S–6481

Sub. Code
23MPH1C1

M.Sc. DEGREE EXAMINATION, APRIL 2025

First Semester

Physics

MATHEMATICAL PHYSICS

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. What do you mean Eigen values and Eigen functions?
2. Define scalar product.
3. Define an analytic function of a complex variables.
4. What do you mean by Electrostatic potential?
5. Define trace of a matrix.
6. What do you understand of inverse of matrix?
7. Find the Laplace transform of e^{-at}.
8. Write Fourier transform equation.
9. Find the differential equation $\frac{d^2y}{dx^2} + y = \sec x \tan x$.
10. Write a Rodrigue formula for leguerre polynomials.

Part B (5 × 5 = 25)

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

11. (a) Write briefly Bra and Ket notation.

Or

(b) Explain linear independence of Gram-Schmidt orthogonalization method.

12. (a) Explain the harmonic functions.

Or

(b) Derive the cauchy's integral theorem.

13. (a) Show that inverse of the matrix $A=\begin{bmatrix}1 & 3\\ 2 & 1\end{bmatrix}$.

Or

(b) Find the Eigen values of the matrix

$$A=\begin{bmatrix}8 & -6 & 2\\ -6 & 7 & -4\\ 2 & -4 & 3\end{bmatrix}.$$

14. (a) Show that Laplace transform of $e^{at}\sin wt$ is $\frac{w}{(s-a)^2+w^2}$.

Or

(b) Find $L\{F(t)\}$ where $F(t)=\begin{cases}t/T & 0<t<T\\ 1 & t>T\end{cases}$.

15. (a) State orthogonal properties of legendre polynomials.

Hence find the values of $\int_{-1}^{+1} [P_4(x)]^2 \, dx$.

Or

(b) Derive the Green's function.

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

Answer any **three** questions.

16. Write briefly isomorphism of vector space.

17. What is an analytic function? Derive necessary and sufficient conditions for a function can be analytic.

18. Derive the Cayley-Hamilton theorem with sufficient explanations.

19. Explain transform of differentiation and integration.

20. Obtain the differential equation of legendre polynomials

$$P_n(x) = \frac{1}{2^n \, n!} \frac{d^n}{dx^n} (x^2 - 1)^n .$$

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S–6482

Sub. Code
23MPH1C2

M.Sc. DEGREE EXAMINATION, APRIL 2025

First Semester

Physics

CLASSICAL MECHANICS AND RELATIVITY

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Why is the transformation equation necessary?

2. Outline the advantages of using generalized coordinates.

3. What is conservative system?

4. Interpret Atwood's machine. Mention its application.

5. Define cyclic coordinates.

6. Define Hamiltonian function.

7. What are normal coordinates?

8. What are called normal modes of vibrations?

9. What is inertial frame of reference?

10. Comment on mass-energy equivalence.

Part B (5 × 5 = 25)

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

11. (a) Show that the angular momentum is conserved on a system of N particles when there is no external torque acting on it.

Or

(b) Interpret virtual displacement and virtual work.

12. (a) State and prove D'Alembert's principle. Give its one applications.

Or

(b) Using Lagrangian equation of motion solve the problem of projectile motion.

13. (a) Using Hamilton's equation of motion. Solve the problem of simple pendulum.

Or

(b) Apply Hamiltonian equation of motion to solve the problem of motion of particle in a central force field.

14. (a) Formulate problem of small oscillations and hence derive Lagrange's equation of small oscillations.

Or

(b) Explain the normal frequencies and normal coordinates of a system.

15. (a) State and deduce the mathematical expression for the law of addition of relativistic velocities.

Or

(b) Write a short note on Minkowski's space.

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

Answer any **three** questions.

16. What are constraints? How is it helpful in studying mechanics of particles? Distinguish between holonomic and non-holonomic constraints.

17. Obtain Lagrange's equation of motion and show that these can be written as $\frac{d}{dt}\left(\frac{\partial L}{\partial g_j}\right) - \frac{\partial L}{\partial g_j} = 0$ for a conservative system.

