S–5342	Sub. Code
	22MPH1C1

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024.

First Semester

Physics

CLASSICAL DYNAMICS AND RELATIVITY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Define generalized momentum.

2. What is D Alembert's principle?

3. State Virial theorem.

4. What is integral power law of potential?

5. Define rigid body.

6. State coriolis force.

7. What is principle of least action?

8. What are Poisson brackets?

9. State inverse Lorentz transformation equation.

10. Write the invariance of Maxwell's equation?

Part B (5 × 5 = 25)

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

11. (a) Write in details about mechanics of a particle and a system of particles.

Or

(b) Define generalized coordinate and obtain the expression for generalized momentum.

12. (a) Deduce equation of motion and first integrals.

Or

(b) Derive the equation for the orbit of a particle moving under the influence of an inverse square central force fields.

13. (a) Briefly explain symmetrical top.

Or

(b) Derive an expression for moment of inertia of rigid body.

14. (a) What are action and angle variables? Discuss how they are applied to the Kepler's problem.

Or

(b) Deduce equation of motion interms of Poisson's bracket.

15. (a) Give the list of postulates of relativity.

Or

(b) Derive the relativistic addition of velocities.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Obtain Lagrange's equation of motion for a holonomic conservation system using D Alembert's principle.

17. Discuss the scattering in a central force problem of two body system.

18. Outline the theory of small oscillations of a system about an equilibrium position and Apply it to the oscillations of a symmetric linear triatomic molecule.

19. Derive the Hamilton's equations from a variational principle.

20. Briefly explain the Lorentz transformation equation in four dimensional spaces.

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S–5343	Sub. Code
	22MPH1C2

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

First Semester

Physics

MATHEMATICAL PHYSICS — I

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. State priori probability.

2. Define Poisson distribution.

3. Find the eigen values of the matrix $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$.

4. What is volume integral?

5. Write the basic concept of partial differential equation.

6. What do you mean by linear differential equation of the first order?

7. Define Laplace transform of a function $f(x)$.

8. What are types of singular points?

9. Define Fourier series.

10. Can you expand $f(x) = \tan x$ in a Fourier series.

Part B (5 × 5 = 25)

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

11. (a) Write down the important characteristics of a normal distribution.

Or

(b) If one card is drawn at random from a pack of 52 cards, what is the probability of getting a queen.

12. (a) Verify Cayley Hamilton's theorem for the matrix $A = \begin{pmatrix} 1 & 2 \\ 2 & -1 \end{pmatrix}$.

Or

(b) Write a short note on surface integral.

13. (a) Find the following differential equations $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 0$.

Or

(b) State and prove the Liouville differential equation.

14. (a) State and prove Cauchy integral formula.

Or

(b) Determine the poles and the residue at simple pole of the function $f(z) = \frac{z^2}{(z-1)^2 (z+2)}$.

15. (a) State some of the basic properties of Fourier transform.

Or

(b) Find the Sine and Cosine transforms of e^{-ax} $(a > 0)$.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Discuss in detail Poisson's distribution, some of the items manufactured in a factory, 2y is defective. What is the probability that there are 3 defective items in a sample of 100?

17. State and prove Stokes theorem.

18. Find the solution of the following differential equation by the method of Frobenius, $(1 - x^2)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + l(l+1)y = 0$ where l is a positive integer.

19. State and prove the Laurent's series.

20. Solve the Fourier series to represent $x - x^2$ from $x = -\pi$ to $x = \pi$.

S–5344

Sub. Code
22MPH1C3

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

First Semester

Physics

ELECTRONICS AND COMMUNICATION

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. What is a Zener diode? Draw the equivalent circuit of an ideal Zener in the breakdown region.
2. Define dynamic drain resistance rd for a JFET.
3. What is meant by virtual ground of an OPAMP?
4. Define
   (a) Resolution
   (b) Accuracy
5. What is active and passive transducer?
6. Define gauge factor of a stain gauge.
7. What is amplitude shift keying?
8. What is baud rate?
9. Define acceptance angle of optical fiber.
10. Write the conditions required for an orbit to be geostationary.

