M.Sc. DEGREE EXAMINATION – DECEMBER, 2019.

Second Year

Physics

QUANTUM MECHANICS

Time : 3 hours   Maximum marks : 75

SECTION A — (5 × 3 = 15 marks)

Answer any FIVE questions.

All questions carry equal marks.

1.   Explain Hilbert space.

2.   Discuss briefly the validity condition of WKB approximation.

3.   Explain time dependent perturbation theory.

4.   Write short notes on spin angular momentum.

5.   Explain the concept of negative energy states.

6.   Write short notes on Born approximation.

7.   Explain Sp^3 Hybridization.

8.   What are number operators? Why are they called so?

SECTION B — (5 × 12 = 60 marks)

Answer ALL questions, choosing either (a) or (b).

9. (a) What is a unitary transformation? List the properties of unitary transformation. Show that $[x, p_x] = i\hbar$.

Or

(b) Obtain the expressions for x, p and Hamiltonian matrices of one dimensional linear harmonic oscillator.

10. (a) Why the hydrogen atom in the ground state does not show a first order Stark effect? Obtain the expression for second order energy correction for hydrogen atom in ground state.

Or

(b) What is adiabatic approximation? Derive an expression for probability for finding the system in the state $u_k(t)$.

11. (a) Derive the matrices for J_+, J_-, J_x and J_y.

Or

(b) Derive the radial equation for an electron in a central potential.

12. (a) What are partial waves? Explain the asymptotic behavior of partial waves.

Or

(b) Outline the Heitler-London wave functions for hydrogen molecule.

13. (a) Obtain Einstein's A and B coefficients.

Or

(b) Derive the classical field equations in Hamiltonian form.

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M.Sc. DEGREE EXAMINATION — DECEMBER, 2019.

Second Year

Physics

CONDENSED MATTER PHYSICS

Time : 3 hours   Maximum marks : 75

PART A — (5 × 3 = 15 marks)

Answer any FIVE questions.

1. Define F-centre.

2. Give the distinguishing property of reciprocal lattice.

3. Classify materials into metals, semiconductory and insulators.

4. State ohm's law.

5. What do you understand by Meissner effect?

6. Write about energy gap of super conductor.

7. What is called dielective susceptibility?

8. State curie-weiss law.

PART B — (5 × 12 = 60 marks)

Answer ALL the questions.

9. (a) Find the primitive translation vectors of the reciprocal lattice to SC, BCC and FCC lattice.

Or

(b) Describe the theory of schottxy defects in ionic crystals.

10. (a) Describe the number of orbitals in a band and hence the classification of solids.

Or

(b) Explain and distinguish between extended zone, reduced zone and periodic zone scheme of plotting energy bands.

11. (a) Discuss the thermodynamics of the superconducting transition.

Or

(b) Explain super conducting tunneling get the formulation of dc Josephson effect. Explain current of de Josephson effect.

12. (a) Derive an expression for local electric field at an atom.

Or

(b) Derive the clausius–Mossotti relation.

13. (a) Describe the quantum theory of paramagnetism and hence derive the curie law.

Or

(b) Describe the weiss theory of ferromagnetism.

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M.Sc. DEGREE EXAMINATION — DECEMBER, 2019.

Second Year

Physics

SPECTROSCOPY

Time : 3 hours   Maximum marks : 75

PART A — (5 × 3 = 15 marks)

Answer any FIVE questions.

1. Distinguish between normal and anomalous zeeman effect.

2. What is Paschen Bach effect?

3. Outline briefly the advantages of FTIR spectroscopy over the conventional procedure.

4. Why anti–stokes lines are less intense than stokes lines?

5. List the basic requirements of a typical NMR spectrometer.

6. Explain the principle of NQR.

7. Why microwave source and techniques have to be applied for the observation of ESR?

8. What is isomer shift? Give examples.

PART B — (5 × 12 = 60 marks)

Answer ALL the questions.

9. (a) Describe the magnetic moment of an atom and derive an expression for Lande 'g' factor.

Or

(b) Explain the following

(i) hyperfine structure

(ii) Quadrupole moment

10. (a) Explain the practical aspects of infrared spectroscopy.

Or

(b) Describe, with theory, rotation vibration spectra of diatomic molecules.

11. (a) Describe the quantum theory of Raman effect.

Or

(b) Explain in detail about Laser Raman spectroscopy.

2 **PG–719**

12. (a) (i) Define chemical shift. Distinguish between δ and τ chemical shifts.

(ii) Derive Bloch equation.

Or

(b) What do you understand by NQR group frequencies? Explain its use in molecular structure determination.

13. (a) Explain the factors responsible for the hyperfine structure in ESR spectra.

Or

(b) Explain recoilless emission and absorption of gamma rays.

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M.Sc. DEGREE EXAMINATION — DECEMBER, 2019.

