M.Sc. Physics Code No. (481)

17P/218/22

Set No : 1

6164

Question Booklet No .....

(To be filled up by the candidate by blue/black ball-point pen)

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

Roll No.
(*Write the digits in words*) .....

Serial No. of OMR Answer Sheet 247 53

Day and Date .....

(*Signature of Invigilator*)

INSTRUCTIONS TO CANDIDATES

(Use only ***blue/black ball-point pen*** in the space above and on both sides of the **Answer Sheet**)

1. Within 30 minutes of the issue of the Question Booklet, check the Question Booklet to ensure that it contains all the pages in correct sequence and that no page/question is missing. In case of faulty Question Booklet bring it to the notice of the Superintendent/Invigilators immediately to obtain a fresh Question Booklet.
2. Do not bring any loose paper, written or blank, inside the Examination Hall *except the Admit Card without its envelope.*
3. A separate Answer Sheet is given. *It should not be folded or mutilated. A second Answer Sheet shall not be provided. Only the Answer Sheet will be evaluated.*
4. Write your *Roll Number and Serial Number of the Answer Sheet by pen* in the space provided above.
5. *On the front page of the Answer Sheet, write by pen your Roll Number in the space provided at the top, and by darkening the circles at the bottom. Also, wherever applicable, write the Question Booklet Number and the Set Number in appropriate places.*
6. No overwriting is allowed in the entries of Roll No., Question Booklet No. and Set No. (if any) on OMR sheet and also Roll No. and OMR sheet No. on the Question Booklet.
7. Any change in the aforesaid entries is to be verified by the invigilator, otherwise it will be taken as unfair means.
8. *Each question in this Booklet is followed by four alternative answers. For each question, you are to record the correct option on the Answer Sheet by darkening the appropriate circle in the corresponding row of the Answer Sheet, by ball-point pen as mentioned in the guidelines given on the first page of the Answer Sheet.*
9. For each question, darken only one circle on the Answer Sheet. If you darken more than one circle or darken a circle partially, the answer will be treated as incorrect.
10. *Note that the answer once filled in ink cannot be changed.* If you do not wish to attempt a question, leave all the circles in the corresponding row blank (such question will be awarded zero mark).
11. For rough work, use the inner back page of the title cover and the blank page at the end of this Booklet.
12. Deposit *only the OMR Answer Sheet* at the end of the Test.
13. You are not permitted to leave the Examination Hall until the end of the Test.
14. If a candidate attempts to use any form of unfair means, he/she is liable to such punishment as the University may determine and impose on him/her.

[उपर्युक्त निर्देश हिन्दी में अन्तिम आवरण-पृष्ठ पर दिये गए हैं]

Total No. of Printed Pages : 27

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ROUGH WORK
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Msc. Physics Code No, (481)

17P/218/22 (1)

No. of Questions : 120

2017

Time : 2 Hours] *[Full Marks : 360*

Note : (1) Attempt as many questions as you can. Each question carries **3 (Three)** marks. **One mark will be deducted for each incorrect answer.** **Zero** mark will be awarded for each unattempted question.

(2) If more than one alternative answers seem to be approximate to the correct answer, choose the closest one.

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1. If N atoms of a gas is mixed with N atoms of the same gas, the entropy of mixing of the gases in thermodynamics is

(1) 2 kN ln2 (2) kN ln2 (3) Zero (4) ln2

where k is Boltzmann constant.

2. The heat involved in going reversibly between two states can be made integrable when multiplied with an integrating factor

(1) $\frac{1}{V}$ (2) T (3) $\frac{1}{T}$ (4) S

3. In an isothermal expansion of 10 gm of nitrogen, its volume becomes 4 times of initial volume. The change in entropy of nitrogen if molecular weight of nitrogen = 28 and for 1 gm-mole gas, gas constant R = 8.3 J/mole- K, is

(1) 4.1 joule/K (2) 41 joule/K (3) 4.1 erg/K (4) 4.1 cal/K

4. The function which remains constant if the thermodynamic process is carried out isobarically and isothermally is called

(1) Internal energy (2) Gibbs' function

(3) Helmholtz function (4) Enthalpy

5. Which of the following gives volume, V ?

(1) $\left(\frac{\partial G}{\partial P}\right)_T$ (2) $\left(\frac{\partial U}{\partial V}\right)_S$

(3) $-\left(\frac{\partial G}{\partial T}\right)_P$ (4) $\left(\frac{\partial U}{\partial S}\right)_P$

where the symbols have their usual meanings.

