Paper Code No: M50 Question Booklet No. 26001-9

ENTRANCE EXAMINATION – 2021 – 22

SET – C

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New Delhi

Roll No. M 5 0 2 0 [illegible]

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Signature of Invigilator

Time: 1 Hour 30 Minutes **Total Marks: 100**

Instructions to Candidates

1. Do not write your name or put any other mark of identification anywhere in the OMR Response Sheet. IF ANY MARK OF IDENTIFICATIONS IS DISCOVERED ANYWHERE IN OMR RESPONSE SHEET, the OMR sheet will be cancelled, and will not be evaluated.
2. **This Question Booklet contains the cover page and a total of 100 Multiple Choice Questions of 1 mark each.**
3. Space for rough work has been provided at the beginning and end. Available space on each page may also be used for rough work.
4. There is negative marking in Multiple Choice Questions. For each wrong answer, 0.25 marks will be deducted.
5. USE/POSSESSION OF ELECTRONIC GADGETS LIKE MOBILE PHONE, iPhone, iPad, pager ETC. is strictly PROHIBITED.
6. Candidate should check the serial order of questions at the beginning of the test. If any question is found missing in the serial order, it should be immediately brought to the notice of the Invigilator. No pages should be torn out from this question booklet.
7. Answers must be marked in the OMR Response sheet which is provided separately. OMR Response sheet must be handed over to the invigilator before you leave the seat.
8. The OMR Response sheet should not be folded or wrinkled. The folded or wrinkled OMR/Response Sheet will not be evaluated.
9. Write your Roll Number in the appropriate space (above) and on the OMR Response Sheet. Any other details, if asked for, should be written only in the space provided.
10. There are four options to each question marked A, B, C and D. Select one of the most appropriate options and fill up the corresponding oval/circle in the OMR Response Sheet provided to you. The correct procedure for filling up the OMR Response Sheet is mentioned below.

CORRECT METHOD
(A) ● (C) (D)

WRONG METHODS				
(A) ✗ (C) (D)	(A) ✓ (C) (D)	(A) ◐ (C) (D)	(A) ● (C) (D)	(A) ● (C) ●

1. The quantum mechanical operator for the momentum of a particle moving in one dimension is given by-

A. $ih\frac{d}{dx}$

B. $-ih\frac{d}{dx}$

C. $ih\frac{d}{dt}$

D. $\frac{h}{2m}\frac{d^2}{dx^2}$

2. Ionic polarization

A. decreases with temperature

B. increases with temperature

C. may increase or decrease with temperature

D. is independent of temperature

3. The correct order of increasing resistivity of the following is

A. nickel, doped silicon, sodium silicate, pure silica

B. doped silicon, pure silica, nickel, sodium silicate

C. pure silica, doped silicon, sodium silicate nickel

D. nickel, pure silica, doped silicon, sodium silicate

4. The majority charge carriers in p-type Ge are

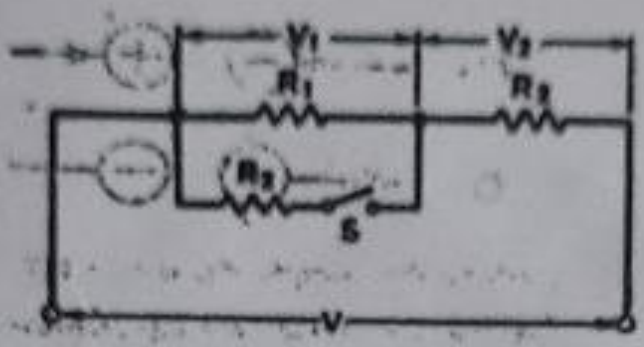
A. free electrons

B. ions

C. holes

D. conduction electrons

5. In the circuit shown below, how the voltage V1 and V2 changes when switch S is closed?



A. V 1 decreases, V2 increases

B. V 1 increases, V2 decreases

C. V1 and V2 decrease

D. V 1 and V2 increase

6. What is the component that converts an electrical signal into a signal suitable for transmission in a given medium called?

