

COMMON P. G. ENTRANCE TEST – 2023 (CPET-2023)

Subject Code : **10**

Test Booklet No. : **013**

Hall Ticket No. :

Subject : **ELECTRONIC SCIENCE**

TEST BOOKLET

Time Allowed : **60 Minutes**

Full Marks : **80**

: INSTRUCTIONS TO CANDIDATES :

1. The Test Booklet contains **16** pages including the cover page and **80** (Question No. 1 to 80) multiple choice questions.
2. DO NOT break 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, ear buds, 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

PN – 10/22

(Turn over)

SEAL

1. Radiative far field from an antenna is proportional to :

(A) $\frac{1}{r}$	(B) $\frac{1}{r^2}$
(C) $\frac{1}{r^3}$	(D) $\frac{1}{r^4}$

2. When an electromagnetic wave propagates inside a conducting medium, the phase difference between the electric field and magnetic field is :

(A) 0	(B) $\pi/4$
(C) $\pi/2$	(D) π

3. The current density that flows between two plates of a capacitor is given by:

(A) $\frac{\partial \vec{E}}{\partial t}$	(B) $\frac{\partial \vec{B}}{\partial t}$
(C) $\frac{\partial \vec{D}}{\partial t}$	(D) $\frac{\partial \vec{H}}{\partial t}$

4. Poynting vector is given by :

(A) $\vec{E} \times \vec{H}$	(B) $\vec{B} \times \vec{H}$
(C) $\vec{D} \times \vec{H}$	(D) $\vec{J} \times \vec{H}$

5. A 10 mA current source and a 1 k Ω resistance constitute a Norton equivalent circuit. This circuit is now converted to a Thevenin equivalent circuit. Then, $V_{th} = ?$

(A) 1 V	(B) 5 V
(C) 10 V	(D) 20 V

6. A 10 H and a 20 H inductances are connected in series opposition. The mutual inductance between them is 0.5 H. The equivalent inductance is :

(A) 30.5 H	(B) 10.5 H
(C) 29 H	(D) 31 H

7. A series RLC resonant circuit having a quality factor of 1000, resonates at 1 MHz. Its bandwidth is :

- (A) 1 kHz (B) 100 kHz
(C) 200 kHz (D) 1 MHz

8. The Y parameters of a network is $\begin{vmatrix} 0 & -1/5 \\ 1/5 & 0 \end{vmatrix}$. The network is :

- (A) Reciprocal and passive (B) Reciprocal and active
(C) Non-reciprocal and passive (D) Non-reciprocal and active

9. If an ideal voltage source and ideal current source are connected in series, the combination :

- (A) Has the same properties as a current source alone
(B) Has the same properties as a voltage source alone
(C) Has the same properties as the source which has a higher value
(D) Makes the branch redundant

10. The Fourier transform of a Gaussian function is a :

- (A) Unit step (B) Impulse
(C) Ramp (D) Gaussian

11. A message signal is having 40 kHz maximum frequency. Which among the following is the most suitable sampling frequency for this signal ?

- (A) 40 kHz (B) 60 kHz
(C) 80 kHz (D) 100 kHz

12. An input signal $x(t)$ is applied to a system having impulse response $h(t)$. Which one of the following is true for the output $y(t)$?

- (A) $y(t) = x(t) h(t)$ (B) $Y(t) = \frac{x(t)}{h(t)}$
(C) $Y(\omega) = X(\omega) H(\omega)$ (D) $Y(\omega) = \frac{X(\omega)}{H(\omega)}$

13. For which signal the Fourier transform doesn't exist ?
 (A) $\delta(t)$ (B) $u(t)$
 (C) $\exp(t)u(t)$ (D) $\exp(-t)u(t)$
14. How many interrupt sources are there in an 8051 microcontroller ?
 (A) 1 (B) 2
 (C) 5 (D) 6
15. The Stack operation in a microprocessor follows :
 (A) first-in-first-out (B) first-in-last-out
 (C) last-in-first-out (D) last-in-last-out
16. The 8085 is an 8-bit microprocessor. Its maximum addressing capability is :
 (A) 4 KB (B) 32 KB
 (C) 64 KB (D) 1 MB
17. CISC and RISC are two microprocessor architectures for computing. The acronym of CISC is :
 (A) Complex Instruction Set Computing
 (B) Complex Instruction Set Computer
 (C) Combined Instruction Set Computer
 (D) Combined Instruction Set Computing
18. #include <stdio . h>
 int main ()
 {
 int a = 3, b = 5;
 int t = a;
 a = b;
 b = t;
 printf("%d %d", a, b);
 return 0;
 }
 Output of the program is :
 (A) 3 5 (B) 3 3
 (C) 5 5 (D) 5 3

