169/2024

Maximum : 100 marks

Time : 1 hour and 30 minutes

1. The importance of Lagrange method is :

(A) It's basic equations take the same form in all coordinate system

(B) It's basic equations take the same form polar coordinate system to Cylindrical coordinate system

(C) It's basic equations take the same form one dimensional coordinate system to two-dimensional coordinate system

(D) It's basic equations take the same form one dimensional coordinate system to three-dimensional coordinate system

2. When a pendulum with length l, and mass m is attached to a sliding down mass m in a frictionless plane inclined at an angle α what would be the degree of freedom and the number of generalized coordinates?

(A) 1, 3 (B) 2, 4

(C) 2, 2 (D) 2, 1

3. Velocity - dependent potential function can sometimes be used to determine :

(A) The field of force that can be applied in order that particles may move in specified paths

(B) The magnetic field direction

(C) The electric and magnetic fields direction

(D) The Lagrangian function and electromagnetic field

4. Hamilton's formulation is logically equivalent to :

(A) Lagrange's first order equation

(B) Newton's third law of motion

(C) Lagrange's second order equation and Newton's second law of motion

(D) Lagrange's first order equations and Newton's third law of motion

5. What is the goal of Hamilton-Jacobi theory?

(A) To transform canonical equation to become directly integrable

(B) It helps to reduce the problem to solving differential equations

(C) It is used to transform partial difference equation into first order differential equations

(D) It is used to transform vector quantities into scalar quantities

6. The Coriolis force affects moving objects in a rotating frame of reference, which of the following describes its effects :

(A) It has no effect on the motion of objects

(B) It causes objects to move in a straight line relative to the surface

(C) It always acts toward the centre of rotation

(D) It deflects the path of moving objects to the right in the northern hemisphere and to the left in southern hemisphere

7. In the context of limit cycle what is Hopf bifurcation :

(A) The effect of damping on oscillatory systems

(B) A type of limit cycle that is always unstable

(C) A change in stability leading to the birth or death of the limit cycle

(D) A transition from chaos to periodic motion

8. In Hamilton-Jacobi theory the function S(q, t) represents :

(A) The action of the system

(B) The Hamiltonian of the system

(C) The total energy of the system

(D) The wave function of the system

9. What does the separability of variables in Hamilton-Jacobi theory allow?

(A) Predicting chaotic behaviour in system

(B) Easy numerical simulations

(C) Simplification of Hamiltonian into independent parts

(D) Exact solutions for all dynamical systems

10. Which of the following is a common method for analyzing nonlinear oscillator?

(A) Numerical simulations (B) Linearization

(C) Perturbation (D) All of the above

11. The number of non-vanishing terms in the Fourier series of $\cos^3\theta$ in the interval $(-\pi, \pi)$ is :

(A) One (B) Two

(C) Three (D) Infinity

12. If n is a positive integer, then the value of Γn is :

(A) $n!$ (B) $(n-1)!$

(C) $(n-2)!$ (D) $\frac{(n-1)!}{2^n}$

13. The value of integral $\int_C \frac{dz}{z^2-2z}$ where C is the circle $|z-2|=1$, traversed in the counter clockwise direction is :

