Total No. of Printed Pages:02

SUBJECT CODE NO- NEPHR-01-2025

FACULTY OF SCIENCE AND TECHNOLOGY

EXAMINATION WINTER 2025

M.SC (FIRST YEAR) (SEM-I)

COMMON PAPER

SVECRM-401-RESEARCH METHODOLOGY(COMPULSORY)

[Time: 3:00 Hours] **[Max.Marks:45]**

"Please check whether you have got the right question paper."

N.B.
1. Question No. 1 is Compulsory.
2. Solve any TWO questions from Question No. 2 to 5.
3. Calculator and log table allowed.

Q.1 Write notes on: **5X3=15**

1. Research objectives
2. Features of good research designing
3. Editing processing operations
4. statistical measures in research
5. Variables

Q.2 1. Describe various steps involved in research. **08**

2. Explain types of research hypothesis. **07**

Q.3 1. Explain meaning and need of good research designing. **08**

2. Describe descriptive and fundamental types of research. **07**

Q.4 1. Calculate, mean, median and mode of the following data. **08**

Class Interval (CI)	Frequency (F)
50-54	2
45-49	5
40-44	8
35-39	7
30-34	10
25-29	5
20-24	9
15-19	2
10-14	1
5-9	1

2. Describe observation method for collection of primary data. **07**

Q.5 1. calculate chi square (x^2) value of the following data. **08**

Excellent	Average	Poor	Total
58	32	30	120

2. Explain in detail case study. **07**

This question paper contains **2** printed pages]

NEPHR—485—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (First Year) (First Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

PHYSICS

Paper SPHYE-401

(Electronic Devices)

(Wednesday, 24-12-2025) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—45

N.B. :— (1) *All* questions carry equal marks.

(2) Question No. **1** is compulsory.

(3) Solve any *two* questions from Q. No. **2** to Q. No. **5**.

(4) Figures to the right indicate full marks.

1. Attempt the following : 15

(*a*) Differentiate between *n*-type and *p*-type semiconductors.

(*b*) Explain the working of a photodiode.

(*c*) Write the symbol and truth table of NAND gate.

(*d*) Define differential Amplifier.

(*e*) Write *three* applications of IC555 timer.

P.T.O.

2.	(*a*)	Explain the construction and VI characteristics of SCR.	8
	(*b*)	Explain in detail MOSFET with neat diagram.	7
3.	(*a*)	Explain the construction and working of solar cell with V-I characteristics.	8
	(*b*)	Explain the construction and working of phototransistors.	7
4.	(*a*)	Explain Op-Amp as an adder and subtractor with circuit diagrams.	8
	(*b*)	Explain Op-Amp as comparator with suitable diagram.	7
5.	(*a*)	Explain with symbol and working of JK flip-flops and its truth-table.	8
	(*b*)	Write a detailed note on R-2R ladder DAC.	7

This question paper contains **3** printed pages]

NEPHR—88—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (First Year) (First Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

Paper SPHYC-401

(Mathematical Methods in Physics)

(Monday, 15-12-2025) **Time : 10.00 a.m. to 12.30 p.m.**

Time—2½ *Hours* *Maximum Marks*—60

N.B. :— (1) *All* questions carry equal marks.

(2) Question No. **1** is compulsory.

(3) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. **6**).

(4) Figures to the right indicate full marks.

1. Solve the following questions (each question **3** marks) : 15

(*a*) Write a short note on Hermitian matrices.

P.T.O.

(*b*) Show that :

$$\int_{-1}^{+1} P_n(x)dx = 0, \text{ if } n \neq 0.$$

(*c*) Show that :

$$\int_{-1}^{+1} P_n(x)dx = 2, \text{ if } n = 0.$$

(*d*) Explain Fourier cosine transforms.

(*e*) State and prove residue theorem.

2. (*a*) Examine for linear dependence [1, 0, 2, 1], [3, 1, 2, 1], [4, 6, 2, 4], [–6, 0, –3, –4] and find the relation between them. 8

(*b*) Explain Gram Schmidt Orthonormalization Process for orthonormalizing a set of vectors in an inner product space. 7

3. (*a*) Derive Rodrigue's formula : 8

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

(*b*) Prove that $J_n(x)$ is the coefficient of z^n in the expansion of $e^{\frac{x}{2}\left(z - \frac{1}{z}\right)}$. 7

4. (*a*) Find the Laplace transform of [4 cosh 2*t* sin 4*t*]. 8

(*b*) Find the Fourier transform of function e^{ax^2}, where $a > 0$. 7

5. (*a*) State and prove Taylor's theorem. 8

(*b*) Derive the necessary condition for $f(z)$ to be analytic. 7

6. Solve any *three* the following questions (each question **5** marks) : 15

(*a*) Prove that the inverse of a matrix is unique.