19. Which one of the following is a loop construct that will always be executed once ?

- (A) for
- (B) while
- (C) switch
- (D) do while

20. #include <stdio.h>

if X == 3

define Y 3

else

define Y 5

endif

int main()

{

printf("%d", Y);

return 0;

}

The output of the program is :

- (A) 3
- (B) 5
- (C) 3 or 5 depending on the value of X
- (D) Compile time error

21. A Silicon diode is connected to a 2 V DC source through a resistor 13 k Ω . The current flowing through the resistor is :

- (A) 0.1 mA
- (B) 0.15 mA
- (C) 0.3 mA
- (D) 0.4 mA

22. In an NPN transistor amplifier, I_E is found to be 26 mA. The value of r_e is :

- (A) 26 m Ω
- (B) 26 Ω
- (C) 1 Ω
- (D) 10 Ω

23. The phase difference between the input and output of a CE BJT amplifier is :

- (A) 0 $^\circ$
- (B) 90 $^\circ$
- (C) 180 $^\circ$
- (D) 270 $^\circ$

24. The current gain provided by a Darlington connection of two identical transistors having a current gain of 200 is :
- (A) 200 (B) 400
(C) 4000 (D) 40000
25. The Karnaugh Map is a graphical technique used to simplify a logical equation conveniently up to _____ number of variables.
- (A) 4 (B) 5
(C) 6 (D) 7
26. 10's complement of 0123 is :
- (A) $(877)_{10}$ (B) $(987)_{10}$
(C) $(9987)_{10}$ (D) $(0123)_{10}$
27. The number of cells in a 5 variable K-map is :
- (A) 16 (B) 21
(C) 32 (D) 64
28. The boolean expression $A(A + B)$ is :
- (A) $A + B$ (B) A
(C) B (D) AB
29. An OpAmp as a voltage follower has a voltage gain of :
- (A) 0 (B) 1
(C) ∞ (D) -1
30. If a capacitor is placed in the feedback path of an op-amp circuit, then the circuit acts as :
- (A) Integrator (B) Differentiator
(C) Adder (D) Multiplier

31. Which among the following modulation technique requires minimum bandwidth ?
(A) PCM (B) PAM
(C) DPCM (D) Delta modulation
32. The number of diodes present in a ring modulator is :
(A) 2 (B) 3
(C) 4 (D) 5
33. The continuous signal of a sample signal is reconstructed by passing it through a :
(A) Low pass filter (B) High pass filter
(C) Band pass filter (D) Band notch filter
34. Hilbert transform is used to analyze which modulation ?
(A) AM (B) DSB-SC
(C) SSB-SC (D) FM
35. The maximum efficiency of AM modulation is :
(A) 15% (B) 33%
(C) 66% (D) 88%
36. Population inversion ?
(A) Excites most of the atoms
(B) Brings most of the atoms to the ground state
(C) Achieve stable condition
(D) Reduces the time of production of laser
37. The input and output power in an optical fiber is $100 \mu\text{W}$ and $1 \mu\text{W}$ and the length of the fiber is 8 km. The signal attenuation per km for the fiber is :
(A) 1 dB/km (B) 1.5 dB/km
(C) 2.5 dB/km (D) 12.5 dB/km