6. Fermi level represents the energy level with probability of its occupation of

(1) 0% (2) 25% (3) 50% (4) 100%

7. The steady state conditions in diffusion are governed by

(1) Fick's second law (2) Fick's first law

(3) Both (1) and (2) (4) Maxwell-Boltzmann's law

8. The electronic polarizability, α_e of a monoatomic gas atom, if r is the radius of orbit of electron, is

(1) $4\Pi\varepsilon_0$ (2) $4\Pi\varepsilon_0 r$ (3) $4\Pi\varepsilon_0 r^3$ (4) $4\Pi\varepsilon_0 r^2$

(Continued)

9. With increase in temperature. the orientational polarization in general

(1) Decreases (2) Increases

(3) Remains same (4) None of these

10. The probability of occupation of an energy level E, when $E\text{-}EF = K\,T$, is given by

(1) 0.73 (2) 0.63 (3) 0.5 (4) 0.27

11. The frequency associated with 20 mm wavelength microwaves is

(1) 100 MHz (2) 400 MHz (3) 73 MHz (4) 15 GHz

12. Total current density, $\overline{J}$, equals

(1) Sum of current density due to free charge carriers and displacement current density

(2) Current density due to free charge carriers only

(3) Displacement current density only

(4) None of these

13. The capacitance of two concentric metal shells, with radii a and b is

(1) $\frac{Q}{4\Pi\varepsilon_0}\left(\frac{1}{a}-\frac{1}{b}\right)$ (2) $4\Pi\varepsilon_0\frac{ab}{(b-a)}$

(3) $\frac{1}{4\Pi\varepsilon_0}\cdot\frac{ab}{(b-a)}$ (4) $4\Pi\varepsilon_0 Q\left(\frac{1}{a}-\frac{1}{b}\right)$

14. For glass-air interface (ng = 1.5 and na = 1) for normal incidence, the reflection coefficient is

(1) 0.2 (2) 0.04 (3) 0.98 (4) 0.96

15. The total energy density associated with an electromagnetic wave in free space is

(1) $\frac{1}{2}\varepsilon_0 E_{rms}^2$ (2) $\varepsilon_0 E_{rms}^2$

(3) $2\varepsilon_0 E_{rms}^2$ (4) None of these

where E_{rms} is the rms value of electric field associated with the electromagnetic wave.

16. Electric flux associated with a small surface area $d\vec{s}$ in an electric field $\vec{E}$ is given by

(1) $\vec{E}\cdot d\vec{s}$ (2) $\varepsilon_0 \vec{E}\cdot d\vec{s}$

(3) $\oint_s \vec{E}\cdot d\vec{s}$ (4) $\vec{E}\times d\vec{s}$

17. If a Gaussian surface encloses no charge, which of the following is true for a point inside it

(1) Electric field must be zero

(2) Electric potential is zero

(3) Electric field and potential are zero

(4) None of these

18. Energy is not transferred by

(1) Transverse progressive wave

(2) Longitudinal progressive wave

(3) Stationary wave

(4) Electromagnetic wave

19. The relation between permeability and susceptibility in C.G.S. system is

(1) $\mu = \mu_0(1+\chi)$ (2) $\mu = 1+4\Pi\chi$

(3) $\mu = \frac{\mu_0}{4\Pi}(1+\chi)$ (4) $\mu = 1+\chi$.

20. Lorentz unit is

(1) $\frac{eB}{4\Pi mc}$ (2) $\frac{eB}{4\Pi m}$

(3) $\frac{eB}{4\Pi hmc}$ (4) $\frac{eB}{4\Pi h}$

21. The unit of magnetic moment is

(1) erg-gauss

(2) erg^{-1} $gauss^{-1}$

(3) m-gauss

(4) Bohr magneton

22. Very low temperatures can be produced by

(1) Adiabatic demagnetisation of a paramagnetic salt

(2) Adiabatic magnetisation of a paramagnetic salt

(3) Isothermal magnetisation of diamagnetic salt

(4) Isothermal demagnetisation of diamagnetic salt

23. The SI unit of $\vec{B}$ is

(1) Tesla (2) Gauss

(3) Tesla mt Amp^2 (4) Amp-mt^2

24. A solenoid having a resistance of 5 Ω and self inductance of 4 Henry, is connected to a battery of emf 10 volt and negligible resistance. After how long, current will become I A in it ?

