



**NATIONAL INSTITUTE OF TECHNICAL TEACHERS
TRAINING AND RESEARCH**
(DEEMED TO BE UNIVERSITY UNDER DISTINCT CATEGORY)
CHANDIGARH

Ph.D. Entrance Examination 2024

Subject / Branch / Department :	APPLIED SCIENCE (<u>PHYSICS</u>)
Roll No. :	/
Candidate Name :	/
Date of Examination :	/

Maximum Marks: 25 (There is no negative marking)

- Notes:** (a) Only one option to be tick-marked out of the four options given as answer
 (b) The Candidate must put his/her signature with date at the bottom of each page
 (c) For any rough work, please use ONLY back-sides of pages which are left blank

- Represents a Laurent series?
 - A series that includes negative powers of the variable
 - A series with only positive powers of the variable
 - A series with only even powers of the variable
 - A series that does not include any powers of the variable
- The central limit theorem states that:
 - The distribution of sample means approaches a normal distribution as the sample size increases.
 - The sum of independent random variables is uniform.
 - The sample mean is always equal to the population mean.
 - The sum of independent random variables is exponential.
- In a non-inertial reference frame, which of the following forces appears?
 - Gravitational force
 - Centrifugal force
 - Magnetic force
 - Electrostatic force

4. The moment of inertia tensor is used to describe:
- A) Angular momentum in a rotating body
 - B) Kinetic energy in linear motion
 - C) Force in a non-inertial frame
 - D) The potential energy of a system
5. The Poynting vector represents:
- A) The energy flux density of an electromagnetic wave
 - B) The magnetic field intensity
 - C) The electric field intensity
 - D) The electric displacement field
6. Maxwell's equations describe:
- A) Electromagnetic waves
 - B) Electric and magnetic fields in free space
 - C) The propagation of light
 - D) All of the above
7. The wavefunction for a particle in a one-dimensional box is:
- A) Sinusoidal
 - B) Exponential
 - C) Gaussian
 - D) Linear
8. The time-independent Schrödinger equation is an example of:
- A) An eigenvalue problem
 - B) A differential equation
 - C) A wave equation
 - D) None of the above
9. The first law of thermodynamics is a statement of:
- A) Conservation of energy
 - B) Conservation of momentum
 - C) Conservation of mass
 - D) Conservation of entropy

10. The canonical ensemble is characterized by:

- A) Constant temperature, volume, and number of particles
- B) Constant energy, volume, and number of particles
- C) Constant temperature, pressure, and number of particles
- D) Constant entropy, volume, and number of particles

11. The chemical potential is defined as:

- A) The change in free energy when the number of particles changes
- B) The energy required to change the temperature
- C) The energy required to change the pressure
- D) The energy required to change the volume

12. Blackbody radiation is best described by:

- A) Planck's law
- B) Wien's law
- C) Stefan-Boltzmann law
- D) All of the above

13. A diode is a device that allows current to flow:

- A) In one direction
- B) In both directions
- C) In a sinusoidal manner
- D) Only when reverse biased

14. A digital signal is:

- A) Continuous
- B) Discrete
- C) Sinusoidal
- D) Triangular

15. Error analysis in experiments is important for:

- A) Determining the accuracy of results
- B) Identifying the sources of errors
- C) Estimating uncertainties
- D) All of the above

16. The fine structure of spectral lines in hydrogen is due to:

- A) Spin-orbit coupling
- B) Zeeman effect
- C) Hyperfine structure
- D) Stark effect

17. The Einstein A coefficient describes:

- A) Absorption
- B) Stimulated emission
- C) Spontaneous emission
- D) Coherent scattering

18. The vibrational spectrum of a diatomic molecule is quantized in terms of:

- A) Harmonic oscillators
- B) Rigid rotators
- C) Spin states
- D) Atomic orbitals

19. The reciprocal lattice is used to describe:

- A) The real space lattice of a crystal
- B) The diffraction pattern of a crystal
- C) The phonon modes in a crystal
- D) The electron energy levels in a crystal

20. The free electron model is used to describe:

- A) Electrical conductivity in metals
- B) Optical properties of semiconductors
- C) Magnetic properties of insulators
- D) Thermal properties of gases

21. The Hall effect is used to measure:

- A) The magnetic field strength
- B) The temperature of a material
- C) The type of charge carriers in a material
- D) The electrical resistance

22. Superconductivity is characterized by:

- A) High electrical resistance
- B) Infinite electrical resistance
- C) High magnetic field strength
- D) Zero electrical resistance

23. The specific heat of solids at low temperatures is explained by:

- A) Drude model
- B) Debye model
- C) Sommerfeld model
- D) Einstein model

24. The beta decay process involves:

- A) The emission of an alpha particle
- B) The emission of a gamma ray
- C) The emission of an electron or positron
- D) The emission of a neutron

25. The Pauli exclusion principle applies to:

- A) Photons
- B) Bosons
- C) Fermions
- D) Gravitons

ssShami

Dean - Academics & Students
NITTTR, Chandigarh - 160019