(*b*) Prove that :

$$x\mathrm{J}'_n = n\mathrm{J}^n - x\mathrm{J}_{(n+1)}.$$

(*c*) If $\mathrm{L}\{f(t)\} = \mathrm{F}(s)$, then $\mathrm{L}\{f(at)\} = \frac{1}{2}\mathrm{F}\left(\frac{s}{a}\right)$.

(*d*) Define the residue at a pole.

This question paper contains **3** printed pages]

NEPHR—311—2025

FACULTY OF SCIENCE

M.Sc. (First Year) (First Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

(SPHYC-403)

(Numerical Techniques and C-Programming)

(Monday, 22-12-2025) **Time : 10.00 a.m. to 12.30 p.m.**

Time—2½ *Hours* *Maximum Marks*—60

N.B. :— (1) Question No. **1** is compulsory.

(2) Solve any *three* questions from Q. No. **2** to Q. No. **6**.

(3) *All* questions carry equal marks.

(4) Use of scientific calculator is allowed.

(5) Figures to the right indicate full marks.

1. Solve the following questions (each question carries **3** marks) : 15

(*a*) State the principle of least squares.

(*b*) Using Simpson's rule, find :

$$\int_0^4 e^x dx$$

(Given : $e^0 = 1$, $e^1 = 2.72$, $e^2 = 7.39$, $e^3 = 20.09$ and $e^4 = 54.6$)

P.T.O.

(*c*) Find the inverse of

$$A = \begin{bmatrix} 1 & 3 \\ 2 & 7 \end{bmatrix}$$

by Gauss-Jordan method.

(*d*) Explain random numbers.

(*e*) Discuss synthetic division method.

2. (*a*) Find a root of equation 7

$$x^3 - 4x - 9 = 0$$

using the bisection method correct to three decimal places.

(*b*) Derive Newton's forward interpolation formula. 8

3. (*a*) Obtain an expression for Newton Cotes formula for numerical integration. 7

(*b*) Explain Euler's method in detail. 8

4. (*a*) On the basis of classification of partial differential equation, discuss the solution for the elliptical equation. 7

(*b*) Solve the following equation using Gauss-Seidel iteration method starting from (1, 1, 1) : 8

$$x_1 + x_2 + 2x_3 = 8$$

$$2x_1 + 3x_2 + x_3 = 12$$

$$5x_1 + x_2 + x_3 = 15.$$

5. (*a*) Explain compilers and interpreters in C-programming. 7

(*b*) Write a C-program for the addition of two 5 × 5 matrix. 8

6. Write short notes on (any *three*) : 15

(*a*) Newton-Raphson method

(*b*) Simpson's 3/8th rule

(*c*) Power method

(*d*) Random walk.

This question paper contains **3** printed pages]

NEPHR—88—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (First Year) (First Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

Paper SPHYC-401

(Mathematical Methods in Physics)

(Monday, 15-12-2025) **Time : 10.00 a.m. to 12.30 p.m.**

Time—2½ *Hours* *Maximum Marks*—60

N.B. :— (1) *All* questions carry equal marks.

(2) Question No. **1** is compulsory.

(3) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. **6**).

(4) Figures to the right indicate full marks.

1. Solve the following questions (each question **3** marks) : 15

(*a*) Write a short note on Hermitian matrices.

P.T.O.

(*b*) Show that :

$$\int_{-1}^{+1} P_n(x)dx = 0, \text{ if } n \neq 0.$$

(*c*) Show that :

$$\int_{-1}^{+1} P_n(x)dx = 2, \text{ if } n = 0.$$

(*d*) Explain Fourier cosine transforms.

(*e*) State and prove residue theorem.