18. Derive Hamilton's canonical equation of motion.

19. Using the method of small oscillations. Calculate the frequencies of vibrations of linear Triatomic molecules.

20. Derive the Lorentz transformation equation in four dimensional spaces.

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S–6483	Sub. Code
	23MPH1E1

M.Sc. DEGREE EXAMINATION, APRIL 2025

First Semester

Physics

Elective – LINEAR AND DIGITAL IC'S AND APPLICATIONS

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. Sketch the block diagram of summing amplifier.
2. Draw the diagram of IC 741 and it's features.
3. Write the types of any two application of OP-AMP.
4. What is mean by divider?
5. Write the types of filters.
6. Draw the diagram of IC 555 timer.
7. What is mean by Switching Regulator?
8. Define voltage and it's unit.
9. What is mean by Inverter?
10. Write a truth table and draw the diagram of NAND Gate.

Part B (5 × 5 = 25)

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

11. (a) Explain the classification of Amplifier.

Or

(b) Explain and working on subtracting and integrating amplifier.

12. (a) Explain and working by Schmitt trigger.

Or

(b) Draw the monotable multivibrators diagram and explain its working.

13. (a) Draw the astable operator and its working.

Or

(b) Describe the 1'st order low and high pass filters.

14. (a) Describe the parallel comparator.

Or

(b) Explain and working of IC 723 general purpose regulators.

15. (a) Explain and working by C-Mos inverter.

Or

(b) Explain and working of OR-AND invert gate.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Explain in detail of Instrumentation of OP-AMP.

17. Write notes on bistable multivibrator.

18. Draw and working of 2nd order all pass filters.

19. Explain following
    (a) Successive approximation ADC
    (b) Dual slope ADC

20. Explain and working in detail CMOS logic.

S–6484

Sub. Code
23MPH1E2

M.Sc. DEGREE EXAMINATION, APRIL 2025

First Semester

Physics

Elective — ENERGY PHYSICS

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Define non-conventional energy.

2. List out available renewable energy sources.

3. Write down the principle of Tidal power.

4. What are the main types of ocean energy?

5. What roles does wind energy play in the global energy need?

6. What are some innovative applications of wind energy?

7. What is meant by solar constant?

8. Define solar cell.

9. Write down properties of bio mass.

10. What are the factors affecting bio gas generation?

Part B

$(5 \times 5 = 25)$

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

11. (a) Describe the role of conventional energy sources in meeting global energy demand.

Or

(b) Explain briefly Nuclear energy sources.

12. (a) Explain utilization of Tidal energy.

Or

(b) Write down the application of Tidal power.

13. (a) Write down applications of wind energy.

Or

(b) Explain briefly forces activities in blades.

14. (a) Explain Aerobic and anaerobic digestion system of biomass process.

Or

(b) Write down properties of bio gas.

15. (a) Explain solar water heater.

Or

(b) Explain green house gases

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Distinguish between conventional energy and non conventional energy sources.

17. Write a short notes on :

    (a) Solar pond

    (b) Solar water heater

    (c) Solar cooker.

18. Explain classification of bio mass plant and also write down advantages.

19. Write down advantages and disadvantages of fuel cells.

20. Explain briefly thermal energy conversion system.

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S–6485

Sub. Code
23MPH2C1

M.Sc. DEGREE EXAMINATION, APRIL 2025

Second Semester

Physics

STATISTICAL MECHANICS

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is thermodynamic potential?

2. Define phase equilibrium.

3. Define phase space.

4. Define entropy.

5. Define canonical ensemble.

6. Define grand canonical ensemble.

7. Define degeneracy.

8. Explain Bose Einstein statistics.

9. Write the short notes on Brownian motion.

10. Define Ising model.

Part B (5 × 5 = 25)

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

11. (a) Explain Ehrenfest classifications.

Or

(b) Briefly explain critical indices.

12. (a) Illustrate the connections between the statics and thermodynamics.

Or

(b) Explain the postulate of statistical mechanics.

13. (a) Calculate statistical quantities.

Or

(b) With neat example explain density of states.

14. (a) Explain statistics of ensembles.

Or

(b) Explain the Fermi Dirac Statistics.

15. (a) Explain cluster expansion of classical gas.

Or

(b) Explain the Langevin theory.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Briefly explain Landau's theory of Phase transitions.

17. Explain micro canonical ensemble.

18. Explain canonical and grand canonical ensembles.

19. Derive plank radiation formula.

20. Derive Fokker Planck equation.

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S–6486

Sub. Code
23MPH2C2

M.Sc. DEGREE EXAMINATION, APRIL 2025

Second Semester

Physics

QUANTUM MECHANICS – I

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. What are stationary states?

