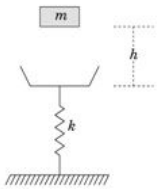
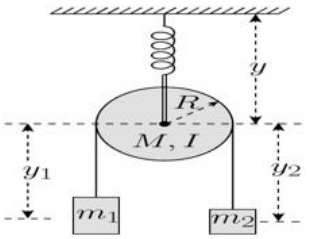
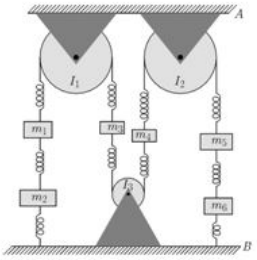
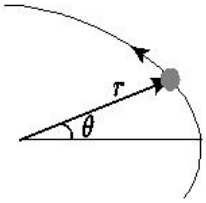
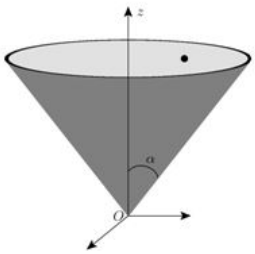
Module Name : PhD Physics-E
Exam Date : 18-Sep-2020 Batch : 12:30-14:30

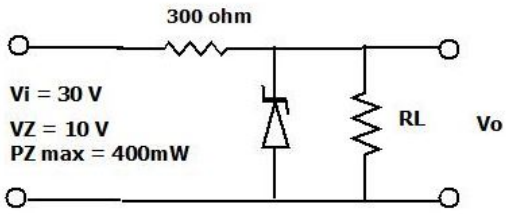
Sr. No.	Client Question ID	Question Body and Alternatives	Marks	Negative Marks
Objective Question				
1	1	In a ^{31}P NMR experiment on an unknown compound, a single resonance with a septet pattern (1:6:15:20:15:6:1) is observed. Which of the following structures would be consistent with this observation? A1 : PF_3 A2 : PH_3 A3 : PMe_3 A4 : PF_6^-	4.0	1.00
Objective Question				
2	2	Which of the following transitions between rotational energy levels is **not** allowed? A1 : J=1 ⟶ J=0 A2 : J=0 ⟵ J=1 A3 : J=1 ⟵ J=3 A4 : J=1 ⟵ J=2	4.0	1.00
Objective Question				
3	3	Which is the correct sequence of wavenumbers associated with the stretching vibration of the following bonds? A1 : C–I < C–Cl < C=O < C≡N A2 : C–I > C–Cl > C=O < C≡N A3 : C–I > C–Cl > C=O > C≡N A4 : C–I > C–Cl < C=O < C≡N	4.0	1.00
Objective Question				
4	4	EPR spectroscopy is often used to investigate copper (II) complexes but not copper (I) complexes. This is because A1 : Cu^{2+} has an s^2d^7 configuration but Cu^+ is d^{10}	4.0	1.00

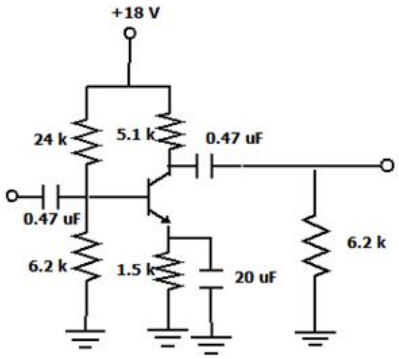
		A2 : Cu^{2+} has a d^9 configuration but Cu^{+} is s^1d^9 A3 : Cu^{2+} has a d^9 configuration but Cu^{+} is d^{10} A4 : Cu^{2+} has an s^1d^8 configuration but Cu^{+} is d^{10}		
Objective Question				
5	5	The change in the rotational constant B when hydrogen is replaced by deuterium in the hydrogen molecule is A1 : 2B A2 : 4B A3 : 3B/2 A4 : B/2	4.0	1.00
Objective Question				
6	6	Calculate the resonance (ESR) frequency when a free electron is placed in a magnetic field of strength 1.3 T. (Given g=2.0023, $\mu_B = 9.274 \times 10^{-24}$ JT^{-1})) A1 : 7.286 GHz A2 : 36.43×10^{10} Hz A3 : 1.825 GHz A4 : 36.43 GHz	4.0	1.00
Objective Question				
7	7	A block of mass m is dropped from a height h on to the pan of a spring balance. The masses of the pan and the spring are negligible. The spring constant of the spring is k. Having stuck to the pan the body starts performing harmonic oscillations in the vertical direction. What is the amplitude of the oscillation?  A1 : $\frac{mg}{k}\sqrt{1+\frac{2kh}{mg}}$ A2 :	4.0	1.00