2. (*a*) Examine for linear dependence [1, 0, 2, 1], [3, 1, 2, 1], [4, 6, 2, 4], [–6, 0, –3, –4] and find the relation between them. 8

(*b*) Explain Gram Schmidt Orthonormalization Process for orthonormalizing a set of vectors in an inner product space. 7

3. (*a*) Derive Rodrigue's formula : 8

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

(*b*) Prove that $J_n(x)$ is the coefficient of z^n in the expansion of $e^{\frac{x}{2}\left(z - \frac{1}{z}\right)}$. 7

4. (*a*) Find the Laplace transform of [4 cosh 2*t* sin 4*t*]. 8

(*b*) Find the Fourier transform of function e^{ax^2}, where $a > 0$. 7

5. (*a*) State and prove Taylor's theorem. 8

(*b*) Derive the necessary condition for $f(z)$ to be analytic. 7

6. Solve any *three* the following questions (each question **5** marks) : 15

(*a*) Prove that the inverse of a matrix is unique.

(*b*) Prove that :

$$x\mathrm{J}'_n = n\mathrm{J}^n - x\mathrm{J}_{(n+1)}.$$

(*c*) If $\mathrm{L}\{f(t)\} = \mathrm{F}(s)$, then $\mathrm{L}\{f(at)\} = \frac{1}{2}\mathrm{F}\left(\frac{s}{a}\right)$.

(*d*) Define the residue at a pole.

Total No. of Printed Pages:01

SUBJECT CODE NO- NEPHR-134-2025

FACULTY OF SCIENCE AND TECHNOLOGY

EXAMINATION WINTER 2025

M.SC. (FIRST YEAR) (SEM-II)

PHYSICS

STATISTICAL MECHANICS

[Time: 2:00 Hours] **[Max.Marks:60]**

"Please check whether you have got the right question paper."

N.B.
1. Question one is compulsory.
2. Solve any three questions from question number 2 to 6.
3. All questions carry equal marks.

Q.1 Solve the following questions (each question carry 3 marks) **15**

a) Show that the relation between entropy and the Partition function is S= $nK16/gz + E/T$.
b) Write a brief note on phase transition.
c) Explain the concept of liquid helium (He) and elementary excitations in liquid helium according to Landau's theory.
d) Explain the postulate of equal a priori probability.
e) Explain the difference between microstate and macrostate.

Q.2 a) Derive the Maxwell-Boltzmann distribution law for a classical ideal gas. **07**
b) Describe in detail the microcanonical, canonical, and grand canonical ensembles. **08**

Q.3 a) Explain white dwarf stars and Chandrasekhar mass limit. **07**
b) Obtain energy and pressure of a strongly degenerated fermi gases at T=0. **08**

Q.4 a) Derive the Bose-Einstein distribution law for indistinguishable bosons. **07**
b) Describe London's theory of super-fluidity. **08**

Q.5 a) Discuss Ising model in one dimension. **07**
b) Explain Brownian motion and fluctuations in displacement. **08**

Q.6 Write a note on (Solve any 3 each question carries 5 marks) **15**

a) Phase space
b) Photoelectric effect
c) Bose-Einstein condensation
d) Viral equation and viral coefficients.

This question paper contains **2** printed pages]

NEPHR—183—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (First Year) (First Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

Paper SPHYC-402

(Classical Mechanics)

(Wednesday, 17-12-2025) **Time : 10.00 a.m. to 12.30 p.m.**

Time—2½ *Hours* *Maximum Marks*—60

N.B. :— (1) *All* questions carry equal marks.

(2) Question No. **1** is compulsory.

(3) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. **6**).

(4) Figures to the right indicate full marks.

1. Solve the following questions (each question **3** marks) : 15

(*a*) State D'Alembert's principle

(*b*) Jacobi integral

(*c*) Rutherford scattering cross-section

P.T.O.

(*d*) Angular momentum of a rigid body

(*e*) Canonical transformation.

2. (*a*) Explain the term "virtual displacement" and state the principle of virtual work. 8

(*b*) What are constraints ? Explain the various types of constraints. Give their significance. 7

3. (*a*) Deduce Hamilton's equation of motion from Hamilton's principle. 8

(*b*) State and explain the virial theorem. 7

4. (*a*) State and prove Kepler's laws of planetary motion. 8

(*b*) Discuss the two-body central force problem. 7

5. (*a*) Euler's equation of motion for a rigid body. 8

(*b*) Explain stable and unstable equilibrium in detail. 7

6. Solve any *three* of the following (each question **5** marks) : 15

(*a*) Degrees of freedom

(*b*) Generalized momenta and cyclic coordinates

(*c*) Principle of least action

(*d*) Coordinate systems.