Part B (5 × 5 = 25)

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

11. (a) Describe construction, principle of operation of MOSFET with a neat diagram.

Or

(b) Explain the construction and working of TRIAC.

12. (a) Draw and explain the circuit of a integrator using OP-AMP.

Or

(b) Explain the operation of R-2R type DAC and derive the expression for the output voltage.

13. (a) Explain the construction and working of LVDT with the help of a neat diagram. Draw the I/P and O/P characteristics of LVDT.

Or

(b) Explain the working of Photoemissive transducer.

14. (a) State Sampling theorem. Explain Pulse Amplitude modulation.

Or

(b) Explain Frequency division Multiplexing.

15. (a) What is Telemetry? Explain its functioning.

Or

(b) What is Code Division multiplexing? Write down the features of CDMA. Explain principles of CDMA.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain the working of a tunnel diode. Draw the V-I characteristics of a tunnel diode and indicate the useful region in the curve.

17. Explain the dual slope of ADC.

18. Explain in detail working of piezoelectric transducer with neat equivalent circuit.

19. What is digital communication? Explain Frequency Shift keying.

20. Explain

    (a) Satellite orbits

    (b) Angle of inclination, descending mode, ascending mode.

S–5348	Sub. Code
	22MPH2C2

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

Second Semester

Physics

QUANTUM MECHANICS — I

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. What are the characteristics of a well behaved wave function?

2. Differentiate between expectation value and eigen value of an observable?

3. What is a linear operator?

4. Give the general uncertainty relation.

5. State Dirac delta function.

6. Define alpha emission.

7. What are the hydrogen orbitals?

8. Write the Schrodinger matrix representation of wave function.

9. State inclusion of spin.

10. Write the equation for Hartree Fock equation.

Part B (5 × 5 = 25)

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

11. (a) Briefly explain about expectation value.

Or

(b) Describe the principle of superposition of states in quantum mechanics.

12. (a) Discuss about Schwartz inequality.

Or

(b) What is Hermitian operator? Prove that momentum operator ($i\hbar \partial/\partial x$) is Hermitian.

13. (a) Explain what you understand by the term square potential barrier?

Or

(b) Discuss quantum mechanically the problem of a particle in a finite square potential well.

14. (a) Obtain on expression for three dimensional square well potential.

Or

(b) Write the Schrodinger equation for the motion of a particle in a spherically symmetric field in spherical polar coordinates.

15. (a) Discuss Hartree self consistent method for determining the potential energy V(r) in central field approximation.

Or

(b) Setup the Eigen functions for a two electron system.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Write the statement of Eirenfest's theorem and also prove.

17. Deduce the equation of motion in the momentum representation.

18. Set up Schrodinger equation for the one dimensional linear harmonic oscillator.

19. Set up Schrodinger equation for deuteron and discuss the solution of the equation.

20. Find an expression for the electron density n(r) in the Thomas Fermi model in terms of the Thomas Fermi function.

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S–5349	Sub. Code
	22MPH2C3

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

Second Semester

Physics

CONDENSED MATTER PHYSICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Define packing fraction.

2. Define the term symmetry operation.

3. Write characteristics of strain stress relation in cubic crystal.

4. How lattice vibrations are quantized?

5. What is Fermi surface?

6. What is de haas van Alphen effect?

7. What are Ferro electric substances?

8. List any to high T_c materials and their advantages.

9. Write difference between diamagnetism and paramagnetism.

10. What is ferrimagnetism?

Part B (5 × 5 = 25)

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

11. (a) What is reciprocal lattice? Discuss some of its important properties and show that the FCC lattice is the reciprocal of BCC lattice.

Or

(b) Explain Sodium chloride crystal structure.

12. (a) Give a brief account on analysis of elastic strain.

Or

(b) Describe the concept of phonons and its momentum.

13. (a) Discuss the Kronig penny model for the energy band structure of Solids.