2. Outline the probability interpretation of the wave function.

3. What are spherical harmonics?

4. What is quantum mechanical tunnelling?

5. What is symmetry transformation?

6. Wave function possess even or odd parity? Explain.

7. For S electron, the spin orbit interaction is zero. Why?

8. What is WKB approximation?

9. Obtain the normalized eigenvectors of σ_x and σ_y matrices.

10. Prove that $\left[J^2, J_y\right] = 0$.

Part B (5 × 5 = 25)

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

11. (a) State and prove Ehrenfest's theorem.

Or

(b) Define a Hermitian operator. Show that eigen values of Hermitian operator are real.

12. (a) Obtain the energy eigen values and eigen functions of a particle trapped in the potential well where $V(x) = 0$ for $-a \le x \le a$ and $V(x) = \infty$ for $|x| > a$.

Or

(b) Show that the zero point energy $\frac{1}{2}\hbar w$ of linear harmonic oscillator is a manifestation of uncertainty principle.

13. (a) Obtain equation of motion for an operator in Heisenberg picture.

Or

(b) Discuss the effect of time reversal in the time dependent Schrödinger equation.

14. (a) Determine first order correction in energy for anharmonic oscillator.

Or

(b) Describe variation method for excited states.

15. (a) Express the operators for angular momentum components L_x, L_y and L_z in spherical polar coordinates.

Or

(b) Show that $(\sigma.A)(\sigma.B) = A.B + i\sigma.(A \times B)$.

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

Answer any **three** questions.

16. Outline the different postulates of quantum mechanics.

17. Obtain the energy eigen values and eigen functions for a linear harmonic oscillator using operation method.

18. Prove that the conservation of angular momentum is a consequence of rotational invariance of the system.

19. Discuss the effect of electric field on $n = 2$ state of hydrogen atom using perturbation method.

20. Obtain the Clebsch-Gordan coefficients for a system having $j_1 = 1$ and $j_2 = 1/2$.

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S–6488

Sub. Code
23MPH2E2

M.Sc. DEGREE EXAMINATION, APRIL 2025

Second Semester

Physics

Elective — ADVANCED OPTICS

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. State the Malu's law.

2. Differentiate polarizer and analyzer.

3. Differentiate the spontaneous emission and stimulated emission.

4. What is population inversion, justify its necessary for the operation of a laser.

5. Give a short notes on total internal reflection.

6. Define the term :
   (a) Critical angle,
   (b) Acceptance angle,
   (c) Relative refractive index difference,
   (d) V-number.

7. What are the basic principles in non-linear optics?

8. Define the term of phase matching.

9. Define Magneto-optical effect.

10. State the Zeeman effect.

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

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

11. (a) Discuss the principles of polarization by double refraction.

Or

(b) Explain about the optical activity.

12. (a) Discuss the construction and working of Ruby laser.

Or

(b) What are the basic components of a laser system. List out the types of laser and its applications.

13. (a) Explain the pulse dispersion in multimode optical fibers.

Or

(b) Explain the parabolic index fiber.

14. (a) Discuss the third harmonic generation.

Or

(b) Discuss the self-focusing of light.

15. (a) Distinguish between normal and anomalous zeeman effects.

Or

(b) Describe the electric double refraction.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe the quarter wave plate and half wave plate contribute in manipulating the polarization of an interference of polarized light.

17. Elaborate the construction and working of Neodymium YAG laser.

18. Explain the working principle of a precision vibration sensor and precision displacement sensor.

19. Elaborate the second harmonic generation.

20. Explain the Kerr electro-optic effect and Pockels electro-optic effect.

S–6489

Sub. Code
23MPH2E3

M.Sc. DEGREE EXAMINATION, APRIL 2025

Second Semester

Physics

Elective — MICROPROCESSOR 8085 AND MICROCONTROLLER 8051

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is memory mapping?

2. What is interrupt?

3. What are the functions to be performed by microprocessor while interfacing an ADC?

4. What is ADC and DAC?

5. What are the main features of 8051 microcontroller??

6. Compare microprocessor and microcontroller.

7. What is stack pointer?

8. Give the addressing modes of 8051.

9. State any four applications of microcontroller.

10. How is pulse generated from microcontroller for stepper motor control?

Part B (5 × 5 = 25)

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

11. (a) Explain the memory mapped i/o addressing scheme.

Or

(b) Explain the Interrupts of 8085 microprocessor.

12. (a) Draw and explain the interfacing of D/A converter to 8085 microprocessor.