(A) $-\pi i$ (B) $2\pi i$

(C) πi (D) None of these

14. If $\frac{d}{dx}[\delta(x)\, f(x)] = f(x)$, then $f(x)$ must be :

(A) 1 (B) e^x

(C) $\log x$ (D) Unit step function $u(x)$

15. The value of Bessel's function $J_0(0)$ is :

(A) Zero (B) One

(C) Two (D) Three

16. The Legendre polynomial $P_n(X)$ has :

(A) n real zero between 0 and 1

(B) n zeroes of which only one is between –1 and +1

(C) $(2n-1)$ real zeroes between –1 and +1

(D) No real zeroes between 0 and 1

17. The value of the beta function $\beta(z, 1)$ is :

(A) $\frac{1}{z}$ (B) $\frac{1}{z+1}$

(C) $\frac{1}{z(z+1)}$ (D) $\frac{z-1}{z+1}$

18. The value of Legendre polynomial $P_3(x)$ is :

(A) $\frac{1}{2}(3x^2-1)$ (B) $3x$

(C) $\frac{1}{2}(5x^2-3x)$ (D) $\frac{1}{2}(5x^3-1)$

19. The residue of $\frac{\cos z}{z}$ at $z=0$ is :

(A) +1 (B) –1

(C) 0 (D) $\frac{\pi}{2}$

20. The function $f(z) = \frac{1}{(z^2 - 1)}$ in the contour C given by $x^2 + y^2 = 4$, has :

(A) No simple pole
(B) A simple pole at $z = 1$
(C) Two simple poles at $z = \pm 1$
(D) Two simple poles at $z = \pm i$

21. Which of the following are true?

(i) Only the carriers of one type are involved in FET
(ii) Carriers move through the base by diffusion in bipolar transistor
(iii) FET is thermally more stable than bipolar transistor

(A) (i) and (ii)
(B) (ii) and (iii)
(C) (i) and (iii)
(D) (i), (ii) and (iii)

22. Which of the following are not the characteristics of an ideal OPAMP?

(i) zero input impedance
(ii) infinite output impedance
(iii) zero common mode rejection ratio

(A) (i) and (ii)
(B) (ii) and (iii)
(C) (i), (ii) and (iii)
(D) (i) and (iii)

23. An electromagnetic wave of 500 MHz is in the band of :

(A) UV
(B) UHF
(C) VHF
(D) IR

24. Which of the following states the operation of FET as a VVR?

(i) resistance is controlled by gate-source voltage
(ii) resistance is controlled by gate to drain current
(iii) resistance is controlled by the voltage between drain and source

(A) (i)
(B) (ii)
(C) (iii)
(D) None of (i), (ii) and (iii)

25. If the resistance is doubled and capacitance halved in an OPAMP used as an astable multivibrator, its frequency would become :

(A) two times the original
(B) 0.5 times the original
(C) four times the original
(D) none of (A), (B) and (C)

26. Which one of the following is (are) correct for FET?

(i) transconductance is the ratio of change in drain current to the change in gate-source voltage at constant drain-source voltage

(ii) transconductance times a.c. drain resistance is the ratio of change in drain-source voltage to the change in gate-source voltage at constant drain current

(iii) positive temperature coefficient of resistance

(A) (i) and (ii) (B) (iii) and (i)

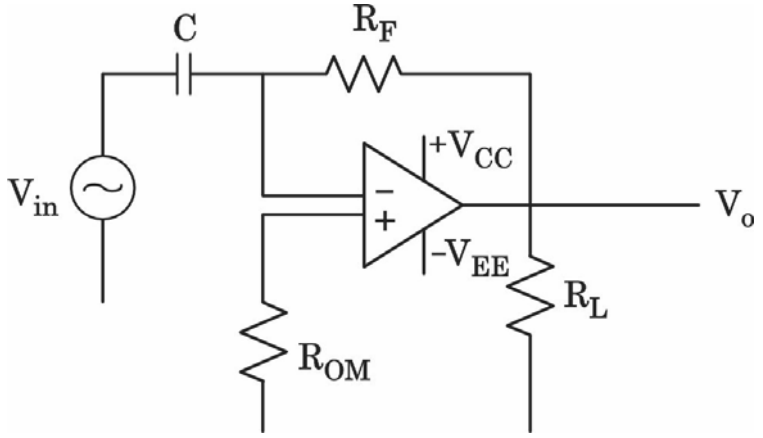
(C) (iii) and (ii) (D) (i)

27. For a wide band pass filter of center frequency 447.2 Hz, low cut off at 200 Hz and high cut off at 500 Hz, quality factor is :

(A) 1.49 (B) 2.73

(C) 10.25 (D) None of (A), (B) and (C)

28. What is the output of the following circuit?



(A) $-R_F C(dV_{in}/dt)$ (B) $-(1/CR_F)(dV_{in}/dt)$

(C) $-(R_F/C)\int_0^t V_{in}dt$ (D) None of (A), (B) and (C)

29. The peak to peak value of AM voltage has a maximum value of 9V and a minimum value of 3V. The percentage of modulation and the amplitude of unmodulated carrier are :