Or

(b) What is the concept of effective mass? Obtain the effective mass of electron moving in a periodic potential.

14. (a) Explain different types of excitons.

Or

(b) Explain BCS theory of superconductivity.

15. (a) Explain the principle of cooling by adiabatic demagnetization.

Or

(b) What is Bloch wall? Calculate its thickness and the energy per unit area. What limits the thickness of thin wall?

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain the rotating crystal method of X ray diffraction.

17. Obtain the various vibrational modes of a linear monatomic lattice. Show that frequencies for the modes of propagation vector K and K+G are the same. Discuss the significance of the result.

18. What is Hall Effect? Find an expression for the hall coefficient of a metal and describe a experimental set up to measure it.

19. With necessary theory explain DC Josephson effect and AC Josephson effect.

20. What are the characteristics of Ferromagnet? Discuss the nature of their ferromagnetic carriers. Discuss the curie Weiss law for their susceptibility.

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S–5350

Sub. Code
22MPH2E1

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

Second Semester

Physics

Elective — MICROPROCESSOR AND MICROCONTROLLERS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is the significance of ALE in 8085 microprocessor?

2. What is the difference between hardware interrupt and software interrupt?

3. What are the ports available in 8255 peripheral device?

4. State the principle of Stepper motor control system.

5. How all the interrupts of microcontroller 8051 will be disabled at a time?

6. Give the flags available in 8051.

7. What are the I/O instructions used in 8051?

8. Write the interrupts of 8051 microcontroller.

9. What are direct and register indirect addressing modes of 8051?

10. Give the vector address for Timer 0 and Serial Communication interrupt.

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

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

11. (a) Discuss the different logic instructions in the instruction set of 8085 with examples.

Or

(b) Explain 8085 interrupt process and mention the difference between a maskable and non maskable interrupts.

12. (a) Draw and Explain the Architecture of 8253 Timer.

Or

(b) Explain in detail about operation of 8257 DMA Controller with neat diagram.

13. (a) Describe any two timer modes of 8051 microcontroller with a diagram.

Or

(b) Discuss the internal memory organization of 8051 microcontoller.

14. (a) Explain different JUMP and CALL instructions of 8051 microcontroller.

Or

(b) Write an Assembly Language Program of biggest and Smallest numbers.

15. (a) List the various instructions available in 8051 microcontorller.

Or

(b) Explain internal memory organization of 8051.

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

Answer any **three** questions.

16. Explain different types of addressing modes available in 8085 with an example for each.

17. What are the operating modes of 8255? Explain Programmable Peripheral interface 8255.

18. Explain the architecture of 8051 microcontroller.

19. What are the various addressing modes of 8051? Explain with Suitable example.

20. Explain the function and operating modes with the associated register of Timer / Counter in 8051 microcontoller.

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S–5352	Sub. Code
	22MPH2N1

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

Second Semester

Physics

NME — EVOLUTION OF PHYSICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. State Michael Faraday's law.

2. Define Alexandra Volta battery.

3. What is Morse code?

4. What is the meaning of MADDIDA?

5. Distinguish between micro ship and nano ship.

6. What is bipolar transistor?

7. What is the cloud storage?

8. Write the applications of blue ray disks.

9. Define Tiros 1 satellite.

10. What is the purpose of launching Apollo mission?

Part B (5 × 5 = 25)

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

11. (a) Write a short note on Kepler's celestial body.

Or

(b) Discuss about Otto von Guericke vacuum pump.

12. (a) Explain the digital revolution of super computer.

Or

(b) Elaborately discuss about digital computer and its uses.

13. (a) Describe the advantages and disadvantages of BJT.

Or

(b) Explain the features of integrated circuits.

14. (a) Write the characteristics, uses and advantages of magnetic tape.

Or

(b) Give an account of HD DVD and its uses.

15. (a) Explain in detail about Hubble space telescope.

Or

(b) Discuss about the GPS constellation.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Derive the Albert Einstein mass energy equivalence.