(1) 1.1 sec (2) 10.55 sec

(3) 2 sec (4) 2.2 sec

25. An L-C-R circuit will oscillate if

(1) $R > LC$ (2) $R < \sqrt{\frac{L}{C}}$

(3) $R > \sqrt{\frac{L}{C}}$ (4) $R = \frac{L}{C}$

(Continued)

26. The lag angle between the current and applied emf in a series LR circuit is given by

(1) $\tan^{-1}\frac{1}{WLR}$ (2) $\tan^{-1}\frac{WL}{R}$

(3) $\tan^{-1} WLR$ (4) $\tan^{-1}(R)$

27. The quality factor of a series L-C-R circuit is given by

(1) $\frac{1}{WLR}$ (2) WCR (3) $\frac{WL}{R}$ (4) WLR

28. For a good conductor, the spin depth varies as

(1) Inversely as angular frequency ω

(2) Directly as ω

(3) Inversely as $\sqrt{\omega}$

(4) Directly as $\sqrt{\omega}$

29. The dielectric constant, ε of water is 80. This does not justify its refractive index $n = 1.33$, violating the expression $n^2 = \varepsilon$. This is because,

(1) The water molecule has no permanent dipole moment

(2) The boiling point of water is 100 °C

(3) The two quantities are measured at different frequencies

(4) Water is transparent to visible light

30. Propagation of electromagnetic waves in a medium with frequency dependence phase velocity is called

(1) Reflection (2) Refraction (3) Polarization (4) Dispersion

31. If σ be conductivity and ε, permitivity of a medium with sinusoidal time varying electric field E of angular frequency, ω, then the ratio of displacement current density to the conduction current density will be

(1) $\frac{\sigma}{E\varepsilon}$ (2) $\frac{\omega\varepsilon}{\sigma}$ (3) $\frac{\sigma}{\omega\varepsilon}$ (4) $\frac{E\varepsilon}{\omega}$

32. For sinusoidally varying electric field, the conduction current and the displacement current differ in phase by

(1) 180 degree (2) Zero degree (3) 90 degree (4) 45 degree

33. A bubbled (input inverted) OR gate is equivalent to

(1) NOR gate (2) NAND gate (3) NOT gate (4) XNOR gate

34. The most suitable gate for comparing two bits is

(1) AND (2) OR (3) NAND (4) X-OR

35. Which of the following gates cannot be used as an inverter ?

(1) NAND (2) AND (3) NOR (4) X-NOR

36. How many NOR gates are required to obtain AND operation ?

(1) 2 (2) 3 (3) 4 (4) 1

(Continued)

37. The velocity of an electron in first orbit of H atom is (approximately)

(1) C (2) 2.2×10^6 m/sec

(3) 5×10^7 m/sec (4) 22×10^7 m/sec

38. For overlap interaction between nearest neighbours of the type,

$\phi(r) = B\exp\left(\frac{-r}{\rho}\right)$, B and ρ are constants, the equilibrium spacing in terms of B and ρ is

(1) $\rho \log e B$ (2) $\frac{\rho}{B}$ (3) B/ρ (4) ρB

39. If a charged particle having charge q and mass m is accelerated through a potential difference of V volts, the de Broglie wavelength associated with the particle is

(1) $\frac{h}{\sqrt{2meV}}$ (2) $\frac{h}{\sqrt{2mqV}}$

(3) $\frac{h}{\sqrt{2qV}}$ (4) $\frac{h}{\sqrt{2mV}}$

40. Number of atoms in a unit cell in BCC lattice is

(1) 8 (2) 1 (3) 2 (4) 4

41. Atomic packing factor for FCC lattice is approximately

(1) 34% (2) 52% (3) 68% (4) 74%

42. Nearest neighbour distance in a simple cubic lattice with lattice parameter a is

(1) $a\sqrt{\frac{3}{2}}$ (2) a (3) $\sqrt{2}\,a$ (4) $\sqrt{3}\,a$

43. For a simple cubic lattice, the ratio of density of points in (111) and (110) planes is

(1) $\frac{2}{3}$ (2) $\frac{\sqrt{2}}{\sqrt{3}}$ (3) $\frac{9}{4}$ (4) $\frac{2}{5}$

44. If Fermi energy of electrons in a metal at some temperature T is 5.5 eV. The average electron energy at same temperature will be given by

