is the correct response.
5. Your responses to the questions are to be indicated in the **OMR Sheet kept inside this Booklet**. If you mark at any place other than in the circles, the OMR Sheet will not be evaluated.
6. Read the instructions given in OMR Sheet carefully. Fill the Booklet Code of Paper-II in OMR Sheet **Compulsorily**.
7. Rough Work is to be done in the end of this booklet.
8. If you write your name or put any mark on any part of the OMR Answer Sheet, except for the space provided for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
9. You have to return the OMR answer Sheet to the invigilators at the end of the examination compulsorily and must NOT carry it with you outside the Examination Hall.
10. You can take away test booklet and carbon copy of OMR Answer Sheet after the examination.
11. **Use only Blue/Black Ball point pen.**
12. **Use of any calculator, electronic gadgets or log table, etc. is prohibited.**
13. **There is no negative mark for incorrect answer.**

1. The energy gap between the valence band and the conduction band in a semiconductor is called the _____.

(A) Fermi level

(B) Bandwidth

(C) Forbidden gap

(D) Bandgap

2. The process of intentionally adding impurities to a semiconductor crystal to modify its electrical properties is called:

(A) Melting

(B) Purification

(C) Doping

(D) Distillation

3. In a BJT, I_C = 100mA and I_E = 100.5mA. The value of β is :

(A) 125

(B) 150

(C) 175

(D) 200

4. The phase difference between the input and output voltages of a transistor connected in a common emitter BJT configuration is :

(A) 0º

(B) 90º

(C) 180º

(D) 270º

5. The extremely high input impedance of a MOSFET is primarily due to the:

(A) Absence of its channel

(B) Negative gate-source voltage

(C) Depletion of current carriers

(D) Extremely small leakage current of its gate capacitor

6. The h-parameter approach gives correct results for:

(A) Large signals only

(B) Small signals only

(C) Both (A) and (B)