		$\frac{mg}{k}\sqrt{1-\frac{2kh}{mg}}$ A3 : $\frac{mg}{k}\sqrt{1+\frac{mg}{2kh}}$ A4 : $\frac{mg}{k}\sqrt{1+\frac{kh}{mg}}$		
Objective Question				
8	8	A reference frame attached to an object in a Cartesian coordinate system and the unit vectors along the axes are $\hat{i}$, $\hat{j}$ and $\hat{k}$. If the object undergoes rotation about a fixed axis, then with respect to a fixed or inertial frame the rate of change $d\hat{k}/dt$ of the unit vector $\hat{k}$ in general may be denoted by A1 : $\alpha\hat{k}+\beta\hat{j}$ A2 : $\alpha\hat{k}+\beta i$ A3 : $\alpha\hat{i}+\beta\hat{j}$ A4 : $\alpha\hat{i}+\beta\hat{j}+\gamma\hat{k}$	4.0	1.00
Objective Question				
9	9	Two masses m_1 and m_2 are connected by an inextensible string which passes through a pulley and the pulley is hung by a spring from a fixed support as shown in the figure. The mass, radius and the moment of inertia of the pulley are denoted by M, R and I. What is the kinetic energy of the system if the oscillation due to the spring is only vertical? Ignore the masses of the string and the spring.  A1 : $\frac{1}{2}\left(m_1(\dot{y}^2+\dot{y}_1^2)+m_2(\dot{y}^2-\dot{y}_1^2)+M\dot{y}^2+(I/R^2)\dot{y}_1^2\right)$ A2 : $\frac{1}{2}\left(m_1(\dot{y}^2+\dot{y}_1^2)+m_2(\dot{y}_1^2-\dot{y}_2^2)+M\dot{y}^2+(I/R^2)\dot{y}_1^2\right)$ A3 : $\frac{1}{2}\left(m_1(\dot{y}^2+\dot{y}_1^2)+m_2(\dot{y}^2-\dot{y}_1^2)+M\dot{y}^2+(I/R^2)\dot{y}^2\right)$ A4 : $\frac{1}{2}\left(m_1(\dot{y}^2+\dot{y}_1^2)+m_2(\dot{y}_1^2-\dot{y}_2^2)+M\dot{y}^2+(I/R^2)\dot{y}^2\right)$	4.0	1.00
Objective Question				

10	10	Six masses m_1, m_2, m_3, m_4, m_5 and m_6 are connected using springs and inextensible strings through three pulleys as shown in the figure. The pulleys have moments of inertia I_1, I_2 and I_3. A and B are fixed supports. Assuming that the springs and strings are massless and that there are only vertical oscillations of the masses, how many degrees of freedom does this system have?  A1 : 8 A2 : 6 A3 : 9 A4 : 7	4.0	1.00
Objective Question				
11	11	In a central force problem the radial and the angular coordinates of the object from the centre of force are related to each other by the relation $re^{\theta} = 1$. What is the nature of the central force $f(r)$?  A1 : $f(r) \propto r$ A2 : $f(r) \propto \frac{1}{r^3}$ A3 : $f(r) \propto e^{-r}$ A4 : $f(r) \propto \frac{e^{-r}}{r}$	4.0	1.00
Objective Question				
12	12	Under a coordinate transformation, two quantities A_1 and A_2 transform as $A_1 \longrightarrow A_1' = \alpha A_1 - \alpha\beta A_2$ and $A_2 \longrightarrow A_2' = \alpha A_2 - \alpha\beta A_1$ where $\alpha^2(1-\beta^2) = 1$. Then which of the following is an invariant quantity under the transformation? A1 : $(A_1)^2+(A_2)^2$ A2 : A_1A_2	4.0	1.00

		A3 : A_1/A_2 A4 : $(A_1)^2-(A_2)^2$		
Objective Question				
13	13	A particle is confined to move on the inner surface of an inverted cone with its tip at the origin and its axis being the z-axis. The half angle of the cone is α. In the cylindrical polar coordinates (ρ,φ), the Lagrangian for the motion of the particle is given by $\mathcal{L}=\frac{1}{2}m\left(\frac{\dot{\rho}^2}{\sin^2\alpha}+\rho^2\dot{\varphi}^2\right)-\frac{mg\rho}{\tan\alpha}$. Which of the following statements is true for this system?  A1 : The momentum conjugate to ρ is conserved. A2 : The momentum conjugate to φ is zero. A3 : The momentum conjugate to φ is conserved. A4 : The momenta conjugate to both ρ and φ are conserved.	4.0	1.00
Objective Question				
14	14	Consider a parallel plate capacitor with a 2000 V across the electrodes, which are separated by 0.5 cm. What would be the final velocity of the electron at positive side if the electron starts at rest on the negative side? A1 : $80x10^6$ m/sec A2 : $80x10^5$ m/sec A3 : $50x10^2$ m/sec A4 : $40x10^4$ m/sec	4.0	1.00
Objective Question				
15	15	Determine the electron (n) and hole (p) concentrations in an n-Si at 300 °K, if the conductivity is 2.08 $(\Omega\text{-cm})^{-1}$ (mobility of electrons in n-Si is 1300 $cm^2/V\text{-s}$). A1 : $n = 10^{16}$ and $p = 10^4$ A2 : $n = 10^{15}$ and $p = 10^5$	4.0	1.00