(A) 0.5, 3V (B) 0.6, 2.5V

(C) 0.8, 4V (D) 0.7, 1.5V

30. An n-channel JFET has I_{DSS} = 10mA and V_p = –4V. If V_{GS} = –2.5V, saturation drain current is :

(A) 5.2 mA (B) 1.4 mA

(C) 0.4 mA (D) 0.05 mA

31. Which of the following statements is correct in the case of parity operator?

(i) Parity operator is Hermitian

(ii) Eigen values of parity operator are +1 and –1

(iii) Parity operator commutes with Hamiltonian

(iv) None of the above

(A) (i) is correct

(B) (i) and (ii) are correct

(C) (i), (ii) and (iii) are correct

(D) (iv) is correct

32. Which among the following is valid in the case of Pauli Spin matrices?

(i) Determinant of $(\sigma_i) = -1$

(ii) Trace of $(\sigma_i) = 0$

(iii) $\sigma_i \sigma_j = -\sigma_j \sigma_i (i \neq j)$

(iv) None of the above

(A) (i) only valid

(B) (i), (ii) and (iii) are valid

(C) (iii) only valid

(D) (iv) only valid

33. Given that $J = \frac{1}{2}$ and $m = \frac{1}{2}$ the angular momentum representation of J_z in this case is :

(A) $Jz = \frac{h}{2\pi}\begin{bmatrix} \frac{1}{2} & 0 \\ 0 & \frac{-1}{2} \end{bmatrix}$

(B) $Jz = \frac{h}{2\pi}\begin{bmatrix} \frac{-1}{2} & 0 \\ 0 & \frac{1}{2} \end{bmatrix}$

(C) $Jz = \frac{h}{2\pi}\begin{bmatrix} 0 & \frac{-1}{2} \\ \frac{1}{2} & 0 \end{bmatrix}$

(D) $Jz = \frac{h}{2\pi}\begin{bmatrix} 0 & \frac{1}{2} \\ \frac{-1}{2} & 0 \end{bmatrix}$

34. Which among the following represent the optical theorem?

(A) $\sigma = \frac{k}{4\pi}\mathrm{Im}[f(0)]$

(B) $\sigma = \frac{4\pi}{k}\mathrm{Im}[f(0)]$

(C) $\sigma = \frac{4\pi}{ik}\mathrm{Im}[f(0)]$

(D) $\sigma = \frac{ik}{4\pi}\mathrm{Im}[f(0)]$

35. Klein Gordon Equation for a free particle is given by :

(A) $\left[-\left[\frac{h}{2\pi}\right]^2 c^2\nabla^2 + m^2c^4\right]\psi = -\left[\frac{h}{2\pi}\right]^2 \frac{\partial^2\psi}{\partial t^2}$

(B) $\left[-\left[\frac{h}{2\pi}\right]^2 c^2\,\nabla^2 + m^2c^2\right]\psi = -\left[\frac{h}{2\pi}\right]^2 \frac{\delta\psi}{\delta t}$

(C) $\left[-\left[\frac{h}{2\pi}\right]^2 c^2\,\nabla^2 + m^2c^4\right]\psi = i\left[\frac{h}{2\pi}\right] \frac{\partial\psi}{\partial t}$

(D) None of the above

36. For the non-degenerate state corresponding to $n=1,\ l=0,\ m_l=0$ of Hydrogen atom with even parity :

(A) There occur first order Stark Effect

(B) There occur no first order Stark Effect

(C) There occur both first order and second order Stark Effect

(D) None of the above

37. The selection rule for the π and σ components of the normal Zeeman Effect is :

(A) $\Delta m_L = +1$ for π component $\Delta m_L = 0, -1$ for σ component

(B) $\Delta m_L = -1$ for π component $\Delta m_L = 0, +1$ for σ component

(C) $\Delta m_L = 0$ for π component $\Delta m_L = \pm 1$ for σ component

(D) None of the above

38. Fermi's Golden Rule is used to determine the transition rate in :

(A) Strong Harmonic Perturbation (B) Weak harmonic perturbation

(C) Strong and weak perturbation (D) None of the above

39. Regarding the Weyl Equation which of the following statements is correct?

(i) It represents the relativistic wave equation for massless spin 1/2 particles

(ii) It is applicable for neutrinos

(iii) There exists two separate solutions for left handed and right handed Weyl Equations

