

COMMON P. G. ENTRANCE TEST – 2020

Test Booklet No. :

**DEPT. OF HIGHER EDUCATION, GOVT. OF ODISHA
TEST BOOKLET**

Subject Code **52**

Subject **ELECTRONIC SCIENCE**

Time Allowed : 90 Minutes

Full Marks : 70

: INSTRUCTIONS TO CANDIDATES :

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ET(C) IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. You have to enter your **Hall Ticket No.** on the Test Booklet in the Box provided alongside. **DO NOT** write *anything else* on the Test Booklet.
3. YOU ARE REQUIRED TO FILL UP & DARKEN HALL TICKET NO. & TEST BOOKLET NO. IN THE ANSWER SHEET AS WELL AS FILL UP TEST BOOKLET SERIAL NO. & ANSWER SHEET SERIAL NO. IN THE ATTENDANCE SHEET CAREFULLY. WRONGLY FILLED UP ANSWER SHEETS ARE LIABLE FOR REJECTION AT THE RISK OF THE CANDIDATE.
4. This Test Booklet contains 70 items (questions). Each item (question) comprises four responses (answers). You have to select the correct response (answer) which you want to mark (darken) on the Answer Sheet. In case, you feel that there is more than one correct response (answer), you should mark (darken) the response (answer) which you consider the best. In any case, choose **ONLY ONE** response (answer) for each item (question).
5. You have to mark (darken) all your responses (answers) **ONLY** on the **separate Answer Sheet** provided by using **BALL POINT PEN (BLUE OR BLACK)**. See instructions in the Answer Sheet.
6. All items (questions) carry equal marks. All items (questions) are compulsory. Your total marks will depend only on the number of correct responses (answers) marked by you in the Answer Sheet. **There is no negative marking.**
7. **After you have completed filling in all your responses (answers) on the Answer Sheet and after conclusion of the examination, you should hand over to the Invigilator the Answer Sheet issued to you. You are allowed to take with you the candidate's copy / second page of the Answer Sheet along with the Test Booklet, after completion of the examination, for your reference.**
8. Sheets for rough work are appended in the Test Booklet at the en(D)

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

1. A number of friends decided to go on a picnic and planned to spend Rs. 96 on eatables. Four of them, however, did not turn up. As a consequence, the remaining ones had to contribute Rs. 4 each extra. The number of those who attended the picnic was :
- (A) 8 (B) 12
(C) 16 (D) 24
2. The solution of the equations $2x + y + 4z = 12$, $4x + 11y - z = 33$, $8x - 3y + 2z = 20$ is :
- (A) $x = -1, y = 2, z = 1$ (B) $x = 1, y = 2, z = 1$
(C) $x = 3, y = 2, z = 1$ (D) $x = -1, y = -2, z = -1$
3. If $a + ib$ is a root of $f(x) = 0$ then the other root is _____.
- (A) $a - ib$ (B) $2a + ib$
(C) $a + 2ib$ (D) ib
4. Let $f(x)$ be an equation such that $f(a) f(b) > 0$ for two real numbers a and b . Then :
- (A) At least one root of $f(x) = 0$ lies in (a, b)
(B) No root lies in (a, b)
(C) Either no root or an even number of roots lie in (a, b)
(D) None of these
5. Let A be an $n \times n$ matrix. Then A is equal to :
- (A) $B + C$, where B is a symmetric matrix and C is a skew symmetric matrix
(B) $B + C$, where B is an orthogonal matrix and C is a unitary matrix
(C) $B + C$, where B is a hermitian matrix and C is a unitary matrix
(D) $B + C$, where B is a symmetric matrix and C is a nilpotent matrix
6. Eigen values of the matrix $\begin{bmatrix} 18 & 0 & 0 \\ 11 & 20 & 0 \\ 10 & 13 & 128 \end{bmatrix}$ are :
- (A) 18, 11, 20 (B) 12, 128, 20
(C) 18, 20, 128 (D) 08, 18, 128

