March 2004 Paper –II

1. The Function $x \ln x$
   (a)Tends to Zero as $x \to 0$ and has minimum between $x = 0$ and $x = 1$

   (b)Tends to minus infinity as $x \to 0$ and has minimum between 0 and 1

   (c)Tend to Zero as $x \to 0$and has minimum between 1 and ∞

   (d)Tends to minus infinity as $x \to 0$ and has a minimum between 1 and ∞

2. Three ideal dice thrown The probability that the sum of number on the upper faces will be equal to or greater than 16 is
   (a) $\frac{2}{108}$ (b) $\frac{1}{54}$

   (c) $\frac{5}{108}$ (d) $\frac{2}{27}$

3. In the direction cosine of a vector are $a + b, a - b, a$ then
   (a) $3a^2 + 2b^2 = 1$ (b) $a^2 + 4ab = 1$

   (c) $a^2 + 2b^2 = 1$ (d) $3a^2 + 2b^2 = 0$

4. A set of four vector in a three dimensional space
   (a) May or May not be linearly dependent

   (b) May or May not be Orthogonal

   (c) Must be Orthogonal

   (d) Must be Linearly dependent

5. The rank of the matrix
   $$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{bmatrix} \text{ is}$$
   (a) 0 (b) 1

   (c) 2 (d) 3

6. Legendary Differential Equation
   $$[1 - x^2]\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + n(n+1)y = 0$$
   has Singular point
   (a)$x = 0$ & $x = \infty$ (b) $x = 1$ & $x = -1$

   (c)$x = \infty$ (d)$x = -\infty$

7. For the Fourier series expansion $f(x) = \frac{\mu_0}{2} + \sum_{n=1}^{\infty} l\, a_n \cos nx + b_n \text{ Sin } nx$ which of the following is not correct ?
   (a)when f(x) is an even function $b_n = 0$

   (b)when f(x) is an odd function $a_n = 0$

   (c)when f(x) is neither even nor odd function both $a_n = 0$ & $b_n = 0$

   (d) a_n & b_n are Finite

8. If the real part of an Analytical function is $\ln [x^2 + y^2]^{1/2}$ then it's imaginary part a part of Constant
   (a) 2xy (b) $\tan^{-1}\frac{y}{x}$

   (c) $3x^2y$ (d) $3xy\,(x - y)$

9. For a system with Lagrangian $L = \frac{1}{2} m (x^2 + y^2) - mgy$ The Lagrangian equation are:
   (a) $\overline{x} = 0, \ddot{y} = g$ (b) $\ddot{y} = 0$ $\overline{x} = g$

   (c) $\overline{x} = g, \ddot{y} = 0$ (d) Non of these

10. A particle is constrained to move along the inner surface of fixed hemi spherical bowl. The number of degree of freedom of the particle is
    (a) 4 (b) 7

    (c) 3 (d) 4

11. The Reduces mass of a system of two particle with mass M_1 and M_2 When M_1 approximately
    (a) $M_1\left[1 + \frac{M_1}{M_2}\right]$ (b) M_2

(c) $M_1\left[1-\frac{M_1}{M_2}\right]$ (d) $M_2\left[1-\frac{M_1}{M_2}\right]$

12. A Mutual potential energy v of two particle and distance $V\langle r\rangle = \frac{a}{r^2} - \frac{b}{r}$ It's an particle are in stable in Static Equilibrium then separate's r is
(a) $\frac{2a}{b}$ (b) $\frac{2b}{a}$

(c) $\frac{a}{b}$ (d) $\frac{b}{a}$

13. Let three coplanar F_1 F_2 & F_3 act particles A in equilibrium. let α, β, γ the image between F_2 & F_3 And F_1 then
(a) $\sin\alpha + \sin\beta + \sin\gamma = 0$

(b) $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 0$

(c) $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 0$

(d) $\frac{F_1}{\sin\alpha} = \frac{F_2}{\sin\beta} = \frac{F_3}{\sin\gamma}$

14. A particle suffers classical elastic scattering from potential. if the initial particle has energy E. and angular momentum l then after scattering
(a) Both E and l same

(b) Both E and l change

(c) E charge but not l

(d) l Change but not E

15. A Body is moving with a speed 0.5 c relative to space ship whose speed with respect to the earth 0.9 c. The speed of the body relative to the earth
(a) 1.4 c (b) 0.4 c

(c) 0.9655 c (d) -0.4 c

16. The Lorentz transformation between the coordinate for observer moving along the z direction is given by
(a) $z' = \frac{z - vt}{\sqrt{1-\frac{c^2}{v^2}}}$ (b) $z' = \frac{z + vt}{\sqrt{1+\frac{c^2}{v^2}}}$

(c) $z' = \frac{z - vt}{\sqrt{1-\frac{v^2}{c^2}}}$ (d) $z' = \frac{z + vt}{\sqrt{1+\frac{v^2}{c^2}}}$