(1) 33 eV (2) 5.5 eV (3) 3.3 eV (4) Zero eV

45. Which of the following characteristics does not necessarily apply to an op-amp ?

(1) High gain (2) Low power

(3) High input impedance (4) Low output impedance

46. Common mode gain in a differential amplifier is

(1) Very high (2) Very low

(3) Always unity (4) Infinite

47. A certain noninverting amplifier has an R_i of 1 kΩ and an R_f of 100 kΩ. The closed loop gain is

(1) 10^6 (2) 10^3 (3) 101 (4) 100

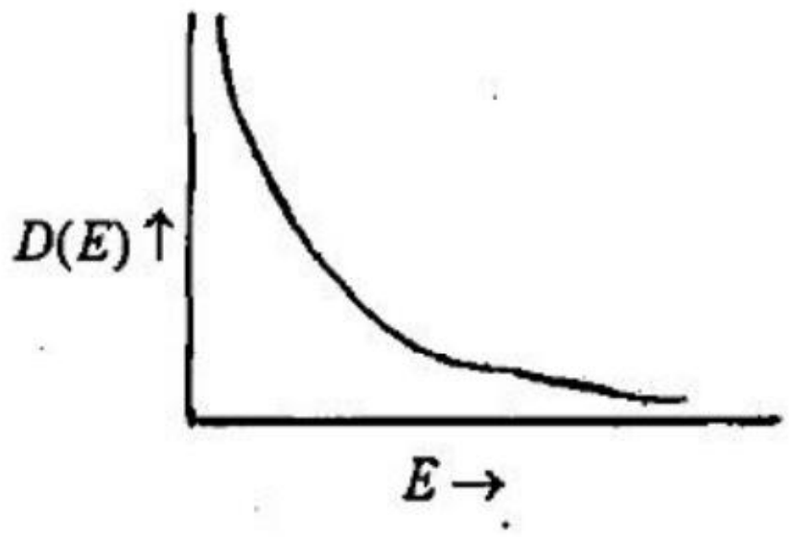
(Continued)

48. A phase-shift oscillator has

(1) Three RC circuits (2) Three LC circuits

(3) a T-type circuit (4) a Π-type circuit

49. The figure given below shows the density of electron states versus energy for a free electron gas in



(1) Three-dimensions (2) One-dimension

(3) Two-dimensions (4) None of these

50. Specific impedance of free space is

(1) 377 Ω (2) 500 Ω (3) 50 Ω (4) 100 Ω

51. Zero-point is related to

(1) Quantization (2) Lasers (3) Uncertainty (4) Duality

52. Stern-Gerlach experiment demonstrated

(1) Uncertainty principle

(2) Quantization of angular momentum

(3) Duality

(4) None of these

53. The distance between (100) planes in a simple cubic crystal with unit cell side a is

(1) a (2) $\frac{a}{\sqrt{2}}$ (3) $\frac{a}{\sqrt{3}}$ (4) $\frac{a}{2}$

54. The term value, T of a state is

(1) $\frac{E}{hc}$ (2) $-\frac{E}{hc}$ (3) $\frac{E}{2\Pi hc}$ (4) $-\frac{E}{2\Pi hc}$

55. The spectral term value corresponding to the ionisation potential of Hg-atom is 84178.5 cm $^{-1}$. The ionisation potential of Hg-atom is

(1) 15 V (2) 10.4 V (3) 13.6 V (4) 1 V

56. Which of the following, best describes the relation between orbital angular momentum and corresponding magnetic moment of electron in an atom ?

(1) $\vec{p}_e = \frac{-2m}{e}\vec{\mu}_e$ (2) $\vec{p}_e = \frac{2m}{e}\vec{\mu}_e$

(3) $\vec{p}_e = \frac{2m}{\hbar}\vec{\mu}_e$ (4) $\vec{p}_e = \vec{\mu}_e$

(Continued)

57. If a well collimated beam of Cu is allowed to pass through non-homogeneous magnetic field in Stern-Gerlach experiment, we get

(1) One trace (2) Double trace

(3) No trace (4) None of these

58. For $^1S_0$ state

(1) J = 1 (2) J = 0 (3) J = 3/2 (4) J = 5/2

59. The magnitude of $\vec{L}$, for a d-electron, in one-electron atomic system is

(1) 2 (2) $\sqrt{5}\,\hbar$ (3) $\sqrt{3}\,\hbar$ (4) $\sqrt{7}\,\hbar$

60. In alkali spectral series, when one goes towards higher value of n,

(1) Doublet separation increases

(2) Doublet separation decreases

(3) Separations remains the same

(4) (1) and (3)

61. The transition $n\,^2P \rightarrow 3\,^2S$, $n = 3, 4, 5....$ in alkali atom gives

(1) Sharp series (2) Principal series

(3) Diffuse series (4) Fundamental series

62. In the following lines of a doublet :

$$^2S_{1/2} \leftarrow {}^2P_{1/2}, \quad {}^2S_{1/2} \leftarrow {}^2P_{3/2}$$

(1) 1st line is stronger

(2) 2nd line is stronger

(3) Both lines have the same intensity

(4) Intensity of 2nd line is half that of 1st

63. For the level $^3D_3$, the Lange's splitting factor g is

(1) 7/3 (2) 5/3 (3) 4/3 (4) Zero

64. In normal Zeeman effect, selection rule $\Delta M_L = 0$ gives

(1) Π components (2) σ components

(3) unpolarized components (4) γ- components

65. If one state is occupied (or allowed) for one microparticle and is denied for other particles, the particles are

(1) Bosons (2) Fermions (3) Phonons (4) Photons

66. The main component responsible for the fall of gain of an RC coupled amplifier in low frequency range is

(1) The active device itself (2) Coupling capacitance

(3) Load resistance (4) Junction capacitance

(Continued)