38. The refractive indices of the core and cladding of an optical fiber are 1.4 and 1.3 respectively. The value of the numerical aperture is :
- (A) 1.7 (B) 0.1
(C) 1.82 (D) 0.52
39. In a single slit Fraunhofer diffraction experiment x_1 and x_2 are the distances of the 1st and 2nd maximum from the center of the diffraction pattern. $x_1 : x_2$ is :
- (A) 3 : 5 (B) 1 : 3
(C) 3 : 4 (D) 4 : 3
40. In Young's double slit experiment, the fringe width will remain the same, if :
- (A) Both λ and D are doubled
(B) Both d and D are doubled
(C) D is doubled but d is halved
(D) λ is doubled but d is halved
- D = distance between screen and plane of slits, d = separation between two slits, and λ = wavelength of light used
41. The forbidden energy gap for Germanium is :
- (A) 0.12 eV (B) 0.72 eV
(C) 1.11 eV (D) 1.52 eV
42. Which of the following is created when trivalent impurities are added to a semiconductor ?
- (A) Free electrons (B) Holes
(C) Bound electrons (D) Valence electrons
43. The relation between the number of free electrons (n) in a semiconductor and its temperature (T) is :
- (A) $n \propto T$ (B) $n \propto T^2$
(C) $n \propto T^{3/2}$ (D) $n \propto T^{1/2}$

44. The temperature co-efficient of resistance of a semiconductor is :

- (A) Positive
- (B) Negative
- (C) Zero
- (D) Can't be defined

45. A forward biased pn junction diode has a resistance of the order of :

- (A) Ω
- (B) $K\Omega$
- (C) $M\Omega$
- (D) $G\Omega$

46. A strain gauge converts :

- (A) Mechanical displacement into a change of resistance
- (B) Pressure into a change of resistance
- (C) Force into a displacement
- (D) Pressure into displacement

47. A high pass RC filter acts as a pure differentiator when :

- (A) $\omega\tau = 1$
- (B) $\omega\tau \ll 1$
- (C) $\omega\tau \gg 1$
- (D) $\omega\tau = 0$

where ω is the applied frequency and τ is the time constant of the RC circuit.

48. An analog transducer has a range of 0 – 10 V. The number of bits of the A/D converter for a resolution of 5 mV is :

- (A) 9
- (B) 10
- (C) 11
- (D) 12

49. A set of readings has a wide range. It will have :

- (A) High accuracy
- (B) High precision
- (C) Low accuracy
- (D) Low precision

50. The formula for skin depth is :

(A) $\sqrt{\frac{2\sigma}{\omega\mu}}$

(B) $\sqrt{\frac{2\mu}{\omega\sigma}}$

(C) $\sqrt{\frac{2\omega}{\sigma\mu}}$

(D) $\sqrt{\frac{\sigma}{\omega\mu}}$

51. Laplace transform of e^{at} is :

(A) $\frac{1}{(s-a)}$

(B) $\frac{1}{(s+a)}$

(C) $\frac{1}{s}$

(D) $\frac{1}{s^2}$

52. Divergence of the curl of a double differentiable continuous vector function is :

(A) Infinity

(B) Zero

(C) Unity

(D) A unit vector

53. Maxwell proposed four equations to unify the electric field and magnetic field. How many of them are time independent ?

(A) 1

(B) 2

(C) 3

(D) 4

54. Net flux across a closed surface is provided by which operator ?

(A) Gradient

(B) Curl

(C) Divergence

(D) Laplace

55. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, then $\frac{dy}{dx} =$:

(A) $1+x$

(B) $(1+x)^{-2}$

(C) $-(1+x)^{-1}$

(D) $-(1+x)^{-2}$

56. The value of the series $1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!} - \dots$:

(A) e

(B) e^2

(C) e^{-1}

(D) $2e$

57. The maximum value of the function $\frac{\sin(x)}{x}$ is :

- (A) 0 (B) 1
(C) $\pi/2$ (D) ∞

58. The rank of the matrix is $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ is :

- (A) 0 (B) 1
(C) 2 (D) 3

59. The solution of the differential equation $dy = (1 + y^2) dx$ is :

- (A) $y = \tan(x) + c$ (B) $y = \tan(x + c)$
(C) $\tan^{-1}(y + c) = x$ (D) $\tan^{-1}(y + c) = 2x$

60. The degree of the differential equation $y = x \frac{dy}{dx} + \left(\frac{dy}{dx}\right)^{-2}$ is :

- (A) 1 (B) 2
(C) 3 (D) 4

61. The atomic packing fraction of the FCC unit cell is :

- (A) 0.34 (B) 0.52
(C) 0.68 (D) 0.74

62. Hook's law states that :

- (A) stress $\propto$ strain (B) stress $\propto \frac{1}{\text{strain}}$
(C) stress $\propto \frac{1}{\text{strain}^2}$ (D) stress $\propto \text{strain}^2$