A. Transmitter

B. Receiver

C. Amplifier

D. Duplexer

7. A Zener Diode is used as a

A. current regulator

B. voltage booster

C. voltage regulator

D. power regulator

8. Hysteresis losses

A. are caused by high frequency a.c. current

B. generally, increases with direct current in a coil

C. can't be produced in an iron core because it is a conductor

D. none of these

9. The population inversion a two-level laser material cannot be achieved by optical pumping because-

A. the rate of upward transition is equal to the rate of downward transitions

B. the upward transitions are forbidden but downward transit ions are allowed

C. the upward transitions are allowed but downward transitions are forbidden

D. the spontaneous decay rate of the higher level is very low

10. The temperature (T) dependence of magnetic susceptibility(X) of a ferromagnetic substance with a Curie temperature (T_c) is given by-

A. $\frac{C}{T-T_c}$ for T<Tc

B. $\frac{C}{T-T_c}$ for T>Tc

C. $\frac{C}{T+T_c}$ for T>Tc

D. $\frac{C}{T-T_c}$ for all temperatures

Where C is constant.

11. For an electron to be confined to nucleus, its speed relative to the speed of light would have to

A. equal
B. less
C. greater
D. equal to infinity

12. The light from a laser source is monochromatic because all the photons

A. are in phase
B. have same energy
C. have same amplitude
D. are in the same direction

13. The process of population inversion is to increase the number of atoms in the

A. excited state
B. ground state
C. intermediate state
D. excited state and ground state

14. Laser light is intense because

A. it has very less number of Photons that in phase
B. it has very less number of Photons that are not in phase
C. it has very large number of Photons that are in phase
D. it has very large number of Photons that are not in phase

15. $\nabla^2 V = -\frac{\rho}{\epsilon}$. The equation is

A. Laplace equation
B. Poisson's equation
C. Maxwell's equation
D. Continuity equation

16. Plasma signifies:

A. electronic medium
B. solid dielectric
C. liquid dielectric
D. gaseous medium

17. When the distance between two charges is doubled, the force between them will be

A. four times
B. double
C. half
D. one fourth

18. An electrostatic field is said to be conservative when:

A. the divergence of the field is equal to zero
B. the curl of the field is equal to zero
C. the curl of the field is equal to $\frac{\partial E}{\partial t^2}$
D. the Laplacian of the field is equal to $\mu\varepsilon\frac{\partial^2 E}{\partial t^2}$

19. Negative feedback in an amplifier

A. reduces gain

B. increases frequency and phase distortions

C. reduces bandwidth

D. increases noise

20. An equivalent 2's complement representation of the 2's complement number 1101 is

A. 110100

B. 001101

C. 110111

D. 111101

21. A sinusoidal amplifier consists of an amplifier and a:

A. phase shifting network

B. gate

C. forward bias

D. non-resistive load

22. An infinitely long closely wound solenoid carrier a sinusoidally varying current. The induced electric field is

A. Zero everywhere

B. Non-zero inside and zero outside the solenoid

C. Non-zero inside as well as outside the solenoid

D. Zero inside and non-zero outside the solenoid

23. Which medium has the highest value of dielectric strength?

A. Mica
B. Porcelain
C. Quartz
D. Glass

24. The capacitance of the capacitor is not affected by

A. area of the plates
B. thickness of the plates
C. distance between the plates
D. both A and C

25. The energy of the particle P in the rest frame of the particle Q is:

A. $\frac{1}{2}m_oc^2$
B. $\frac{5}{4}m_oc^2$
C. $\frac{19}{13}m_oc^2$
D. $\frac{11}{9}m_oc^2$

26. The polarization of dielectric materials results in

A. absorption of electrons
B. release of high velocity protons
C. creation of dielectric poles
D. production of eddy currents

27. The circuit enables the generation of the ASCII code when the key is pressed.

A. generator
B. debouncing
C. encoder
D. logger

28. Consider the linear differential equation $\frac{dy}{dx} = xy$. If $y = 2$ at $x = 0$, then the value of y at $x = 2$ is given by

A. e^{-2}
B. $2e^{-2}$
C. e^{2}
D. $2e^{2}$

29. The magnetization of a superconductor of

A. 0
B. -B
C. -1
D. -H

30. With increase in temperature, the orientation polarization in general

A. increases
B. decreases
C. is constant
D. none of these

31. In most general case, which one of the following quantities is NOT a second order tensor?

A. Stress
B. Strain
C. Moment of Inertia
D. Pressure

32. Thermal expansion of materials arises from

A. strong bonds
B. weak bonds
C. thermal vibrations
D. asymmetry of potential energy curve

33. In an intrinsic semiconductor the free electron concentration depends on

A. effective mass of electrons only
B. effective mass of holes only
C. temperature of the semiconductor
D. width of the forbidden energy band of the semiconductor