67. Compared to a CB amplifier, the CE amplifier has

(1) Lower input resistance

(2) Higher output resistance

(3) Lower current amplification

(4) Higher current amplification

68. $r^n\vec{r}$ is solenoidal for

(1) $n = 3$ (2) $n = -3$ (3) $n = 2$ (4) $n = -2$

69. If $I = \int_0^\infty e^{-au^2} du$, then

(1) $I = \sqrt{\Pi / a}$ (2) $I = \frac{1}{2}\sqrt{\Pi / a}$

(3) $I = \frac{3}{8}\sqrt{\frac{\Pi}{a}}$ (4) $I = \sqrt{\frac{\Pi}{2a}}$

70. The coefficient of t^n in the expansion of the function $e^{\frac{x}{2}\left(t-\frac{1}{t}\right)}$ is called

(1) The Legendre function

(2) The Bessel function of first kind of order n

(3) Laugurre function

(4) Hermite polynomial of order n

71. $H_{n-1}(x)+H_{n+1}(x)$ equals (where terms have their usual meanings)

(1) $\frac{2n}{x}H_n(x)$ (2) $2n\,H_n(x)$

(3) $2H_n'(x)$ (4) $H_{n+2}(x)$

72. Transpose conjugate of two matrices A and B i.e., $(AB)^{\dagger}$ equals

(1) $A^{\dagger}B^{\dagger}$ (2) $B^{\dagger}A^{\dagger}$ (3) $B'A'$ (4) AB

73. The product of a singular matrix with its adjoint gives

(1) a unitary matrix (2) a null matrix

(3) a diagonal matrix (4) None of these

74. The generalised momenta is defined by

(1) $p_i=\frac{\partial L}{\partial q_i}$ (2) $p_i=\frac{\partial H}{\partial q_i}$

(3) $p_i=\frac{\partial L}{\partial \dot{q}_i}$ (4) $p_i=\frac{\partial H}{\partial \dot{q}_i}$

75. If $\delta(x)$ is delta function then

(1) $x\,\delta(x)=x$ (2) $x\,\delta x=\delta x$

(3) $x\,\delta(x)=0$ (4) $\delta(x)=\infty$

(Continued)

76. 1 m Curie is equal to

(1) 3.7×10^7 disintegrations/sec

(2) 3.7×10^{10} disintegrations/sec

(3) 10^6 disintegrations/sec

(4) 10^3 disintegrations/sec

77. Nuclei with even mass numbers have

(1) Zero or integral spin (2) Half integral spin

(3) Imaginary spin (4) None of these

78. In Mosley's law, $\sqrt{\upsilon} = a(z-b)$, the screening constant b for K series is

(1) 1 (2) 7.4 (3) 19.6 (4) 2.7

79. For crystals, having two atoms per primitive cell, square of angular frequency of lattice vibration is given by $\omega^2 = \frac{C/2}{M_1 + M_2} K^2 a^2$ corresponds to

(1) Optical branch

(2) Acoustical branch

(3) To both acoustical and optical branches

(4) Band gap

80. The wave vector associated with free electrons at Fermi surface has magnitudes

(1) $\left(\frac{2mE_F}{\hbar^2}\right)^{1/2}$ (2) $\frac{2mE_F}{\hbar^2}$

(3) $\left(\frac{2m}{\hbar^2}\right)^{\frac{1}{2}}$ (4) $\left(\frac{2mE_F}{\hbar^2}\right)^{3/2}$

81. The total forward electric current, including the effects of both holes and electrons, in a p-n junction is given by

(1) $I = I_0\left(e^{\frac{eV}{KT}} - 1\right)$ (2) $I = I_0\left(e^{\frac{-eV}{KT}} - 1\right)$

(3) $I = I_0$ (4) $I = I_0 e^{\frac{eV}{KT}}$

where the terms have their usual meaning.

82. Compton wavelength $\frac{h}{m_0 e}$ equals

(1) 0.024 Å (2) 0.012 Å (3) 2.4 nm (4) 2.4×10^{-11} m

83. According to free electron theory of metals, potential experienced by electrons inside the metal is

(1) A constant large potential

(2) A variable potential

(3) Zero potential

(4) Periodic potential

(Continued)

