R8384	Sub. Code
	521401

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Fourth Semester

Physics

CONDENSED MATTER PHYSICS – II

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Section A (10 × 2 = 20)

Answer **all** questions.

1. Define Dielectric constant.

2. What is Dielectric breakdown?

3. Give all the properties of Ferroelectrics.

4. What is called Piezoelectric effect?

5. Define magnetic susceptibility.

6. Explain Neel Temperature.

7. State the occurrence of Superconductivity.

8. What is Meissner effect?

9. What is Nanotechnology?

10. Mention some of the applications of Nano Science.

Section B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Explain in detail about Ionic polarization.

Or

(b) Write a detail note on Dielectric Loss.

12. (a) Explain the classification of Ferroelectric crystals.

Or

(b) Write a note on Antiferroelectricity.

13. (a) Outline Weiss molecular field theory.

Or

(b) Write a note on Spintronics

14. (a) Explain BCS theory in detail.

Or

(b) Give the differences between Type-I & Type-II Superconductors.

15. (a) Write a note on BN nano tubes.

Or

(b) Write a note on Nano single electron Transistor.

Section C (3 × 10 = 30)

Answer any **three** questions.

16. Derive an expression for Local electric field of an atom and hence deduce Clasius- Mosotti relation.

17. Explain in detail about Piezo electric parameters and its measurements.

18. Explain the Quantum theory of Paramagnetism.

19. Derive London Equations and hence derive an expression for penetration depth.

20. Briefly explain about excitons in Nano semiconductors.

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R8385	Sub. Code
	521402

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Fourth Semester

Physics

NUCLEAR AND PARTICLE PHYSICS

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Section A $(10 \times 2 = 20)$

Answer **all** the questions.

1. What are the information observed on nuclear force from the study of complex nuclei?

2. Define exchange force.

3. What are the major differences observed in liquid drop model than general similarities?

4. What is nuclear rotation?

5. Fill the following equations.

   (a) ${}^{7}_{3}Li + H^{1}_{1} \rightarrow$ ——— + ———

   (b) ${}^{12}_{6}C + H^{1}_{1} \rightarrow$ ——— + ———

6. What is nuclear fission? Mention its reaction mechanism.

7. Define Kurrie plot.

8. What are parity selection rule?

9. What are Laptons and Baryons?

10. How does K —Meson lose energy by ionization pass through matter?

Section B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) What are the characteristics of nuclear forces? Explain each of them.

Or

(b) Describe the effective range theory of n-p scattering at low energy.

12. (a) Write Weizaker's mass empirical formula. Explain the terms clearly.

Or

(b) Explain the collective model theory of Bohr and Motteison.

13. (a) What are knock out reaction, pick up reaction and stripping reaction?

Or

(b) Explain the nuclear reaction kinetics and obtain the Q-value of the ground state.

14. (a) Describe the classifications of beta transmission was proposed by Fermi, Gamow and Teller.

Or

(b) What is internal conversion? Also obtain the conversion coefficient.

15. (a) Relate the baryon number B, the strangeness S, the isospin I_3 of quarks and hadrons to the electric charge Q by Gell-Mann —Nishijima's theory.

Or

(b) Write the elementary concept of weak interaction. Also explain an interpretation of charged weak and neutral weak interactions.

Section C $(3 \times 10 = 30)$

Answer any **three** questions.

16. (a) Write the properties of non-central force.

(b) Obtain the expression of magnetic moment of deuteron as $\mu_d = (\mu_n + \mu_p) - \frac{3}{2} P_D (\mu_n + \mu_p - \frac{1}{2})$

17. What is Bohr wheeler's theory? Discuss the similarities between liquid drop and nuclear fragmentation.

18. Deduce the expression of Breit Wigner single resonance dispersion formula by resonance cross section concept.

19. Deduce the expression of Gamow's theory of Alpha decay using one dimensional wave equation.

20. Describe the special unitary group of eight fold way [SU(3) symmetry] in three dimensions.

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M.Sc. DEGREE EXAMINATION, APRIL – 2023

Fourth Semester

Physics

THERMODYNAMICS AND STATISTICAL MECHANICS

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. State second law of thermodynamics.