		A3 : $n = 10^{14}$ and $p = 10^{6}$ A4 : $n = 10^{13}$ and $p = 10^{7}$		
Objective Question				
16	16	Calculate the Hall voltage V_H in n-Si bar with $N_D = 10^{16}$ cm^{-3}. Assume $B_Z = 2Wb/m^2$, thickness (d = 4 mm) and width (w = 3 mm) and $E_X = 10$ V/cm A1 : 1.04 V A2 : 2.64 V A3 : 2.04 V A4 : 3.64 V	4.0	1.00
Objective Question				
17	17	Determine the minimum value of R_L of the circuit to keep the diode in the ON state.  A1 : 300 Ω A2 : 150 Ω A3 : 450 Ω A4 : 100 Ω	4.0	1.00
Objective Question				
18	18		4.0	1.00

		Calculate the current gain of the following BJT amplifier network (β = 150);  A1 : ~50 A2 : ~215 A3 : ~390 A4 : ~150		
Objective Question				
19	19	Identify the correct binary number for CF8E hexadecimal number. A1 : 1100101001010111 A2 : 1001011101000010 A3 : 0001000010100100 A4 : 1100111110001110	4.0	1.00
Objective Question				
20	20	What would be the ideal barrier height in a Tungsten:n-Si ($N_d = 10^{16}$ cm^{-3}) Schottky diode for zero applied bias at T = 300 K ? (Work function of Tungsten is 4.55 eVand Electron affinity of Silicon is 4.01 eV) A1 : 0.72 eV A2 : 1.1 eV A3 : 1.4 eV A4 : 0.54 eV	4.0	1.00
Objective Question				

21	21	Two equal negative charges $-q$ are fixed at points (0, +a) and (0, -a) on the Y-axis. A positive charge $+qis$ released from rest at the point (2a, 0) on the X-axis. Then the charge $+q$ will A1 : execute simple harmonic motion about origin A2 : execute oscillatory but not simple harmonic motion A3 : move to the origin and remained at rest A4 : move to infinity	4.0	1.00
Objective Question				
22	22	A sphere of radius R has a concentric cavity of radius a. Let σ be the relative density of the material of the sphere. It just floats when placed in a tank full of water. Then the ratio (R/a) is A1 : $[(\sigma+1)/\sigma]^{1/3}$ A2 : $[(\sigma-1)/\sigma]^{1/3}$ A3 : $[\sigma/(\sigma+1)]^{1/3}$ A4 : $[\sigma/(\sigma-1)]^{1/3}$	4.0	1.00
Objective Question				
23	23	The electric field intensity at the surface of charge conductor is A1 : zero A2 : tangential to the surface A3 : at an angle of 45^{o} to the surface A4 : perpendicular to the surface	4.0	1.00
Objective Question				
24	24	A point charge q is placedat the centre of a hollow conducting spherical shell of inner radius r and outer radius R. A net charge Q isplacedon the conducting shell. The magnitude of the electric potential at a distance d, where $r < d < R$ will be (Assume that the electric potential is zero at infinity) A1 : $(q+Q) / (4\pi\varepsilon_0 r)$ A2 : $(q) / (4\pi\varepsilon_0 R)$ A3 : $(q+Q) / (4\pi\varepsilon_0 R)$	4.0	1.00

		A4 : zero		
Objective Question				
25	25	A motor contains a coil with a total resistance of 10 ohm and issupplied by a voltage of 120 volts. When the motor is running at its maximum speed, the back emf is 70 volts. The current (in amperes) in the coil at the instant the motor is turned on and when the motor has reached maximum speed will be A1 : 1.2, 0.5 A2 : 1.2, 5 A3 : 12, 5 A4 : 12, 0.5	4.0	1.00
Objective Question				
26	26	The following series : $\sum_{n=0}^{\infty} \frac{(-1)^n x^{2n+1}}{(2n+1)}$ is : A1 : tan(x) A2 : cos(x) A3 : sin(x) A4 : sec(x)	4.0	1.00
Objective Question				
27	27	exp(-ln(sec(x))) is equal to A1 : 1+cos(x) A2 : cos(x) A3 : –cos(x) A4 : 1-cos(x)	4.0	1.00
Objective Question				
28	28	Solving the second order differential equation : $100y'' + 20y' - 99y = 0$ gives the solution : A1	4.0	1.00