7. Let D be a 2×2 orthogonal matrix. If ω be one of its eigen value, then the another eigen value of D is :

(A) $\omega + 1$

(B) $\omega^2 + 1$

(C) $\omega^2 + \omega + 1$

(D) $\frac{1}{\omega}$

8. Inverse of the matrix E having characteristic polynomial $x^2 - 4x + 1 = 0$ is :

(A) $\begin{pmatrix} 0 & 0 \\ 0 & 4 \end{pmatrix}$

(B) $\begin{pmatrix} 0 & -4 \\ -1 & 0 \end{pmatrix}$

(C) Does not exist

(D) $\begin{pmatrix} -4 & 1 \\ 2 & 0 \end{pmatrix}$

9. Let S be a set containing the natural numbers n , such that $1 \leq n \leq 10$. What is the cardinality of the set $P(P(S))$, where $P(S)$ is the power set of S :

(A) 2^{10}

(B) $2^{2^{10}}$

(C) 2^{10-2}

(D) $2^{2^{10-2}}$

10. $\lim_{x \rightarrow \infty} \frac{1}{n} \left(\frac{n}{n+1} + \frac{n}{n+2} + \frac{n}{n+3} + \dots + \frac{n}{2n} \right) = ?$

(A) 1

(B) 0

(C) $\log_e 2$

(D) e^2

11. If the kinetic energy of a free electron doubles, its de Broglie wavelength changes by the factor :

(A) 2

(B) $1/2$

(C) $\sqrt{2}$

(D) $1/\sqrt{2}$

12. Lenz law is in accordance with Law of Conservation of :

(A) Energy

(B) Mass

(C) Charge

(D) Momentum

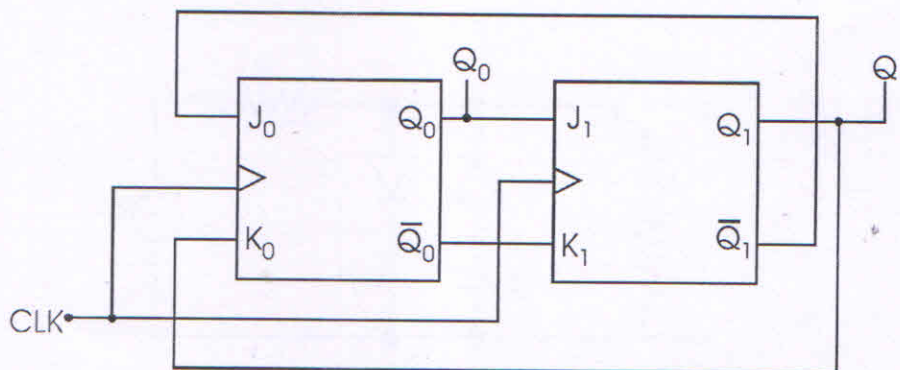
13. Rest mass energy of electron is :
- (A) 1.02 MeV (B) 0.511 KeV
(C) 0.511 MeV (D) 2.02 MeV
14. In photocell Cesium, coated oxidized silver cathode emits electrons for :
- (A) Visible light (B) Ultraviolet
(C) Infrared light (D) X-rays
15. Compton shift is max for scattering angle of :
- (A) 0° (B) 45°
(C) 90° (D) 180°
16. Cathode ray oscilloscope displays graph of waveforms based on :
- (A) Current (B) Resistance
(C) Potential difference (D) Temperature
17. The inverse Laplace transforms of $1/(s+1)s^2$ is :
- (A) $(t^2 e^{-t})/2$ (B) $t^2/2 + (1 - e^{-t})$
(C) $(1 - e^{-t})t^2/2$ (D) $t - 1 + e^{-t}$
18. If the electrostatic potential in spherical polar coordinates is, $V = V_0 \exp(-r/r_0)$ then the charge density at a distance $r = r_0$ is :
- (A) $\epsilon_0 V_0 / e(r_0)^2$ (B) $e\epsilon_0 V_0 / 2(r_0)^2$
(C) $-\epsilon_0 V_0 / e(r_0)^2$ (D) $-e\epsilon_0 V_0 / 2(r_0)^2$
19. A particle in one dimension moves under the influence of a potential $V(x) = ax^6$, where a is a real constant. For large n the quantized energy level E_n depends on n as :
- (A) $E_n \sim n^3$ (B) $E_n \sim n^{4/3}$
(C) $E_n \sim n^{6/5}$ (D) $E_n \sim n^{3/2}$