Or

(b) Explain the step sequence of Stepper Motor interfacing with 8085.

13. (a) Explain the I/O port structure of 8051.

Or

(b) Explain the memory structure of 8051 Microcontroller.

14. (a) Explain the Data transfer instructions and Program control instructions of 8051 microcontroller.

Or

(b) Explain various types of jump instructions according to range.

15. (a) Explain the temperature measurement using 8051 Microcontroller.

Or

(b) Explain how to interface an 8-bit ADC with 8051 Microcontroller.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. With neat block diagram explain Programmable DMA controller.

17. Describe with the diagram, seven segment display interfacing with 8085.

18. Discuss about the organization of Internal RAM and Special function registers of 8051 Microcontroller in detail.

19. Explain the arithmetic and control instructions of 8051 microcontroller.

20. Discuss how a seven segment display can be interfaced with 8051 Microcontroller.

S–6491

Sub. Code
23MPH2S1

M.Sc. DEGREE EXAMINATION, APRIL 2025

Second Semester

Physics

SOLAR ENERGY UTILIZATION

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is solar time?

2. Define conduction.

3. What is heat removal factor?

4. Define radiative loss.

5. What are the basic elements of a water heater?

6. List any two disadvantages of solar heating system.

7. Define photo-voltaic effect.

8. What are the types of solar cells?

9. What is reference electrode?

10. What is fuel cell?

Part B (5 × 5 = 25)

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

11. (a) Explain the different types of solar radiation.

Or

(b) List the effects of solar radiation.

12. (a) Explain the energy spectrum of blackbody radiation.

Or

(b) Write a note on collecting characteristics.

13. (a) Explain the pressurized natural circulation solar water heater.

Or

(b) Explain the modes of operation of solar heating system.

14. (a) List the advantage of photo-voltaic solar energy conversion.

Or

(b) What are the criteria for designing the solar cells? Explain.

15. (a) List the uses of nanostructure in fuel cell technology.

Or

(b) Write a note on fuel cell catalysts.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain the classification of different solar energy instruments.

17. Describe the general characteristics of flat-plate solar collectors.

18. Explain the principle of solar ponds and classification of solar ponds.

19. Describe the process flow of silicon solar cell.

20. Discuss the usage of nanotechnology in hydrogen production and storage.

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S–6493

Sub. Code
23MPH3C2

M.Sc. DEGREE EXAMINATION, APRIL 2025

Third Semester

Physics

NUMERICAL METHODS AND COMPUTER PROGRAMMING

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Write the condition for convergence in Iteration method.

2. Compare the Direct and indirect method.

3. What are the two direct methods to solve system of linear equation?

4. Write a note on eigen values and eigen vectors of matrices.

5. State the Newton's divided difference interpolation formula.

6. Write down the Lagrange's interpolating formula.

7. What do you mean by Numerical integration?

8. State the basic principle for deriving Euler method.

9. What is flow chart?

10. Define Functions.

Part B (5 × 5 = 25)

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

11. (a) Explain Newton-Raphson method of finding roots of transcendental equation.

Or

(b) Perform five iterations of the bisection method to obtain a root of the equation.

$$f(x) = \cos x - x e^{x} = 0$$

12. (a) Use Power method, Find out the eigen values of $A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$.

Or

(b) Solve the equation by using the Gauss Elimination method.

$$\begin{aligned} 10x_1 + x_2 + 2x_3 &= 4 \\ x_1 + 10x_2 - x_3 &= 3 \\ 2x_1 + 3x_2 + 20x_3 &= 7 \end{aligned}$$

13. (a) Use Lagrange's interpolation formula find the value of $f(x)$ from the following data.

x	0	1	2	5
y	2	3	12	147

Or

(b) Explain Newton divided difference formula upto 3 terms.

14. (a) Evaluate the integral $I = \int_0^1 \frac{dx}{1+x}$ using Gauss-Legendre three point formulas.

Or

(b) Evaluate $I = \int_{-\infty}^{\infty} \frac{e^{-x^2}}{x^2+x+1} dx$, using the Gauss-Hermite two-point and three point formulas.

15. (a) Discuss about integer and floating point arithmetic expression in C-Programming.

Or

(b) Explain the Executable and non-executable statements with suitable example.

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

Answer any **three** questions.