(D) None of the above

7. In a quantum well structure, what is the typical dimension that confines electrons in the transverse direction?

(A) Micrometres

(B) Millimetres

(C) Nanometres

(D) Centimetres

8. Quantum dots can emit light of different colours due to:

(A) Their large size

(B) Electromagnetic shielding

(C) Quantum confinement of charge carriers

(D) Lack of interactions with other materials

9. The unique electronic structure of carbon nanotubes can lead to the phenomena of:

(A) Superconductivity

(B) Quantum tunnelling

(C) Electrostatic repulsion

(D) Ionization

10. Arrange the sequential steps in the operation of a Charge-Coupled Device:

I. Readout

II. Accumulation

III. Transfer

(A) I, II, III

(B) II, III, I

(C) III, I, II

(D) Any of the above order

11. Which process involves creating a thin insulating layer over the silicon wafer?

(A) Etching

(B) Diffusion

(C) Oxidation

(D) Photolithography

12. What is photolithography in the context of IC fabrication?

(A) A process to create chemical reactions on the silicon wafer

(B) A method to clean the silicon surface using light

(C) A technique to create intricate patterns on the wafer using light

(D) A process to etch away unwanted material from the wafer

13. What is X-ray diffraction mainly used for?

(A) Generating X-ray images of biological samples

(B) Analyzing the elemental composition of materials

(C) Studying crystal structures and lattice arrangements

(D) Measuring the electrical conductivity of materials

14. What is the primary principle of Transmission Electron Microscopy?

(A) It uses visible light to image samples

(B) It uses X-rays to study crystal structures

(C) It uses a beam of electrons to pass through a sample

(D) It uses magnetic fields to manipulate nanoparticles

15. In MOS technology, what is the function of the oxide layer?

(A) To provide mechanical support to the device

(B) To conduct electricity between metal and silicon

(C) To insulate the gate electrode from the channel

(D) To enhance the optical properties of the device

16. What is the primary advantage of MOS technology as compared to Bipolar Junction Transistors?

(A) Lower cost

(B) Higher switching speed

(C) Simpler fabrication process

(D) Better compatibility with digital applications

17. What is the purpose of the shift register in a CCD?

(A) To amplify the captured image signal

(B) To convert the charge into light

(C) To synchronize the exposure time

(D) To move charge from one pixel to another

18. What is the main advantage of a CMOS inverter over an NMOS inverter?

(A) Higher output current

(B) Lower power consumption

(C) Faster switching speed

(D) Simpler fabrication process

19. What is the primary objective of physical design in VLSI?

(A) To design complex algorithms for VLSI circuits

(B) To layout components on the chip to optimize performance, area, and power

(C) To develop software for simulating VLSI circuits

(D) To design the transistor-level logic for VLSI circuits

20. Which technique is used to reduce signal delay and enhance performance in VLSI circuits?

(A) Clock gating

(B) Clock skewing

(C) Pipeline processing

(D) Clock stretching

21. What is the primary advantage of frequency modulation over amplitude modulation?

(A) FM provides higher power efficiency

(B) FM allows for longer transmission distances

(C) FM has better noise immunity and higher audio fidelity

(D) FM requires simpler demodulation techniques

22. Which demodulation technique is typically used for FM signals?

(A) Envelope detection

(B) Phase detection

(C) Frequency division

(D) Discriminator detection

23. Which application commonly uses FDM for transmission?

(A) Bluetooth communication

(B) Satellite television broadcasting

(C) Simplex radio communication

(D) Point-to-point microwave links

24. Which modulation technique is commonly used in optical communication to transmit digital data?

(A) Amplitude Modulation

(B) Frequency Modulation

(C) Phase Shift Keying

(D) On-Off Keying

25. What is quantum efficiency, when a 3×10^{11} photons each with a wavelength of 0.85μm are incident on a photodiode, on average 1.5×10^{11} electrons are collected at the terminals of the device ?

(A) 20%

(B) 30%

(C) 40%

(D) 50%

26. A multimode-graded index fiber exhibits a total pulse broadening of 0.2μs over a distance of 15 km. Determine the maximum possible bandwidth on the link assuming no intersymbol interference :

(A) 2.5 MHz

(B) 5 MHz

(C) 10 MHz

(D) 12.5 MHz

27. A carrier is frequency modulated with a sinusoidal signal of 2 kHz, resulting in a maximum frequency deviation of 3 kHz. What is the bandwidth of the modulated signal?

(A) 7 kHz

(B) 14 kHz

(C) 21 kHz

(D) 28 kHz

28. What is the Nyquist sampling rate of the signal $sinc(100\pi t) + 3sinc^3(60\pi t)$?

(A) 30π Hz

(B) 60π Hz

(C) 120π Hz

(D) 180π Hz

29. A noise power of –100dBm is available from a receiver antenna system over a 20 MHz bandwidth. Assume room temperature 290° K. Find the noise temperature of the antenna :

(A) 181° K

(B) 362° K

(C) 543° K

(D) 734° K

30. A discrete memoryless channel has four symbols with probabilities of 0.4, 0.3, 0.2, and 0.1. What is average information?

(A) 0.5 b/symbol

(B) 1.05 b/symbol

(C) 1.85 b/symbol

(D) 2.05 b/symbol

31. What is the capacity of the channel, if an AWGN channel has 4 kHz bandwidth and noise power spectral density is 10^{-12} W/Hz. The signal power required at the receiver is 0.1mW ?

(A) $54.44 \times (10^3)$ b/s

(B) $64.44 \times (10^3)$ b/s

(C) $74.44 \times (10^3)$ b/s

(D) $84.44 \times (10^3)$ b/s

32. What is the signal energy of a signal $x(t) = e^{-|t|}$?

(A) 0.1

(B) 1.0

(C) 1.5

(D) 2.0

33. Identify the impulse response of the FIR system :

(A) h(n) = n

(B) h(n) = 1–n

(C) h(n) = 1

(D) All of the above

34. Find the z-transform of the signal $x(n) = u(-n)$, when ROC is $|z| < 1$:

(A) $\frac{1}{z} - 1$

(B) $\frac{1}{1+z}$

(C) $\frac{1}{-1+z}$

(D) $\frac{1}{1-z}$

35. The following item consist of two statements, one labelled as "Assertion (A)" and the other is labelled as "Reason (R)" :

Assertion (A): When MOSFET is in a conductive state, the saturation current flows after the channel is pinched off.