63. An ideal gas in a cylinder is separated by a piston in such a way that the entropy of one part is S_1 and that of the other part is S_2 . Given that $S_1 > S_2$. If the piston is removed then the total entropy of the system will be :
- (A) $S_1 S_2$ (B) $S_1 - S_2$
 (C) $S_1 + S_2$ (D) S_1 / S_2
64. Thermocouple works on :
- (A) Peltier effect (B) Kelvin effect
 (C) Thomson effect (D) Seebeck effect
65. The mass of two particles X and Y are m_x and m_y , respectively, such that $m_x > m_y$. If both the particles have the same de Broglie wavelength, then :
- (A) Their energies are not the same (B) Their velocities are the same
 (C) Their momenta are the same (D) X has less energy than Y
66. Polarization of light supports its :
- (A) Particle nature (B) Dual nature
 (C) Wave nature (D) Ray nature
67. What happens to the free electrons when an electric field is applied ?
- (A) They move randomly and collide with each other
 (B) They move in the direction of the field
 (C) They remain stable
 (D) They move in the direction opposite to that of the field
68. A non-ferromagnetic toroid core has an inner radius of 22 cm and an outer radius of 28 cm. Around it, 4000 turns of a wire are wound. If the current in the wire is 9 A, the magnetic field inside the core of the toroid is :
- (A) $2.88 \times 10^{-2} \text{ T}$ (B) $28.8 \times 10^{-2} \text{ T}$
 (C) $9 \times 10^{-2} \text{ T}$ (D) $36 \times 10^{-2} \text{ T}$

69. Which among the following material has the maximum relative permeability ?

(A) Diamagnetic

(B) Ferromagnetic

(C) Paramagnetic

(D) Non-magnetic

70. Elements having an energy band gap of more than 5 eV act as :

(A) Insulator

(B) Superconductor

(C) Conductor

(D) Semiconductor

71. The modes of propagation supported by a rectangular waveguide are :

(A) TM, TEM, TE

(B) TM, TE

(C) TM, TEM

(D) TE, TEM

72. The function $f(x)$ is evaluated at four values of x at regular intervals as follows :

x	$f(x)$
0	1
1	0.5
2	0.2
3	0.1

$\int f(x)dx$ using the Trapezoidal rule is :

(A) 0.9

(B) 1.8

(C) 1.25

(D) 2.5

73. The bisection method is applied to compute a zero of the function $f(x) = x^4 - x^3 - x^2 - 4$ in the interval $[1, 9]$. After how many iterations the method converges to a solution ?

(A) 1

(B) 3

(C) 5

(D) 7

74. For which of the following diodes when the voltage is increased the current flowing through it decreases ?

(A) Tunnel Diode

(B) Schottky Diode

(C) Laser Diode

(D) Zener Diode

75. Ten signals, each requiring 3 kHz, are multiplexed onto a single channel using FDM. How much minimum bandwidth is required for the multiplexed channel ? Assume the guard bands are 300 Hz wide :
- (A) 30 kHz (B) 33 kHz
(C) 32.7 kHz (D) 33.7 kHz
76. The air between the plates of a capacitor is replaced by a medium of dielectric constant K. The electric field between the plates :
- (A) Decreases by $K^{1/2}$ times (B) Increases by K times
(C) Decreases by K times (D) Remains same
77. The measure of the change in instrument output that occurs when the quantity being measured changes by a given amount is :
- (A) Sensitivity (B) Linearity
(C) Hysteresis (D) Resolution
78. Cascading of two amplifiers will result in :
- (A) Reduction in overall gain and increase in overall bandwidth
(B) Reduction in overall gain and reduction in overall bandwidth
(C) Increase in overall gain and increase in overall bandwidth
(D) Increase in overall gain and reduction in overall bandwidth
79. Which of the following devices has characteristics very close to the ideal voltage source ?
- (A) Zener Diode (B) FET
(C) BJT (D) MOSFET
80. GSM frequency allocation in India is :
- (A) 700 MHz / 1,500 MHz (B) 600 MHz / 1,200 MHz
(C) 500 MHz / 1,000 MHz (D) 900 MHz / 1,800 MHz



SPACE FOR ROUGH WORK

SEAL

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