84. Energy equivalent to rest mass of electron is

(1) 1.02 MeV (2) 0.51 MeV (3) 1.53 MeV (4) 0.51 keV

85. A particle is moving with 90% of the velocity of light. Ratio of its relativistic mass with its rest mass is

(1) 2.29 (2) 3.00 (3) 5.00 (4) 2.00

86. In a solenoid, magnetic field is maximum at

(1) Its centre (2) Ends

(3) Away from it (4) None of these

87. Two interfering coherent waves have amplitudes in the ratio 2 : 1. The ratio of maximum to minimum intensity is

(1) 9 : 1 (2) 3 : 1 (3) 12 : 1 (4) 4 : 1

88. In Fresnel's biprism, coherent sources are formed due to

(1) Division of amplitude (2) Multiple reflection

(3) Division of wavefront (4) Reflection

89. In colour photography

(1) Progressive wave-formation is used

(2) The formation of stationary waves is used

(3) Diffraction is used

(4) Reflection is used

90. In case of Newton's ring, central ring will be dark in

(1) Reflected system of light

(2) Transmitted system

(3) In reflected as well as transmitted system

(4) In case plano-convex lens is silvered

91. Diffraction of light can be exhibited by light with an obstacle having dimension of the order of

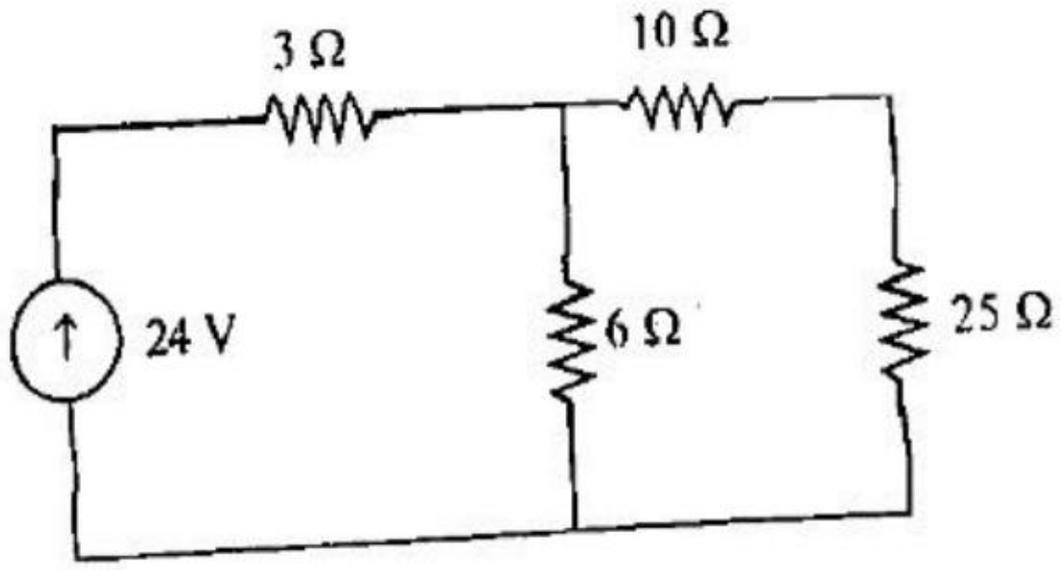
(1) 100 cm (2) 10 cm (3) 10^{-5} cm (4) 10 m

92. At polarising angles, reflected and refracted rays are

(1) Parallel (2) Antiparallel

(3) at 90° (4) at 45°

93. The Thevenin equivalent voltage for the network shown is



(1) 24 V (2) 12 V (3) 16 V (4) 8 V

(Continued)

94. A certain JFET has a g_m = 4 ms. With an ac drain resistance of 1.5 kΩ. the ideal voltage gain is

(1) 6×10^3 (2) 2.6 (3) 6 (4) 2.6×10^3

95. The wavelength associated with an electron accelerated through a potential difference 100 V is

(1) 1.2 Å (2) 12.2 Å (3) 12 nm (4) 1.22 pm

96. The typical de Broglie wavelength of an electron in a metal at *TK is*

(1) $\lambda = \frac{1}{\sqrt{3mKT}}$ (2) $\lambda = \frac{h}{\sqrt{3mKT}}$

(3) $\lambda = \frac{h/2}{\sqrt{3mKT}}$ (4) $\lambda = \frac{h}{\sqrt{2mKT}}$

97. Slow neutrons are incident on a sample of Uranium containing both $^{235}_{92}U$ and $^{238}_{92}U$ isotopes, then

(1) Both isotopes will undergo fission and breakup

(2) only $^{235}_{92}U$ atoms undergo fission

(3) only $^{238}_{92}U$ atoms undergo fission

(4) None of the isotopes will break up

98. The half life of $^{218}P_0$ is 3 minute. What fraction of a 10 gm sample of $^{218}P_0$ will remain after 15 minutes ?