16. Find the number of real and complex roots of the polynomial equation

(a) $P_3(x) = x^3 - 5x + 1 = 0$

(b) $P_4(x) = 4x^4 + 2x^2 - 1 = 0$

17. Find the largest eigen value of the Matrix $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & 0 \\ 0 & -1 & 0 \end{bmatrix}$ by Power method. Also find its corresponding eigen vector.

18. For the following data calculate the Difference and obtain the Newtons forward and backward interpolation difference polynomials. Interpolate at $x = 0.25$ and $x = 0.35$

x	0.1	0.2	0.3	0.4	0.5
$f(x)$	1.40	1.56	1.76	2.0	2.28

19. Explain the Simpson's rule of numeric integration. What is the estimated error in this method? Write the algorithm for the Simpson's method.

20. Write a program to find the real root of nonlinear equation using Newton-Raphson method.

S–6494

Sub. Code
23MPH3C3

M.Sc. DEGREE EXAMINATION, APRIL 2025

Third Semester

Physics

ELECTROMAGNETIC THEORY

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Give the relation between electric susceptibility and molecular polarizability.

2. What is a multipole expansion and give an examples?

3. State the Biot- Savart's law.

4. Define magnetostatic energy. Give an example of magnetostatic boundary conditions.

5. Write the Maxwell's equation.

6. State the Poynting's theorem.

7. What do you mean by linear polarization?

8. List out the physical significance of an electromagnetic wave propagates in a conducting medium.

9. What is magnetic field confinement of plasma?

10. Give the detail about bump-on-tail instability in plasmas.

Part B (5 × 5 = 25)

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

11. (a) Derive an expression of laplace equation in three dimension.

Or

(b) Give the detailed explanation of multipole expansion.

12. (a) Deduce the equation of magnetic field of a localized current distribution.

Or

(b) Briefly explain the magnetostatic energy.

13. (a) Discuss the scalar and vector potentials.

Or

(b) Derive an expression of Lorentz and coulomb gauges.

14. (a) Discuss the stokes parameters of linear and circular polarization.

Or

(b) Derive the equation of an inhomogeneous wave equation and retarded potentials.

15. (a) Elaborate plasma as a conducting fluid by magneto hydrodynamics phenomenon.

Or

(b) Explain the Alfren waves and magnetosonic waves.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain the boundary value problems with dielectric.

17. Derive an expression of force and torque on a localized current distribution in an external magnetic induction field.

18. Determine the equation of conservation of energy and momentum for a system of charged particles and electromagnetic fields.

19. Derive the equation of reflection and refraction of electromagnetic waves at a plane interface between dielectric.

20. Explain plasma oscillation. Derive an expression for plasma frequency in an electron plasma oscillation

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S–6495	Sub. Code
	23MPH3E1

M.Sc. DEGREE EXAMINATION, APRIL 2025.

Third Semester

Physics

Elective : PHYSICS OF NANOSCIENCE AND TECHNOLOGY

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. Define nanotechnology.

2. What is meant by quantum confinement?

3. Define ductility.

4. What is specific heat capacity?

5. What is lithography?

6. What is CVD?

7. What is the difference between the resolution and magnification?

8. What are the limitations of STM?

9. List out the applications of nanomaterials in electronics.

10. What is carbon nanotube emitter?

Part B (5 × 5 = 25)

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

11. (a) Write a short note on quantum dot.

Or

(b) Why surface area/volume ratio is very large for nano particles compared to bulk material? Explain.

12. (a) Briefly explain super para magnetism.

Or

(b) Explain super lattice of nanomaterials.

13. (a) Write a note on plasma arc discharge.

Or

(b) Explain the process of photolithography.

14. (a) Explain the working principle of vibrating sample magnetometer.

Or

(b) Explain the imaging modes of TEM.

15. (a) Write a note on super capacitor.

Or

(b) Explain the photodynamic therapy.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Discuss the different modes of classification of nanomaterials in detail.

17. Discuss any four salient properties of nano-materials.

18. Explain how oxide nanoparticles can be obtained by sol gel method.

19. Describe the basic principle and operation of scanning electron microscope.

20. Discuss various applications of nanosensors in biology.

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S–6497

Sub. Code
23MPH3S1

M.Sc. DEGREE EXAMINATION, APRIL 2025

Third Semester

Physics

SOLID WASTE MANAGEMENT

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is solid waste?

2. What is the composition of municipal solid wastes?

3. What is the hierarchy of solid waste management?

4. Define moisture content.

5. What is called Composting?

6. Specify the role of transfer station in municipal solid waste management.

7. "Economy is dependant on exploitation of natural resource" Justify.