This question paper contains **3** printed pages]

NEPHR—311—2025

FACULTY OF SCIENCE

M.Sc. (First Year) (First Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

(SPHYC-403)

(Numerical Techniques and C-Programming)

(Monday, 22-12-2025) **Time : 10.00 a.m. to 12.30 p.m.**

Time—2½ *Hours* *Maximum Marks*—60

N.B. :— (1) Question No. **1** is compulsory.

(2) Solve any *three* questions from Q. No. **2** to Q. No. **6**.

(3) *All* questions carry equal marks.

(4) Use of scientific calculator is allowed.

(5) Figures to the right indicate full marks.

1. Solve the following questions (each question carries **3** marks) : 15

(*a*) State the principle of least squares.

(*b*) Using Simpson's rule, find :

$$\int_0^4 e^x dx$$

(Given : $e^0 = 1$, $e^1 = 2.72$, $e^2 = 7.39$, $e^3 = 20.09$ and $e^4 = 54.6$)

P.T.O.

(*c*) Find the inverse of

$$A = \begin{bmatrix} 1 & 3 \\ 2 & 7 \end{bmatrix}$$

by Gauss-Jordan method.

(*d*) Explain random numbers.

(*e*) Discuss synthetic division method.

2. (*a*) Find a root of equation 7

$$x^3 - 4x - 9 = 0$$

using the bisection method correct to three decimal places.

(*b*) Derive Newton's forward interpolation formula. 8

3. (*a*) Obtain an expression for Newton Cotes formula for numerical integration. 7

(*b*) Explain Euler's method in detail. 8

4. (*a*) On the basis of classification of partial differential equation, discuss the solution for the elliptical equation. 7

(*b*) Solve the following equation using Gauss-Seidel iteration method starting from (1, 1, 1) : 8

$$x_1 + x_2 + 2x_3 = 8$$

$$2x_1 + 3x_2 + x_3 = 12$$

$$5x_1 + x_2 + x_3 = 15.$$

5. (*a*) Explain compilers and interpreters in C-programming. 7

(*b*) Write a C-program for the addition of two 5 × 5 matrix. 8

6. Write short notes on (any *three*) : 15

(*a*) Newton-Raphson method

(*b*) Simpson's 3/8th rule

(*c*) Power method

(*d*) Random walk.

Total No. of Printed Pages:01

SUBJECT CODE NO- NEPHR-486-2025

FACULTY OF SCIENCE AND TECHNOLOGY

EXAMINATION WINTER 2025

M.SC. (FIRST YEAR) (SEM-I)

PHYSICS

ENERGY MANAGEMENT

[Time: 2:00 Hours] **[Max.Marks:45]**

"Please check whether you have got the right question paper."

N.B. 1. Question 1 is compulsory.
2. Solve any two questions from Question No. 2 to Question No. 5.

Q.1 Write a note on the following. (3 Marks each) **15**

a) Energy conversion devices
b) Electricity pricing in India
c) Types of energy audit
d) Energy plantation
e) Importance of energy conservation

Q.2 a) Explain the working of a hydroelectric power plant. **08**
b) Discuss in detail solar energy. **07**

Q.3 a) Explain in details the load curves. **08**
b) Describe how energy impacts economic development. **07**

Q.4 a) Define energy management. Explain its significance and objectives. **08**
b) Discuss the role of energy audit software in efficient energy use. **07**

Q.5 a) Compare base load, intermediate load, and peak load power plants. **08**
b) Explain the Energy management control systems. **07**

Total No. of Printed Pages:1

SUBJECT CODE NO:- NEPHR-43-2025
FACULTY OF SCIENCE & TECHNOLOGY
EXAMINATION WINTER 2025
M.Sc.(FIRST YEAR) (SEM –II)
PHYSICS
QUANTUM MECHANICS

[Time: 2:00 Hours] **[Max.Marks:60]**

"Please check whether you have got the right question paper."

N.B.
1) All questions carry equal marks
2) Q.1 is compulsory
3) Solve any three questions from Q.2 to Q.6
4) Figure to the right indicate full marks

Q.1 Solve the following questions **15**

1. State wave function and its physical significance.
2. Explain Stationary Perturbation theory.
3. Explain Spin Angular Momentum
4. Explain Centre of mass reference frame.
5. Explain ket and Bra notations.