		: $y=C_1\exp(-0.9x)+C_2\exp(-1.1x)$ A2 : $y=C_1\exp(0.9x)+C_2\exp(-1.1x)$ A3 : $y=C_1\exp(0.9x)+C_2\exp(1.1x)$ A4 : $y=C_1\exp(-0.9x)+C_2\exp(1.1x)$		
Objective Question				
29	29	Solving the second order differential equation : $x^2y''-6y=0$ gives the solution : A1 : $y=C_1x^3+C_2x^2$ A2 : $y=C_1x^{-3}+C_2x^{-2}$ A3 : $y=C_1x^3+C_2x^{-2}$ A4 : $y=C_1x^{-3}+C_2x^2$	4.0	1.00
Objective Question				
30	30	Consider the following system : $\frac{dy}{dx}=\begin{pmatrix}-1 & 1\\ -1 & -1\end{pmatrix}y$ The solution of this system has a spiral point located at A1 : (x,y) = (1,0) A2 : (x,y) = (1,1) A3 : (x,y) = (0,1) A4 : (x,y) = (0,0)	4.0	1.00
Objective Question				
31	31	Legendre polynomials are denoted as $P_0(x)$, $P_1(x)$, $P_2(x)$, $P_3(x)$,…….The difference between $P_2(x)$ and $P_3(x)$ is equal to 50, when x is equal to : A1 : 2 A2 : 3 A3 : 4	4.0	1.00

		A4 : 5		
Objective Question				
32	32	Consider the following Sturm – Liouville problem : $y'' + \lambda y = 0$, with the boundary conditions : $y(0) = y(5) = 0$. The eigenvalues and eigenfunctions are : A1 : $\lambda_m = \left(\frac{m\pi}{5}\right), m = 1,2,...\text{and } y_m = \sin\left(\frac{m\pi x}{5}\right)$ A2 : $\lambda_m = \left(\frac{m\pi}{5}\right)^2, m = 1,2,...\text{and } y_m = \sin^2\left(\frac{m\pi x}{5}\right)$ A3 : $\lambda_m = \left(\frac{m\pi}{5}\right), m = 1,2,...\text{and } y_m = \sin^2\left(\frac{m\pi x}{5}\right)$ A4 : $\lambda_m = \left(\frac{m\pi}{5}\right)^2, m = 1,2,...\text{and } y_m = \sin\left(\frac{m\pi x}{5}\right)$	4.0	1.00
Objective Question				
33	33	The convolution of exp(kt) and exp(-kt) is : A1 : $\frac{1}{2k}\left(e^{2kt} - e^{-2kt}\right)$ A2 : $\frac{1}{2k}\left(e^{-2kt} - e^{2kt}\right)$ A3 : $\frac{1}{2k}\left(e^{-kt} - e^{kt}\right)$ A4 : $\frac{1}{2k}\left(e^{kt} - e^{-kt}\right)$	4.0	1.00
Objective Question				
34	34	How many linearly independent vectors are there in the following set : {(1,1,0,1),(-1,-1,0,-1),(1,0,1,1),(-1,0,-1,-1) A1 : 1 A2 : 2 A3 : 3 A4 : 4	4.0	1.00
Objective Question				
35	35	Given are $x_1 = 1+i, x_2 = 2+i, y_1 = 3+i$ and $y_2 = 4+i$ If the Cauchy – Schwartz inequality is being verified, then one the	4.0	1.00

		following will arise: A1 : 185 < 189 A2 : 105 < 109 A3 : 85 < 89 A4 : 15 < 19		
Objective Question				
36	36	Diagonalisation of the matrix $A=\begin{pmatrix}1 & 1+i\\ 1-i & 2\end{pmatrix}$ gives : A1 : $\begin{pmatrix}3 & 0\\ 0 & 0\end{pmatrix}$ A2 : $\begin{pmatrix}3i & 0\\ 0 & 0\end{pmatrix}$ A3 : $\begin{pmatrix}0 & 0\\ 0 & 3\end{pmatrix}$ A4 : $\begin{pmatrix}0 & 0\\ 0 & 3i\end{pmatrix}$	4.0	1.00
Objective Question				
37	37	The principal value argument of the complex variable $Z=7\pm 7i$ is A1 : ±3π/4 A2 : ±2π/4 A3 : ±π/4 A4 : Zero	4.0	1.00
Objective Question				
38	38	The Fourier Transform of the following function : $f(x)=\begin{cases}-1;-1<x<0\\ 1;0<x<1\\ 0;otherwise\end{cases}$ Is : A1 : $\sqrt{2\pi}\left(\frac{i}{\omega}\right)(\cos\omega-1)$	4.0	1.00