20. The energy of the first excited quantum state of a particle in the two-dimensional potential $V(x,y) = 1/2 m \omega^2 (x^2 + 4y^2)$ is :
- (A) $2\hbar\omega$ (B) $3\hbar\omega$
 (C) $3/2\hbar\omega$ (D) $5/2\hbar\omega$
21. If the output of a three-input AND gate must be a logic LOW, what must the condition of the inputs be ?
- (A) All inputs must be LOW (B) All inputs must be HIGH
 (C) At least one input must be LOW (D) At least one input must be HIGH
22. A 2-input NOR gate is equivalent to a _____.
- (A) Negative-OR gate (B) Negative-AND gate
 (C) Negative-NAND gate (D) None of the above
23. Determine the values of A, B, C and D that make the sum term $\bar{A} + B + \bar{C} + D$ equal to zero :
- (A) $A = 1, B = 0, C = 0, D = 0$ (B) $A = 1, B = 0, C = 1, D = 0$
 (C) $A = 0, B = 1, C = 0, D = 0$ (D) $A = 1, B = 0, C = 1, D = 1$
24. How many gates would be required to implement the following Boolean expression before simplification ?
- $XY + X(X + Z) + Y(X + Z)$:
- (A) 1 (B) 2
 (C) 4 (D) 5
25. What is the primary motivation for using Boolean algebra to simplify logic expressions ?
- (A) It may make it easier to understand the overall function of the circuit
 (B) It may reduce the number of gates
 (C) It may reduce the number of inputs require
 (D) All of the above

26. Which of the examples below expresses the distributive law of Boolean algebra ?
- (A) $(A + B) + C = A + (B + C)$ (B) $A(B + C) = AB + AC$
 (C) $A + (B + C) = AB + AC$ (D) $A(BC) = (AB) + C$
27. How many outputs are on a BCD decoder ?
- (A) 4 (B) 16
 (C) 8 (D) 10
28. How many possible outputs would a decoder have with a 5-bit binary input ?
- (A) 16 (B) 32
 (C) 64 (D) 128
29. One application of a digital multiplexer is to facilitate :
- (A) Data generation (B) Serial-to-parallel conversion
 (C) Parity checking (D) Data selector
30. If two inputs are active on a priority encoder, which will be coded on the output ?
- (A) The higher value (B) The lower value
 (C) Neither of the inputs (D) Both of the inputs
31. How many select lines would be required for an 8-line-to-1-line multiplexer ?
- (A) 2 (B) 3
 (C) 4 (D) 8
32. What is an energy gap ?
- (A) The space between two orbital shells
 (B) The energy equal to the energy acquired by an electron passing a 1 V electric field
 (C) The energy band in which electrons can move freely
 (D) An energy level at which an electron can exist