Second Year

Physics

LASER AND FIBER OPTICS

Time : Three hours   Maximum marks : 75

PART A — (5 × 3 = 15 marks)

Answer any FIVE questions.

1.   Mention the characteristics of laser light?

2.   Define electro optic effect.

3.   Define Numerical Aperture.

4.   What are double heterostructure LEDs?

5.   What is photoluminescence?

6.   What are liquid crystals?

7.   What is a semiconductor laser?

8.   What is plasma?

PART B — (5 × 12 = 60 marks)

Answer FIVE questions.

9. (a) Derive the Einstein's relatons and the conditions required for laser action.

Or

(b) Describe the construction and working of He-Ne laser. Explain the medical applications

10. (a) Explain electro optic and magneto optic effects.

Or

(b) Explain reflection and refraction at the boundary of an absorbing medium of a solid.

11. (a) Explain Fiber Fabrication Technique.

Or

(b) Explain the various types of losses in an optical fiber.

12. (a) Explain briefly about distributed feedback laser.

Or

(b) Write short notes on (i) Quantum well laser (ii) index guided laser

2   **PG 720**

13. (a) (i) What is an LED display? Mention its types with its applications. (8)

(ii) Give the concept of Drive circuits. (4)

Or

(b) (i) Mention the advantages and disadvantages of plasma display. (6)

(ii) Write a note on LCD display. (6)

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M.Sc. DEGREE EXAMINATION – DECEMBER 2019.

Second Year

Physics

NUMERICAL METHODS

Time : 3 hours   Maximum marks : 75

PART A — (5 × 3 = 15 marks)

Answer any FIVE questions.

1. Prove that the Newton Raphson method has a second order convergence.

2. Explain briefly Gauss-Seidal iteration method to solve a set of three equations in three unknowns.

3. Distinguish between direct and iterative methods of solving simultaneous equations.

4. Write down to normal equations to fit a quadratic curve by least square method.

5. Find the third differences of $f(x)$ from the following table.

$$x :\qquad 0 \quad 1 \quad 2 \quad 3 \quad 4$$
$$y = f(x) \quad 1 \quad 3 \quad 7 \quad 13 \quad 21$$

6. IF $f(x) = x^2 - 2x + 2$, find $\Delta^2 f(x)$, taking the interval of differencing as 1.

7. Given $y^1 = x + y$, $y(0) = 1$ find $y(0.1)$ by Evler's method.

8. Compare Runge-Kutta methods and predictor-corrector methods for solution of initial value problem.

PART B — (5 × 12 = 60 marks)

Answer ALL questions.

9. (a) (i) Find a real root of the equation $x^3 + x^2 - 100 = 0$

(ii) Find the real root of the equation

$$\rho = \frac{\rho^3}{3} + \frac{\rho^5}{1^0} - \frac{\rho^7}{4^2} - \frac{\rho^9}{216} - \frac{\rho^{11}}{1320} + \ldots = 0.4431135.$$

Correct to 4 decimal places.

Or

(b) (i) Write short notes on Brige Veita method.

(ii) Solve $x^4 - 5x^3 + 20x^2 - 40x + 60 = 0$, given that all the roots of $f(x) = 0$ are complex, by Brige vieta method.

10. (a) Solve (i) by Gauss-elimination method (ii) by Gauss Jordom method the equations.

$2x+y+4z=12$

$8x-3y+22=20$.

$4x+11y-z=33$

Or

(b) Find the dominant eigen value and eigen vector of

$A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$ using power method.

11. (a) (i) Derive Lagrange's interpolation formula for unequal intervals.

(ii) Using Lagrange's interpolation formula, find the value corresponding to $x=10$ from the following table.

x	5	6	9	11
y	12	12	14	16

Or

(b) Derive Newton's forward interpolation formula.

12. (a) (i) Derive Newton's forward difference formula to compute the derivations.

(ii) From the following table of values of x and y. find $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$ for $x=1.05$.

x:	1.00	1.05	1.10	1.15	1.20	1.25	1.30
y:	1.00000	1.02470	1.04881	1.07238	1.09544	1.11803	1.14017

Or

(b) (i) Derive Newton-Cote's formula

(ii) Compute the value of the definite integral $\displaystyle\int_{4}^{5.2} \log_e{}^x dx$ using (1) Trapezodial rule (2) Simpson's rule.

13. (a) (i) Explain about the Taylor series method for solving differential equation.

(ii) Using Taylor series method, compute the value of $y(0.2)$ correct to 3 decimal places from $\dfrac{dy}{dx}=1-2xy$ given that $y(0)=0$.

Or

(b) (i) Derive the formula for fourth order Runge-Kutta method.

(ii) By applying the fourth order Runge-Kutta method find $y(0.2)$ from $y^1 = y = x,\ y(0)=2$ taking $h=0.1$.

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