Q.2 a) Explain and derive the Schrodinger's time independent wave equation. **08**
b) What is rotational symmetry and explain conservation of angular momentum. **07**

Q.3 a) State and explain Stark Effect in the ground state of H-atom. **08**
b) Explain Fermi-Golden Rule, Adiabatic and Sudden Approximations. **07**

Q.4 a) Explain the basic principle of Variational method and derive an equation of expectation value of energy in ground state. **08**
b) What is WKB approximations? Derive the connection formulae by using it. **07**

Q.5 a) What is mean by Identical Particles? Derive symmetric wave function for N-particle system. **08**
b) Explain the scattering by a perfectly rigid sphere and by a square well potential. **07**

Q.6 Write short notes on the following questions(Any three) **15**

1. Dirac Delta function and its properties
2. Clebsch_Gorden Coefficient
3. Slater's Determinant
4. Adiabatic and Sudden Approximations

This question paper contains **2** printed pages]

NEPHR—415—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (First Year) (Second Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

Paper SPHYE-451

(Atomic and Molecular Physics)

(Tuesday, 23-12-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—45

N.B. :— (1) *All* questions carry equal marks.

(2) Question No. **1** is compulsory.

(3) Solve any *two* of the remaining four questions (Q. No. **2** to Q. No. **5**).

(4) Figures to the right indicate full marks.

1. Solve the following questions (each question **3** marks) : 15

(*a*) L-S Coupling

(*b*) J-J Coupling

P.T.O.

(*c*) Symmetric top molecules

(*d*) Application of vibrational Spectroscopy

(*e*) Stock and Anti-Stock Shift in Raman Spectra.

2. (*a*) Explain Quantum Numbers Associated with Vector Atom Model. Explain the concept of spatial quantization and the spinning electron hypothesis in vector atom model. 8

(*b*) Write a note on Normal and Anomalous Zeeman Effect. 7

3. (*a*) Explain the Spectrum of a Non-Rigid Rotator. 8

(*b*) Explain Determination of Inter-Atomic Distances Using Isotopic Substitution. 7

4. (*a*) Graphical Representation of Morse curve and its explanation. 8

(*b*) Explain Born-Oppenheimer approximation. 7

5. (*a*) Selection Rules for Raman Lines. 8

(*b*) Discuss the Raman spectra of symmetric top molecule. 7

This question paper contains **2** printed pages]

NEPHR—416—2025

FACULTY OF SCIENCE

M.Sc. (First Year) (Second Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

Paper SPHYE-452

(Computational Physics)

(Tuesday, 23-12-2025) **Time : 10.00 a.m. to 12.00 Noon**

Time—2 *Hours* *Maximum Marks*—45

N.B. :— (1) *All* questions carry equal marks.

(2) Question No. **1** is compulsory.

(3) Solve any *two* of the remaining four questions (Q. No. **2** to Q. No. **5**).

(4) Figures to the right indicate full marks.

1. Solve the following questions (each question **3** marks) : 15

(*a*) Explain Hermitian Matrix with an example.

(*b*) Discuss about Assessing, Randomness and uniformity.

P.T.O.

(*c*) Write a short note on Significant Figures.

(*d*) Write a short note on Radioactive Decay.

(*e*) Explain the difference between Print and String in python programming.

2. Explain the different types of decay in detail. 15

3. Explain simulation of single particle motion and visualization in 2D & 3D trajectories. 15

4. Write short notes on : 15

(*a*) Floating Point arithmetic

(*b*) Rounding off Errors

(*c*) Accuracy in the evaluation of formulas.

5. Explain interpolation and curve fitting in detail with an example. 15

This question paper contains **2** printed pages]

NEPHR—20—2025

FACULTY OF SCIENCE

M.Sc. (Second Year) (Third Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

Paper SPHYC501

(Electrodynamics)

(Friday, 12-12-2025) **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 *Hours* *Maximum Marks*—80

N.B. :— (1) *All* questions carry equal marks.

(2) Question No. **1** is compulsory.

(3) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. **6**).

(4) Figures to the right indicate full marks.

1. Solve the following questions (each question carries **5** marks) : 20

(*a*) Derive the electromagnetic wave equations from Maxwell's field equations in conducting medium.