34. The impurity commonly used for realizing the base region of a silicon n-p-n transistor is

A. Gallium
B. Indium
C. Boron
D. Phosphrous

35. n type silicon is obtained by doping silicon with

A. Germanium
B. Aluminium
C. Boron
D. Phosphrous

36. Pointing vector for an electron Magnetic wave is equal to

A. H.E
B. H x E
C. E x H
D. E.H

37. If dielectric is placed in an electric field, the field strength

A. increases
B. decreases
C. remains unaltered
D. becomes zero

38. Which of the following is a paramagnetic material?

A. Aluminium
B. Cobalt
C. Copper
D. Silver

39. What is the difference between an ion and an atom?

A. ions have always larger mass than an atom of the same element
B. ions are neutral particles while atoms always carry a positive charge
C. ions are always charged particles while the atoms are neutral as a whole
D. ions can only exist in liquid solutions

40. The probability of occupation of an energy level E, when $E - E_F = kT$, is given by

A. 0.73
B. 0.63
C. 0.27
D. 0.50

41. The unit of electrical conductivity is

A. ohm m

B. $mohm^{-1}m^{-1}$

C. $m^{-3}C^{-2}S^{-1}Kg^{-1}$

D. $ohm^{-1}m^{-1}$

42. In a Zener diode

A. only P region is heavily doped

B. only N region is heavily doped

C. both P and N regions are heavily doped

D. both P and P regions are lightly doped

43. The unit cell with three lattice parameters is

A. tetragonal

B. orthorhombic

C. monoclinic

D. triclinic

44. The number of members in the family <123> in a cubic crystal are

A. 8

B. 12

C. 24

D. 48

45. What other effect of the electric current is also present in fluorescent lamp and causes loses in efficiency of the lamp?

A. the chemical effect
B. the magnetic effect
C. the heating effect
D. The chemical and magnetic effect

46. Which of the following acts as a depolarizer in a dry cell?

A. Carbon powder
B. Manganese dioxide
C. Ammonium chloride
D. Zinc chloride

47. In Bose-Einstein condensates, the particles

A. have strong interparticle attraction
B. condense in real space
C. have overlapping wave functions
D. have large and positive chemical potentials

48. If one solid phase splits into two solid phases on heating, the reaction is

A. eutectic
B. peritectic
C. eutectoid
D. peritectoid

49. The degree of freedom when ice, water and water vapour co-exist in equilibrium is

A. 1
B. triple point
C. 0
D. -1

50. The de Broglie wavelength for an electron of energy 150 eV is

A. 10^{-8}m
B. 10^{-10}m
C. 10^{-12} m
D. 10^{-14}m

51. A particle is in a three dimensional cubic well of width L with impenetrable walls. The sum of the energies of the third and the fourth levels is

A. $\frac{10\pi h}{mL^2}$
B. $\frac{10\pi^2 h^2}{3mL^2}$
C. $\frac{11\pi^2 h^2}{2mL^2}$
D. $\frac{15\pi^2 h^2}{2mL^2}$

52. The phase space orbit of a body sliding down a frictionless inclined plane in uniform gravity is

A. a straight line
B. an ellipse
C. a parabola
D. a hyperbola

53. The tetrahedral bond angle of (sp3) bonds is

A. 90°

B. 99°

C. 104°

D. 109.5°

54. If x and p are the x components of the position and the momentum operators of a particle respectively, the commutator $[x^2, p^2]$ is

A. ih(xp - px)

B. 2ih(xp - px)

C. ih((xp + px)

D. 2ih(xp + px)

55. For differential equation

$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 0$

One solution is

A. e^x

B. ln

C. e^{-x^2}

D. e^{x^2}

56. The bandgap of Silicon at room temperature is

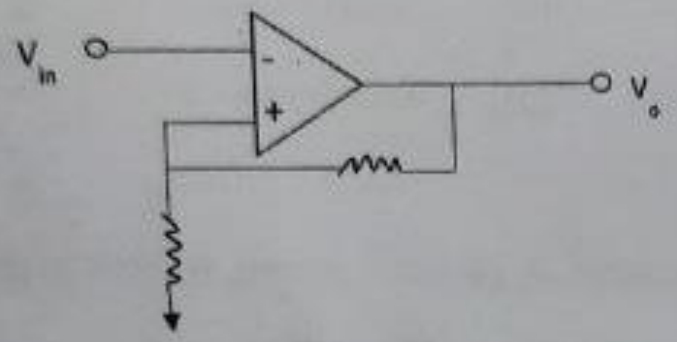
A. 1.3 eV

B. 0.7 eV

C. 1.1eV

D. 1.4 eV

57. The circuit shown in the figure is that of



A. a non-inverting amplifier
B. an inverting amplifier
C. an oscillator
D. a Schmitt trigger

58. Dielectric constant and dielectric strength are

A. same
B. different
C. one is a number and other indicates when the breakdown of the dielectric occurs when a potential difference is applied
D. one is dimensionless and the other is kV/mm