		A2 : $\sqrt{2\pi}\left(\frac{i}{\omega}\right)(\cos\omega+1)$ A3 : $\sqrt{2\pi}\left(\frac{i}{\omega}\right)(\sin\omega-1)$ A4 : $\sqrt{2\pi}\left(\frac{i}{\omega}\right)(\sin\omega+1)$		
Objective Question				
39	39	There are four complex functions being considered. (a) $f(z)=\mathrm{Re}(z)$, (b) $f(z)=\frac{\exp(z^2)}{2}$, (c) $f(z)=\tan(z^2)$ and (d) $f(z)=\frac{1}{2\lvert z\rvert^3}$. You are trying to integrate these functions counter-clockwise around an unit circle. The Cauchy's Integral Theorem is applicable to the functions indicated in options : A1 : a, b, c, d A2 : a, b, c A3 : b, c A4 : a, d	4.0	1.00
Objective Question				
40	40	Evaluating the following complex integral using Cauchy Integral Formula : $\oint\frac{\sinh\pi z}{z^2-3z}dz$, given $C:\lvert z\rvert=1$ will give the result : A1 : 2 A2 : 1 A3 : 0 A4 : -1	4.0	1.00
Objective Question				
41	41	The sign of the nuclear magnetic dipole moment gives the relative orientation of the A1 : nuclear spin and electron spin	4.0	1.00

		A2 : magnetic dipole moment and the angular momentum vectors of the nucleus A3 : electric and magnetic field vectors associated with the nucleus A4 : the electric dipole vector and the magnetic field vector		
Objective Question				
42	42	A proton decay is not observed in nature because A1 : a proton decay violates uncertainity principle A2 : a proton decay violates mass-energy conservation A3 : it cannot decay without violating baryon number as there is no baryon less massive than the proton A4 : a proton decay is a weak interaction	4.0	1.00
Objective Question				
43	43	Which of the following is the isospin for the combined system of particles : $\pi^0 + p$? A1 : 1/2, 3/2 A2 : 5/2, 7/2 A3 : 7/2, 9/2 A4 : 1, 0, -1	4.0	1.00
Objective Question				
44	44	Which of the following particles have opposite values of the strangeness quantum number ? A1 : K^- and Λ^0 A2 : K^+ and Λ^0 A3 : Σ^- and Σ^+ A4 : proton and neutron	4.0	1.00
Objective Question				
45	45	The reaction : $p \rightarrow \pi^0 + e^+$	4.0	1.00

		A1: violates lepton number and baryon number conservation and hence does not occur A2: conserves energy, mass and linear momentum and hence occurs A3: violates charge conservation and hence does not occur A4: conserves lepton, baryon numbers, charge, energy, mass and linear momentum and hence occurs.		
Objective Question				
46	46	Einstein's A and B coefficient relates A1: Stimulated emission and spontaneous emission A2: Different free energies A3: Entropy and enthalpy A4: Fresnel and Fraunhofer diffraction	4.0	1.00
Objective Question				
47	47	Which statement is incorrect regarding lasers? A1: Stimulated photon emits in the same direction as that of incident photon A2: Four level atomic systems are more favourable for lasing action as compared to two level systems A3: We prefer three- and four- level atomic systems, since itemit more energetic photons A4: Coherency in the lasing output is due to simultaneous emission of photon between same two levels	4.0	1.00
Objective Question				
48	48	Which of the phenomenon is incorrect when the active lasing medium is introduced in the cavity between two highly reflecting mirrors A1: It ensures that lasing action is due to four level system A2: It reduces the number of oscillating modes which can be sustained by the cavity A3: It reduces the divergence of the emerging beam A4: It provides large effective length to extract sufficient energy to overcome losses and then amplify	4.0	1.00

Objective Question				
49	49	Identify the incorrect option: Line-width of laser emission depends A1 : Nature of pumping mechanism A2 : Reflectivity of the cavity mirror A3 : Nature of the medium e.g. gas, solid, liquid A4 : Pulse-width of the emitted light	4.0	1.00
Objective Question				
50	50	If the screen is kept at a distance of 2m with light source emitting at 500nm wavelength, illuminates the circular aperture of 10 micron radius, we observe _____ diffraction due to the object on the screen A1 : Fresnel A2 : Fraunhoffer A3 : Near-field A4 : No	4.0	1.00
Objective Question				
51	51	At thermal equilibrium, with temperature T, population levels in the two levels 1 and 2 is N1 and N2 with corresponding energy levels of E1 and E2 (E2>E1) respectively. The temperature is such that energy difference between the two levels is equal to energy of the thermal bath.The ratio of population N1/N2 would be A1 : 1.0 A2 : 2.718 A3 : 1/2.718 A4 : 7.389	4.0	1.00
Objective Question				
52	52	The divergence due to diffraction limited He-Ne laser (λ_0 = 0.6328 μm) having an Gaussian output of ω_0 = 5μm is given as A1 : 2.3° A2 : 23° A3 4.6°	4.0	1.00

