Examination: **Ph.D. Physics**

Section 1 - Section 1

Question No.1 4.00

Bookmark

A particle of energy E is incident on a potential step of infinite width and height V0. According to quantum mechanics, if E> V_0, then ----------

- The reflectivity and transmittance of the particle will be finite
- The particle will definitely get reflected
- The reflectivity of the particle will be zero
- The particle will definitely get transmitted

Question No.2 4.00

Bookmark

A simple instruction to clear the lower 4 bits of the accumulator in 8085 assembly language

- XRI OHF
- XRI FOH
- ANI FOH
- ANI OFH

Question No.3 4.00

Bookmark

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 E_x and V are zero at the origin, $f(x)$ is

- $3x^2 - 4e^{2x} + 8x$
- $4e^{2x} - 8x$
- $3x^2 - 4e^{2x} + 16x$
- $3x^2 - 4e^{2x}$

Question No.4 4.00

Bookmark

Raman effect is due to collision of ….

- Electron with photon
- Photon with molecule
- Photon with electron
- Electron with atom

Question No.5 4.00

Bookmark ☐

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---

- $M_gL/3$
- M_gL
- $M_gL/9$
- $M_fL/18$

Question No.6 4.00

Bookmark ☐

A silicon diode is in series with a 1.0 kW resistor and a 5V battery. If the anode is connected to the positive battery terminal, the cathode voltage with respect to the negative battery terminal is---

- 0.3 V
- 5.7 V
- 4.3 V
- 0.7 V

Question No.7 4.00

Bookmark ☐

Psychologist : Neurosis

- Kids : Pediatrician
- Dermatologist: Sprain
- Oncologist: Measles
- Opthamologist : Catract

Question No.8 4.00

Bookmark ☐

Eight drops of mercury of equal radii and possessing equal charge combine to form a big drop. The capacitance of the big drop, as compared to each smaller drop, is---

- 2 times
- 4 times
- 16 times
- 8 times

Question No.9 4.00

Bookmark ☐

Choose the correct meaning of the italicized idiom.
The party in power *came down* on the side of a flexible and early economic policy to help the weaker sections.

- Decide to support
- Decide to speak secretly
- Decide to rebuke severely
- Decide to go to the corner

Question No.10 4.00

Bookmark ☐

If g is the acceleration due to gravity on the earth's surface, the gain in the potential energy of an object of mass m raised from the surface of the earth to a height equal to the radius R of the earth is---

- ¼ mgR
- ½ mgR
- mgR
- 2mgR

Question No.11 4.00

Bookmark

_____ she had been lied to, Sally got really angry.

- If Sally discovered
- Having discovered
- Sally when discovered
- Sally discovered

Question No.12 4.00

Bookmark

Two conductors of the same shape and size, one of copper and the other of aluminium (less conducting), are placed in a uniform electric field. The charge induced in aluminium---

- Will be equal to that to copper
- Will be more than in copper
- Will be zero
- Will be less than in copper

Question No.13 4.00

Bookmark

If the degree of freedom of a gas is n, then the ratio of C_p and C_v is---

- $1+\frac{2}{n}$
- $\frac{2n}{2n+1}$
- $1+\frac{1}{n}$
- $1+\frac{1}{2n}$

Question No.14 4.00

Bookmark

Statement: Opening a Library in Achupatti will be a wastage.
Assumptions:
I. Inhabitants of Achupatti are illiterate.
II. Inhabitants of Achupatti are not interested in reading

- If both I and II are implicit
- If only assumption II is implicit
- If neither I nor II is implicit
- If only assumption I is implicit

Question No.15 4.00

Bookmark

A reference frame attached to the earth---

- Cannot be an inertial frame because the earth is resolving round the sun
- Is an inertial frame because Newton's law are applicable in this frame
- Is in inertial frame by definition
- Is an inertial frame because the earth is far away from the sun

Question No.16 4.00

Bookmark

The order and degree of the differential equation are y^''-y'+y^3=0

- 3, 2
- 2, 2
- 3, 3
- 2, 3

Question No.17 4.00

Bookmark

The Hall co-efficient of a metal is low. It means that ----------

- The Hall field produced in that metal is high
- The charge carrier density in that metal is low
- The charge carrier density in that metal is high
- The conductivity of the metal is zero