59. The local stacking arrangement at a stacking fault in a HCP crystal

A. ....ABCABABC...
B. ....ABABCABABAB...
C. ...ABABCABABC...
D. ...ABCABABCABABC...

60. A cation vacancy and an anion vacancy in a crystal of the type AB is called

A. Schottky defects
B. Frenkel defect
C. Pair of vacancies
D. Both (a) and (c)

61. A cylinder of mass M and radius R is rolling down without slipping on an inclined plane of angle of inclination (theta).The number of generalized coordinate required to describe the motion of the system is-

A. 1
B. 2
C. 4
D. 6

62. The 8-bit encoding format used to store data in a computer is -

A. ASCII
B. EBCDIC
C. ANCI
D. USCII

63. Which memory device is generally made of semiconductors?

A. RAM
B. Hard-disk
C. Floppy disk
D. CD

64. The order of magnitude of the energy gap of a typical superconductor is-

A. 1MeV
B. 1keV
C. 1eV
D. 1meV

65. The unit of q/KT are

A. V
B. v-1
C. J
D. J/K

66. The factors that obstruct domain wall motion in Fe are

1. Dislocation tangles
2. Impurity atoms
3. Voids
4. Non-magnetic inclusions

A. 1and 2
B. 2 and 3
C. 3 and 4
D. All above

67. The temperature of the antiferromagnetic-to-paramagnetic transition is called

A. Antiferromagnetic Curie temperature
B. Curie-Weiss temperature
C. Neel temperature
D. Debye temperature

68. The curl of the vector A =zi+xj+yk is given by

A. i+j+k
B. i-j+k
C. i+j-k
D. -i-j-k

69. Which of the following expressions are correct?

A. dH=TdS+VdP, where H is enthalpy

B. dF=SdT+PdV, where F is Helmhotz free energy

C. dG=SdT-VdP, where G is Gibbs function

D. SdT=dE+PdV, where E is the internal energy

70. Vector potential is a vector

A. whose curl is equal to the magnetic flux density

B. whose curl is equal to the electric field intensity

C. whose divergence is equal to the electric field potential

D. which is equal to the vector product EXH

71. Which of the following statements is correct for a common emitter amplifier circuit?

A. the output is taken from the emitter

B. there is 180° shift between the output and input voltages

C. there is no phase shift between the output and input voltages

D. both p-n junctions are forward biased

72. During the execution of the instructions, a copy of the instructions is placed in

A. Register

B. RAM

C. System Heap

D. Cache

73. The speed of a particle whose kinetic energy is equal to its rest mass energy is given by (c is the speed of light in vacuum)

A. $\frac{c}{3}$

B. $\frac{\sqrt{2}c}{3}$

C. $\frac{c}{2}$

D. $\frac{\sqrt{3}c}{2}$

74. Consider the electron gas in a simple metal at room temperature

A. This is a degenerate Fermi-Dirac gas

B. the gas displays Paramagnetism owing the spins of the electrons

C. all the electrons are in the same-particle energy level

D. the electrons have wave functions localized about the lattice positions of the positive ions.

75. The de Broglie wavelength of particles of mass m with average momentum p at a temperature Tin three dimensions is given by

A. $\lambda = \frac{h}{\sqrt{2mK_BT}}$

B. $\lambda = \frac{h}{\sqrt{3mK_BT}}$

C. $\lambda = \frac{h}{\sqrt{2K_BT}}$

D. $\lambda = \frac{h}{\sqrt{2m}}$

76. X and p are two operators which satisfy $[x, p] = i$. The operators X and P are defined as $X = x \cos\theta + p \sin\theta$ and

$y = -x \sin\theta + p \cos\theta$,

For ø real. Then [X, P] equals

A. 1

B. -1

C. i

D. $-i$

77. If the copper wire moves in a magnetic field,

A. a current is induced in the wire

B. a voltage is induced in the wire

C. the wire becomes magnetic

D. the wire becomes electric

78. In CMOS technology, shallow P-well or N-well regions can be formed using

A. low pressure chemical vapour deposition

B. low energy sputtering

C. low temperature dry oxidation

D. low energy ion-implantation

79. Which of the following can be used in the vibrational analysis of structure?

A. Maser

B. Quarts

C. Electrical Waves

D. Laser

80. The time dependent Schrodinger of a system represents the conversation of the

A. total binding energy of the system

B. total potential energy of the system

C. total kinetic energy of the system

D. total energy of the system

81. A particle is confined to the region $0 < x < L$ in one dimension. If the particle is in the first excited state, then the probability of finding the particle is maximum at