2. What is meant by equation of state in thermodynamics?

3. State equipartition theorem.

4. Why do we need partition function in statistical mechanics?

5. Write the heat equation.

6. What is Joule Thomson process?

7. Write the expression for energy density of black body radiation.

8. What is Brownian motion?

9. State Gibb's phase rule.

10. Distinguish between first order and second order phase transitions.

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Derive any two Maxwell's thermodynamic relations.

Or

(b) Describe the density of gases and volume occupied by a quantum state.

12. (a) Derive the Maxwell distribution of molecular velocities.

Or

(b) Explain the relation between canonical and grand canonical distribution functions.

13. (a) Derive the Boltzmann equation for change of state without collision.

Or

(b) Discuss fluctuations in different ensembles.

14. (a) Obtain the expression for energy density for Fermi gas at zero temperature.

Or

(b) Write a note on Bose condensation.

15. (a) Derive the expression for heat capacity of homonuclear diatomic gas.

Or

(b) Explain the heat capacity of metals.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Discuss in detail about the four thermodynamic processes: reversible, irreversible, adiabatic and isothermal.

17. State Gibb's paradox and resolve it to get the correct formula for entropy.

18. Describe Bose- Einstein distribution.

19. Obtain the expression for chemical potential for an non-interacting Bose- Einstein gas.

20. Derive Debye's expression for specific heat capacity.

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	521510

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Fourth Semester

Physics

ELEMENTARY NUMERICAL ANALYSIS

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** the questions.

1. Mention some unary operator?

2. What is conditional statement? Draw the flowchart for it.

3. Mention what are the steps to follow the bisection method?

4. Define truncation error.

5. Write the properties of divided difference system.

6. Find the second degree polynomial fitting of the following data.

x : 1 2 4

y : 4 5 13

7. Write a basic principle used in Newton's cotes method.

8. Write an expression of Taylor's series.

9. What are partial pivoting and complete pivoting?

10. What is iteration? Mention it advantages.

Part B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Describe the function of *getchar* and *putchar* functions.

Or

(b) Explain what are arrays and strings?

12. (a) Write the comparison between Newton and secant methods.

Or

(b) Find the real root of $xe^x - 2 = 0$ correct to three places of decimals using Newton's method.

13. (a) Write a C program to compute the interpolation value at a specified point for a set of data points using Lagrange interpolation.

Or

(b) Write the formula of linear interpolation method and determine the square root of 2.5 for the given data.

x :	1	2	3	4	5
f(x) :	1	1.4142	1.7321	2	2.2361

14. (a) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by Trapezoidal rule with h = 0.2, Hence determine the value of π.

Or

(b) Compute the C program for Simpson's $\frac{1}{3}$ rule.

15. (a) Find the inverse of the matrix by Gauss elimination method.

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

Or

(b) Solve the system of equation by Dolilttle LU decomposition method.

$3x + 2y + z = 10;\ 2x + 3y + 2z = 14;\ x + 2y + 3z = 14$

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Give a brief explanation on operator and its different categories.

17. Using Newtons divided difference formula, find f(x) and f(6) for the given data.

x :	1	2	7	8
f(x) :	1	5	5	4

18. Find the age corresponding to the annuity value 13.6 given the table using inverse interpolation formula.

Age x:	30	35	40	45	50
Annuity Value f(x):	15.9	14.9	14.1	13.3	12.5

19. (a) Using Euler's method, find $y(0.4)$ given $y' = xy, y(0) = 1$.

(b) Write the C program for the same.

20. Solve the following system of equation by Triangularization method.

$x + y + z = 1;\ 4x + 3y - z = 6;\ 3x + 5y + 3z = 4$.

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