Question No.18 4.00

Bookmark

A moving body is covering distances in proportion to the square of time. The acceleration of the body is----

- Decreasing
- Zero
- Increasing
- Constant

Question No.19 4.00

Bookmark

A germanium semiconductor is doped with acceptor impurity concentration of 1015 atoms/cm^3. For the given hole mobility of 1800 cm^2/V-s, the resistivity of the material is

- 3.47 Ω cm
- 0.69 Ω cm
- 0.288 Ω cm
- 6.88 Ω cm

Question No.20 4.00

Bookmark

The value of p for which the vector field $\vec{V} = (2x + y)\hat{i} + (3x - 2z)\hat{j} + (x + pz)\hat{k}$ is solenoid is ----------

- 0
- 2
- -2
- 1

Question No.21 4.00

Bookmark ☐

Study the following information carefully and answer the question below it:

P, Q, R, S T went on a picnic. P is son of Q but Q is not the father of P. R is the son of S, who is the brother of P. T is the wife of S.

How many males are present in the group?

- 3
- 4
- 1
- 2

Question No.22 4.00

Bookmark ☐

The average value of the function $f(x)=4x^3$ in the interval 1 to 3 is

- 15
- 20
- 40
- 80

Question No.23 4.00

Bookmark ☐

When a bar magnet of magnetic moment M is deflected through an angle q in a uniform magnetic field of induction B, the work done in doing so is---

- $MB\,(1-\cos\theta)$
- $MB\sin\theta$
- MB
- $MB\cos\theta$

Question No.24 4.00

Bookmark ☑

Statements: Stories are True, All true incidents are rumours.

Conclusion:

I. Stories are rumours.

II. Rumours are stories

- If neither I nor II follows
- If either I or II follows
- If only conclusion II follows
- If only conclusion I follows

Question No.25 4.00

Bookmark ☐

A proton is moving round in a circular path with a constant speed. From this one can infer that these must be an uniform---

- Magnetic field along the plane of the orbit
- Magnetic field normal to the plane of the orbit
- Electric field normal to the plane of the orbit
- Electric field along the plane of the orbit

Question No.26 4.00

Bookmark ☐

Unpolarized light can be converted into a partially polarized or plane polarized light by several processes. Which of the following does not do that?

- Scattering
- Reflection
- Diffraction
- Double refraction

Question No.27 4.00

Bookmark ☐

The orbital speed of Jupiter is---

- Zero
- Greater than the orbital speed of earth
- Less than the orbital speed of earth
- Equal to the orbital speed of earth

Question No.28 4.00

Bookmark ☑

A missile is launched with a velocity less than the escape velocity. The sum of its kinetic energy and potential energy is---

- Positive
- Negative
- Zero
- May be positive or negative depending upon its initial velocity.

Question No.29 4.00

Bookmark ☐

- 1
- 2
- 4
- 3

Question No.30 4.00

Bookmark ☐

Is Planck's constant 'h', dimensionally

- The product of energy and distance
- The product of linear momentum and distance
- The ratio of energy and time
- The product of force and time

Question No.31 4.00

Bookmark ☐

When a mass is rotating in a plane about a fixed point, its angular momentum is directed along---

- The radius
- A line perpendicular to the plane of rotation
- The tangent to the orbit
- A line parallel to the plane of rotation

Question No.32 4.00

Bookmark ☐

Find the odd one out?

- Circle : Arc
- Cover : Page
- Flower : Petal
- Chair : Arm

Question No.33 4.00

Bookmark ☐

Study the following information carefully and answer the question below it

Lakshman passes through seven lanes to reach his school. He finds that 'Truth lane' is between his house and 'Lie lane'. The third lane from his school is 'Karma lane'. 'Dharma lane' is immediately before the 'Yog lane'. He passes 'Salvation lane' at the end, 'Lie lane' is between 'Truth lane' and 'Dharma lane', the sixth lane from his house is 'Devotion lane'.

How many lanes are there between 'Lie lane' and 'Devotion lane'?

