Hall Ticket Number

Q.B. No. 100029

Booklet Code : A

Marks : 100

DL-326-ELEC

Time : 120 Minutes

Paper-II

Signature of the Candidate

Signature of the Invigilator

INSTRUCTIONS TO THE CANDIDATE
(Read the Instructions carefully before Answering)

1. Separate Optical Mark Reader (OMR) Answer Sheet is supplied to you along with Question Paper Booklet. Please read and follow the instructions on the OMR Answer Sheet for marking the responses and the required data.
2. The candidate should ensure that the **Booklet Code printed on OMR Answer Sheet and Booklet Code supplied are same.**
3. **Immediately on opening the Question Paper Booklet by tearing off the paper seal, please check for (*i*) The same booklet code (A/B/C/D) on each page. (*ii*) Serial Number of the questions (1-100), (*iii*) The number of pages and (*iv*) Correct Printing.** In case of any defect, please report to the invigilator and ask for replacement of booklet with same code within five minutes from the commencement of the test.
4. Electronic gadgets like Cell Phone, Calculator, Watches and Mathematical/Log Tables are not permitted into the examination hall.
5. **There will be 1/4 negative mark for every wrong answer.** However, if the response to the question is left blank without answering, there will be no penalty of negative mark for that question.
6. Record your answer on the OMR answer sheet by using Blue/Black ball point pen to darken the appropriate circles of (1), (2), (3) or (4) corresponding to the concerned question number in the OMR answer sheet. Darkening of more than one circle against any question automatically gets invalidated and will be treated as wrong answer.
7. Change of an answer is **NOT** allowed.
8. Rough work should be done only in the space provided in the Question Paper Booklet.
9. **Return the OMR Answer Sheet and Question Paper Booklet to the invigilator before leaving the examination hall.** Failure to return the OMR sheet and Question Paper Booklet is liable for criminal action.

This Booklet consists of **17** Pages for **100** Questions **+2** page of Rough Work **+1** Title Page i.e. Total **20** pages

1. The gradient of the two variable function $f(x, y) = 1 + e^{x-y}$ at $x = 0$, $y = 0$ is :

(1) $(-1, 1)$ (2) $(1, -1)$

(3) $(1/\sqrt{2}, -1/\sqrt{2}, 0)$ (4) $(1, 1, 1)$

2. Choose the options with the set of *correct* statements for the matrix

$$A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & 1 \\ 3 & 0 & 2 \end{bmatrix} :$$

A. The set of vectors (1, –1, 1), (2, 1, 1) and (3, 0, 2) is linearly independent

B. The rank of the matrix 'A' is 1

C. The rank of matrix 'A' is 2

D. The set of vectors (1, –1, 1), (2, 1, 1) and (3, 0, 2) is linearly dependent

(1) (A, B) (2) (A, C)

(3) (B, D) (4) (C, D)

3. For any $n > 1$, suppose P_n is the Legendre polynomial of degree n. The value of $(n + 1)\int_{-1}^{1} P_{n+1}(x)P_n(x)\,dx - (2n+1)\int_{-1}^{1} xP_n^2(x)\,dx$ is :

(1) 1 (2) 0

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

4. Consider the wave equation in a single spatial variable :

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2},$$

where $u(x, t)$ is a function of the spatial variable x and the time variable t. Consider the boundary conditions

(initial displacement) $u(x, 0) = f(x)$, (zero initial velocity) $\frac{\partial u}{\partial t}(x, 0) = 0$.

Then the solution to this wave equation is :

(1) $(f(x - t) + f(x + t))/2$ (2) $f(x - t) + f(x + t)$

(3) $f(x + xt) + f(x - xt)$ (4) $f(x)$

5. The Fourier transform of the function $f(x) = \begin{cases} 1-|x| & |x| \le 1 \\ 0 & \text{otherwise} \end{cases}$ is given by :

(1) $\sin c\Omega$ (2) $\sin c^2\Omega$

(3) $\sin c^3\Omega$ (4) $\sqrt{\sin c\Omega}$

6. The Laplace transform of $f(t) = \sin^2(t)$ is :

(1) $\frac{2}{s(s^2 + 4)}$ (2) $\frac{2}{(s^2 + 4)}$

(3) $\frac{2}{s(s^2 - 4)}$ (4) $\frac{1}{s(s^2 + 4)}$

7. If A is a scalar and **B** is a second rank tensor, then the product $A\mathbf{B}$ is :

(1) A scalar (2) Not defined

(3) A second rank tensor (4) A first rank tensor

8. Which of the following is *not* a metric tensor property ?

(1) Symmetry (2) Asymmetry

(3) Positive definiteness (4) Preservation of tensor symmetry

9. A bead of mass m is constrained to move under gravity along a planar rigid wire that has a parabolic shape $y = \frac{x^2}{l}$, where x and y are the horizontal and vertical coordinates respectively. The Lagrangian of the system is :