(1) $\frac{1}{5}$ (2) $\frac{1}{25}$ (3) $\frac{1}{32}$ (4) $\frac{1}{64}$

99. Hard magnetic material is characterized by

(1) High coercive force and low residual magnetic induction

(2) Low coercive force and high residual magnetic induction

(3) Only low coercive force

(4) High coercive force and high residual magnetic induction

100. The density of carriers in a pure semiconductor is proportional to

(1) $\exp\left(\frac{-Eg}{KT}\right)$ (2) $\exp\left(\frac{-2Eg}{KT}\right)$

(3) $\exp\left(\frac{-Eg}{KT^2}\right)$ (4) $\exp\left(\frac{-Eg}{2KT}\right)$

101. Imperfection arising due to the displacement of an ion from a regular site to an interstitial site maintaining overall electrical neutrality of ionic crystal is called

(1) Frenkel imperfection (2) Schottky imperfection

(3) Point imperfection (4) Volume defect

(Continued)

102. Miller indices of the diagonal plane of a cube are

(1) (200) (2) (111) (3) (010) (4) (110)

103. If the load resistance of a capacitor filtered full wave rectifier is reduced, the ripple voltage

(1) Increases (2) Decreases

(3) Is not affected (4) has a different frequency

104. If one of the diodes in a bridge full wave rectifier opens, the output is

(1) 0 V

(2) One-fourth the amplitude of the input voltage

(3) a half-wave rectified voltage

(4) a 100 Hz voltage

105. When operated in cutoff and saturation, the transistor acts like

(1) a linear amplifier (2) a switch

(3) a variable capacitor (4) a variable resistor

106. The low frequency response of an amplifier is determined in part by

(1) the voltage gain (2) the type of transistor

(3) the supply voltage (4) the coupling capacitors

107. If the rate of change of current in a current carrying coil is unity. then the induced emf is equal to

(1) Coefficient of self induction

(2) Magnetic flux linked with the coil

(3) Number of turns in the coil

(4) Thickness of the coil

108. The velocity of the ejected photoelectrons depends upon the

(1) Frequency of incident light

(2) Intensity of incident light

(3) Both (1) and (2)

(4) Neither (1) nor (2)

109. If the electron in a hydrogen atom jumps from an orbit with level $n_i = 3$ to an orbit with level $n_f = 2$, the emitted radiation has a wavelength given by

(1) $\lambda = \frac{36}{5R}$ (2) $\lambda = \frac{5R}{36}$

(3) $\lambda = \frac{6}{R}$ (4) $\lambda = \frac{R}{6}$

where R is Rydberg constant.

110. Consider α-particles, β-particles and γ-rays, each having an energy of 0.5 MeV. In the increasing order of penetrating powers, the radiations are

(1) α, β, γ (2) α, γ, β (3) β, γ, α (4) γ, β, α

(Continued)

111. The wavelength of γ-rays is of the order of

(1) 10^{-7} metre (2) 10^{-10} metre

(3) 10^{-12} metre (4) 10^{-8} metre

112. $[L^2, L_x]$ equals

(1) $i\hbar L_x$ (2) $i\hbar L_y$ (3) Zero (4) $\hbar L_z$

113. An electron falls from rest in a region with potential difference of 100 V. The de Broglie wavelength associated with electron will be nearly

(1) 12.3 nm (2) 1.23 nm (3) 123 nm (4) 0.123 nm

114. An electromagnetic wave going through vacuum is described by $E = E_0 \sin(kx - \omega t)$ and $B = B_0 \sin(kx - \omega t)$, then

(1) $E_0 K = B_0 \omega$ (2) $E_0 B_0 = \omega K$

(3) $E_0 \omega = B_0 K$ (4) $\frac{E_0}{B_0} = \omega / K$

115. The energy density of states of an electron in a one-dimensional potential well of infinitely high walls is (the symbols have their usual meaning)

(1) $\frac{L\sqrt{m}}{\Pi\hbar\sqrt{2E}}$ (2) $\frac{Lm}{\Pi\hbar\sqrt{E}}$

(3) $\frac{Lm}{\Pi\hbar\sqrt{2E}}$ (4) $\frac{L\sqrt{m}}{2\Pi\hbar E}$

116. The commutator $[x, px]$, where x and px are position and momentum operator respectively, is

(1) $2i\hbar px$ (2) $-i\hbar px$ (3) $2i\hbar xpx$ (4) $-2i\hbar xpx$

117. Value of $\left[f(x), px^2\right]$ is

(1) $i\hbar$ (2) $i\hbar \frac{\partial f}{\partial x}$

(3) $ih \frac{\partial f}{\partial px}$ (4) $n\ i\hbar$

118. The equation of states of a dilute gas at very high temperature is described by $\frac{pV}{K_B T} = 1 + \frac{B(T)}{V}$, where V is the volume per particle and $B(T)$ is a – ve quantity. One can conclude that this is a property of

(1) a van der Waals' gas (2) an ideal Fermi gas

(3) an ideal Bose gas (4) an ideal inert gas

119. Which of the following relations between the particle number density n and temperature T must hold good for a gas consisting of non-interacting particles to be described by quantum statistics ?