- five
- two
- four
- three

Question No.34 4.00

Bookmark ☐

In the quantum mechanical operators of two observables of a system do not commutate, then ----------

- It is impossible to know the exact values of observables simultaneously
- Parity of the wave function will be odd
- Total energy of the system must be negative
- Observables must be time dependent

Question No.35 4.00

Bookmark ☑

There is a force F between two point charge+q and +q distant r apart. If one charge be stationary and the other revolve around it in circle of radius r, then the work done will be---

- F x R
- Zero
- F/2pr
- F x 2pr

Question No.36 4.00

Bookmark ☐

A spaceship is travelling with a velocity 0.4c, where c is the velocity of light. A person performing an experiment in these spaceship observers a particle moving with a velocity 0.4c in the same direction as that of the motion of the spaceship. A stationary observer on the earth would observe the particle to have the velocity.....

- 0.50c
- 0.69c
- 0.80c
- 0.73c

Question No.37 4.00

Bookmark ☐

From the following type of matrix, the diagonal elements of which matrix must be pure imaginary numbers or zero.

- Hermitian
- Skew symmetric
- Symmetric
- Skew Hermitian

Question No.38 4.00

Bookmark ☑

As the diameter of the objective lens of a telescope increases, the resolution of the telescope---

- Decreases
- Remain the same
- Depends on the focal length of the lens
- Increases

Question No.39 4.00

Bookmark ☐

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---

- α
- $\alpha\sqrt{2}$
- α/2
- 2α

Question No.40 4.00

Bookmark ☐

The existence of zero point energy for a linear harmonic oscillator is a consequence of

- Uncertainty principle
- Matter waves
- Special theory of relativity
- Pauli exclusion principle

Question No.41 4.00

Bookmark

book : _____ : : comb : tooth

- Page
- Cover
- Knowledge
- Title

Question No.42 4.00

Bookmark

How many atoms per unit cell are in face-centered cubic structure?

- 3
- 4
- 1
- 2

Question No.43 4.00

Bookmark

The packing fraction of diamond cubic crystal structure is ……

- 90%
- 34%
- 56%
- 60%

Question No.44 4.00

Bookmark

Select the Pair that best respresents the relationship that is given in the question:
Professor : Erudite

- Inventor : Imaginative
- Carpenter : Furniture
- Mason : Architecure
- Entrepreneur : Hardwork

Question No.45 4.00

Bookmark

Study the following information carefully and answer the question below it

The Director of an MBA college has decided that six guest lectures on the topics of Motivation, Decision Making, Quality Circle, Assessment Centre, Leadership and Group Discussion are to be organised on each day from Monday to Sunday.
(i) One day there will be no lecture (Saturday is not that day), just before that day Group Discussion will be organised.
(ii) Motivation should be organised immediately after Assessment Centre.
(iii) Quality Circle should be organised on Wednesday and should not be followed by Group Discussion
(iv) Decision Making should be organised on Friday and there should be a gap of two days between Leadership and Group Discussion

On which day there is no lecture?

- Wednesday
- Tuesday
- Sunday
- Monday

Question No.46 4.00

Bookmark

For an anisotropic dielectric media, the relative permittivity is a ….

- Linear quantity
- Tensor quantity
- Scalar quantity
- Vector quantity

Question No.47 4.00

Bookmark

Which of the following statement is correct for a common emitter amplifier circuit?

- The output is taken from the emitter
- There is no phase shift between input and output voltages
- Both p-n junctions are forward biased
- There is a phase shift between input and output voltages

Question No.48 4.00

Bookmark

The maximum current which can flow through a 20k ohms resistor, rated 2W is---

- 100 mA
- 10 mA
- 40 mA
- 1 mA

Question No.49 4.00

Bookmark

For good conductor's skin depth varies inversely with ……power of frequency

- Half
- Two
- Three
- One

Question No.50 4.00

Bookmark

The coordinates of the three vertices of a triangle are (0, 0, 0), (1, 1, 0) and (-2, 1, 0) then the area of the triangle is

- 1/2
- 3
- 3/2
- 1

Question No.51 4.00

Bookmark

According to Dirac equation,
Dirac Hamiltonian $(\overline{H})$ is ___.

