



PUNJAB TECHNICAL UNIVERSITY JALANDHAR

Max. Marks: 90

Time: 90 Mins.

Entrance Test for Enrollment in Ph.D. Programme

Important Instructions

- Fill all the information in various columns, in capital letters, with blue/black ball point pen.
- Use of calculators is not allowed. Use Blue/Black ball point pen for attempting the questions.
- All questions are compulsory. No negative marking for wrong answers.
- To attempt a question, make a tick mark (✓) at the right option/answer.
- Each question has only one right answer.
- Questions attempted with two or more options/answers will not be evaluated.

Stream (Engg./Arch./Pharm./Mgmt./App.Sci./Life Sci.)

Applied Sciences

Discipline

Physics

Name

Father's Name

Roll No.

Date: **15-01-2011**

Signature of Candidate

Signature of Invigilator

Q1. When a gunshot is fired, the gun is pushed backward, because :

- a) Every action has an equal and opposite reaction
- b) This happens only among the inexperienced gunmen
- c) It is impossible to design a gun without this phenomenon
- d) The gun is heavy.

Q2. A cricket ball is thrown by maximum distance when thrown at an angle of :

- a) 30°
- b) 15°
- c) 45°
- d) 90°

Q3. The best conductor of electricity is :

- a) Wood
- b) Water
- c) Copper
- d) Glass

Q4. Dr. C.V. Raman is associated with the :

- a) Scattering of light waves when they pass through same solutions
- b) Theory of evolution
- c) Scattering of ultrasonics as they pass through tissues
- d) Scattering of X-rays from the surface of the crystals.

Q5. When stored in a tank, water has :

- a) Potential energy
- b) Kinetic energy
- c) Momentum
- d) None of the above

Q6. Acoustic is the study of :

- a) Light
- b) Space
- c) Sound
- d) None of these

Q7. A mixture of alcohol and water can be separated by

- a) Evaporation
- b) Filtration
- c) Sedimentation
- d) Distillation

Q8. If a red object is seen in blue light, it will appear :

- a) Violet
- b) Red
- c) Green
- d) Black

Q9. What's the Avogadro number :

- a) 6.023×10^{21}
- b) 6.023×10^{23}
- c) 6.023×10^0
- d) 6.023×10^{25}

Q10. The minimum velocity required to escape from the earth's gravitational field is :

- a) 10.2 km/s
- b) 11.2 km/s
- c) 9.2 km /s
- d) 12.2 km/s

Q11. Einstein was awarded the Nobel Prize for :

- a) Theory of relativity
- b) Einstein shift
- c) Photoelectric effect
- d) Bose-Einstein condensation theory

Q12. The length contraction predicts that :

- a) the length of an object approaches zero as its speed approaches the speed of light in vacuum.
- b) the length of the object is directly proportional to its velocity.
- c) there is no change in length of an object when its speed approaches the speed of light in vacuum.
- d) None of these

Q13. The energy of photon is :

- a) independent of the frequency
- b) inversely proportional to the amplitude
- c) directly proportional to the frequency
- d) inversely proportional to the frequency

Q14. The intangible medium to carry the electromagnetic waves, pervading all space, empty or otherwise is :

- a) elasticity
- b) ether
- c) cosmic
- d) solid

Q15. The number of oscillations per unit time is called :

- a) wavelength
- b) amplitude
- c) frequency
- d) displacement

Q16. Which instrument is used to measure electric current ?

- a) Voltmeter
- b) Electrometer
- c) Ammeter
- d) Rheostat

Q17. At sun rise or sunset, the sun appears to be reddish while at mid-day it looks white. This is because :

- a) Scattering due to dust particles and air molecules causes this phenomenon
- b) The sun is colder at sunrise and sunset
- c) At sunrise it is fresh and at sunset it is about to set
- d) At sunset or sunrise it is nearer to earth

Q18. A convex mirror makes a good rear view mirror for a motor vehicle because :

- a) It does not form diminished images
- b) It has no focal point
- c) Its image can be thrown a screen
- d) It forms erect, reduced images.