(1) $\frac{n}{T^{1/2}} \ll 1$ (2) $\frac{n}{T^{3/2}} \ll 1$

(3) $\frac{n}{T^{3/2}} \gg 1$ (4) $\frac{n}{T^{1/2}}$ and $\frac{n}{T^{3/2}}$ can have any values

(Continued)

120. If the kinetic energy of a body is twice its rest mass energy, what will be the ratio of relativistic mass to the rest mass of the body

(1) 3 (2) 1 (3) $\frac{1}{2}$ (4) 2

ROUGH WORK

रफ़ कार्य

ROUGH WORK

रफ़ कार्य

अभ्यर्थियों के लिए निर्देश

(इस पुस्तिका के प्रथम आवरण–पृष्ठ पर तथा उत्तर–पत्र के दोनों पृष्ठों पर केवल नीली या काली बाल–प्वाइंट पेन से ही लिखें)

1. प्रश्न पुस्तिका मिलने के 30 मिनट के अन्दर ही देख लें कि प्रश्नपत्र में सभी पृष्ठ मौजूद हैं और कोई प्रश्न छूटा नहीं है। पुस्तिका दोषयुक्त पाये जाने पर इसकी सूचना तत्काल कक्ष-निरीक्षक को देकर सम्पूर्ण प्रश्नपत्र की दूसरी पुस्तिका प्राप्त कर लें।
2. परीक्षा भवन में *लिफाफा रहित प्रवेश–पत्र के अतिरिक्त,* लिखा या सादा कोई भी खुला कागज साथ में न लायें।
3. उत्तर-पत्र अलग से दिया गया है। **इसे न तो मोड़ें और न ही विकृत करें।** दूसरा उत्तर-पत्र नहीं दिया जायेगा, **केवल उत्तर–पत्र का ही मूल्यांकन किया जायेगा।**
4. अपना *अनुक्रमांक तथा उत्तर–पत्र का क्रमांक प्रथम आवरण–पृष्ठ पर पेन से* निर्धारित स्थान पर लिखें।
5. *उत्तर–पत्र के प्रथम पृष्ठ पर पेन से अपना अनुक्रमांक निर्धारित स्थान पर लिखें तथा नीचे दिये वृत्तों को गाढ़ा कर दें।जहाँ–जहाँ आवश्यक हो वहाँ प्रश्न–पुस्तिका का क्रमांक तथा सेट का नम्बर उचित स्थानों पर लिखें।*
6. ओ॰ एम॰ आर॰ पत्र पर अनुक्रमांक संख्या, प्रश्न-पुस्तिका संख्या व सेट संख्या (यदि कोई हो) तथा प्रश्न-पुस्तिका पर अनुक्रमांक संख्या और ओ॰ एम॰ आर॰ पत्र संख्या की प्रविष्टियों में उपरिलेखन की अनुमति नहीं है।
7. उपर्युक्त प्रविष्टियों में कोई भी परिवर्तन कक्ष निरीक्षक द्वारा प्रमाणित होना चाहिये अन्यथा यह एक अनुचित साधन का प्रयोग माना जायेगा।
8. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं। *प्रत्येक प्रश्न के वैकल्पिक उत्तर के लिये आपको उत्तर–पत्र की सम्बन्धित पंक्ति के सामने दिये गये वृत्त को उत्तर–पत्र के प्रथम पृष्ठ पर दिये गये निर्देशों के अनुसार पेन से गाढ़ा करना है।*
9. प्रत्येक प्रश्न के उत्तर के लिये केवल एक ही वृत्त को गाढ़ा करें। एक से अधिक वृत्तों को गाढ़ा करने पर अथवा एक वृत्त को अपूर्ण भरने पर वह उत्तर गलत माना जायेगा।
10. *ध्यान दें कि एक बार स्याही द्वारा अंकित उत्तर बदला नहीं जा सकता है।* यदि आप किसी प्रश्न का उत्तर *नहीं देना चाहते हैं,* तो सम्बन्धित पंक्ति के सामने दिये गये सभी वृत्तों को खाली छोड़ दें। ऐसे प्रश्नों पर शून्य अंक दिये जायेंगे।
11. रफ़ कार्य के लिये प्रश्न-पुस्तिका के मुखपृष्ठ के अन्दर वाले पृष्ठ तथा अंतिम पृष्ठ का प्रयोग करें।
12. परीक्षा के उपरान्त ***केवल ओ॰ एम॰ आर॰ उत्तर–पत्र*** परीक्षा भवन में जमा कर दें।
13. परीक्षा समाप्त होने से पहले परीक्षा भवन से बाहर जाने की अनुमति नहीं होगी।
14. यदि कोई अभ्यर्थी परीक्षा में अनुचित साधनों का प्रयोग करता है, तो वह विश्वविद्यालय द्वारा निर्धारित दंड का/की, भागी होगा/होगी।