(1) $L = \frac{m\dot{x}^2}{2}\left(1 - \frac{2x^2}{l^2}\right) - \frac{mgx^2}{l}$ (2) $L = \frac{m\dot{x}^2}{2}\left(1 + \frac{4x^2}{l^2}\right) - \frac{mgx^2}{l}$

(3) $L = \frac{m\dot{x}^2}{2}\left(1 + \frac{2/3x^2}{l^2}\right) - \frac{mgx^2}{l}$ (4) $L = \frac{m\dot{x}^2}{2}\left(1 - \frac{3/2x^2}{l^2}\right) - \frac{mgx^2}{l}$

10. Consider a system with Hamiltonian (H) given by $H = \frac{p^2}{2m}e^{-\alpha t} + \frac{1}{2}m\omega^2 x^2 e^{\alpha t}$, where α, ω, m are constants, x and p are position and momentum coordinates. The equation of motion is given by :

(1) $\ddot{x} - \frac{\dot{x}}{\alpha} + \omega^2 x = 0$ (2) $\ddot{x} + \alpha\dot{x} - \omega^2 x = 0$

(3) $\alpha\ddot{x} - \dot{x} + \omega^2 x = 0$ (4) $\ddot{x} - \alpha\dot{x} - \omega^2 x = 0$

11. The number of photons emitted per second by a 100 W sodium lamp are :

(1) 2.96×10^{20} (2) 4.84×10^{19}

(3) 3.15×10^{23} (4) 5.26×10^{26}

12. If λ_{nr} and λ_r be the non-relativistic and relativistic wavelengths of the electron, then :

(1) $\lambda_{nr} \propto \frac{1}{\lambda_r}$ (2) $\lambda_{nr} = \lambda_r$

(3) $\lambda_{nr} > \lambda_r$ (4) $\lambda_{nr} < \lambda_r$

13. In view of uncertainty principle, the spectral lines are :

(1) infinitely sharp (2) broad

(3) intense (4) faint

14. A stationary state in quantum mechanics is that for which the probability of finding the particle at a point in space is :

(1) independent of position (2) dependent on time

(3) dependent on position (4) independent of time

15. If $\int \psi_1^* . (\hat{A}\psi_2) d\tau = \int (\hat{A}\psi_1)^* . \psi_2 d\tau$, then $\hat{A}$ is :

(1) additive (2) Hermitian

(3) multiplicative (4) linear

16. The value of $\left[\hat{x}, \frac{\hat{\partial}}{\partial x}\right]$ is :

(1) -1 (2) 1

(3) -2 (4) 0

17. When a particle of mass m having an energy E meets a potential barrier of height $V_0 (E < V_0)$, the penetration depth is Δx is :

(1) $\frac{V_0 \quad E}{h}$ (2) $\sqrt{\frac{2m(V_0 - E)}{h^2}}$

(3) $\sqrt{\frac{\hbar^2}{2m(V_0 - E)}}$ (4) $\frac{2m(V_0 - E)}{h}$

18. The eigen energy of a three-dimensional harmonic oscillator is given by :

(1) $(n+1)\hbar\omega$ (2) $n\hbar\omega$

(3) $(n+3/2)\hbar\omega$ (4) $(n+3)\hbar\omega$

19. The size of a phase-space cell for quantum statistics is of the order of :

(1) $\frac{h^3}{2}$ (2) $\frac{1}{h^3}$

(3) h^3 (4) h^2

20. If n_i is the number of identical and indistinguishable particles in the i^{th} energy state with degeneracy g_i, then classical statistics can be applied if :

(1) $\frac{n_i}{g_i} >> 1$ (2) $\frac{n_i}{g_i} << 1$

(3) $g_i = 0$ (4) $\frac{n_i}{g_i} = 1$

21. The Miller indices of a plane having intercepts 2, ∞, ∞ units on the $\vec{a}, \vec{b}$ and $\vec{c}$ axes respectively are :

(1) (2 0 0) (2) (0 2 0)

(3) (1 0 1) (4) (0 0 1)