(iv) There exists one unique solution for left handed and right handed Weyl Equation

(A) (i) and (ii) are correct

(B) (i) and (iii) are correct

(C) (i) and (iv) are correct

(D) (i), (ii) and (iii) are correct

40. Who introduced the Hole Theory in Quantum Mechanics during 1929?

(A) Wolfgang Pauli (B) Paul Dirac

(C) Enrico Fermi (D) Neils Bohr

41. Consider two samples of an ideal gas at a common initial temperature, T and particle density, n. If we mix these two samples, then entropy of mixing will be :

(A) $\Delta S = 0$ (B) $\Delta S = k(N_1 + N_2)\ln\dfrac{(V_1 + V_2)}{(N_1 + N_2)}$

(C) $\Delta S = k(N_1)\ln\dfrac{(V_1)}{(N_1)} + k(N_2)\ln\dfrac{(V_2)}{(N_2)}$ (D) $\Delta S = k\ln(N_1 + N_2)!$

42. Out of the following statements, which is not true according to Liouville's theorem :

(A) $\dfrac{\partial\rho}{\partial t} = 0$ (B) $\dfrac{d\rho}{dt} = 0$

(C) $[\rho, H] = 0$ (D) $\dfrac{d\rho}{dt} = \dfrac{\partial\rho}{\partial t} + [\rho, H]$

43. If the virial coefficients are zero, the virial equation of state assumes the form :

(A) $PV = NkT$ (B) $PV^{5/3} = a\ constant$

(C) $PV^{2/3} = a\ constant$ (D) $\dfrac{P}{NkT} = 1$

44. For a quantum mechanical system in a state of equilibrium, consider the following statements :

(i) $\hat{\rho} = \hat{\rho}(H)$

(ii) $\dfrac{dH}{dt} = 0$

(iii) $\dot{\rho} = 0$

(iv) $[H, \hat{\rho}] = \dfrac{ih}{2\pi}$

(A) (i) and (ii) are true (B) (i) and (iv) are true

(C) Only (iii) is true (D) (i), (ii) and (iii) are true

45. Give the condition for the onset of Bose-Einstein condensation when we hold N and V as constants and vary temperature, T :

(A) $N < VT^{\frac{3}{2}}\dfrac{(2\pi mk)^{3/2}}{h^3}\zeta\left(3/2\right)$ (B) $T > \left(T_c = \dfrac{h^2}{2\pi mk}\left\{\dfrac{N}{V\zeta\left(3/2\right)}\right\}^{\frac{2}{3}}\right)$

(C) $T < \left(T_c = \dfrac{h^2}{2\pi mk}\left\{\dfrac{N}{V\zeta\left(3/2\right)}\right\}^{\frac{2}{3}}\right)$ (D) $N = VT^{\frac{3}{2}}\dfrac{(2\pi mk)^{3/2}}{h^3}\zeta\left(3/2\right)$

46. Consider an ideal Bose gas under normal conditions: What is the value of, $\gamma = C_p / C_v$, when $T \to T_C$?

(A) $\gamma = 5/3$ (B) $\gamma > 5/3$

(C) $\gamma < 5/3$ (D) $\gamma \to \infty$

47. Establish the relation connecting the ground state pressure of an ideal fermi gas and the number density, n :

(A) $P_0 \propto n^{5/3}$ (B) $P_0 \propto n^{2/3}$

(C) $P_0 \propto n^{3/5}$ (D) $P_0 \propto n^{1/3}$

48. When compared to the lowest possible energy state μ_0, the chemical potential (μ) for an ideal Bose gas is always

(A) $-\infty < \mu < \infty$ (B) $\mu_0 < \mu < \infty$

(C) Zero (D) $-\infty < \mu < \mu_0$

49. Identify the correct behavior of ideal Bosons and Fermions at low temperatures, on account of the variation of Entropy (S) with temperature, T :