- $C\bar{\alpha}.\bar{p} + \beta mC^2$
- $-C\bar{\alpha}.\bar{p} - \beta mC^2$
- $C\bar{\alpha}.\bar{p} - i\hbar\beta mC^2$
- $C\bar{\alpha}.\bar{p} - \beta mC^2$

Question No.52 4.00

Bookmark

Choose the correct meaning of the italicized idiom.
When Peter left he was extremely disappointed. I think he has *gone for good.*

- Permanently
- To a foreign country
- To seek good fortune
- To a good place

Question No.53 4.00

Bookmark

A signal frequency of 10 kHz is being digitized by an A/D converter. A possible sampling time which can be used is ----------

- 5μs
- 50 μs
- 100 μs
- 150 μs

Question No.54 4.00

Bookmark ☑

Based on the information given answer the following question.
1. In a family of six persons, there are people from three generations. Each has separate professions and they like different colours. There are two couples.
2. Shyam is an Engineer and his wife is not a doctor and she does not like Red colour.
3. Chartered Accountant likes green colour and his wife is a teacher.
4. Manisha is the mother-in-law of Sunita and she likes orange colour.
5. Vimal is the grand father of Tarun and tarun is the Principal and likes black colour.
6. Nyna is the grand daughter of Manisha and she likes blue colour. Nyna's Mother likes white colour.

Who is the Chartered Accountant?

- Manisha
- Nyna
- None of the above
- Vimal

Question No.55 4.00

Bookmark ☐

Eigen value of the particle exchange operator is/are ----------

- 1
- iħ
- ±1
- ± iħ

Question No.56 4.00

Bookmark ☐

In a JFET the change in drain current is due to the applied----

- Magnetic field between G and S
- Electric field between S and D
- Magnetic field between S and D
- Electric field between G and S

Question No.57 4.00

Bookmark ☐

A particle describes a circular orbit gives by r = 2a cosθ under the influence of an attractive central force directed towards a point on the circle. The force inversely proportional to

- r^3
- r^5
- r^4
- r^2

Question No.58 4.00

Bookmark ☐

Out of the following quantities, pick out one that is invariant under a Galilean transformation.....

- Force
- Momentum
- Velocity
- Displacement

Question No.59 4.00

Bookmark ☐

A planet is revolving around a star in an elliptic orbit. The ratio of the farthest distance to the closest distance of the planet from the star is 4. The ratio of kinetic energies of the planet at the farthest to the closest position is.....

- 16:01
- 4:01
- 1:16
- 1:04

Question No.60 4.00

Bookmark ☐

For repulsive inverse square forces, the shape of orbit will be.....

- Hyperbolic
- Elliptic
- Circular
- Parabolic

Question No.61 4.00

Bookmark ☐

Vector C is the sum of two vectors A and B and vector D is the cross product of vectors A and B. What is the angle between vectors C and D?

- 60^o
- zero
- 30^o
- 90^o

Question No.62 4.00

Bookmark ☐

A spherically symmetric potential leads to the atomic states which are ----------

- Degenerate with degeneracy (2l+1) where l is the angular momentum
- Non-degenerate except for the ground state
- All non-degenerate in general
- Degenerate or non-degenerate depending on the principal quantum number

Question No.63 4.00

Bookmark ☐

A calcite crystal is placed over a dot on a place of paper and rotated. On seeing through the calcite, one will see---

- Two rotating dots
- Two stationary dots
- One dot rotating about the other
- One dot only

Question No.64 4.00

Bookmark

If magnetic monopole existed, then which of the following Maxwell's equation will be modified?

- $div\bar{D} = \rho$
- $div\bar{B} = 0$
- $curl\ \bar{H} = J + \frac{\partial \bar{D}}{\partial t}$
- $curl\ \bar{E} = -\frac{\partial B}{\partial t}$

Question No.65 4.00

Bookmark

The rank of the matrix

$$\begin{bmatrix} 2 & -2 & 0 & 6 \\ 4 & 2 & 0 & 2 \\ 1 & -1 & 0 & 3 \\ 1 & -2 & 1 & 2 \end{bmatrix}$$

- 1
- 5
- 4
- 3

Question No.66 4.00

Bookmark

It is important to realize that the ties that bind us together in common activity are so _____ that they can disappear at any moment.