22. In a crystal having N primitive cells, the maximum number of electrons per band is :

(1) N (2) 2N

(3) ∞ (4) $\frac{N}{2}$

23. Debye's theory of lattice specific heat assumes that the vibrations of the atomic oscillators are :

(1) damped (2) dependent and damped

(3) independent and free (4) coupled

24. The time-dependence of polarizability is expressed as :

(1) $p(t) = p_0 e^{t/\tau}$ (2) $p(t) = p_0 e^{\tau/t}$

(3) $p(t) = p_0 e^{-t/\tau}$ (4) $p(t) = p_0 e^{-\tau/t}$

25. The susceptibility of antiferromagnetic material is given by :

(1) $\Xi = \frac{C}{T - 0}$ (2) $\Xi = C(T + \theta)$

(3) $\Xi = \frac{C}{T - 0}$ (4) $\Xi = \frac{C}{0 - T}$

26. Assume that the Fermi level in a semiconductor is near the valence band. Which of the following is true ? (Here n, p and n_i represent electron, hole and intrinsic concentrations respectively).

(1) $n = p = n_i$ (2) $n > p, n >> n_i$

(3) $n < p, n >> n_i$ (4) $p >> n, n << n_i$

27. As temperature increases from 0 K to high temperature, the carrier concentration in a doped semiconductor goes through three regions. In what order does the transition occur ?

(1) intrinisc, extrinsic, freezeout (2) extrinsic, intrinsic, freezeout

(3) freezeout, intrinsic, extrinsic (4) freezeout, extrinsic, intrinsic

28. An intrinsic semiconductor is doped such that the electron concentration is changed from n to n_f, where f is a constant. If μ_n and μ_p are mobilities of electrons and holes respectively the conductivity of the doped semiconductor will be :

(1) $nq\mu_n - n_i^2 q\mu_p / n$ (2) $nq\mu_p + pq\mu_n$

(3) $1/(nq\mu_n + pq\mu_p)$ (4) $nfq\mu_n - n_i^2 q\mu_p / nf$

29. Consider a PN junction with a built-in potential V_0 and an applied bias of V_A. The ratio of excess hole concentration at the edge of the depletion region relative to the equlibrium hole concentration in the n side is given by :

(1) $\exp(q(V_A - V_0))$ (2) $P_{n0} \exp(q(V_0 - V_A))$

(3) $n_{p0} \exp(q(V_A - V_0))$ (4) $\exp(q(V_0 - V_A))$

30. The maximum built-in potential of any PN junction is roughly equal to which of the following ?

(1) kT/q [eV]

(2) Bandgap of semiconductor E_g [eV]

(3) 1.1 [eV]

(4) Electron affinity of semiconductor χ [eV]

31. The current in an electronic circuit is represented by segments of a sinusoid as shown in figure 1. What are the average value of the current ?