(A) $S_{fermion} \propto T^{3/2}; S_{boson} \propto T$ (B) $S_{boson} \propto T^{3/2}; S_{fermion} \propto T$

(C) $S_{boson} = S_{fermion} = 0$ (D) $S_{boson} \propto T; S_{fermion} \propto T$

50. The low field susceptibility of an ideal fermi gas is negative. It indicates that :

(A) The effect is diamagnetic but it depends on the sign of charge on the particle

(B) The effect is paramagnetic which is irrespective of the sign of charge on the particle

(C) The effect is diamagnetic which is irrespective of sign of the charge on the particle

(D) The effect is neither diamagnetic nor paramagnetic

51. Determine the stable nucleus that has a radius one third that of Os^{189} :

(A) Be^{8} (B) C^{12}

(C) O^{16} (D) Li^{7}

52. For a uniformly charged ellipsoidal nucleus, the electric quadrupole moment is related to its deformation. According to standard nuclear physics formulas, the quadrupole moment depends on which of the following parameters?

(A) The mass number A

(B) The radius of the nucleus

(C) The charge distribution and deformation parameter

(D) The binding energy per nucleon

53. In the quark model, a baryon is composed of :

(A) Two quarks

(B) A quark and an antiquark

(C) Three quarks

(D) Four quarks

54. The binding energy per nucleon decreases for very heavy nuclei (e.g., Uranium) because:

(A) Coulomb repulsion between protons becomes significant

(B) The number of neutrons far exceeds the number of protons

(C) There are too many electron shells

(D) The nuclear spin-orbit interaction weakens

55. According to the quark model, the Ω^- is composed of :

(A) Two up quarks and one down quark

(B) Three strange quarks

(C) One up quark, one down quark and one strange quark

(D) Two strange quarks and one charm quark

56. Parity violation in weak interactions implies that the laws of physics :

(A) Are the same for left-handed and right-handed coordinate systems

(B) Are not invariant under mirror reflection

(C) Maintain invariance under charge conjugation

(D) Are symmetric for all fundamental forces

57. X-ray diffraction is commonly used to determine :

(A) The electron configuration of atoms

(B) The lattice structure and interatomic spacing in crystals

(C) The magnetic properties of materials

(D) The thermal expansion coefficient of substances

58. If CPT symmetry is violated, which of the following implications might occur in a physical theory?

(A) Particles and antiparticles could have different masses

(B) Conservation of energy would be violated

(C) Lorentz invariance would still be maintained

(D) Electromagnetic interactions would cease to exist

59. What are "magic numbers" in nuclear physics?

(A) Specific numbers of protons or neutrons at which nuclei exhibit extra stability

(B) Numbers corresponding to the sum of protons and neutrons that result in stable nuclei

(C) The number of excited states a nucleus can have before undergoing decay

(D) Numbers that represent the maximum possible spin for a given nucleus

60. In QCD, gluons are responsible for :

(A) Mediating the electromagnetic force between charged particles

(B) Binding quarks together via the strong interaction

(C) Determining the mass of fundamental particles

(D) Interacting only with leptons, not hadrons

61. A crystal has a face-centered cubic lattice structure with a lattice constant a = 3.6 A°. The volume of the first brillouin zone and volume of primitive cell for this crystal are respectively :

(A) $2.13 \times 10^{31}/m^3, 1.16 \times 10^{-29}\ m^3$

(B) $2.13 \times 10^{31}\ m^3, 1.16 \times 10^{-29}/m^3$

(C) $1.16 \times 10^{-29}\ m^3, 2.13 \times 10^{31}/m^3$

(D) $6.16 \times 10^{-30}\ m^3, 2.13 \times 10^{31}/m^3$

62. What is the main difference between Type I and Type II superconductors?

(A) Type I superconductors have only one critical temperature

(B) Type II superconductors can exhibit both normal and superconducting states within a range of magnetic fields