		: A4 : 46^o		
Objective Question				
53	53	Which of the following is responsible for the stability of a nucleus? A1 : Proton A2 : Electron A3 : Neutron A4 : Gamma rays	4.0	1.00
Objective Question				
54	54	X-rays are electromagnetic radiations. They can, therefore, be deflected by___ A1 : Electric and magnetic fields together A2 : Electric fields only A3 : Magnetic fields only A4 : Neither electric nor magnetic fields	4.0	1.00
Objective Question				
55	55	At the time of solar eclipse, the spectrum of solar radiation would be____ A1 : A large number of dark Fraunhofer lines A2 : No lines at all A3 : A smaller number of dark Fraunhofer lines A4 : All Fraunhofer lines changed into bright colours	4.0	1.00
Objective Question				
56	56	Apparent weight of a body in a lift will be double of its real weight when____ A1 : Lift comes down with acceleration g A2 : Lift goes up with velocity of 9.8m/sec	4.0	1.00

		A3 : Lift goes up with acceleration g A4 : Lift goes down with velocity of 9.8 m/sec		
Objective Question				
57	57	The orbital speed of Jupiter is____ A1 : Greater than the orbital speed of earth A2 : Less than the orbital speed of earth A3 : Equal to the orbital speed of earth A4 : Zero	4.0	1.00
Objective Question				
58	58	Two cars of masses m_1 and m_2 are moving in circles of radii r_1 and r_2. Their speeds are such that they complete one revolution in the same time. The ratio of their angular speeds is_____ A1 : $m_1:m_2$ A2 : $r_1:r_2$ A3 : 1:1 A4 : m_1r_1 and m_2r_2	4.0	1.00
Objective Question				
59	59	A proton is moving round in a circular path with a constant speed. From this one can infer that these must be an uniform____ A1 : Electric field normal to the plane of the orbit A2 : Electric field along the plane of the orbit A3 : Magnetic field normal to the plane of the orbit A4 : Magnetic field along the plane of the orbit	4.0	1.00
Objective Question				
60	60	A vessel contains oil (density = 0.8 gm/cm^3) over mercury (density = 13.6 gm/cm^3). A homogeneous sphere floats with half its volume immersed in mercury and the other half in oil. The density of the material of the sphere in gm/cm^3 is _____	4.0	1.00

		A1 : 3.3 A2 : 6.4 A3 : 7.2 A4 : 12.8		
Objective Question				
61	61	An electron and a proton are situated in a uniform electric field. The ratio of their acceleration will be equal to___ A1 : Zero A2 : Unity A3 : Ratio of the masses of proton and electron A4 : Ratio of the masses of electron and proton	4.0	1.00
Objective Question				
62	62	A uniform chain of length l and mass m is lying on a smooth table such that one-third of its length is hanging vertically down over the edge of the table. If g is the acceleration due to gravity then the work required to pull the hanging part on the table is____ A1 : $m_g l$ A2 : $m_g l/3$ A3 : $m_g l/9$ A4 : $m_l l/18$	4.0	1.00
Objective Question				
63	63	The maximum current which can flow through a 20k ohms resistor, rated 2W is___ A1 : 10 mA A2 : 1 mA A3 : 40 mA A4 : 100 mA	4.0	1.00

Objective Question				
64	64	The particle is moving towards east with a velocity of 5 m/sec. In 10 seconds the velocity changes to 5 m/sec towards north. Average acceleration in this time is____ A1 : Zero A2 : $\frac{1}{\sqrt{2}}$ m/sec² towards north-west A3 : $\frac{1}{\sqrt{2}}$ m/sec² towards north-east A4 : $\frac{1}{2}$ m/sec² towards north-west	4.0	1.00
Objective Question				
65	65	A spring has force constant k and a mass is suspended from it. The spring is cut in half and the same mass is suspended from one of the halves. If the frequency of oscillation in the first case is α, then the frequency in the second case will be____ A1 : 2α A2 : α A3 : $\alpha/2$ A4 : $\alpha\sqrt{2}$	4.0	1.00
Objective Question				
66	66	In a JFET the change in drain current is due to the applied___ A1 : Electric field between S and D A2 : Electric field between G and S A3 : Magnetic field between S and D A4 : Magnetic field between G and S	4.0	1.00
Objective Question				
67	67	If the degree of freedom of a gas is n, then the ratio of C_p and C_v is____ A1 : $1+\frac{2}{n}$ A2 : $1+\frac{1}{n}$ A3	4.0	1.00