17. Explain the following

    (a) FM and

    (b) Modern computer

18. Briefly discuss about vacuum tube and its uses.

19. Describe in detail about blue ray disks and explain how does it work?

20. Discuss about the features of James Webb space telescope.

S–5353	Sub. Code
	22MPH3C1

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

Third Semester

Physics

QUANTUM MECHANICS – II

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. What are ladder operators? Why are they called so?

2. What are Clebsch-Gordon coefficients?

3. State Hellmann- Feynman theorem.

4. What do you understand by a classical turning point?

5. What is perturbation theory? When it is applied?

6. Define the two significant quantities of the time dependent perturbation.

7. What is scattering amplitude?

8. How is scattering amplitude related to scattering cross-section?

9. The Dimensions of Dirac's Matrices has to be even. Why?

10. What are negative energy states?

Part B (5 × 5 = 25)

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

11. (a) Derive matrices for the operators J^2, J_z, J_x and J_j for $j = 3/2$.

Or

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

12. (a) Explain the variational principle.

Or

(b) Explain the ground state of deuteron.

13. (a) Explain the perturbation theory that specifies the first order correction.

Or

(b) Obtain the Hamiltonian operator for a charged particle in an electromagnetic field.

14. (a) Derive an expression for Phase Shifts.

Or

(b) Explain the validity of Born approximation.

15. (a) Derive the Klein – Gordan relativistic wave equation of a free particle.

Or

(b) Prove that the operator $c\alpha$, where α stands for Dirac matrix, can be interpreted as the velocity operator.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Obtain the Clebsch- Gordan coefficients for a system having $j_1 = 1$ and $j_2 = \frac{1}{2}$.

17. Estimate the ground state energy of Helium atom using variation method.

18. Discuss the effect of Electric field on the ground state of Hydrogen.

19. Describe the partial wave analysis of scattering problem.

20. Obtain the Dirac's equation in an electromagnetic field.

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S–5354	Sub. Code
	22MPH3C2

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

Third Semester

Physics

NANOPHYSICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Define surface to volume ratio.

2. Define quantum confinement.

3. State Moore's law.

4. What is meant by the ball milling method?

5. What is called X -ray diffraction?

6. State the principle of Auger electron spectroscopy.

7. What is coulombic interaction in nanostructured particles?

8. Write quantum hall effect.

9. Write a short note on exciton.

10. Why do we need nano electronics?

Part B (5 × 5 = 25)

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

11. (a) What are nanomaterials? Explain the size dependent properties of nanomaterials.

Or

(b) Briefly explain the 3D, 2D and 1D nanostructures.

12. (a) Explain bottom up approach to synthesis the nanomaterials.

Or

(b) Discuss in detail about gas phase condensation.

13. (a) Describe the conceptual idea and advantages of XPS in treating the nanomaterials.

Or

(b) Compare STM and AFM techniques in analysing the nanoparticles.

14. (a) Write a short note on the following phenomenons:

(i) Absorption

(ii) Emission

(iii) Luminescence.

Or

(b) Explain the carrier transport in low dimensional system.

15. (a) What are the difference among on nanoparticles, nanowires and thin film.

Or

(b) Write brief notes on nanosensors with suitable examples.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe the concept of band structure and also express the density of states for nanomaterials.

17. Explain in detail the chemical vapour deposition to make a surface of thin film at nanoscale.

18. With a neat sketch describe the TEM instrument with its advantages.

19. Describe the SPR optical properties and how this will infer the nanostructure.

20. Give in detail the nanoelectrodes for battery applications.

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S–5355

Sub. Code
22MPH3C3

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

Third Semester

Physics

ELECTROMAGNETIC THEORY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions

1. Give the physical significance of curl.

2. State Gauss's Law.

3. State Ampere's circuital Law.

4. What is meant by magneto static energy?

5. Define motional EMF.

6. Write the differential and integral form of Maxwell's equation using Faradays law.

7. State the properties of uniform plane wave.

8. What is Brewster's angle?

9. What do you understand by cavity resonator?

10. Define anomalous dispersion.

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

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

11. (a) Discuss the applications of Gauss law in electrostatics.