Reason (R): The substrate bias doesn't affect the threshold voltage of a MOSFET.

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

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

(C) A is correct but R is not correct.

(D) A is not correct but R is correct.

36. Match the following items in List-I and List-II correctly :

List-I		List-II	
P.	Mobile Communication	I.	Computer communication
Q.	Open Systems Interconnection	II.	Connecting audio-video devices
R.	High-Definition Multimedia Interface	III.	Short-range wireless technology
S.	Bluetooth	IV.	General Packet Radio Services

(A) P-IV, Q-I, R-II, S-III

(B) P-III, Q-II, R-IV, S-I

(C) P-II, Q-III, R-I, S-IV

(D) P-I, Q-IV, R-III, S-II

37. Match the following properties of a P-N junction with their descriptions in List-I and List-II correctly :

List-I		List-II	
P.	Majority carriers are electrons	I.	An area with no free charge carriers
Q.	Majority carriers are holes	II.	Allows current in one direction and blocks in the other
R.	Forms a depletion region	III.	Donor impurities dominate
S.	Acts as a rectifier	IV.	Acceptor impurities dominate

(A) P-IV, Q-III, R-II, S-I

(B) P-III, Q-IV, R-I, S-II

(C) P-II, Q-I, R-III, S-IV

(D) P-I, Q-IV, R-III, S-II

38. What is the range for a 3½ digital meter?

(A) 0 to 1999

(B) 0 to 1500

(C) 0 to 999

(D) 0 to 19999

39. Measurement of flow, thermal conductivity and liquid level using thermistors make use of :

(A) Resistance increases with temperature

(B) Resistance decreases with temperature

(C) Self-heating phenomenon

(D) Change of resistivity

40. A capacitive transducer with its plate separation of 0.05mm under static condition has a capacitance of $5x10^{-12}$ F. The displacement required to cause a change of capacitance of $0.75x10^{-12}$ F is :

(A) 0.0333mm

(B) 3.33mm

(C) 0.333mm

(D) 33.3mm

41. Which of the following is not a self-generating type transducer?

(A) Thermocouple and thermopile

(B) Photovoltaic cell

(C) Magnetostriction gauge

(D) Piezoelectric pick-up

42. The full scale deflection current of a meter is 1mA and its internal resistance is 100 ohms. This meter is to have full deflection when 100 V is measured., what is the value of the series resistance to be used?