		: $1+\frac{1}{2n}$ A4 : $\frac{2}{2n+1}$		
Objective Question				
68	68	The path followed by a particle in sliding from one point to another in absence of friction in the shortest time is a_____? A1 : Sphere A2 : Sigmoid A3 : Cycloid A4 : Catenary of revolution	4.0	1.00
Objective Question				
69	69	For repulsive inverse square forces, the shape of orbit will be____ A1 : Elliptic A2 : Parabolic A3 : Hyperbolic A4 : Circular	4.0	1.00
Objective Question				
70	70	The motion of simple pendulum undergoing large oscillation can be described as A1 : Harmonic and conservative A2 : Harmonic and non-conservative A3 : Unharmonic and conservative A4 : Unharmonic and non-conservative	4.0	1.00
Objective Question				
71	71	The rest mass of the electron is m_0 when it moves with a velocity v = 0.6 c, then its rest mass is____ A1 : m_0	4.0	1.00

		A2 : $5/4\ m_0$ A3 : $4/5\ m_0$ A4 : $2\ m_0$		
Objective Question				
72	72	A particle describes a circular orbit gives by $r = 2a\cos\theta$ under the influence of an attractive central force directed towards a point on the circle. The force inversely proportional to A1 : r^2 A2 : r^3 A3 : r^4 A4 : r^5	4.0	1.00
Objective Question				
73	73	$\nabla^2 = -4\pi\rho$ represents_____ A1 : Maxwell's equation A2 : Laplace's equation A3 : Poisson's equation A4 : Lagrangian's equation	4.0	1.00
Objective Question				
74	74	For good conductor's skin depth varies inversely with _____power of frequency A1 : One A2 : Two A3 : Three A4 : Half	4.0	1.00
Objective Question				
75	75	For an anisotropic dielectric media, the relative permittivity is a____	4.0	1.00

		A1 : Scalar quantity A2 : Tensor quantity A3 : Vector quantity A4 : Linear quantity		
Objective Question				
76	76	The value of p for which the vector field $\vec{V} = (2x + y)\hat{\imath} + (3x - 2z)\hat{\jmath} + (x + pz)\hat{k}$ is solenoid is ---------- A1 : 2 A2 : 0 A3 : -2 A4 : 1	4.0	1.00
Objective Question				
77	77	The existence of zero point energy for a linear harmonic oscillator is a consequence of _____ A1 : Pauli exclusion principle A2 : Special theory of relativity A3 : Matter waves A4 : Uncertainty principle	4.0	1.00
Objective Question				
78	78	In the Born approximation, the effective cross-section of scattering depends on _____ A1 : Momentum p of the incident particle only A2 : The angle of scattering θ A3 : p and θ in any combination A4 : p and θ only in combination p sin θ/2	4.0	1.00

Objective Question				
79	79	Let us consider the transmission of particle through a potential barrier of width L. If p is the linear momentum of the particle inside the barrier then for a perfect transmission the minimum value of $\frac{pL}{\hbar}$ is ---------- A1 : 0 A2 : 1 A3 : π A4 : ∞	4.0	1.00
Objective Question				
80	80	A spherically symmetric potential leads to the atomic states which are_____ A1 : Degenerate or non-degenerate depending on the principal quantum number A2 : All non-degenerate in general A3 : Degenerate with degeneracy (2l+1), where l is the angular momentum A4 : Non-degenerate except for the ground state	4.0	1.00
Objective Question				
81	81	In the quantum mechanical operators of two observables of a system do not commutate, then _____ A1 : Total energy of the system must be negative A2 : Parity of the wave function will be odd A3 : It is impossible to know the exact values of observables simultaneously A4 : Observables must be time dependent	4.0	1.00
Objective Question				
82	82	Eigen value of the particle exchange operator is/are _____ A1 : 1 A2 : $i\hbar$ A3 : $\pm i\hbar$	4.0	1.00