Q19. When two drops of mercury are brought into contact they form a bigger drop because liquids have tendency to possess :

- a) Minimum surface area
- b) Minimum volume
- c) Maximum size
- d) Maximum surface area

Q20. A liquid in syringe rises when its piston is pulled up because :

- a) Of the property of surface tension
- b) Of capillary action
- c) Of the action of atmospheric pressure
- d) There is a force of cohesion between the liquid molecules and the glass syringe

Q21. If $\vec{a} = 2i + 2j + 2k$, $\vec{b} = -i + 2j + k$ and $\vec{c} = 3i + j$, then $\vec{a} + t\vec{b}$ is perpendicular to \vec{c} if t is equal to :

- a) 8
- b) 4
- c) 6
- d) 2

Q22. A field is irrotational if :

- a) $\text{grad } \vec{A} = 0$
- b) $\text{div } \vec{A} = 0$
- c) $\text{curl } \vec{A} = 0$
- d) None of the above

Q23. The eigen value of the matrix

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix} :$$

- a) 1,1,2
- b) 0,1,2
- c) 2,2,0
- d) 2,2,1

Q24. The Cauchy-Riemann equation in polar form is given as :

a) $\frac{\partial u}{\partial r} = \frac{\partial u}{\partial \theta}$ and $\frac{\partial u}{\partial r} = -\frac{\partial v}{\partial r}$

b) $\frac{\partial u}{\partial r} = r \frac{\partial v}{\partial \theta}$ and $\frac{\partial u}{\partial \theta} = -\frac{\partial v}{\partial r}$

c) $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}$ and $\frac{1}{r} \frac{\partial u}{\partial \theta} = -\frac{\partial v}{\partial r}$

d) $\frac{\partial u}{\partial r} = \frac{\partial v}{\partial \theta}$ and $\frac{1}{r} \frac{\partial u}{\partial \theta} = -\frac{\partial v}{\partial r}$

Q25. The residue of $\frac{z^4}{(z-1)(z-2)(z-3)}$ at $Z=1$ is :

a) $\frac{16}{81}$

b) $\frac{175}{16}$

c) $\frac{525}{8}$

d) $\frac{525}{16}$

Q26. Whatever dimension a generalized co-ordinate has, the product of the generalized force and generalized

displacement (co-ordinate) must have the dimension of :

- a) Work
- b) Force
- c) Torque
- d) None of the above

Q27. Langrangian for a charged particle in an electromagnetic field is given as :

a) $\frac{1}{2}mv^2 + q\phi + \frac{q}{c}\vec{v}\cdot\vec{A}$

b) $\frac{1}{2}mv^2 + q\phi - \frac{q}{c}\vec{v}\cdot\vec{A}$

c) $\frac{1}{2}mv^2 - q\phi - \frac{q}{c}\vec{v}\cdot\vec{A}$

d) $\frac{1}{2}mv^2 - q\phi + \frac{q}{c}\vec{v}\cdot\vec{A}$

Q28. The value of m and n for which the transformations are $Q = q^m \cos(np)$; $p = q^n \sin(np)$ represents a canonical transformations are :

a) $m = \frac{1}{2}, n = 2$

b) $m = 2, n = 1$

c) $m = 2, n = \frac{1}{2}$

d) $m = 1, n = 2$

Q29. Motion which repeats itself after a definite interval of time is :

- a) periodic Motion
- b) circular motion
- c) translational motion
- d) parabolic motion

Q30. The particle always has some probability of penetrating the potential barrier. This is called :

- a) barrier effect
- b) tunneling effect
- c) potential effect
- d) penetration effect

Q31. Who proved light to be an electromagnetic wave ?

- a) Maxwell
- b) Newton
- c) Lorentz
- d) Einstein

Q32. In Rutherford scattering cross-section, differential scattering cross-section is proportional to :

- a) e^4
- b) e^3
- c) e
- d) e^2

Q33. Electric field due to a point charge is :

a) $\frac{q}{4\pi\epsilon_0}$

b) $\frac{q}{4\pi r^2}$

c) $\frac{q}{4\pi\epsilon_0 r^2}$

d) qV_0

Q34. Electric charge is :

- a) scalar quantity
- b) quantized
- c) both (a) and (b)
- d) None of these

Q35. The electric field inside a spherical shell of uniform surface charged density is :

- a) Zero
- b) Non-zero constant
- c) Directly proportional to distance from centre
- d) Inversely proportional to distance from centre

Q36. The Poynting vector \vec{S} of an electromagnetic wave is :

- a) $\vec{S} = \vec{E} \times \vec{H}$
- b) $\vec{S} = \vec{E} \times \vec{B}$
- c) $\vec{S} = \frac{\vec{E}}{\vec{B}}$
- d) $\vec{S} = \frac{\vec{E}}{\vec{H}}$

Q37. \vec{E} and \vec{H} are always _____ to each other :

- a) parallel
- b) perpendicular
- c) opposite
- d) equal

Q38. A free electron is placed in the path of a plane electromagnetic wave. The electron will start moving :

- a) Along the electric field
- b) Along the magnetic field
- c) Along the direction of propagation of the wave
- d) In a plane containing the magnetic field and the direction of propagation

Q39. Consider the reflection and refraction of a plane wave at a dielectric interface, which of the following is true ?