8. What are alternative options for combating the climate change?

9. What is the purpose of industrial visit?

10. What are steps involved in presentation?

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

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

11. (a) Differentiate between municipal and non-municipal solid waste.

Or

(b) Write a note on renewal act.

12. (a) List the factors affecting solid waste generation.

Or

(b) List the advantages of solid waste management.

13. (a) Explain the types of composting techniques.

Or

(b) What type of Problems with landfills in disposal?

14. (a) Write a brief note on concepts and issues of SWM in economic development.

Or

(b) How does climate change impact environmental economics?

15. (a) List the processes involved in data analysis.

Or

(b) Write a note on data collection.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain the sources and types of solid wastes.

17. Mention the various physical and chemical characteristics of solid waste.

18. Explain the types of transportation methods in solid waste management.

19. How environment and economy linked together? Explain in detail.

20. Write a detailed visit report of your visit to any environmental sensitive area.

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S–6498	Sub. Code
	23MPH4C1

M.Sc. DEGREE EXAMINATION, APRIL 2025

Fourth Semester

Physics

NUCLEAR AND PARTICLE PHYSICS

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. What are magic numbers?

2. Explain electric quadruple moment.

3. What do you mean by tensor forces?

4. Define meson.

5. Define Q value.

6. State reciprocity theorem.

7. Write the selection rule for forbidden beta decay.

8. Define helecity.

9. What are hadrons?

10. Distinguish fermions and bosons.

Part B (5 × 5 = 25)

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

11. (a) Write the salient features of liquid drop model.

Or

(b) Write short notes on collective model of a nucleus.

12. (a) Illustrate the idea of Yukawa potential.

Or

(b) Explain the properties of nuclear forces.

13. (a) With neat example explain types of nuclear reactions.

Or

(b) Calculate scattering length of nuclear reactions.

14. (a) Draw and explain continuous beta ray spectrum.

Or

(b) Explain nuclear isomerism and parity of gamma decay.

15. (a) Distinguish strangeness and hypercharge of elementary particles.

Or

(b) Explain SU (3) symmetry using nuclear ideas.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Derive weizacker semi empirical mass formula.

17. Explain meson theory of nuclear forces.

18. State and prove reciprocity theorem.

19. Elaborate fermi's theory of beta decay.

20. Explain the classification of elementary particles.

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S–6499

Sub. Code
23MPH4C2

M.Sc. DEGREE EXAMINATION, APRIL 2025

Fourth Semester

Physics

SPECTROSCOPY

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What are asymmetric molecules?

2. Define degeneracy.

3. What do you mean by band origin?

4. Write the frequencies of fundamental and first overtone of an harmonic oscillator.

5. Write any two example of Raman active samples.

6. Define molecular polarizability.

7. Write the short notes on population of energy levels.

8. Define NMR spectroscopy.

9. State Beer Lambert law.

10. State Bougher Lambert law.

Part B

$(5 \times 5 = 25)$

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

11. (a) Explain non rigid rotator.

Or

(b) Briefly explain the instrumentation of microwave spectroscopy.

12. (a) Illustrate the idea of interpretation of Vibrational spectra of molecules.

Or

(b) Explain the instrumentation of IR spectroscopy.

13. (a) With neat example explain rotational Raman spectra of linear molecules.

Or

(b) With neat example explain Vibrational Raman spectra of linear molecules.

14. (a) Explain Double resonance condition.

Or

(b) Explain the applications of ESR in medical field.

15. (a) Distinguish UV spectra absorption in organic and inorganic solvents.

Or

(b) Explain color in organic compounds.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain the rotational spectra of polyatomic of linear molecules.

17. Explain diatomic vibrating rotator.

18. Explain classical theory of Raman effect.

19. Explain instrumentation of NMR spectroscopy with neat sketch.

20. Explain the double beam UV spectrophotometer.

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S–6500

Sub. Code
23MPH4E1

M.Sc. DEGREE EXAMINATION, APRIL 2025

Fourth Semester

Physics

Elective — MATERIALS SCIENCE

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Mention few Electro optic material and their properties.