17. Two conducting sphere of radius R_1& R_2 Carry charge q_1 & q_2 respectively, and are both at a distance d , $d \gg R_1$ R_2 from each other. They are then connected by a Conducting wire their final charges
(a) $Q_1 = q_1$ $Q_1 = q_1$

(b) $Q_1 = \frac{q_1R_2}{R_1+R_2}$ $Q_2 = \frac{q_2R_2}{R_1+R_2}$

(c) $Q_1 = \frac{q_1R_1}{R_1+R_2}$ $Q_2 = \frac{q_2R_2}{R_1+R_2}$

(d) $Q_1 = \frac{[q_1+q_2]R_1}{R_1+R_2}$ $Q_2 = \frac{[q_1+q_2]R_2}{R_1+R_2}$

18. The electric potential at a perpendicular distance "r" from a long striate wire of cross section radius "a". is given $V(r) = -K\ln\frac{r}{a}$ K = Constant. The electric field as a function of distance "r" is given by
(a) $\frac{k}{r}$ (b) k

(c) Kr (d) $\frac{k}{r^2}$

19. A Metallic ring of cross section $2.5cm^2$ mean the radius 40 cm and relatively permeability 1500 is wound uniformly with 3000 turn of the wire. If a current of 1.6 A is passing through the wire then mean $\overline{B}$. Field in the ring will be :
(a) 0.036 T (b) 0.36 T

(c) 3.6 T (d) 36 T

20. A coil of wire consisting of 20 turn in shape of an equilateral triangle of side 5 cm. is placed in a magnetic field of 10^{-3}T. Parreal to the plan of the triangle. if the current 0.1 A is passed through the coil the torque acting on the coil will be
(a) 1.1×10^{-7}Nm (b) 2.2×10^{-6}Nm

(c) 0 Nm (d)2.2×10^{-10} Nm

21. The electric field associated with a lesser beam having energy density 10^6 joule / cm^3 is
(a) $4.8 \times 10^{11} \frac{V}{m}$ (b) $4.8 \times 10^{9} \frac{V}{m}$

(c) $9.6 \times 10^{11} \frac{V}{m}$ (d) $9.6 \times 10^{9} \frac{V}{m}$

22. A diffraction limited telescope has an Aperture of 1 m. At focus is a TV detector has whose resolution element size is 10^{-5}m. the wavelength λ . at which the telescope function optically in the sense that 10^{-5}m. correspond to diffraction line will be :
(a) 2000 A^0 (b) 4000 A^0

(c) 6000 A^0 (d) 8000 A^0

23. A Resistor is connect across two horizontal metal rail A closed circuit is formed by a metal rod which slides along 'v' there is a magnetic field B. perpendicular to the plane of the rails .The external force required to maintain the slightly motion of the rod
(a) $\frac{BLvt}{R}$ (b) $\frac{B^2L^2v}{R^2}$

(c) $\frac{B^2L^2v}{R}$ (d) $\frac{B^2L^2vt}{R}$

24. The Scalar and vector potential in the coulomb gauge are given in term source and current densities $\emptyset\,(\overline{x}, t) = \int \frac{\rho(\overline{x},t)}{|\vec{x}-\vec{x}'|}\, d^3x'$ and the solution of

$$\nabla^2\overline{A} - \frac{1}{C^2}.\frac{\partial^2\overline{A}}{\partial t^2} = -\frac{4\pi}{c}\,\vec{j}$$

Which of the following statement is correct?
(a) Causally is violated Necessary in this gauge

(b) Electric and magnetic field are causal

(c) Magnetic fields are casual but not electric field.

(d) Electric field are equal but magnetic field are not

25. Which of the following wave function can be solution of Schrodinger's equation for all value of x?
(a) $\varphi = A\sec x$ (b) $\varphi = \tan x$

(c) $\varphi = Ae^{x^2}$ (d) $\varphi = Ae^{-x^2}$

26. The Normalize wave function of a certain particle is $\varphi = A\cos^2 x$ for the $\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$
Then the value of A is:
(a) $\sqrt{\frac{8}{3\pi}}$ (b) $\sqrt{\frac{3}{8\pi}}$

(c) $\sqrt{\frac{1}{2\pi}}$ (d) $\sqrt{\frac{4}{3\pi}}$

27. The Degree of Degeneracy for three- Dimensional isotropic harmonic Oscillator is
(a) n^2

(b) $2n + 1$

(c) $\frac{1}{2}(2n + 1)(2n + 2)$

(d) $\frac{1}{2}(2n + 1)(n + 2)$

28. Which of the following is an Eigen function of L_z
(a) Cos Ø (b) SinØ

(c) $e^{i\emptyset}$ (d) $Cos^2\,\emptyset$

29. The Operator X_p is :
(a) Unitary (b)Herniation

(b) Skew- Herniation (d)Symmetric

30. The values of total angular momentum arising out of the addition out of the addition of the angular momentum $j_1 = 2$ & $j_2 = \frac{1}{2}$ are
(a) $\frac{5}{2}, \frac{3}{2}, \frac{1}{2}$ (b) $\frac{5}{2}, \frac{3}{2}$

