COMMON P. G. ENTRANCE TEST – 2024 (CPET-2024)

Test Booklet No. : 00278

Subject Code : 09

Hall Ticket No. :

Subject : ELECTRONIC SCIENCE

TEST BOOKLET

*Time Allowed : **60** Minutes*

*Full Marks : **80***

: INSTRUCTIONS TO CANDIDATES :

1. The Test Booklet contains **15** pages including the cover page and **80** (Question Nos. 1 to 80) multiple choice questions.
2. DO NOT break open the seal of the Test Booklet until the invigilator instructs to do so.
3. The candidates must check discrepancy, if any (like up-printed or torn or missing pages or missing questions) in the Test Booklet immediately after breaking the seal of the Test Booklet. If detected, the invigilator may be requested to replace the same.
4. Candidates are required to fill up and darken the **Hall Ticket No., Test Booklet Serial No.** and OMR Answer Sheet Serial No. in attendance sheet carefully. Wrongly filled in OMR Answer Sheet is liable for rejection.
5. Each question has four choices / answers marked (A), (B), (C), (D). Candidate has to select the most appropriate choice / answer to each question and darken the oval completely against the question number provided in the OMR Answer Sheet.
6. Indicate only one choice / answer from the options provided by darkening the appropriate oval in the OMR Answer Sheet. More than one response to a question shall be treated as a wrong answer.
7. Use only **Black Ball Point Pen** for darkening the oval for answering.
8. All the questions are compulsory and they carry equal marks. The total marks scored by a candidate depends on the number of correct choices / answers darkened in the OMR Answer Sheet. There will be no negative marking for wrong answers.
9. No candidate shall be allowed to leave the Examination Hall / Room till all OMR Answer Sheets have been collected by the invigilator.
10. On completion of the entrance test, the original OMR Answer Sheet be handed over to the invigilator. Candidates are allowed to take the second copy of the OMR Answer Sheet along with the used Test Booklet for reference.
11. Candidates are not allowed to carry any personal belongings including electronic devices such as scientific calculator, cell phones, headphones, earbuds, or any other type of devices that allow communication of any kind inside the Examination Room / Hall.
12. The candidates are advised not to scribble or make any mark on the OMR Answer Sheet except marking the answers at the appropriate places and filling up the details required. Rough work, if any, may be done in the blank sheet(s) provided at the end of the Test Booklet.
13. Any malpractice / use of unfair means will lead to your disqualification from the entrance test / admission process and may also lead to appropriate legal action as deemed fit.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

SEAL

1. White light exhibits dispersion due to different wavelengths of light having different refractive indices. Cauchy's formula for the refractive index of a material for light of wavelength λ is given by :