- a) The frequency of the wave does not change
- b) The energy of the wave does not change
- c) The polarization does not change
- d) The momentum of the wave does not change

Q40. If a particle of mass m moves with a velocity v and λ is the de-Broglie wavelength associated with it, then the de-Broglie equation is given as :

- a) $\lambda = \frac{hm}{v}$
- b) $h = \frac{\lambda m}{v}$
- c) $\lambda = hmv$
- d) $\lambda = \frac{h}{mv}$

Q41. The state of the system is described by the :

- a) Wave function $\psi(x,t)$
- b) Hermitian
- c) Momentum
- d) Position vector

Q42. The expression

$$i\hbar \frac{\partial}{\partial t} \psi(x,t) = H \psi(x,t)$$
 is :

- a) Schrodinger equation
- b) Hermitian equation
- c) Momentum equation
- d) Correspondence equation

Q43. Of the following having the same kinetic energy, which has the largest wavelength :

- a) An electron
- b) A proton
- c) A neutron
- d) An α -particle

Q44. The de-Broglie hypothesis is associated with :

- a) Wave nature of electrons only
- b) Wave nature of α -particles only
- c) Wave nature of radiations
- d) Wave nature of all material particles

Q45. The ionization potential of hydrogen atom is 13.6 eV. The energy required to remove an electron from the second orbit of hydrogen is :

- a) 3.4 eV
- b) 6.8 eV
- c) 13.6 eV
- d) 27.2 eV

Q46. Which one of the following pairs of phenomena illustrates the particle aspect of wave particle duality ?

- a) Compton effect and Bragg's law
- b) Photoelectric effect and Compton effect
- c) Compton effect and Pauli's principle
- d) Bragg's law and photoelectric effect

Q47. Which of the following is not a fermion ?

- a) Muons
- b) Electrons
- c) Neutrons
- d) Photon

Q48. The amount of heat required to raise the temperature of a unit mass of the substance by 1° is known as :

- a) Quantity of heat
- b) Specific heat
- c) Latent heat
- d) Mechanical equivalent of heat

Q49. The temperature at which centigrade and Fahrenheit scales give the same reading is :

- a) 32°F
- b) -32°F
- c) 40°F
- d) -40°F

Q50. Joule is the unit of :

- a) Specific heat
- b) Quantity of heat
- c) Latent heat
- d) Thermal capacity

Q51. Temperature remaining constant, the volume of an enclosed mass of gas varies inversely as the pressure, this law is known as :

- a) Boyle's law
- b) Charle's law
- c) Avogadro's law
- d) Newton's law

Q52. When the temperature rises, the mercury in the clinical thermometer :

- a) Expands more than the glass
- b) Expands less than the glass
- c) Expands equal to the glass
- d) Mercury does not expand

Q53. When boiling water is poured into a tumbler made of thick glass, the glass breaks. This is because :

- a) Glass conducts heat very quickly
- b) Glass is brittle
- c) Glass gets molten at the boiling temperature of water
- d) Uneven expansion of the inner and outer walls of the tumbler with hot water

Q54. The temperature at which the kinetic energy of gas molecules will be zero is :

- a) 273°C
- b) -273°C
- c) 273°F
- d) -273°F

Q55. $(C_p - C_v)$ is equal to :

- a) RJ
- b) R/J
- c) J/R
- d) $1/JR$

Q56. What type of process is Carnot's cycle ?

- a) Reversible
- b) Neither reversible nor irreversible
- c) Irreversible
- d) May be reversible or irreversible

Q57. Electromagnetic waves with minimum wavelength is :

- a) Ultraviolet rays
- b) X-rays
- c) Infrared rays
- d) γ -rays

Q58. Apparent weight of a body in a lift will be double of its real weight when :

- a) Lift comes down with acceleration 'g'
- b) Lift goes up with velocity of 9.8 m/s
- c) Lift goes up with acceleration 'g'
- d) Lift goes down with velocity of 9.8 m/s

Q59. Phase difference between voltage and current in a capacitor in A.C. circuit is :

- a) $\pi/2$
- b) π
- c) 0
- d) $\pi/3$

Q60. In a vacuum flask the double wall glass container has reflective silvered outer shell. This helps to avoid heat loss by

- a) Convection
- b) Conduction
- c) Radiation
- d) Evaporation

Q61. The highest energy particle accelerator is :

- a) Large Hadron Collider, CERN
- b) Tevatron, Fermi Lab
- c) SLAC, Stanford
- d) RHIC, Brookhaven National Lab

Q62. The circuit used to change A.C to D.C. is :

- a) Oscillator
- b) Rectifier
- c) Amplifier
- d) None of the above

- Q63.** Which analog modulation is preferred from noise point of view?
- Amplitude Modulation
 - Single Side Band Modulation
 - Frequency Modulation
 - Phase Modulation
- Q64.** Microwave communication is
- Line of sight communication
 - Ionospheric communication
 - Tropospheric communication
 - None of these
- Q65.** The modulation index for Frequency modulation is:
- Less than 1
 - Greater than 1
 - Equal to 1
 - None of these
- Q66.** The diameter of the fiber cable is of the order of
- μm
 - mm
 - cm
 - km
- Q67.** The information transfer in the fiber cable is by
- Electron
 - Photon
 - Proton
 - Neutron
- Q68.** To make extrinsic semiconductor the impurity is added in the order of :
- 1 in 10^6
 - 1 in 10^{12}
 - 1 in 10^2
 - 1 in 10
- Q69.** Which of the following diode is used for the stability of voltage :
- Zener diode
 - Light emitting diode
 - Tunnel diode
 - Varactor diode
- Q70.** Which of the following is an active component :
- Resistor
 - Diode
 - Capacitor
 - Inductor
- Q71.** In TV, audio and video signals are transmitted through
- Audio – FM and Video – AM
 - Audio – AM and Video – FM
 - Audio – FM and Video – FM
 - Audio – AM and Video – AM
- Q72.** The rate of diffusion will increase if temperature is :
- decreased
 - increased
 - constant
 - sub-zero
- Q73.** A material is stable when its potential energy is :
- maximum
 - infinite
 - minimum
 - zero
- Q74.** Material used for transformer-cores at high frequencies is :
- soft iron
 - nickel
 - ferrite
 - steel
- Q75.** Piece of copper and another of germanium are cooled from room temperature to 80K. The resistance of :
- each of them increases
 - each of them decreases
 - copper increases & germanium decreases
 - copper decreases & germanium increases
- Q76.** Metallic solids are always opaque because :
- they reflect all the incident light
 - they scatter all the incident light
 - the incident light is readily absorbed by the free electrons in metal
 - the energy band traps the incident light
- Q77.** Which of the following properties can be different along different directions in a crystalline solid :
- electric conductivity
 - refractive index
 - mechanical strength
 - all of the above

Q78. The main constituent of commercial glasses

is :

- a) Silca
- b) alumina
- c) sodium oxide
- d) lead oxide

Q79. With the rise in temperature the specific resistance of a semiconductor :

- a) Increases
- b) remains unchanged
- c) decreases
- d) first decreases and then increases

Q80. At Curie temperature, a ferromagnetic material becomes :

- a) nonmagnetic
- b) diamagnetic
- c) paramagnetic
- d) Ferromagnetic

Q81. What happens during alpha decay?

- a) helium nucleus is emitted
- b) helium atom is emitted
- c) neutron is emitted
- d) proton is emitted

Q82. In the ground state, a nucleus has

- a) zero energy
- b) minimum energy
- c) maximum energy
- d) negative energy

Q83. In the process of pair production the electron and positron are obtained from :

- a) the electron capture process
- b) the conversion of gamma ray energy into mass
- c) the nucleus
- d) the internal conversion process

Q84. Which radiations are most harmful for the human body?

- a) Beta radiations
- b) Gamma radiations
- c) Alpha radiations
- d) Neutron radiations

Q85. What is radioactivity ?

- a) Half life
- b) Radiation per time
- c) Energy per time
- d) Decays per time

Q86. The rest mass energy of electron is :

- a) 931 MeV
- b) 138 MeV
- c) 0.511 MeV
- d) 2.0 MeV

Q87. Which of the Following scientist was awarded double noble prize

- a) J. Chadwick
- b) M. Curie
- c) N. Bohr
- d) A. H. Compton

Q88. Which of the following is fundamental particle

- a) Neutron
- b) Electron
- c) Proton
- d) Deuteron

Q89. The atomic number of an element is :

- a) number of electrons
- b) number of protons
- c) number of neutrons
- d) sum of protons and neutrons

Q90. In X-rays and γ -rays :

- a) energy is same
- b) velocity is same
- c) wave length is same
- d) frequency is same