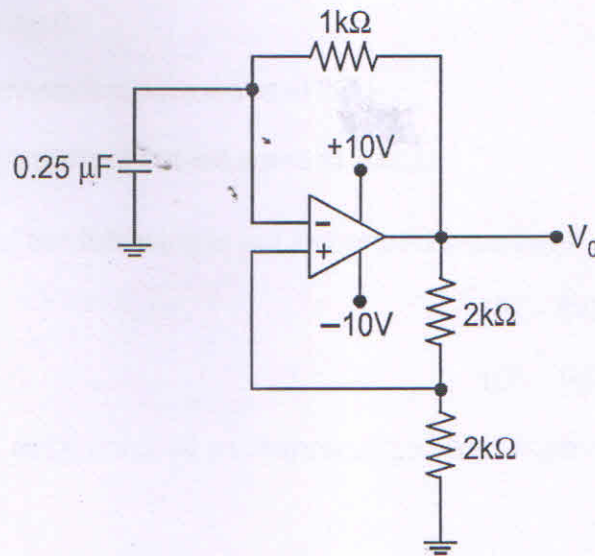
33. Silicon atoms combine into an orderly pattern called a :
- (A) Covalent bond (B) Crystal
(C) Semiconductor (D) Valence orbit
34. In "N" type semiconductor, majority carriers would be :
- (A) Holes (B) Doner
(C) Acceptor (D) Electrons
35. A commonly used pentavalent material is :
- (A) Arsenic (B) Boron
(C) Gallium (D) Neon
36. Which material may also be considered a semiconductor element ?
- (A) Carbon (B) Ceramic
(C) Mica (D) Argon
37. Forward bias of a silicon P-N junction will produce a barrier voltage of approximately how many volts ?
- (A) 0.2 (B) 0.3
(C) 0.7 (D) 0.8
38. When is a P-N junction formed ?
- (A) In a depletion region
(B) In a large reverse biased region
(C) The point at which two opposite doped materials come together
(D) Whenever there is a forward voltage drop
39. Electron pair bonding occurs when atoms :
- (A) Lack electrons (B) Share holes
(C) Lack holes (D) Share electrons

40. How many valence electrons are in every semiconductor material ?
- (A) 1 (B) 2
(C) 3 (D) 4
41. Suppose that resistors R_1 and R_2 are connected in parallel to give an equivalent resistor R . If resistors R_1 and R_2 have tolerance of 1% each, the equivalent resistor R for resistors $R_1 = 300\Omega$ and $R_2 = 200\Omega$ will have tolerance of :
- (A) 0.5% (B) 1%
(C) 1.2% (D) 2%
42. When a bipolar junction transistor is operating in the saturation mode, which one of the following statement is TRUE about the state of its collector-base (CB) and the base-emitter (BE) junctions ?
- (A) The CB junction is forward biased and the BE Junction is reverse biased
(B) The CB junction is reversed and the BE junction is forward biased
(C) Both the CB and BE junctions are forward biased
(D) Both the CB and BE junctions are reverse biased
43. In the following sequential circuit, the initial state (before the first clock pulse) of the circuit is $Q_1Q_0 = 00$. The state (Q_1Q_0) immediately after the 333rd clock pulse is :

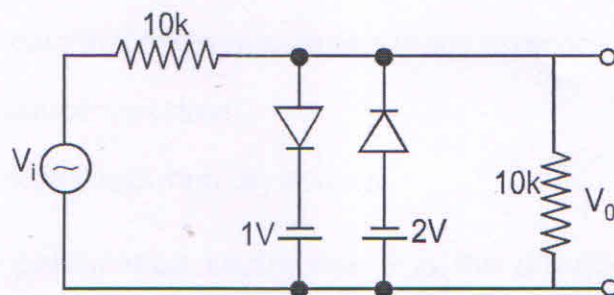


- (A) 00 (B) 01
(C) 10 (D) 11

44. The saturation voltage of the ideal op-amp shown below is $\pm 10V$. The output voltage v_o of the following circuit in the steady-state is :



- (A) Square wave of period 0.55 ms
 (B) Triangular wave of period 0.55 ms
 (C) Square wave of period 0.25 ms
 (D) Triangular wave of period 0.25 ms
45. Assuming the diodes to be ideal in the figure, for the output to be clipped, the input voltage v_i must be outside the range :