(c) $2, \frac{1}{2}$ (d)2,1,0

31. The Quantum mechanically scattering amplitude has the dimension of :
(a) Time (b)Length

(c) Area (d)Volume

32. The Pauli's spin matrices σ_x σ_y & σ_y stratify the relation
(a)$\sigma_x{}^2 + \sigma_y{}^2 + \sigma_y{}^2 = 1$

(b) $\sigma_x{}^3 + \sigma_y{}^3 + \sigma_y{}^3 = 1$

(c) $\sigma_x + \sigma_y = \sigma_z$

(d) $\sigma_x \,.\, \sigma_y = \sigma_z$

33. In a refrigerator the heat exhausted to the outer Surrounding

(a)Less than that Absorbed from the content of the Refrigerator

(b)Same as that Absorbed from the content

(c)More than that Absorbed from the content

(d)Any of the above depending upon the working substance

34. The enthalpy of unit mass for any system is
(a) $H = U + PV + S$

(b) $H = U + PV - S$

(c) $H = U + PV$

(d) $H = U - PV + S$

35. The Colossus- Clapeyron equation indicates that an increase in the pressure increase the melting point in the all cases
(a) All Substances

(b) Substances which expands on solidification

(c) Substances which contract on solidification

(d) Substance which neither expand nor contact solidification

36. In conical ensemble a system Δ of the fixed volume is an thermal contact with a large resvoiur B then
(a) A can exchange only energy with B

(b) A can exchange only particle with B

(c) A can exchange neither energy nor particles with β

(d) A can exchange both energy and particle with B.

37. Which of the following relation between free energy F and canonical partition function z is true ?
(a) $F = -\frac{\partial}{\partial T}\{\log z\}$

(b) $F = k_B T^2 \frac{\partial}{\partial T}\{\log z\}$

(c) $F = -kT\{\log z\}$

(d) $F = kT \frac{\partial}{\partial V}\{\log z\}$

38. At 300 k , the root mean square speed of oxygen molecule is closest to

(a) $5 \frac{m}{s}$ (b) $500 \frac{m}{s}$

(c) $5000 \frac{m}{s}$ (d) $50 \frac{m}{s}$

39. Consider the Fermi gas having Fermi energy E_F at a low temperature the average occupy at energy $E = E_F$ will be the closest

(a) $\frac{2}{3}$ (b) $\frac{1}{2}$

(c) $\frac{1}{4}$ (d) 0

40. Curie-Weiss law is an example

(a) First order phase transition

(b) second order phase transition

(c) Zero order phase transition

(d) none of these

41. Photo emissive detector will respond to an incident radiation of

(a) Any wavelength

(b) Only cut-off wavelength

(c) Wavelength up to cut-off wave length

(d) Wavelength greater than cut off wave length

42. A Cathode ray tube the part played by Grid is

(a) Control intensity only

(b) Control intensity and frequency

(c) Control focusing

(d) none of these

43. An input to the vertical amplifier to CRO is a square wave output on the screen is shown below

(a) High frequency response of vertical amplifier is poor

(b) Low frequency response of vertical amplifier is poor

(c) High frequency response of horizontal amplifier is poor

(d) Low frequency response of horizontal amplifier is poor

44. The audio generator generally Consist of:

(a) Lead or lag type phase shift Oscillator

(b) Wein Bridge Oscillator

(c) LC Oscillator

(d) Multi Vibrator

45. A Constant current source the Regulating transistor work in

(a) Saturation (b) Cut off Region

(c) Deep Saturation (d) Active Region

46. An Ideal voltage source has

(a) Zero static impedance

(b) Zero dynamic impedance

(c) Infinite static impedance

(d) Infinite dynamic impedance

47. A Zenner diode is used is a Reference voltage sourced in a regulated power supply because

(a) It offers almost constant voltage irrespective current passing through it

(b) It offers almost current irrespective of the voltage across it

(c) IT offers zero statics impedance

(d) It offers infinite impedance

48. The Number of nearest neighbors in FCC s crystal

(a) 6 (b) 8

(c) 12 (d) 24

49. Which of the following is not ultra-high vacuum pump (UHV)

(a) Turbo molecular pump

(b) Spatter ion pump

(c) Sorption pump

(d) Cryo pump

50. White noise is characterized by

(a) $\frac{1}{f}$ Dependence

(b) $\frac{1}{f^2}$ Dependence

(c) f Dependence

(d) Frequency independent

Answer Key				
1. a	2. c	3.	4. c	5. c
6. b	7. c	8. b	9.	10.
11. c	12. a	13. d	14. a	15. c
16.	17. d	18. a	19. a	20. b
21.	22.	23.	24. b	25. d
26. a	27. b	28. c	29. b	30. b
31. c	32. a	33. a	34. c	35. c
36. a	37. c	38. a	39.	40. b
41. c	42. a	43. a	44. b	45. d
46. a	47. b	48. c	49. b	50. a