A. $x = \frac{L}{6}$

B. $x = \frac{L}{2}$

C. $x = \frac{L}{3}$

D. $x = \frac{L}{4}$ and $x = \frac{3L}{4}$

82. No reflection will be observed from a Diamond Crystal (DC) (a= 3 A0) if the wavelength of x- rays is greater than

A. $3.0\ A^0$

B. $3.25\ A^0$

C. $3.37\ A^0$

D. $3.46\ A^0$

83. If there are six electrons in the d orbital of a transition metal, the number of unpaired electrons are

A. 6

B. 5

C. 4

D. 0

84. Which of the following processes is preferred to form the gate dielectric (SiO_2) of MOSFETs?

A. Sputtering
B. Molecular beam epitaxy
C. Wet oxidation
D. Dry oxidation

85. The frequencies in ultra -high frequency range are propagated by means of

A. Ground Wave
B. space wave
C. Sky wave
D. Surface wave

86. The following does not exist in waveguides

A. TM waves
B. TE waves
C. TEM waves
D. TE and TM waves

87. The internal components of the processor are connected by

A. Processor intra-connectivity circuitry
B. Processor bus
C. Memory bus
D. RAM bus

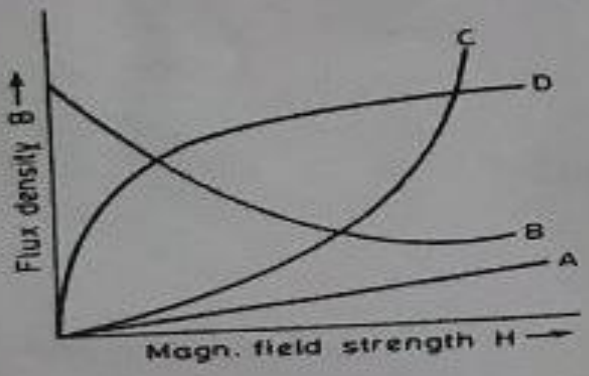
88. --------- is used to store data in registers

A. D Flip Flop
B. JK flip flop
C. RS flip flop
D. both A and B

89. ANSI stands for

A. American National Standard Institute
B. American National Standard Interface
C. American Network Standard Interfacing
D. American National Security Interrupt

90. Which of the curves shows the relation between the flux density B and the magnetic field strength H for a dynamo sheet?



A. Curve 'A'
B. Curve 'B'
C. Curve 'C'
D. Curve 'D'

91. The electric flux of a hemisphere of radius R and electric field E is

A. $4\pi R^2 E$

B. $\pi R^2 E$

C. $2\pi R^2 E$

D. $\frac{1}{2}\pi R^2 E$

92. The drain source voltage at which the drain current becomes nearly constant i called

A. barrier voltage

B. breakdown voltage

C. pick-off voltage

D. pinch-off voltage

93. Which of the following is a unique property of laser?

A. directional

B. speed

C. coherence

D. wavelength

94. What is the need to achieve population inversion?

A. To excite most of the atoms

B. To excite most of the atoms

C. To achieve stable condition

D. To reduce the time of production of laser

95. An electron is moving with a velocity of 0.85c in the same direction as that of a moving photon. The relative velocity of the electron with respect to photon is

A. c
B. -c
C. 0.15c
D. -0.15c

96. What is the type of laser that is used most widely in industrial materials application processing?

A. Dye Laser
B. Nd: YAG Laser
C. Carbon Dioxide Laser
D. Both B and C

97. The minimum number of double bonds required in the monomer for cross linking is

A. 0
B. 1
C. 2
D. 3

98. An octahedron has

A. 8 corners
B. 8 faces, 12 edges
C. 8 edges
D. 12 edges

99. An admissible potential between the proton and the neutron in a deutron is

A. Coulomb

B. Harmonic Oscillator

C. Finite square well

D. Infinite square well

100. The electrons revolve around the nucleus with high velocity. Which type of force acts against the centrifugal force and keeps the electrons in their orbits?

A. Electrostatic force of attraction

B. Electromagnetic force of attraction

C. Gravitational force

D. Adhesive force