2. Define Electro optic effect.

3. Give the properties of Glass.

4. What are refractories?

5. What is polymerisation?

6. Give the classification of polymers.

7. What is a composite material?

8. What is ceramic-matrix composite?

9. What are shape memory alloys?

10. Define Pseudo elasticity.

Part B (5 × 5 = 25)

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

11. (a) A 1.6 eV photon is absorbed by a valence band electron in GaAs. If the bandgap of GaAs is 1.41 eV, calculate the energy of the electron and heavy hole produced by the photon absorption.

Or

(b) Write a short on charge injection.

12. (a) Explain how slurry of ceramic powder is processed via casting routes.

Or

(b) Write a note on glass.

13. (a) Write a note on addition and condensation polymerization.

Or

(b) Explain viscoelastic behaviour of materials.

14. (a) List and explain the reinforcements used in the composite.

Or

(b) Write a note on role and selection of fibers.

15. (a) Explain one-way memory effect.

Or

(b) Explain pseudo-elasticity.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe the Electro-optic effect and modulation.

17. Discuss the sintering process of ceramics.

18. (a) Obtain an expression for weight average molecular weight of polymer.

    (b) Elucidate with the suitable diagram, how a helical structure plays a role in a polymer of biological origin.

19. Explain with a neat sketch solid state processing of MMC.

20. Discuss the classification, size effect on structural and functional properties of Nanomaterials.

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S–6501

Sub. Code
23MPH4E2

M.Sc. DEGREE EXAMINATION, APRIL 2025

Fourth Semester

Physics

Elective – CONDENSED MATTER PHYSICS

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. List out the important features of Miller indices.

2. What is modeling constant? Give its value for NaCl structure.

3. What are Brillouin zones?

4. Give assumptions of classical theory of Lattice specific heat.

5. What is Hall effect?

6. Define effective mass in semiconductors.

7. Why diamagnetic materials have negative susceptibility?

8. What are Domains?

9. Differentiate between Types 1 and Type 2 super conductors.

10. What is Josephson's effect?

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

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

11. (a) Show that the atomic packing factor for SC and FCC structure.

Or

(b) Obtain Lave equation and show how they lead to Bragg's law.

12. (a) What are Phonons and write their important properties?

Or

(b) Explain the inelastic scattering by neutrons by phonons.

13. (a) Derive the relation between thermal to electrical conductivity.

Or

(b) Explain De Haas-Van Alpen effect in detail.

14. (a) Describe the Quantum theory of ferromagnetism in detail.

Or

(b) What is hysteresis? Discuss its occurence on the basis of domain concept.

15. (a) Discuss isotope effect and critical field in super conductors.

Or

(b) What is single particle tunneling. Derive an expression for AC and DC Josephson effects.

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

Answer any **three** questions.

16. Describe the various types of lattices and mention their distinguishing features.

17. Obtain an expression for the specific heat capacity of solids on the basis of Debye's theory.

18. Derive the equation for free electron gas in three dimension.

19. Analyse the Quantum theory of Paramagnetism.

20. Discuss the BCS theory for super conductivity with experimental evidence.

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S–6502

Sub. Code
23MPH4S1

M.Sc. DEGREE EXAMINATION, APRIL 2025

Fourth Semester

Physics

SEWAGE AND WASTE WATER TREATMENT AND REUSE

(CBCS – 2023 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Why wastewater treatment is important?

2. Define sedimentation.

3. What are the effects of UV radiation on waste water?

4. What do you meant by pretreatment?

5. What is meant by chemical coagulation?

6. What is meant by Perikinetic flocculation?

7. What is the role of filtration in physical disinfection?

8. What are the applications of radiation in disinfection?

9. What is the purpose of conducting an industrial visit?

10. What are some key things to observe during the visit?

Part B (5 × 5 = 25)

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

11. (a) Compare slow sand filter with rapid sand filter.

Or

(b) Write short notes on mechanical flocculator.

12. (a) List out the requirements of good disinfectant.

Or

(b) Explain the common methods used for disinfecting water.

13. (a) Write a note on disinfection by products.

Or

(b) List the difference between disinfection and sterilization.

14. (a) What is physical disinfection and how does it differ from chemical disinfection?

Or

(b) What factors influence the effectiveness of physical disinfection?

15. (a) What should be included in a report or presentation about the visit?

Or

(b) Explain the key things to observe during the visit.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. What are the steps that takes place during filtration? Explain.

17. List the types of chlorination and explain break point chlorination in detail.

18. Describe the general characteristics of chemical disinfections.

19. Discuss the process of electrochemical oxidation water disinfection by microwave heating.

20. How do you document what you learned during the visit? Explain.

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