- (A) $-1V$ to $-2V$
 (B) $-2V$ to $-4V$
 (C) $+1V$ to $-2V$
 (D) $+2V$ to $-4V$

46. A 10 kHz even-symmetric square wave is passed through a band pass filter with centre frequency at 30 kHz and 3dB pass band of 6 kHz. The filter output is :
- (A) A highly attenuated square wave at 10kHz
 - (B) Nearly zero
 - (C) A nearly perfect sine wave at 30kHz
 - (D) A nearly perfect cosine wave at 30kHz
47. Which one of the following is not a vectored interrupt ?
- (A) TRAP
 - (B) INTR
 - (C) RST 7.5
 - (D) RST 3
48. The output data lines of microprocessor and memories are usually tri-stated because :
- (A) More than one device can transmit information over the data bus by enabling only one device at a time
 - (B) More than one device can transmit over the data bus at the same time
 - (C) The data line can be multiplexed for both input and output
 - (D) It increases the speed of data transfer over the data bus
49. Ready pin of microprocessor is used :
- (A) To indicate that microprocessor is ready to receive inputs
 - (B) To indicate that microprocessor is ready to receive outputs
 - (C) To introduce wait state
 - (D) To provide direct memory access
50. If n is the polarization vector and k is the direction of propagation plane electromagnetic wave, then :
- (A) $n = K$
 - (B) $n = -K$
 - (C) $n \cdot K = 0$
 - (D) $n \times K = 0$

51. How many bytes are allotted to float data types by C-Compiler ?
- (A) 2 Bytes (B) 4 Bytes
(C) 8 Bytes (D) Platform defined
52. Which of the following correctly shows the hierarchy of arithmetic operations in C ?
- (A) / + * - (B) * - / +
(C) / * + - (D) + - / *
53. Which of the following are unary operators in C ?
1. !
 2. Size of
 3. ~
 4. &&
- (A) 1, 2, 3 (B) 1, 2
(C) 2, 4 (D) 1, 3
54. Which of the following searching method is fastest ?
- (A) Binary Search (B) Linear Search
(C) Hashing (D) None of these
55. If the characters 'D', 'C', 'B', 'A' are placed in a queue (in that order) and then removed one at a time, in what order will they be removed ?
- (A) ABCD (B) BACD
(C) DCAB (D) DCBA
56. A computer program that translates one program instructions at a time into machine language is called a / an :
- (A) Interpreter (B) Compiler
(C) Both (A) and (B) (D) None of these

57. The ALU of a computer responds to the commands coming from _____.
- (A) Primary memory (B) Control section
(C) External memory (D) Cache memory
58. Before a disk drive can access any sector record, a computer program has to provide the record's disk address. What information does this address specify ?
- (A) Track number (B) Sector number
(C) Surface number (D) All of these
59. The two kinds of main memory are _____ and _____.
- (A) Primary and Secondary (B) Random and Sequential
(C) ROM and RAM (D) All of these
60. While working with MS-DOS, which command is used to copying the files to transfer from one PC to another one ?
- (A) Rename (B) Path
(C) Dir (D) Copy
61. A program at runtime is called _____.
- (A) Process (B) Procedure
(C) Module (D) Instructions
62. An Assembler is _____.
- (A) Programming language dependent
(B) Syntax dependent
(C) Machine dependent
(D) Data dependent
63. To measure light intensity, which one is used :
- (A) LED with forward bias (B) LED with reverse bias
(C) Photodiode with reverse bias (D) Photodiode with forward bias

64. What is rectifier used for ?
- (A) For converting alternating current into direct current
 - (B) For converting direct current into alternating current
 - (C) For increasing the power of signal
 - (D) For decreasing the voltage
65. The process which causes the elimination of one or more electrons from the atomic shell is known as :
- (A) Excitation
 - (B) Ionisation
 - (C) Diffusion
 - (D) Refraction
66. The square of the magnitude of a wave function is called :
- (A) Current density
 - (B) Power density
 - (C) Probability density
 - (D) Energy density
67. What do we call the process in which no exchange of heat energy takes place between the gas and the surroundings ?
- (A) Adiabatic
 - (B) Isothermal
 - (C) Isochoric
 - (D) Isobaric
68. What do we call the magnitude of the drift velocity per unit electric field ?
- (A) Current Density
 - (B) Mobility
 - (C) Conductance
 - (D) Resistance
69. Waves associated with moving electrons are referred to as :
- (A) Plasma Wave
 - (B) Gamma Wave
 - (C) Sonic Wave
 - (D) Matter Wave
70. Fermi level represents the energy level with the probability of its occupation of :
- (A) 25%
 - (B) 50%
 - (C) 75%
 - (D) 100%



SPACE FOR ROUGH WORK