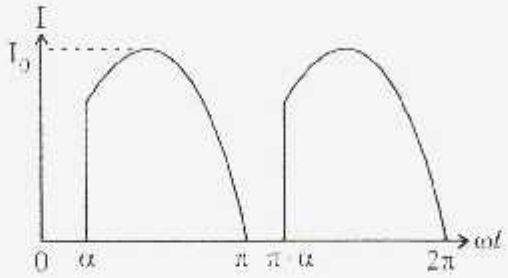

Figure 1

(1) $I_0(1 + \cos(\alpha)/\pi$ (2) $I_0/2$

(3) $2I_0/\pi$ (4) $\pi/2I_0$

32. For the circuit shown in figure 2, the output voltage V_o is given by :

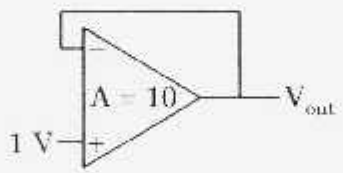

Figure 2

(1) 11/10 (2) 11

(3) 10/11 (4) 10

33. The output voltage V_o for an ideal Opamp circuit shown in figure 3 is given by :

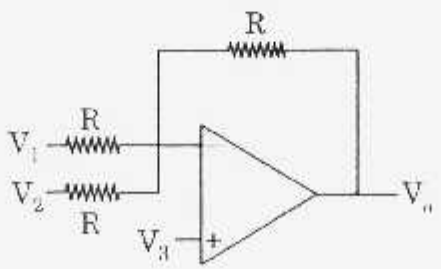

Figure 3

(1) $-V_1 - V_2 + V_3$ (2) $-V_1 - V_2 + 3V_3$

(3) $-V_1 + V_2 - 3V_3$ (4) $V_1 + V_2 + 3V_3$

34. The output voltage (V_0) of the non-inverting summer in figure 4 is given by :

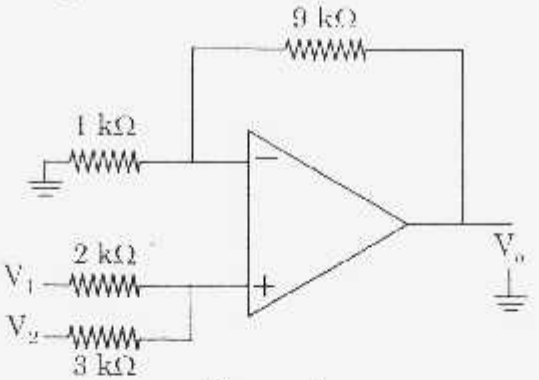

Figure 4

(1) $4.5V_1 + 3V_2$ (2) $5V_1 + 10V_2/3$

(3) $6V_1 + 4V_2$ (4) $4V_1 + 6V_2$

35. In the circuit shown in figure 5, find V_{out} for $t > 0$. Given R = 1kΩ, C = 1 μF, V_{in} = sin (2000t) and $V_{out}(0) = 0$.

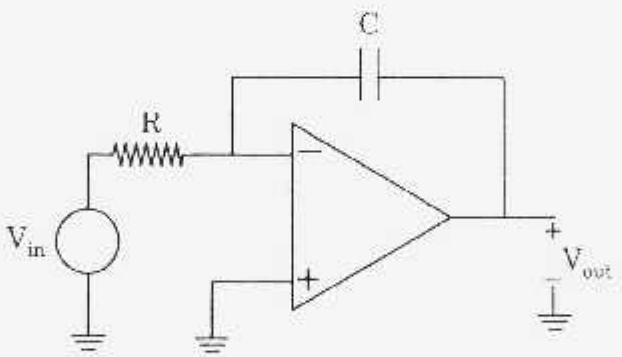

Figure 5

(1) 0.5 cos (2000t) (2) –0.5 (cos (2000t) –1)

(3) 2 cos (2000t) (4) –2 (sin (2000t) –1)

36. Assume A, B are the binary inputs and C is previous borrow input to a full-subtractor. The expression for the borrow output is given by :

(1) AC + A'B + BC' (2) AC' + A'B' + BC

(3) A'C + A'B + BC (4) AC + AB + BC

37. Which of the following is a passive device ?

(1) BJT (2) MOSFET

(3) Zener diode (4) Thyristor

38. The simplified form of the Boolean expression Y = A'B'C' + AB'C' + AB'C is :

(1) Y = B'C' + AB'C (2) Y = A'B'C' + AB'

(3) Y = B'C' + AB' (4) Y = AB'

39. The simplified form of the Boolean expression $Y = \bar{x}\,\bar{y} + xy\bar{z}$ is :

(1) $Y = x + y + \bar{z}$ (2) $Y = x + y$

(3) $Y = \bar{x} + \bar{z}$ (4) $Y = xyz$

40. In a binary coded decimal (BCD) counter, what is the next state if the current state is 1001 ?

(1) 1000 (2) 1010

(3) 0000 (4) 0001

41. A 2-1 digital multiplexer has two inputs A and B, select line S and output Z.

(1) $Z = A.S + B.\bar{S}$ (2) $Z = \bar{A}.S + B.\bar{S}$

(3) $Z = A.S + \bar{B}.\bar{S}$ (4) $Z = A.\bar{S} + \bar{B}.S$

42. For the digital circuit shown in figure 6 the input clock frequency is f_0 and the input (In) is logic high, frequency of the output is :

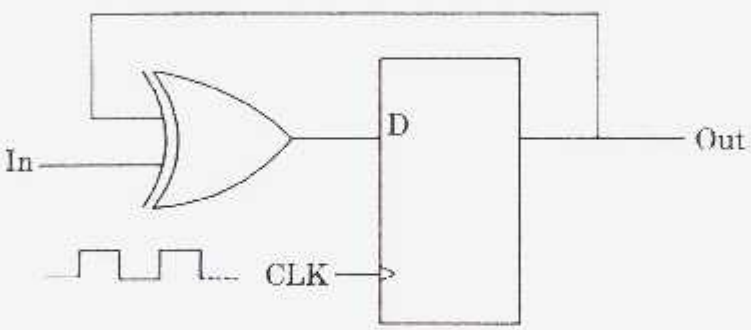

Figure 6

(1) f_0 (2) $2f_0$

(3) $f_0/2$ (4) 0

43. The sum output of a full adder can be implemented by which of the following gates ?

(1) Two 2-input NAND gates

(2) One 3-input NOR gate

(3) Three 2-input AND gates and two 2-input OR gates

(4) Two 2-input XOR gates

44. The logical expression $F = AC + B\bar{C}$ can be used to implement which of the following ?

(1) A decoder (2) A multiplexer

(3) An encoder (4) A demultiplexer

45. A 1 kHz square wave ($t_r = t_f = 1$ µs) is fed into an ideal low pass filter ($f_0 = 1.5$ kHz). The output of the filter will be :

(1) 1 kHz sine wave

(2) 1 kHz square wave similar to input.

(3) 1 kHz square wave with $t_r = t_f > 1$ µs

(4) 1 kHz square wave with $t_r = t_f < 1$ µs

46. A nucleus $^{64}_{29}X$ has radius 5.2×10^{-13} cm. The radius of a nucleus $^{27}_{13}Y$ is expected to be (in cm) :

(1) 3×10^{-13} (2) 6×10^{-13}

(3) 4×10^{-13} (4) 12×10^{-13}

47. The measured mass of deuteron atom ($^{2}_{1}H$), Hydrogen atom ($^{1}_{1}H$), proton (p) and neutron (n) are 2.0141 U, 1.0078 U, 1.0073 U and 1.0087 U respectively (1 U = 931.5 MeV). The binding energy of the deuteron nucleus is :

(1) 1.1 MeV (2) 2.2 MeV

(3) 3.3 MeV (4) 4.4 MeV

48. Choose the option with the *correct* set of statements :

A. Positron emission leads to daughter nuclues of lower atomic number

B. Neutron outside the nucleus decays into proton

C. Electron capture occurs more often than positron emission in heavy nuclides

D. Proton outside the nucleus decays into neutron

(1) B, C, D (2) A, C, D

(3) A, B, C (4) A, B, D

49. A radioactive substance is initially absent is formed at constant rate p nuclei per second. If the decay constant of the nuclei formed is λ, then the number of nuclei N present after time t seconds is :

(1) $\frac{p}{\lambda}(e^{-\lambda t}-1)$ (2) $\frac{p}{\lambda}(1-e^{-\lambda t})$

(3) $\frac{p}{\lambda}e^{-\lambda t}$ (4) $\frac{p}{\lambda}$

50. If a certain odd parity shell model can accommodate upto a maximum of 12 nucleons, the J and l values are respectively :

(1) 5, 3/2 (2) 5/2, 2

(3) 7/2, 3 (4) 5/2, 3

51. A permanently deformed even even nucleus with $J^P = 2^+$ has rotational energy 93 keV. The energy of the first excited state :

(1) 186 keV (2) 372 keV

(3) 310 keV (4) 273 keV

52. According to liquid drop model, the atomic number of most stable isobar with mass number equal to 64 is :

(1) 23 (2) 36

(3) 29 (4) 43

53. Let Q be the electric quadrupole moment of nucleus. Choose the option with the correct set of statements :

A. Q = 0 if nucleus has spherically symmetric charge distribution

B. Q = 0 if nuclear spin I = 0 and I = 1/2

C. Q = 0 if nucleus is rotational ellipsoid of small eccentricity and has uniform charge density

D. Q = 0 if nuclear spin I = 3/2 and I = 5/2

(1) A, B (2) C, D

(3) A, D (4) B, C

54. Thermal neutrons are captured by $^{10}_{5}B$ to form $^{11}_{5}B$ which decays by α-particle emission to Li. The atomic masses of $^{10}_{5}B$, $^{1}_{0}n$, $^{7}_{3}Li$, $^{4}_{2}He$ are 10.01611 amU, 1.008987 amU, 7.01822 amU and 4.003879 amU respectively (1 amU = 931 MeV). The Q value of decay in the units of MeV is :

(1) 1.6 (2) 2.2

(3) 2.8 (4) 3.9

55. Neutrons incident on a heavy nucleus with spin $I_N = 0$ show a resonance at an incident energy $E_R = 250$ eV in the total cross-section with a peak magnitude of 1300 barns. If the width of the peak is 20 eV, the elastic partial width of the resonance is :

(1) 2.5 eV (2) 1.5 eV

(3) 3.0 eV (4) 3.8 eV

56. An unstable particle of rest mass 1000 MeV decays into a muon and a neutrino and has a mean life of 10^{-8} sec when at rest. If the particle has a momentum of 1000 MeV/c, the mean decay distance will be given by :

(1) 140 cm (2) 200 cm

(3) 300 cm (4) 420 cm

57. A 16 uA beam of alpha particles having cross-sectional area of 10^{-4} cm^2 is incident on a Rh target of thickness 1 μm, thereby producing neutrons. The number of alpha particles hitting the target per second is :

(1) 10^{14} (2) 5×10^{14}

(3) 2.5×10^{13} (4) 5×10^{13}

58. Choose the option with the set of *correct* statements about Deuteron :

A. Deuteron is the only two-nucleon bound system

B. The ground state spin of deuteron is $I_d = 1$ and ground state parity is even

C. Quadrupole moment of deuteron is zero

D. The magnetic moment of deuteron is not exactly equal to the sum of magnetic moments of proton and neutron

(1) A, B, C (2) A, B, D

(3) A, C, D (4) B, C, D

59. Choose the option with the set of *correct* statements about Mossbauer spectroscopy :

A. Mossbauer spectroscopy is capable of detecting changes in few parts per 10^{11}

B. Mossbauer spectroscopy can detect phenomena related to isomer shift, quadrupole splitting and magnetic hyperfine splitting

C. Solid, liquid as was as gas phases suitable samples can be used in Mossbauer spectroscopy

D. Second order transverse Doppler effect predicted by theory of relativity has been observed by Mossbauer spectroscopy

(1) A, B, C (2) B, C, D

(3) A, C, D (4) A, B, D

60. At a fixed frequency the resonance of a nuclear spin is observed at a slightly different magnetic field in metal than in a diamagnetic solid. This effect is known as :

(1) Isomer effect (2) Knight effect

(3) Zeeman effect (4) Doppler shift.

61. Choose the option with the set of *correct* statements :

A. In solids, the magnetization approaches equilibrium by spin lattice interactions which involve processes such as emission or absorption of phonon and Raman scattering of phonons.

B. The equations describing variation of magnetization with time in terms of spin-lattice relaxation time are known as Bloch equations.

C. The line width increases for nuclei in rapid relative motion.

D. Spin resonance at microwave frequencies in ferromagnets is similar in principle to nuclear spin resonance.

(1) B, C, D (2) A, B, C

(3) C, D (4) A, B, D

62. Choose the option with the set of *correct* statements about phase contrast microscopy :

A. It converts phase shifts in light passing through a transparent specimen to brightness changes in the image.

B. It has lower resolution than a bright field microscope.

C. It is particularly important in biology.

D. It involves making phase change visible by separating the illuminating or background light from the specimen-scattered light.

(1) A, B, C (2) A, B, D

(3) A, C, D (4) B, C, D

63. Choose the option with the set of *correct* statements about scanning electron microscopy (SEM) :

A. It is better than optical microscopy due to higher de Broglie wavelengths of scanning electrons as compared to wavelength of light in optical region.

B. The high energy beam of electrons interact with the sample and produce Auger electrons, secondary electrons, back scattered electrons and characteristic X-rays.

C. The maximum resolution in an SEM depends on factors such as electron spot size, interaction volume of electron with sample etc.

D. Modern SEM can provide resolution in range 0.1 – 1 nm.

(1) A, B, C (2) A, B, D

(3) B, C (4) A, C, D

64. Choose the option with the set of *correct* statements about transmission electron microscopy (TEM) :

A. In TEM, the transmitted beam of electrons contains information about electron density, phase and periodicity.

B. The electron lenses for TEM use electromagnetic coils to generate a convex lens.

C. For conventional TEM, the samples should be very thin (< 100 nm).

D. The limit of resolution for a TEM may be described in terms of cut off value of the contrast transfer function.

(1) A, B, C (2) B, C, D

(3) A, C, D (4) A, B, C, D

65. Choose the option with the set of *correct* statements about nuclear quadrupole resonance (NQR) and nuclear quadrupole moment (Q) :

A. Q is a measure of the ellipticity of the distribution of charge in the nucleus.

B. Q is positive and negative for egg shaped nucleus and saucer shaped nucleus respectively.

C. NQR refers to observation of nuclear quadrupole splittings in the presence of applied static magnetic field.

D. The quadrupole splitting are large in covalently bonded molecules such as Br_2.

(1) A, B (2) A, B, C

(3) A, C, D (4) A, B, D

66. A conducting sphere of radius R has a charge +Q. If the charge on the sphere is doubled and radius halved, the energy associated with the electric field will :

(1) Increase four times (2) Decrease four times

(3) Increase eight times (4) Remain the same

67. A sphere of radius a has a charge density which varies with distance according to $\rho = Ar^{1/2}$. The electric field at a distance $r < a$ varies with r as :

(1) $r^{3/2}$ (2) $r^{1/2}$

(3) $r^{1/2}$ (4) $r^{5/2}$

68. A plane electromagnetic wave propagating in +z direction is represented by $\vec{E} = \hat{i}E_{x0}\cos(\omega t - \beta z)$. The Poynting vector is given by :

(1) $\hat{z}\eta E_{x0}^2\cos^2(\omega t - \beta z)$ (2) $\hat{z}\frac{E_{x0}^2}{\eta}\cos^2(\omega t - \beta z)$

(3) $-\hat{z}\frac{E_{x0}^2}{\eta}\cos^2(\omega t - \beta z)$ (4) $\hat{y}\frac{E_{x0}^2}{\eta}\cos^2(\omega t - \beta z)$

69. The magnitudes of the open circuit and short-circuit impedances of a transmission line are 100 Ω and 25 Ω respectively. The characteristic impedance of the line is :

(1) 25 Ω (2) 50 Ω

(3) 75 Ω (4) 100 Ω

70. An air filled rectangular wave guide has dimensions a = 1 cm and b = 3 cm. What is the cut-off frequency of the TE_{01} mode ?

(1) 5 GHz (2) 7.5 GHz

(3) 5 MHz (4) 15 GHz

71. Emitter Coupled Logic (ECL) performs better than Transistor Transistor Logic (TTL) and Complementary MOS (CMOS) in terms of which of the following parameters ?

(1) Fanout (2) Noise immunity

(3) Average propagation delay (4) Power consumption

72. Which of the following 8085 reprocessor instruction can be used to double the contents of accumulator, if the carry flag is reset prior to the execution of this instruction ?

(1) SUB A (2) RAL

(3) RRC (4) ANA A

73. Which of the following is NOT true of a one-transistor dynamic memory cell ?

(1) Has a row select line

(2) Has a read/write line

(3) Designed to reduce area consumption

(4) Uses two capacitors-one for 0 state and one for 1 state

74. The DMA controller is used to :

(1) Interface an input/output device directly to main memory

(2) Interface an input/output device directly to CPU

(3) Main memory directly to CPU

(4) Interface an input/output device to main memory via CPU

75. Which of the following is a non-maskable interrupt in the 8085 microprocessor ?

(1) INTR (2) RST5.5

(3) TRAP (4) RST6.5

76. When a RST7.5 interrupt is received in the 8085, the processor branches to which of the following addresses ?
(1) 2CH (2) 24H
(3) 34H (4) 3CH

77. Which of the following is NOT true in a 8086 microprocessor ?
(1) 8 bit data bus
(2) HMOS technology
(3) 40 pin dual-inline-package
(4) Address and data lines are multiplexed

78. In programmable peripheral interface IC, which of the following statements is true about But Set Reset (BSR) mode ?
(1) BSR mode is selected only when $D_7 = 1$ of the control word register.
(2) BSR control word does not affect port A and port B functioning
(3) Multiple bits of port C can be either set or reset simultaneously
(4) It is used to configure the modes of port B.

79. Which of the following is NOT true about the READY signal in 8086 ?
(1) Acknowledgement of data transfer completion
(2) The signal is active high
(3) 8284A is used for signal synchronization
(4) The signal is active low

80. Which of the following is NOT true in a Pentium Architecture ?
(1) 64 bit bus (2) One 8 KB cache on chip
(3) Superscalar architecture (4) Upward code compatibility

81. Which of the following is an advantage of base modulation over collector modulation in a transistor class C amplifier ?
(1) Lower modulating power
(2) Higher power output per transistor
(3) Improved efficiency
(4) Improved linearity

82. Which of the following statements is NOT true for the Nyquist sampling theorem ?
(1) Valid for square waves
(2) Depends on signal bandwidth
(3) Helps avoid aliasing
(4) Allows for digital processing of analog signals

83. A continuous time signal $x(t)$ has a Nyquist rate of Ω_0. The Nyquist rate of $y(t) = x(t) \cos(\Omega_0 t)$ is given by :
(1) Ω_0 (2) $2\Omega_0$
(3) $3\Omega_0$ (4) $4\Omega_0$

84. For a raised cosine pulse based communication system, given a roll-off factor of 0.5 and a bandwidth of 10 MHz, the required transmission bandwith will be :
(1) 0.5 MHz (2) 10 MHz
(3) 15 MHz (4) 20 MHz

85. If the modulation index of an AM wave is changed from 0 to 1, its transmission power is :

(1) unchanged (2) halved

(3) doubled (4) increased by 50%

86. Which of the following *cannot* be used for Single Side Band demodulation ?

(1) Bipolar transistor balanced modulator

(2) Product detector

(3) Diode balanced modulator

(4) Complete phase shift generator

87. A baseband signal $m(t)$ of 5 kHz is PCM encoded. The minimum bandwidth required to transmit the encoded signal with a maximum quantization error as half of the amplitude of $m(t)$ is :

(1) 2.4 kHz (2) 40 kHz

(3) 80 kHz (4) 100 kHz

88. Which of the following about Pulse Amplitude Modulation (PAM) is *false* ?

(1) It is two-dimensional

(2) It is a special case of Amplitude Shift Keying (ASK)

(3) It has $M = 2^b$ signals, where b is number of bits

(4) It typically uses a basis function $\phi(t) = \frac{1}{\sqrt{T}} \sin c\left(\frac{t}{T}\right)$, where T is the pulse duration

89. Given a symbol duration of T, the minimum frequency separation required to ensure othogonality in non-coherent FSK is :

(1) $\frac{1}{2T}$ (2) $\frac{1}{T}$

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

90. The maximum number of bits/symbol that can be communicated using a 128 PSK modulation scheme is :

(1) 1 (2) 6

(3) 7 (4) 128

91. The general expression for the PSK signal is :

(1) $s_i(t) = A_i g(t) \cos(2\pi f_c t)$

(2) $s_i(t) = A_i g(t) \sin(2\pi f_c t)$

(3) $s_i(t) = Ag(t) \cos\left[(2\pi f_c t) + \frac{2\pi(i-1)}{M}\right]$

(4) $s_i(t) = A_i \cos(\theta_i) g(t) \cos(2\pi f_c t) - A_i \sin(\theta_i) g(t) \sin(2\pi f_c t)$

92. The sequence of symbols transmitted using DPSK for the bit sequence 1011 starting at the kth symbol time assuming the transmitted symbol at the $(k-1)$th symbol was $s(k-1) = Ae^{j\pi}$ is :
(1) A, A, $Ae^{j\pi}$ (2) A, A, A
(3) $Ae^{j\pi}$, A, A (4) $Ae^{j\pi}$, A, $Ae^{j\pi}$

93. In a transmission line, the velocity factor :
(1) Is higher for a solid dielectric than air
(2) Increases the velocity along the transmission line
(3) Is governed by the skin effect
(4) Depends on the material's dielectric constant

94. Which of the following is *not* true about a transmission line termination with infinite Standing Wave Ratio (SWR) ?
(1) a short circuit (2) a complex impedance
(3) an open circuit (4) a pure reactance

95. A transmission line has a characteristic impedance of 50 Ω and resistance of 0.1 Ω/m. If the line is distortionless, then the attenuation constant (in Np/m) is :
(1) 0.04 (2) 0.004
(3) 0.02 (4) 0.2

96. The frequency dependence of the total power radiated by an electric dipole is :
(1) ω^3 (2) ω^4
(3) ω^{-3} (4) ω^{-4}

97. Electromagnetic waves propagate in a wave guide by :
(1) travelling along the broader wall
(2) travelling through the dielectric and not along the wall
(3) travelling along all four walls
(4) relecting along the walls but not travelling along them

98. The magnitude of reflection coefficient for a device that has return loss of 20dB is :
(1) 0.01 (2) 0.1
(3) 0.2 (4) 0.02

99. Which of the following is *false* about a varactor diode at microwave frequencies ?
(1) can be used as an oscillator
(2) can be used for electronic tuning
(3) can be used for frequency multiplication
(4) can be used as a parametric amplifier

100. Gallium arsenide is preferred to silicon in Gunn diodes because :
(1) It has a higher electron mobility
(2) It has a suitable empty energy band
(3) It has lower noise at the highest frecuencies
(4) It is capable of handling higher power densities

Space for Rough Work

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