		A4 : ± 1		
Objective Question				
83	83	A signal frequency of 10 kHz is being digitized by an A/D converter. A possible sampling time which can be used is _____ A1 : 150 µs A2 : 5µs A3 : 100 µs A4 : 50 µs	4.0	1.00
Objective Question				
84	84	A simple instruction to clear the lower 4 bits of the accumulator in 8085 assembly language A1 : XRI OHF A2 : ANI FOH A3 : XRI FOH A4 : ANI OFH	4.0	1.00
Objective Question				
85	85	The electrostatic potential *V(x,y)* in free space in a region where the charge density ρ is zero is given by *V(x,y)*=4e^{2x}+*f(x)*-3y^2. Given that the x-component of the electric field Ex and V are zero at the origin, *f(x)* is A1 : $3x^2$-4e^{2x}+8x A2 : $3x^2$-4e^{2x}+16x A3 : 4e^{2x}-8x A4 : $3x^2$-4e^{2x}	4.0	1.00
Objective Question				
86	86	If the electric and magnetic fields are unchanged when the potential $\vec{A}$ changes (in suitable units) according to $\vec{A} \to \vec{A} + \hat{r}$, where $\vec{r} = r(t)\hat{r}$, then the scalar potential Φ must simultaneously changes to ___ A1 : $\Phi - r$	4.0	1.00

		A2 : $\Phi + r$ A3 : $\Phi - \frac{\partial r}{\partial t}$ A4 : $\Phi + \frac{\partial r}{\partial t}$		
Objective Question				
87	87	According to Dirac equation, Dirac Hamiltonian $(\overline{H})$ is _____ A1 : $C\bar{\alpha}.\bar{p} - \beta mC^2$ A2 : $C\bar{\alpha}.\bar{p} + \beta mC^2$ A3 : $C\bar{\alpha}.\bar{p} - i\hbar\beta mC^2$ A4 : $-C\bar{\alpha}.\bar{p} - \beta mC^2$	4.0	1.00
Objective Question				
88	88	According to equipartition theorem, for a nonrelativistic particle moving in a one dimensional potential, $V(x)=kx^6$, what is the average potential energy at temperature T? A1 : k_BT A2 : $k_BT/2$ A3 : $k_BT/6$ A4 : $3k_BT/2$	4.0	1.00
Objective Question				
89	89	Molar specific heat of an ideal gas of diatomic molecules in terms of gas constant R, at temperature where vibrational degrees of freedom are frozen is given by A1 : 7R/2 A2 : 3R/2 A3 : 3R A4 : 5R/2	4.0	1.00
Objective Question				

90	90	Consider a system particles in d dimension, with energy of the particles as $\varepsilon \propto p^s$, where p is the momentum of the particle. What is the value of PV/U, where P is the pressure, V is the volume and U is the internal energy of the system. A1 : s/d A2 : 2/d A3 : s/3 A4 : d/s	4.0	1.00
Objective Question				
91	91	The entropy of black body radiation varies with temperature as A1 : T^2 A2 : T^3 A3 : T A4 : $T^{3/2}$	4.0	1.00
Objective Question				
92	92	The total energy per particles of a collection of fermions is 6.0 eV. The Fermi energy of the system is A1 : 5.0 eV A2 : 15.0 eV A3 : 10.0 eV A4 : 9.0 eV	4.0	1.00
Objective Question				
93	93	Pressure of an ideal Fermi gas at T = 0 K relates to number density (n) of Fermions as A1 : $n^{2/3}$ A2 : $n^{3/2}$ A3 : $n^{3/5}$	4.0	1.00

		A4 : $n^{5/3}$		
Objective Question				
94	94	Which of the following probability distribution functions (ρ) qualify to be equilibrium probability distribution function for any given Hamiltonian H? A1 : ρ depends only on coordinate variables A2 : ρ depends only on momentum variables A3 : ρ depends on coordinate and momentum variables through the Hamiltonian A4 : ρ can be an arbitrary function of coordinate and momentum variables.	4.0	1.00
Objective Question				
95	95	The temperature at the Fermi level of energy 0.25 ev is approximately A1 : 812 K A2 : 1212 K A3 : 1812 K A4 : 2212 K	4.0	1.00
Objective Question				
96	96	C_V/T vs. T^2 plot of a crystal solid according to Debye theory is A1 : Circular curve A2 : Parabola A3 : Straight line A4 : Hyperbola	4.0	1.00
Objective Question				
97	97	The spin contribution to magnetic moment for Co^{2+} ($3d^7$) ion A1 : 2 μB A2 : 3 μB	4.0	1.00

		A3 : 5 μB A4 : 8 μB		
Objective Question				
98	98	A good example of van der Waals bond soild is A1 : NaCl A2 : Na A3 : Ge A4 : Ar	4.0	1.00
Objective Question				
99	99	Reciprocal lattice structure of hcp structure is A1 : SC structure A2 : Bcc structure A3 : Fcc structure A4 : hcp structure	4.0	1.00
Objective Question				
100	100	$Ge_{1-x}Ga_x$ is an example A1 : intrinsic semiconductor A2 : n type semiconductor A3 : p type semiconductor A4 : insulator	4.0	1.00