(A) $\mu = a + \frac{b}{\lambda} + \frac{c}{\lambda^2}$

(B) $\mu = a - \frac{b}{\lambda} + \frac{c}{\lambda^2}$

(C) $\mu = a + \frac{b}{\lambda^2} + \frac{c}{\lambda^4}$

(D) $\mu = a - \frac{b}{\lambda^2} + \frac{c}{\lambda^4}$

2. Electromagnetic radiation consists of :

(A) Nothing

(B) Phonos

(C) Electrons

(D) Photons

3. The maximum kinetic energy of electrons emitted in the photoelectric effect increases when :

(A) Intensity of light is increased

(B) Light source is brought near the metal

(C) Frequency of light is decreased

(D) Wavelength of light is decreased

4. The de Broglie wavelength of an electron inside a region with a potential difference V is :

(A) $\frac{0.1225}{\sqrt{(V)}}$ Å

(B) $\frac{1.225}{\sqrt{(V)}}$ Å

(C) $\frac{12.25}{\sqrt{(V)}}$ Å

(D) $\frac{122.5}{\sqrt{(V)}}$ Å

5. Which of the following oscillators uses a capacitive voltage divider to provide feedback ?

(A) Hartley

(B) RC phase shift

(C) Colpitts

(D) Wien Bridge

6. During population inversion, which of the following processes is dominant ?

(A) Stimulated absorption

(B) Stimulated emission

(C) Spontaneous emission

(D) Spontaneous absorption

7. If the error in the measurement of the radius of a sphere is 1%, then the error in the measurement of volume is :

(A) 1%

(B) 3%

(C) $\frac{4\pi}{3}\%$

(D) $\frac{1}{3}\%$

8. Which of the following is not a fundamental quantity ?

(A) Charge

(B) Current

(C) Time

(D) Mass

9. Planck's constant has the dimension of :

(A) Force

(B) Energy

(C) Linear momentum

(D) Angular momentum

10. When a wave passes from air to water, which of the following doesn't change ?

(A) Amplitude

(B) Wavelength

(C) Frequency

(D) Speed

11. Red (R), Green (G), and Blue (B) LEDs were fabricated using p-n junctions of three different semiconductors having different band gaps. The built-in voltages of red, green, and blue diodes are V_R, V_G, and V_B, respectively. Assume the donor and acceptor doping to be the same on the p and n sides of all three diodes. Which one of the following relationships about the build-in voltages is true ?

(A) $V_R > V_G > V_B$

(B) $V_R < V_G < V_B$

(C) $V_R = V_G = V_B$

(D) $V_R > V_G < V_B$

12. To increase the capacity of a parallel plate capacitor, one should introduce between the plates a sheet of :

(A) Mica

(B) Tin

(C) Copper

(D) Stainless steel

13. A charged particle is undergoing circular motion in a magnetic field. The time period is independent of :

(A) Speed
(B) Mass
(C) Charge
(D) Magnetic field

14. On placing a dielectric in an electric field, the field strength :

(A) Decreases
(B) Increases
(C) Remains the same
(D) Reduces to zero

15. A region around a time-varying electric charge has :

(A) Electric field
(B) Magnetic field
(C) Both electric and magnetic field
(D) Neither electric nor magnetic field

16. The smallest change in the input signal to an instrument that produces detectable output is called :

(A) Resolution
(B) Threshold
(C) Both (A) and (B)
(D) Sensitivity

17. LVDT is a :

(A) Capacitive transducer
(B) Resistive transducer
(C) Inductive transducer
(D) Optical transducer

18. Hall effect devices can be used to :

(A) Divide one signal by another
(B) Add two signals
(C) Multiply two signals
(D) Subtract one signal from another

19. Lissajous patterns on CRO can be used to determine :

(A) Phase
(B) Voltage
(C) Current
(D) Power

20. The electron relaxation time of metal A is 2.7×10^{-4} s and that of B is 1.35×10^{-4}s. The ratio of the resistivity of B to the resistivity of A will be :

(A) 4
(B) 2
(C) 0.5
(D) 0.25

21. The structure of a silicon crystal is :

(A) Like that of a diamond
(B) Like that of NaCl
(C) Like that of cesium chloride
(D) Simple cubic

22. The forbidden energy gap between the valence band and the conduction band is the least in the case of :

(A) Mica
(B) Pure silicon
(C) Pure germanium
(D) Impure silicon

23. The movement of charge carriers from an area of high carrier concentration to an area of low carrier concentration is called :

(A) Drift
(B) Diffusion
(C) Recombination
(D) Gradient

24. In a silicon diode, the reverse saturation current is of the order of :

(A) 1pA
(B) 1nA
(C) 1μA
(D) 1mA

25. Clamping is the process of introducing a/an :

(A) DC level into an AC signal
(B) AC level into an AC signal
(C) AC level into a DC signal
(D) DC level into a DC signal

26. In a JFET, beyond the pinch-off voltage, as the drain voltage increases, the drain current :

(A) Remains almost constant
(B) Decreases
(C) Increases
(D) May increase or decrease

27. The AC component in the output of a full wave rectifier is _____ the DC component.

(A) Equal to
(B) Greater than
(C) Less than
(D) Greater than or equal to

28. The voltage gain of the BJT amplifier is highest in :

(A) CB configuration
(B) CE configuration
(C) CC configuration
(D) Same in all configurations

29. A transistor is said to be in a quiescent state when :

(A) It is unbiased
(B) No signal is applied to it
(C) No current is flowing in it
(D) Emitter junction bias is equal to collector junction bias

30. The effect of cascading several amplifier stages is to :

(A) Reduce the overall gain
(B) Reduce the overall frequency response
(C) Increase the overall gain and reduce the frequency response
(D) Decrease the overall gain and increase the frequency response

31. The adverse effect of noise in a communication system is maximum in :

(A) Encoder
(B) Channel
(C) Receiver
(D) Source

32. The modulation index in a frequency-modulated signal with a carrier frequency of 100 kHz, modulating frequency of 4 kHz, and frequency deviation of 50 kHz is :

(A) 2
(B) 12.5
(C) 25
(D) 0.5

33. A pre-emphasis circuit is placed :

(A) After the modulation circuit
(B) Before the modulation circuit
(C) Before the detection circuit
(D) After the detection circuit

34. Which of the following modulation systems is digital ?

(A) PPM
(B) PCM
(C) PWM
(D) PFM

35. A balanced modulator produces :

(A) DSB-SC signal
(B) FM signal
(C) PM signal
(D) PAM signal

36. With a feedback system, transient response :

(A) Decays constantly
(B) Decays slowly
(C) Decays quickly
(D) Raises fast

37. The system generally preferred is :

(A) Underdamped
(B) Critically damped
(C) Overdamped
(D) Oscillatory

38. The transient response of a system is basically because of :

(A) Coupling
(B) Forces
(C) Friction
(D) Stored energy

39. Electrical resistance is analogous to :

(A) Inertia
(B) Dampers
(C) Spring
(D) Fluid capacity

40. The dominant mode in a rectangular waveguide is :

(A) TE_{11}
(B) TEM
(C) TE_{01}
(D) TE_{10}

41. The cut-off frequency of the TEM wave is :

(A) Zero
(B) Infinity
(C) Negative
(D) Finite

42. The input impedance of a lossless transmission line is 100Ω when terminated in a short-circuit, and 64Ω when terminated in an open-circuit. The characteristic impedance of the line is :

(A) 80Ω
(B) 164Ω
(C) 36Ω
(D) 64Ω

43. The equation $\nabla \cdot J = 0$ is :

(A) Poisson's equation (B) Laplace equation

(C) Continuity equation (D) Maxwell equation

44. The capacitance per unit length and the characteristic impedance of a lossless transmission line are 'C' and 'Z_0', respectively. The velocity of a traveling wave on the transmission line is :

(A) Z_0C (B) $1/(Z_oC)$

(C) Z_0/C (D) C / Z_0

45. When a charge is given to a conductor :

(A) It distributes uniformly all over the surface

(B) It distributes uniformly all over the volume

(C) It goes to the center

(D) It stays where it was placed

46. The vector H in the far field of an antenna satisfies :

(A) $\nabla \cdot H = 0$ and $\nabla \times H = 0$ (B) $\nabla \cdot H \neq 0$ and $\nabla \times H \neq 0$

(C) $\nabla \cdot H = 0$ and $\nabla \times H \neq 0$ (D) $\nabla \cdot H \neq 0$ and $\nabla \times H = 0$

47. Given h(n) = {1, 2, $\underline{1}$, 0, 2}, then the system is :

(A) Causal and stable (B) Non-causal and stable

(C) Causal and unstable (D) Non-causal and unstable

48. The Hilbert transform introduces a phase shift of :

(A) $\pm 0^o$ (B) $\pm 45^o$

(C) $\pm 90^o$ (D) $\pm 180^o$

49. A periodic signal that can be expanded in Fourier series :

(A) Is a power signal

(B) Is a energy signal

(C) Is neither a power nor an energy signal

(D) Can be either a power or an energy signal

50. A network N is a dual of network N if :

(A) Both of them have the same mesh equations

(B) Both of them have the same node equations

(C) Mesh equations of one are the node equations of the other

(D) KCL and KVL equations are the same

51. The number of address lines required to address 8k bytes of memory is :

(A) 13 (B) 14

(C) 8 (D) 16

52. While an instruction is executed, the Programme Counter (PC) should contain the address of :

(A) The current instruction (B) The next sequential instruction

(C) The operand (D) The previous instruction

53. Static RAM :

(A) Is a volatile memory

(B) Is a non-volatile memory

(C) Needs refreshing to retain its value

(D) Contains static information that can't be modified

54. How many dual-purpose ports are there in the 8051 microcontroller ?

(A) 1 (B) 2

(C) 3 (D) 4

55. The stack pointer in a microprocessor is a register containing :

(A) The address of the next operand

(B) The current size of the stack

(C) The address of the top of the stack

(D) The address for storing the result of an arithmetic operation

56. We use a crystal oscillator because :

(A) It gives a high output voltage

(B) It works at high efficiency

(C) The frequency of oscillations remains substantially constant.

(D) It requires a very low Dc supply voltage.

57. $(11)_2 + (11)_3 = (11)_?$

(A) 2 (B) 5

(C) 6 (D) 4

58. A voltage source can be converted into a constant current source by adding :

(A) High resistance in series with the voltage source

(B) Low resistance in series with the voltage source

(C) Low resistance in parallel with the voltage source

(D) High resistance in parallel with the voltage source

59. The minimum gain of an amplifier, when it is used in a 3-stage RC phase shift oscillator, is :

(A) 44.5 (B) 29

(C) 3 (D) 1

60. Negative feedback in an amplifier :

(A) Increase gain (B) Decreases gain

(C) Decreases bandwidth (D) Increases noise level

61. Knowledge of binary number systems is required for the designers of computers and other digital systems because :

(A) It is easy to learn the binary number system

(B) It is easy to learn Boolean algebra

(C) It is easy to use binary codes

(D) The devices used in these systems operate in binary

62. When two n-bit numbers are added, the sum will contain at most :

(A) n bits
(B) (n + 1) bits
(C) (n + 2) bits
(D) (n + n) bits

63. An arithmetic operation in the 8085 microprocessor sets the sign and parity flags. The contents of the accumulator after the execution of the operation can be :

(A) 1011 0100
(B) 0010 1101
(C) 1010 1101
(D) 0110 0111

64. The mass of an electron in kg equals :

(A) 9.1×10^{-19}
(B) 9.1×10^{-31}
(C) 9.1×10^{-19}
(D) 1.6×10^{-31}

65. The ionization energy of a hydrogen atom in eV is :

(A) 1.36
(B) 13.6
(C) 1.61
(D) 16.1

66. The color of the nanogold particles is :

(A) Yellow
(B) Orange
(C) Red
(D) Variable

67. GPRS stands for :

(A) General Packet Radio Service
(B) Global Positioning Radio Service
(C) Geological Packet Radio Service
(D) Geological Positioning Radio Service

68. A field of technology that deals with a combination of the real world and the data generated from computers is :

(A) Machine Learning
(B) Artificial Intelligence
(C) Augmented Reality
(D) Internet of Things

69. How many degrees of freedom does an object in 2D space have ?

(A) 1 (B) 2

(C) 3 (D) 6

70. Quantum computers are very good at dealing with :

(A) Clarity (B) Certainty

(C) Uncertainty (D) Reliability

71. The Fourier transform of the exponential $e^{j\omega_o t}$ is :

(A) A constant (B) An impulse

(C) A rectangular gate (D) A series of impulses

72. The value of the integral $\int_0^{\infty} \frac{\sin x}{x} dx$ is :

(A) 0 (B) $-\frac{\pi}{2}$

(C) $\frac{\pi}{2}$ (D) 1

73. The response of an LTI system is given by the _____ of input and impulse response.

(A) Convolution (B) Correlation

(C) Superposition (D) Multiplication

74. An operational amplifier possesses :

(A) Very large input resistance and very large output resistance

(B) Very small input resistance and very small output resistance

(C) Very large input resistance and very small output resistance

(D) Very small input resistance and very large output resistance

75. How many bytes are in 4kB of memory ?

(A) 4024 (B) 4048

(C) 4182 (D) 4096

76. Which of the following hexadecimal numbers represents an even decimal number ?

(A) DB (B) D5

(C) BF (D) AC

77. The output of a logic gate is '1' when all its inputs are at logic '0'. The gate is either :

(A) AND or XOR (B) NAND or XNOR

(C) NOR or XNOR (D) AND or XNOR

78. e^x is periodic, with a period of :

(A) 2π (B) $2i\pi$

(C) π (D) $i\pi$

79. The Taylor's series expansion of sinx is :

(A) $x - \frac{x^3}{3} + \frac{x^5}{5} - .....$ (B) $x - \frac{x^2}{2} + \frac{x^4}{4} - .....$

(C) $1 - \frac{x^3}{3} + \frac{x^5}{5} - .....$ (D) $1 - \frac{x^2}{2} + \frac{x^4}{4} - .....$

80. Frequency of the wave $y(x, t) = 0.5 \sin \frac{2\pi}{3.2} (64t - x)$ is :

(A) 1 Hz (B) 20 Hz

(C) $\frac{64}{2\pi}$ Hz (D) 64 Hz

SPACE FOR ROUGH WORK

SEAL