Or

(b) Obtain the solution to Laplace equation in spherical polar coordinates.

12. (a) Explain Magnetic vector potential.

Or

(b) Explain the divergence and curl of a magnetic field.

13. (a) Derive the integral form of Maxwell's equation.

Or

(b) Discuss the boundary conditions of D, E, B and H.

14. (a) Derive Fresnel's equation.

Or

(b) Compare oblique incidence with normal incidence.

15. (a) List the difference between TE and TM Mode.

Or

(b) Explain the process of Thomson's scattering.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Give the Poisson equation and deduce the potential of a localized charged distribution.

17. State and explain Biot-Savart law.

18. Discuss in detail about Gauge transformations.

19. Explain the propagation of electromagnetic waves in a conducting Media.

20. Describe the progation of TE waves in rectangular wave guide and deduce the guide wavelength.

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S–5357

Sub. Code
22MPH4C1

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

Fourth Semester

Physics

THERMODYNAMICS AND STATISTICAL PHYSICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** the questions

1. State zeroth law of thermodynamics.
2. Define Enthalpy.
3. What is meant by mean free path?
4. Give the validity of Boltzmann transport equation.
5. What is a micro state of substances?
6. Define phase space.
7. Give any two postulates of quantum mechanics.
8. What is ideal gas?
9. Why is the transition from He I to He II known as lambda transition?
10. What are the drawbacks of Einstein's theory?

Part B (5 × 5 = 25)

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

11. (a) Discuss about the change of entropy in a reversible process.

Or

(b) Briefly explains the thermodynamics potentials.

12. (a) Deduce Maxwell — Boltzmann distribution of velocities.

Or

(b) Obtain binomial distribution equation using random walk problem.

13. (a) State and prove Liouville's theorem.

Or

(b) Explain micro canonical and grand canonical ensamples.

14. (a) Derive Bose Einstein distribution law.

Or

(b) Write a note on quantum statistical of identical particles.

15. (a) Explain the Einstein theory of specific heat of solids.

Or

(b) Describe specific heat anomaly of metals and its solutions.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Obtain on expression for Vander walls equation of state.

17. Explain Brownian motion. Give Einstein's theory of Brownian movement.

18. State and prove equipartition theorem.

19. Derive an expression for BE and FD statistics.

20. Describe the liquefaction of Helium gas.

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S–5359

Sub. Code
22MPH4C3

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024

Fourth Semester

Physics

NUCLEAR AND PARTICLE PHYSICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** the questions

1. Write any two properties of nuclear forces.
2. Give the drawbacks of liquid drop model.
3. Define gamma decay process.
4. Point out the three modes of beta radioactivity.
5. State Chain reaction.
6. What is controlled thermonuclear reaction?
7. When is the nuclear reaction said to be exoergic and endoergic?
8. What are the major conclusions that can be arrived from the partial wave analysis?
9. Draw Su(2) symmetry.
10. What is the strange behavior of kaons and hyperons?

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) Briefly explains the collective model.

12. (a) Briefly explain the working of semiconductor detector.

Or

(b) Explain the beta and gamma decay processes.

13. (a) Describe the power type reaction with neat diagram.

Or

(b) Comment on the controlled thermonuclear reactions.

14. (a) Derive an expression for the Q value of a nuclear reaction.

Or

(b) Write a short note on stripping and pick up reactions.

15. (a) Explain the CP violation in kaon decay.

Or

(b) Write a note on CPT theorem.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Explain the properties of ground state of deuteron and show that it is a loosely bounded system.

17. Explain the principle, construction and working of a scintillation counter.

18. Using liquid drop model, explain the Bohr wheelers theory of nuclear fission.

19. Obtain Breit Wigner formula for nuclear reaction.

20. Elaborate Gellmann — Nishijima formula.

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