(C) Type I superconductors are used in magnetic levitation

(D) Type II superconductors are restricted to low temperatures

63. In the Kronig-Penney model, the formation of energy bands arises due to :

(A) Overlapping of electron orbitals between atoms

(B) The periodic potential of the lattice

(C) The effect of external electric fields

(D) The spin of the electron in the magnetic field

64. Which phenomenon does the Langevin's theory primarily explain?

(A) Ferromagnetism (B) Paramagnetism

(C) Diamagnetism (D) Superconductivity

65. Einstein's model of specific heat is primarily limited to low temperatures because :

(A) It assumes atoms are non-interacting

(B) It considers only one vibrational mode

(C) It does not account for quantum mechanical effects

(D) It treats the crystal as a collection of independent harmonic oscillators

66. Which statement is true about antiferromagnetism?

(A) Magnetic moments of neighboring atoms align in parallel directions

(B) It shows no magnetic response to an external magnetic field

(C) Magnetic moments of neighboring atoms align in opposite directions

(D) It exhibits spontaneous magnetization even without an external field

67. A crystal plane intersects the crystallographic axes at 2a, 3b and 32c. Calculate the Miller indices for this plane :

(A) (48, 32, 3) (B) (32, 48, 2)

(C) (24, 16, 6) (D) (16, 24, 3)

68. In a Type II superconductor, which of the following best describes the behavior of magnetic flux lines?

(A) The magnetic flux lines are fully expelled from the material

(B) The magnetic flux lines penetrate the material as quantized vortices

(C) The magnetic flux lines remain constant throughout the material

(D) The magnetic flux lines increase linearly with temperature

69. Calculate the energy of a phonon mode in a crystal where the Debye temperature is 500 K. Use Boltzmann's constant $k = 1.380649 \times 10^{-23}$ J/K?

(A) 0.043 eV (B) 6.9×10^{-21} J

(C) Both option (A) and (B) (D) None of the above options

70. The local electric field in a dielectric is different from the external field due to the contribution of :

(A) Bound charges (B) Free charges

(C) Magnetic moments (D) Heat capacity

71. In the presence of an internal electric field gradient, how many lines will appear in the Mössbauer spectrum for a nucleus with ground state spin $I_g = \frac{1}{2}$ and excited state spin $I_e = \frac{3}{2}$?

(A) 1 (B) 2

(C) 3 (D) 4

72. The isomer shift arises of Mössbauer spectrum due to the interaction between which two components :

(A) Nuclear quadrupole moment and electron charge distribution

(B) Nuclear charge distribution and electron spin

(C) Nuclear quadrupole moment and electron spin

(D) Nuclear charge distribution and electron charge distribution

73. Which of the following nuclei will not show NMR spectrum?

(A) ^{12}C (B) ^{14}N

(C) ^{19}F (D) ^{35}Cl

74. NMR spectrum of CH_3CH_2OH has bunches of spectral lines corresponding to each functional group. The number of lines corresponding to the CH_3 group is :

(A) 3 (B) 4

(C) 5 (D) 6

75. What is a key feature of the rotational Raman spectrum of symmetric top molecules?

(A) Equally spaced lines with $\Delta J = \pm 1$

(B) Equally spaced lines with $\Delta J = \pm 2$

(C) Unequally spaced lines with $\Delta J = \pm 1$

(D) Unequally spaced lines with $\Delta J = \pm 2$

76. What kind of transitions do molecules undergo during the inverse Raman effect?

(A) Electronic transitions (B) Rotational transitions

(C) Vibrational transitions (D) Nuclear spin transitions

77. Which of the following statements is true regarding the vibrational modes of CO_2?

(A) All modes are IR-active (B) Only one mode is IR-active

(C) Only one mode is IR-inactive (D) All modes are IR-inactive

78. Which of the following is a symmetric top molecule?

(A) NaCl (B) HCN

(C) CH_3Cl (D) H_2O

79. Which of the following statements is true regarding electronic spectra of homonuclear diatomic molecules?

(A) Show electronic spectra with vibrational structures, but no rotational structures

(B) Show electronic spectra with both rotational and vibrational structures

(C) Show electronic spectra with rotational structures, but no vibrational structures