- tenacious
- tenuous
- restrictive
- tentative

Question No.67 4.00

Bookmark

A plane-polarized monochromatic electro-magnetic wave incident on a plane interface at the Brewster angle gives rise to a reflected wave which is

- Unpolarised
- Partially polarized
- Polarized parallel to the interface
- Polarized perpendicular to the interface

Question No.68 4.00

Bookmark ☐

Digital circuit can be made by repetitive use of …..

- AND gates
- NOT gates
- NAND gates
- OR gates

Question No.69 4.00

Bookmark ☐

Choose the antonym of the italicized word.
The habit of *squandering* money should not be encouraged.

- hoarding
- saving
- collecting
- discarding

Question No.70 4.00

Bookmark ☐

The rest mass of the electron is m0 when it moves with a velocity v = 0.6 c, then its mass is.....

- 4/5 m_0
- m_0
- $2m_0$
- 5/4 m_0

Question No.71 4.00

Bookmark ☐

Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T. If the gravitational force of attraction between the planet and the star is proportional to $R^{-5/2}$ then---

- T^2 is proportional to $R^{3/2}$
- T^2 is proportional to $R^{3.76}$
- T^2 is proportional to R^3
- T^2 is proportional to $R^{7/2}$

Question No.72 4.00

Bookmark ☐

A body is moved along a straight line by a machine delivering constant power. The distance moved by the body in time t is proportional to---

- $t^{1/2}$
- $t^{3/2}$
- $t^{3/4}$
- t^2

Question No.73 4.00

Bookmark

The polarizing angle and the refractive index (m) are related to each other by the relation---

- $\mu = \sin\theta$
- $\mu = \tan\theta$
- $\mu = \cot\theta$
- $\mu = \cos\theta$

Question No.74 4.00

Bookmark

When there are no external forces, the shape of a small liquid drop is determined by---

- Density of liquid
- Viscosity of liquid
- Surface tension
- Temperature of air only

Question No.75 4.00

Bookmark

A ROM is a ……

- Read/write memory
- Non-volatile memory
- Volatile memory
- Byte – organised memory

Question No.76 4.00

Bookmark

If the electric and magnetic fields are unchanged when the potential $\vec{A}$ changes (in suitable units) according to $\vec{A} \rightarrow \vec{A} + \hat{r}$, where $\vec{r} = r(t)\hat{r}$, then the scalar potential Φ must simultaneously changes to -----

- $\Phi + \frac{\partial r}{\partial t}$
- $\Phi + r$
- $\Phi - \frac{\partial r}{\partial t}$
- $\Phi - r$

Question No.77 4.00

Bookmark ☐

The gravitational and electrical forces between two electrons 10 cm apart are F_g and F_e respectively. The ratio F_g/F_e is of the order---

- 10
- Oct-36
- Oct-43
- 1036

Question No.78 4.00

Bookmark ☐

Intensity of light scattered by molecules of air in the atmosphere is proportional to---

- λ^2
- $1/\lambda^4$
- λ
- $1/\lambda^2$

Question No.79 4.00

Bookmark ☐

Dad often comes home late these days, _____?

- is it?
- doesn't he?
- isn't it?
- does he?

Question No.80 4.00

Bookmark ☐

If two soap bubbles of different radii are in contact then---

- Sizes of the bubbles remain the same
- Air rushes from smaller bubble to bigger bubble which continuous to grow at the cost of the smaller bubble
- Air rushes from the bigger bubble into the smaller bubble until the size of smaller bubble becomes equal to that of bigger and vice-versa.
- Air rushes from the bigger bubble to smaller bubble until the sizes of the two become same

Question No.81 4.00

Bookmark ☐

What is the rest mass energy of an electron?

- 1 MeV
- 931 MeV
- 913 MeV
- 0.51 MeV

Question No.82 4.00

Bookmark

An electron of mass M kg and charge e coulomb travels from rest through a potential difference of V volts. The final energy is---

- $\mathrm{MeV}\, j$
- $\frac{eV}{M} j$
- $\frac{e}{V} j$
- $\mathrm{eV}\, j$

Question No.83 4.00

Bookmark

The escape velocity of a particle depends upon its mass m, being proportional to---

- m^0
- m^2
- $m^{1/2}$
- m

Question No.84 4.00

Bookmark

Choose the best synonym of the italicized word.
Nobody knew that Sunil had a *sinister* design in marrying her.