(A) 99.99 k ohms

(B) 150 k ohms

(C) 99 ohms

(D) 150 ohms

43. The accuracy of the digital voltmeter is specified as :

(A) Percentage of the actual reading

(B) Percentage of the full scale reading

(C) Number of least significant digits

(D) All of the above

44. Carey Foster bridge is specially designed to determine :

(A) The high resistance of the wire

(B) The internal resistance of the battery

(C) The difference between two nearly equal resistance

(D) The emf of the voltage source

45. Which of the following bridge is used to measure inductance of the low Q-inductor?

(A) Maxwell's bridge

(B) Hay's bridge

(C) Wien bridge

(D) Anderson's bridge

46. A diode is connected in anti-parallel with a thyristor, then :

(A) Both turn-off power loss and turn-off time increases

(B) Both turn-off power loss and turn-off time decreases

(C) Turn-off power loss increases and turn-off time decreases

(D) Turn-off power loss decreases and turn-off time increases

47. For an SCR, dv/dt protection is achieved through the use of :

(A) RL across SCR

(B) RL in series with SCR

(C) RC across SCR

(D) RC in series with SCR

48. The speed of a dc shunt motor above rated speed can be controlled by using:

(A) Armature voltage control method

(B) Flux control method

(C) Both flux and armature control method

(D) Using auxiliary dc motor

49. The closed loop transfer function (TF) is

$$TF = \frac{K}{s^3 + 5s^2 + 7s + K}$$

The range of K for stability is

(A) $K < 0$

(B) $0 < K < 35$

(C) $0 < K < 7$

(D) $K > 7$

50. The transfer function of a system is

(A) The Laplace transform of its impulse response with zero initial condition

(B) The Laplace transform of its step response with zero initial condition

(C) The Laplace transform of its ramp response with zero initial condition

(D) The Laplace transform of its parabolic response with zero initial condition

51. With PD controller :

(A) Damping ratio improves and maximum overshoot reduces

(B) Rise time reduces

(C) Bandwidth increases

(D) All of the above

52. For a stable system :

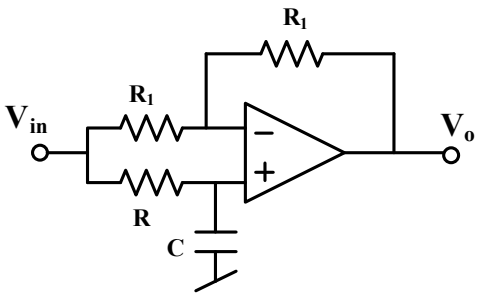
(A) Phase margin is positive and gain margin is negative

(B) Phase margin is negative and gain margin is positive

(C) Both phase margin and gain margin is negative

(D) Both phase margin and gain margin is positive

53. For the circuit shown below with ideal op-amp the maximum phase shift of the output V_o with reference to input V_{in} is



(A) 0^o

(B) -90^o

(C) 90^o

(D) 180^o

54. An audio amplifier is designed to have a small signal bandwidth of 20 kHz. The open loop low frequency voltage gain of the op-amp is 10^5 and unity gain bandwidth is 1MHz. The maximum closed loop voltage gain for this amplifier is :

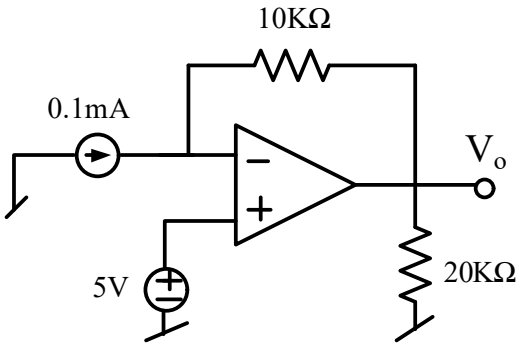
(A) 500

(B) 50,000

(C) $2x10^5$

(D) 50

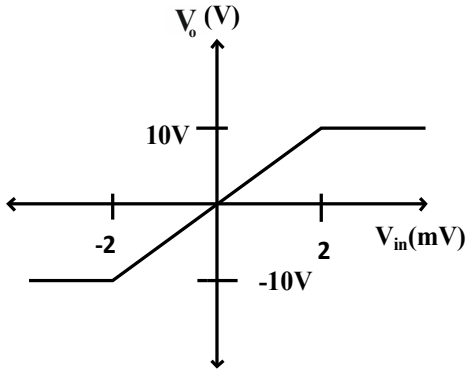
55. Assuming an ideal op-amp, the output voltage V_o for the circuit shown below is :



(A) 4V (B) – 4V

(C) 5V (D) –5V

56. The voltage transfer characterizes of an op-amp is shown below. What are the values of gain and offset voltage for this op-amp?



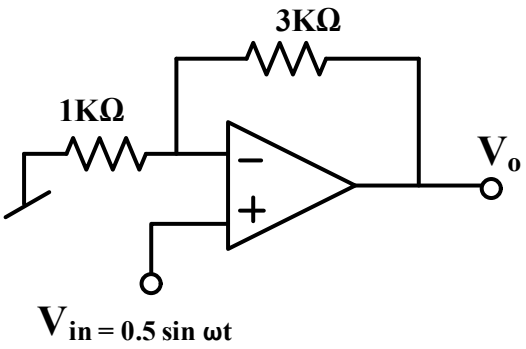
(A) 10, 1mV

(B) 7500, –1mV

(C) 20, 2mV

(D) 7500, –2mV

57. The op-amp shown below has slew rate of 1V/ns, what is the highest frequency for which no slewing occurs



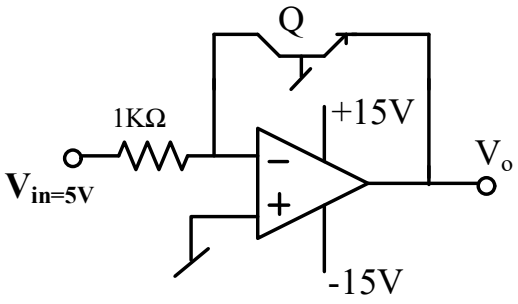
(A) 153.8MHz

(B) 63.7MHz

(C) 79.6MHz

(D) 127.4MHz

58. For the circuit shown below, what is the value of V_o if silicon transistor Q and ideal op-amp are used?



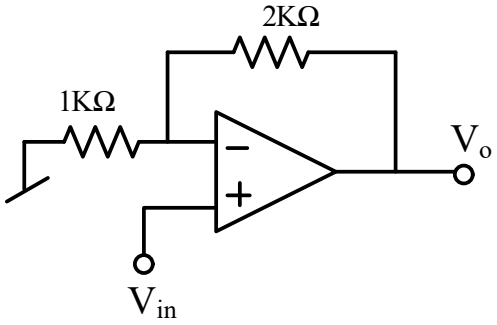
(A) +15V

(B) –15V

(C) – 0.7V

(D) 0.7V

59. The nature of feedback in the op-amp circuit shown below is :



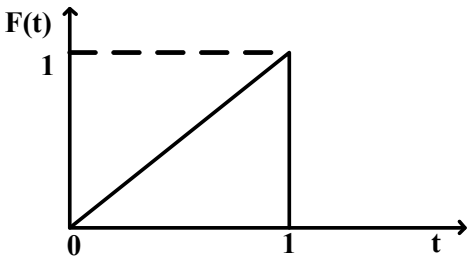
(A) Current-current feedback

(B) Voltage-voltage feedback

(C) Current-voltage feedback

(D) Voltage-current feedback

60. The Laplace transform of the waveform shown below is :



(A) $\frac{1}{s^2} - e^{-s}\left[\frac{1}{s} + \frac{1}{s^2}\right]$

(B) $\frac{1}{s^2} + e^{-s}\left[\frac{1}{s} - \frac{1}{s^2}\right]$

(C) $e^{-s}\left[\frac{1}{s} + \frac{1}{s^2}\right] - \frac{1}{s^2}$

(D) $e^{-s}\left[-\frac{1}{s} - \frac{1}{s^2}\right] - \frac{1}{s^2}$

61. For physically realizable circuit, impulse response is :

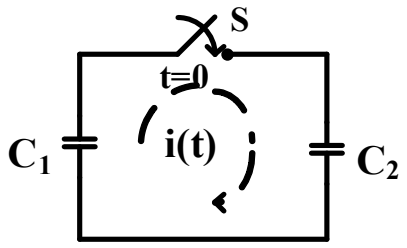
(A) Zero for $t < 0$

(B) Zero for $t > 0$

(C) One for $t < 0$

(D) Infinite for $t > 0$

62. In figure shown below, C_1 and C_2 are ideal capacitors. C_1 had been charged to 12 V before the ideal switch S is closed at t=0



The current i(t) for all t is :

(A) Zero

(B) A step function

(C) An exponentially decaying function

(D) An impulse function

63. The following item consist of two statements, one labelled as "Assertion (A)" and the other is labelled as "Reason (R)" :

Assertion(A): A four passive linear network will always have an equivalent T-network.

Reason (R): The Thevenin's theorem is applicable in case of transfer function also.

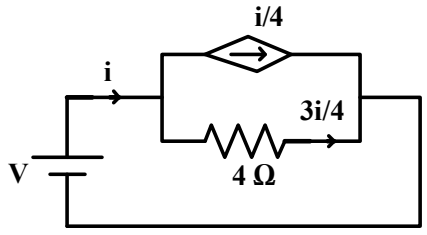
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).

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

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

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

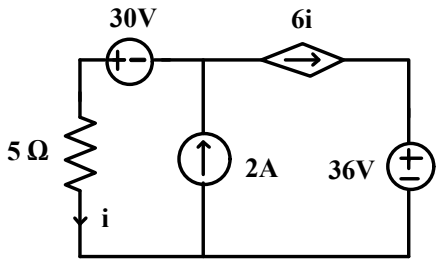
64. In the network shown below the effective resistance faced by the voltage source is :



(A) 4Ω (B) 3Ω

(C) 2Ω (D) 1Ω

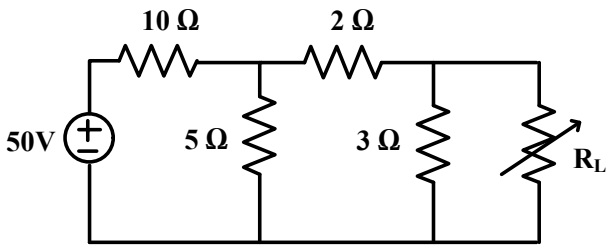
65. For the circuit shown below, the current through 5Ω resistor is :



(A) 3.6 A (B) 4.2A

(C) 4.8 A (D) 2.2A

66. For the network shown below find the load resistance R_L to receive maximum power from the source:



(A) 8.3 Ω (B) 10 Ω

(C) 1.9 Ω (D) 3 Ω

67. For transmission network to be reciprocal the condition of reciprocity is

(A) AD – BC = 1

(B) BC – AD = 1

(C) A = D

(D) B = C

68. In a certain application, a simple RC low pass filter is designed to reduce high frequency noise. If the designed corner frequency is 20 kHz and capacitance C = 0.5μF then required value of resistor R would be :

(A) 200Ω (B) 18.3Ω

(C) 100Ω (D) 15.9Ω

69. The following item consist of two statements, one labelled as "Assertion (A)" and the other is labelled as "Reason (R)" :

Assertion(A): For a system to be stable, all coefficients of the characteristic polynomial must be positive.

Reason(R): All coefficients of the characteristic polynomial of a system is a sufficient condition for stability.

(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 but (R) is false.

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

70. The following item consist of two statements, one labelled as "Assertion (A)" and the other is labelled as "Reason (R)" :

Assertion(A): Steady state error can be reduced by increasing integral gain.

Reason(R): Overshoot can be reduced by increasing derivative gain.

(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 but (R) is false.

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

71. Which digital logic family is known for its low power consumption and is commonly used in battery-powered devices?

(A) TTL

(B) CMOS

(C) ECL

(D) RT

72. In CMOS logic, what happens when both the nMOS and pMOS transistors are on simultaneously?

(A) Short circuit

(B) High power consumption

(C) Low power consumption

(D) Logic state depends on the input conditions

73. What is the primary advantage of using edge-triggered flip-flops over level-triggered flip-flops?

(A) Faster operation

(B) Simplicity of design

(C) Lower power consumption

(D) Better noise immunity

74. What is the primary difference between a latch and a flip-flop?

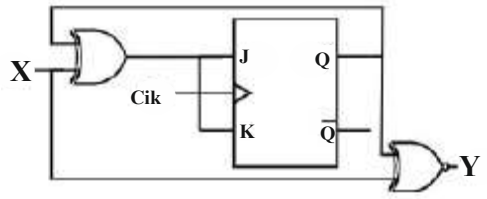
(A) Latches are edge-triggered, while flip-flops are level-triggered

(B) Latches are asynchronous, while flip-flops are synchronous

(C) Latches have two stable states, while flip-flops have four

(D) Latches are not used in digital circuits

75. Consider the following sequential circuit. Which of the following is correct?



(A) $J = X\bar{Q} + \bar{X}Q$

(B) $Y = X\bar{Q} + \bar{J}Q$

(C) $Q = X\bar{J} + \bar{X}K$

(D) $J = 1$

76. Starting from an initial state of 011 in a modulo-8 down counter, what will be the state of the counter after 77 clock pulses?

(A) 111 (B) 011

(C) 010 (D) 110

77. Which is the simplified Boolean expression for the following logic function realization using NAND gates?

$$f(X,Y,Z,W) = \sum m(1, 2, 5, 8, 9, 11, 15) + d(2,13) + d(2,13)$$

(A) $(X + \overline{Y} + Z)(Z + \overline{W})$

(B) $(X + \overline{Y} + \overline{Z})(\overline{Z} + W)(\overline{Y} + W)$

(C) $X\overline{Y}\,\overline{Z} + \overline{Z}W + \overline{Y}W + XW$

(D) $X\overline{Y}\,\overline{Z} + \overline{Z}W$

78. Which memory technology is characterized by its ability to retain data even when the power is turned off, making it suitable for storing firmware and configuration data?

(A) SRAM

(B) DRAM

(C) Flash Memory

(D) EEPROM

79. What is the fundamental building block in an FPGA that can be configured to perform various logic functions?

(A) Logic Cell

(B) Clock Buffer

(C) Memory Block

(D) I/O Block

80. What is the main advantage of using Carry Look-Ahead Adders (CLA) over Ripple Carry Adders (RCA) in arithmetic circuits?

(A) Lower gate count

(B) Lower power consumption

(C) Reduced propagation delay

(D) Simplicity of design

81. Which addressing mode in the 8086 allows an instruction to access memory using a combination of a base address and an offset within the instruction itself?

(A) Absolute Addressing

(B) Register Indirect Addressing

(C) Indexed Addressing

(D) Immediate Addressing

82. The 8086 microprocessor uses a segmented memory model. What is the maximum size of a code or data segment in real mode?

(A) 64 KB (B) 1 MB

(C) 16 MB (D) 4 GB

83. During interrupt handling in an 8086 microprocessor, which of the following is the correct order of steps?

I. Save the flags register

II. Disable interrupts

III. Fetch the interrupt vector

IV. Execute the interrupt service routine (ISR)

Choose the correct order of steps

(A) I, II, III, IV

(B) II, IV, III, I

(C) III, II, IV, I

(D) IV, I, III, II

84. In the context of I/O interfacing, what is "handshaking"?

(A) A technique for selecting I/O devices

(B) A method of addressing I/O devices

(C) A process of data transfer coordination between the CPU and I/O device

(D) A type of error correction mechanism

85. An 8086 microprocessor initially has the value 0x5678 stored in the AX register. Consider the following subroutine:

```
MY_SUBROUTINE:
PUSH AX
MOV AX, 0x1234
ADD AX, 0x5678
POP AX
RET
```

What value does AX contain after calling MY_SUBROUTINE using a CALL instruction?

(A) 0x0000

(B) 0x1234

(C) 0x68AC

(D) 0x5678

86. What is the purpose of the INT instruction in 8086 assembly language?

(A) To initialize the interrupt controller

(B) To perform addition

(C) To generate a software interrupt

(D) To load data from memory

87. In the 8051 microcontroller, what is the purpose of the ALE (Address Latch Enable) signal?

(A) It enables the program memory

(B) It enables the data memory

(C) It latches the address from the P0 port

(D) It latches the address from the PC (Program Counter)

88. What is the function of the PSEN pin on the 8051 microcontroller?

(A) It enables the program memory

(B) It enables the data memory

(C) It is used for serial communication

(D) It is not used in the 8051 microcontroller

89. Which register is used to enable or disable individual bits of an I/O port as interrupt sources in the 8051 microcontroller?

(A) TCON

(B) IE

(C) IP

(D) IECON

90. In 8051 microcontroller programming, which interrupt is commonly used to handle incoming data from an RS232 device?

(A) Timer interrupt

(B) External interrupt

(C) Serial interrupt

(D) Reset interrupt

91. In a region of space, Laplace's Equation ($\nabla^2 V = 0$) implies that:

(A) The electric field is zero everywhere

(B) The electric field is constant everywhere

(C) The electric potential is constant everywhere

(D) The charge density is zero everywhere

92. The following item consists of two statements, one labelled as Assertion (A) and other labelled as Reason (R):

Assertion (A): Gauss's Law can be applied to determine the electric field for a charged spherical conductor.

Reason (R): Gauss's Law is valid only for closed surfaces that enclose a charge, and the electric field inside a charged conductor is zero in a static situation.

(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 correct explanation of (A).

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

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

93. Which of the following phenomena demonstrates electromagnetic induction?

(A) Photoelectric effect

(B) Compton scattering

(C) Hall effect

(D) Faraday's experiment with a moving magnet and a coil

94. Dielectric materials increase the capacitance of a capacitor by:

(A) Reducing the electric field between the plates

(B) Increasing the charge stored on the plates

(C) Enhancing the magnetic field around the plates

(D) Increasing the voltage across the plates

95. The electric field of a plane wave is represented by

$E = 10\hat{y}\cos(10^9 t + 30z)$ V/m.

The phase velocity is:

(A) Equal to the velocity of light

(B) 300 m/s

(C) $3/10^8$ m/s

(D) $10^8/3$ m/s

96. Let the incident power of electromagnetic radiation at a certain location on the Earth's surface is 1.5 kW/m², what is the approximate amplitude of the electric field associated with this radiation?

(A) 1.5 N/C (Newton per Coulomb)

(B) 950 N/C

(C) 300 N/C

(D) 1063 N/C

97. Which mode of propagation in a rectangular waveguide has the lowest cutoff frequency?
(A) TE10
(B) TE01
(C) TM11
(D) TEM00

98. The following item consists of two statements, one labelled as Assertion (A) and other labelled as Reason (R):
Assertion (A): Coaxial transmission lines are often used for high-frequency applications.
Reason (A): Coaxial lines have a lower characteristic impedance as compared to other types of transmission lines.
(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 correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.

99. Match the following items in List-I and List-II correctly:
List -I
P. Reflex Klystron .
Q. Magnetron
R. TWT (Traveling-Wave Tube)
S. Gunn diode
List -II
I. A semiconductor device that operates in the negative resistance region of its voltage-current characteristic
II. Operates on the principle of velocity modulation of electrons in a series of resonant cavities.
III. Amplifies microwave signals by allowing them to travel along a slow-wave structure.
IV. Utilizes the interaction of electrons with a magnetic field and resonant cavities to generate microwaves.
(A) P-I, Q-II, R-III, S-IV
(B) P-IV, Q-II R-I, S-III
(C) P-II, Q-IV, R-III, S-I
(D) P-IV, Q-III, R-I, S-II

100. Consider the following statements:
Statement-I: Radar operating in the L-band typically uses frequencies in the range of 1 GHz - 2 GHz.
Statement-II: The radar range equation relates radar range (R) to transmitted power (Pt), received power (Pr), radar cross-section (σ), and other factors.
Statement-III: Increasing transmitted power (Pt) in radar systems can lead to a reduction in radar sensitivity.
(A) Only I and II are true.
(B) Only II and III are true.
(C) Only I and III are true.
(D) All I, II, and III are true.

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