(D) Show pure rotational spectra

80. In the rotational spectrum of non-rigid rotator, the spacing between adjacent lines :

(A) increases by $D_J J(J+1)$ (B) decreases by $D_J J(J+1)$

(C) increases by $D_J J^2(J+1)^2$ (D) decreases by $D_J J^2(J+1)^2$

81. In a microprocessor the register used to store memory address of the next instruction to be executed is called :

(A) Stack pointer (B) Program counter

(C) Data pointer (D) Accumulator

82. In 8085 microprocessor the instructions :

LXI H,2000 H

MOV B, M

(A) Will move the content of the memory location 2000H to register B

(B) Will move the content of the register B to memory location 2000H

(C) Will move the value 2000H to register B

(D) None of the above

83. The clock frequency of 8085 microprocessor is 5 MHz, The number of T states required to execute an instruction is 7. The time required to execute the instruction is :

(A) 0.2 μs (B) 2.8 μs

(C) 0.7 μs (D) 1.4 μs

84. The content of Accumulator A and register B of 8085 microprocessor are 47 H and 39 H respectively. The content of Accumulator (A), the status of Sign flag (S) and Auxiliary carry flag (AC) after the execution of the instruction ADD B is :

(A) A = 80 H AC = 0 and S = 1 (B) A = 80 H AC = 1 and S = 0

(C) A = 80 H AC = 1 and S = 2 (D) None of these

85. Which one of the following flag condition is used for BCD arithmetic operations in 8085 microprocessor?

(A) Carry flag
(B) Parity flag
(C) Auxiliary carry flag
(D) All the above

86. The lowest priority interrupt in 8085 is :

(A) INTR
(B) TRAP
(C) RST 6.5
(D) RST 7.5

87. The programmable peripheral interface chip that can be interfaced with the 8085 microprocessor to perform various input/output operations is :

(A) 8251
(B) 8255
(C) 8253
(D) 8155

88. The 8051 microcontroller has :

(A) 16-bit address bus and 16-bit data bus
(B) 8-bit address bus and 16-bit data bus
(C) 8-bit address bus and 8-bit data bus
(D) 16-bit address bus and 8-bit data bus

89. The signal related to Direct Memory Access in 8085 microprocessor is :

(A) HOLD
(B) RST 5.5
(C) INTR
(D) SID

90. The total external data memory that can be interfaced with 9051 microcontroller is :

(A) 32 K
(B) 16 K
(C) 64 K
(D) 4 K

91. The ratio of spontaneous emission to stimulated emission in a laser system is governed by the Einstein A and B coefficients. If the Einstein A coefficient is increased, what effect does it have on the laser's gain?

(A) Gain increases
(B) Gain decreases
(C) Gain remains unchanged
(D) Gain become negative

92. In an optical system using spatial frequency filtering, which type of filter would you use to remove high-frequency noise?

(A) Low pass filter
(B) High pass filter
(C) Band pass filter
(D) Notch filter

93. In holography, the interference pattern recorded is a function of the light's :

(A) Amplitude (B) Frequency

(C) Phase (D) Wavelength

94. Which of the following is a key advantage of a four-level laser system compared to a three-level system?

(A) Lower threshold pump energy

(B) No need for population inversion

(C) Higher quantum efficiency

(D) No thermal management required

95. Which mechanism is responsible for Doppler broadening?

(A) Collisions between atoms (B) Thermal motion of atoms

(C) Quantum uncertainty (D) Pressure of the medium

96. In mode-locking, what is synchronized in the laser?

(A) Photon absorption (B) Phases of longitudinal modes

(C) Atomic excitation (D) Transverse modes

97. Which device can be used to modulate light in a Q-switched laser system?

(A) Diffraction grating (B) Saturable absorber

(C) Optical fiber (D) Pockels cell

98. Inherent defect losses in optical fibers are primarily caused by :

(A) Manufacturing imperfections (B) External electric fields

(C) Core misalignment (D) Polarization of light

99. What is the typical application of a single-mode fiber?

(A) Short-distance communication (B) High-power lasers

(C) Long-distance communication (D) Fiber optics lighting

100. Which among the following is an active mode locking method?

(A) Colliding pulse mode locking

(B) Additive pulse mode locking

(C) Kerr lens mode locking

(D) Synchronously pumped mode locking

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK