



B.E/B.TECH DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Second Semester

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

U18PHT2203: Advanced Physics

COURSE OUTCOMES

- CO1:** Impart knowledge on the concepts of electrodynamics for various conditions and its applications.
CO2: Understand the behavior of magnetostatics conditions, materials and its applications.
CO3: Study the importance of various operators and its application in quantum computing.
CO4: Infer the nuclear reactions and its impact in energy models for data processing.
CO5: Explore the types of high energy particles and its characteristic effects.
CO6: Understand the various materials aspects for identify modelling using various tools.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Match anti particle with its rest energy

CO5 [K₁]

Anti Particle	Rest Energy (MeV)
(A) Pion	i. 497.76
(B) Kaon	ii. 134.97
(C) Lambda	iii. 939.55
(D) Neutron	iv. 1115.60

- | | A | B | C | D |
|----|-----|----|-----|-----|
| a) | ii | i | iii | iv |
| b) | iii | iv | ii | i |
| c) | ii | i | iv | iii |
| d) | iii | i | ii | iv |

2. The entire charge resides on the surface of the conductor at a single position will be provided CO1 [K₁]

by

- | | |
|-----------------------|---------------------|
| a) Maxwell's equation | b) Poisson equation |
| c) Gauss equation | d) Laplace equation |

3. Consider the following statements. CO2 [K₂]
1. Paramagnetic materials do not have permanent magnetic dipoles.
 2. Paramagnetic materials do have permanent magnetic dipoles.
 3. Paramagnetic materials do not exhibit magnetic hysteresis.
 4. Paramagnetic materials obey Curie – Weiss law.
- Identify the correct statements from the above given statements.
- a) 1,3 b) 2,4
 c) 1,2 d) 2,3
4. Magnetic moment associated with spin angular momentum is given by CO3 [K₁]
- a) $\mu_n = -\frac{e}{m_e} S$ b) $\mu_s = -\frac{e}{m_e} S$
 c) $\mu_n = -\frac{e}{m_n} S$ d) $\mu_s = -\frac{e}{m_n} S$
5. Assertion (A): Eddy current loss is high in hard magnetic materials. CO2 [K₂]
 Reason (R): It is due to high resistivity of the materials
- a) Both A and R are individually true and R is the correct explanation of A b) Both A and R are individually true but R is not the correct explanation of A
 c) A is true but R is false d) A is false but R is true
6. Two spin-half particles in a state where their spins are opposite direction arises due to CO3 [K₂]
- a) Intervention b) Spin effect
 c) Wavefunction d) Entanglement
7. Sequence the following accessories in Particle accelerators. CO4 [K₁]
- 1) Isocenter
 - 2) RF generator
 - 3) Gantry
 - 4) Electron gun
- a) 4-2-1-3 b) 1-3-2-4
 c) 3-4-2-1 d) 4-1-3-2
8. The electronic polarizability at moderate temperature is CO1 [K₁]
- a) Linearly depending on absolute temperature b) Independent of temperature
 c) Inversely depending on temperature d) Linearly depending on square of temperature

9. Assertion (A): Triad refers to three-fold symmetry. CO6 [K₂]
Reason (R): The axes pass through centers of opposite edges
- a) Both A and R are Individually true, and R is the correct explanation of A b) Both A and R are Individually true, but R is not the correct explanation of A
c) A is true but R is false d) A is false but R is true
10. The atoms are displaced in two separate planes perpendicular to each other is called CO6 [K₁]
- a) Point defects b) Screw dislocation
c) Impurity defects d) Edge dislocation

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. Rewrite the nature of Gradient in electromagnetic field. CO1 [K₂]
12. The dielectric constant of helium gas at NTP is 1.0000684. Calculate the electronic polarizability of the atoms, if the gas contains 2.7×10^{25} atoms m^{-3} . CO1 [K₂]
13. Calculate the intensity of magnetization of the bar magnet whose mass, magnetic moment and density are 200 g, 2 Am^{-2} and 8 g cm^{-3} , respectively. CO2 [K₃]
14. Compare the properties of paramagnetic and ferromagnetic material. CO2 [K₃]
15. Mention the condition of weak-field Zeeman effect. CO3 [K₂]
16. Recall the importance of angular-momentum operators in computing. CO3 [K₂]
17. Compute the binding energy per nucleon in ${}_{6}\text{C}^{12}$. Masses of proton, neutron and electron are 1.007276, 1.008665 and 0.00055 u respectively. The mass of ${}_{6}\text{C}^{12}$ atom is 12.000000 u. CO4 [K₂]
18. Mention the nature of exchange forces using Feynman diagram. CO5 [K₁]
19. Outline the formation of Hydrogen bonding. CO6 [K₁]
20. List out the surface defects based on same and different phases. CO6 [K₂]

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 350 words)

21. a) Prove that divergence of charge density (ρ) is positive for electric field using electric flux through any closed surface is zero. 8 CO1 [K₃]
- b) Explain the behavior of skin depth under the influence of electromagnetic field. 6 CO1 [K₂]
22. a) Interpret the proton behavior under the influence of magnetic field and explain the importance of magnetization vector and gradients in the generation of images using MRI. 10 CO2 [K₃]

- b) Express the nature of boundary conditions between two mediums and show its dependence on permeability ratio. 4 CO2 [K₃]
23. Describe the importance of operators in designing Simon algorithm in detail. 14 CO3 [K₂]
24. Explain the nature of stability curve under various decay mechanisms and provide the prediction mechanisms for various isotopes. 14 CO4 [K₃]
25. a) Describe in detail about the types, construction and working of linear accelerators in the production of elementary particles. 12 CO5 [K₂]
- b) Calculate the needed radius in proton synchrotron to attain particle energies of 10 GeV, if a guiding field of 1.8 Wb/m² is available. 2 CO5 [K₂]
26. a) Define reciprocal lattice and deduce the same for Body Centered Cubic (BCC) and Face Centered Cubic (FCC) system. 8 CO6 [K₄]
- b) Tabulate the types of point groups and analyze the same for trigonal crystal system. 6 CO6 [K₃]