- selfish
- sinful
- murderous
- evil

Question No.85 4.00

Bookmark

X-rays are electromagnetic radiations. They can, therefore, be deflected by---

- Neither electric nor magnetic fields
- Electric and magnetic fields together
- Electric fields only
- Magnetic fields only

Question No.86 4.00

Bookmark

Which of the following phenomena is responsible for the production of shadow?

- Polarisation
- Diffraction
- Rectilinear propagation of light
- Interference

Question No.87 4.00

Bookmark ☐

For an op-amp with negative feedback, the output is

- Fed back to the inverting input
- Equal to the input
- Increased
- Fed back to the non- inverting input

Question No.88 4.00

Bookmark ☐

One day, Ravi walked a distance of 75 metres towards the north. Then he turned left and walked for about 25 metres, he turned left again and walked 80 metres. Finally, he turned to the right at an angle of 45^{o}. In which direction was he moving finally?

- South-east
- North-east
- South-west
- North-west

Question No.89 4.00

Bookmark ☐

Choose the correct meaning of the italicized idiom.
Raju has a very nice manner, but you would better take what he says *with a grain of salt.*

- To complement
- To criticize
- To talk sensibly
- To listen to something with considerable doubt

Question No.90 4.00

Bookmark ☐

An electron and a proton are situated in a uniform electric field. The ratio of their acceleration will be equal to---

- Ratio of the masses of proton and electron
- Unity
- Zero
- Ratio of the masses of electron and proton

Question No.91 4.00

Bookmark ☑

Newton-Raphson method is applicable to the solution of

- Both algebraic and transcendental equations
- Both algebraic and transcendental and also used when the roots are complex
- Transcendental equations only
- Algebraic equations only

Question No.92 4.00

Bookmark ☐

The absolute temperature of a gas is increased 3 times. The root mean square velocity of the molecules will be---

- 9 times
- $\sqrt{3}$ times
- 3 times
- 1/3 times

Question No.93 4.00

Bookmark

Which of the following series in the spectrum of the hydrogen atom lies in the visible region of the electromagnetic spectrum?

- Brackett series
- Lymen series
- Paschen series
- Balmer series

Question No.94 4.00

Bookmark

The path of a charged particle in crossed electric and magnetic field is ----------

- A cycloid
- Hyperbolic
- Circular
- Parabolic

Question No.95 4.00

Bookmark

The line on the earth's surface joining the points, where the field is horizontal, is called----

- Magnetic line
- Magnetic axis
- Magnetic meridian
- Magnetic equator

Question No.96 4.00

Bookmark

Apparent weight of a body in a lift will be double of its real weight when---

- Lift comes down with acceleration g
- Lift goes down with velocity of 9.8 m/sec
- Lift goes up with velocity of 9-8m/sec
- Lift goes up with acceleration g

Question No.97 4.00

Bookmark

A player tossed two coins. If two head show he wins Rs. 4. If one head shows he wins Rs.2, but if two tails show he payRs. 3 as penalty. Calculate the expected value of Rupees he wins in the game.

- Rs.9
- Rs. 2.15
- Rs. 0.25
- Rs. 1.25

Question No.98 4.00

Bookmark

Which one of the following is not a point defect?

- Vacancy
- Compositional defect
- Screw dislocation
- Interstitial

Question No.99 4.00

Bookmark ☐

A diffraction pattern is obtained using a beam of red light. What happens if the red light is replaced by blue light?

- No change
- Diffraction bands become narrower and crowded together
- Diffraction bands becomes broader and farther apart
- Bands disappear

Question No.100 4.00

Bookmark ☐

An alpha particle of energy 5 MeV is scattered through 180^{o} by a fixed uranium nucleus. The distance of closest approach is of the order of ---

- 10^{-15} cm
- 1 Å
- 10^{-10} cm
- 10^{-12} cm