(*b*) Write a short note on Brewster's angle.

P.T.O.

(*c*) Derive an expression for the resultant electric intensity due to an array of antennae.

(*d*) Explain the 4-vectors in electrodynamics.

2. (*a*) Obtain the Poynting's theorem for the conservation of energy in electromagnetic fields. 10

(*b*) State and explain the Maxwell's fields equations for the electromagnetic fields. 10

3. (*a*) Derive the Fressnel's equation for the reflected in case of electric field normal to the plane of incident. 10

(*b*) Discuss the phenomenon of total internal reflection on the basis of Maxwell's fields equations. 10

4. (*a*) Derive expressions for the field radiated by an accelerated charged particle at high velocities. 10

(*b*) Derive Lienard radiation formula by using Larmor formula. 10

5. (*a*) Discuss in detail electromagnetic field tensor. 10

(*b*) Explain the 4-potential and 4-current in electrodynamics. 10

6. Write short notes on (each questions carries **5** marks) : 20

(*a*) Lorentz gauge

(*b*) Rectangular wave guides-TM modes

(*c*) Larmor Formula

(*d*) Length contraction.

This question paper contains **2** printed pages]

NEPHR—184—2025

FACULTY OF SCIENCE

M.Sc. (Second Year) (Third Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

PHYSICS

Paper SPHYC-503A

(Electronic-I : Microwave Devices)

(Wednesday, 17-12-2025) **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 *Hours* *Maximum Marks*—80

N.B. :— (1) *All* questions carry equal marks.

(2) Question No. **1** is compulsory.

(3) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. **6**).

(4) Figures to the right indicate full marks.

1. Solve the following questions (each question carries **5** marks) : 20

(*a*) Discuss propagation constant and losses in transmission line.

(*b*) Draw the schematic of TRAPATT diode and explain its operation in brief.

(*c*) With neat diagram describe E-plane Tee.

(*d*) Discuss factors affecting range of Radar.

P.T.O.

2. (*a*) What do you mean by standing wave ? Explain standing wave ratio and VSWR in brief. 10

(*b*) Explain Smith chart along with its applications. 10

3. (*a*) What are transferred electron devices ? Explain principle of operation of Gunn diode. 10

(*b*) With schematic diagram describe velocity modulation and bunching process in two cavity klystron. 10

4. (*a*) Enlist microwave Tee junctions and with neat diagram explain construction and working of magic tee. 10

(*b*) Draw the neat diagram of two hole directional coupler and explain construction and working of it. 10

5. (*a*) Draw the block diagram of pulsed Radar system and describe each block. 10

(*b*) With neat block diagram explain the working of CW Doppler Radar. 10

6. Write short notes on (each question carries **5** marks) : 20

(*a*) Types of microwave transmission line

(*b*) Microwave transistors

(*c*) Wave guide termination

(*d*) Maximum unambiguous range of Radar.

This question paper contains **2** printed pages]

NEPHR—185—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Second Year) (Third Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

PHYSICS

Paper SPHYC-503B

(Fiber Optics and Amp. Lasers-I)

(Wednesday, 17-12-2025) **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 *Hours* *Maximum Marks*—80

N.B. :— (1) Question No. **1** is compulsory.

(2) Attempt any *three* questions from Q. No. **2** to Q. No. **6**.

(3) *All* questions carry equal marks.

(4) Symbols have their usual meaning in the subject.

1. Solve the following questions : 20

(*a*) Describe the basic structure of optical fiber. Explain different types of optical fiber.

(*b*) Describe the vapour phase deposition technique of a fiber fabrication.

(*c*) Write a note on Mono-chromaticity and coherence of LASER light.

(*d*) Give applications of lasers in ranging and navigation.

P.T.O.

2. (*a*) What is NA (Numerical Aperture) of a fiber ? Calculate NA of a fiber if refractive index of the core and cladding is 1.55 and 1.50 respectively. 10

(*b*) Explain different types of losses in an optical fiber. 10

3. (*a*) Explain in detail the modified chemical vapour deposition technique. 10

(*b*) Describe the fiber drawing technique in detail. 10

4. (*a*) Explain 2-level and 3-level systems for laser action. 10

(*b*) Explain the Electrical pumping and optical pumping process. 10

5. (*a*) Write a note on the applications of LASER in machining. 10

(*b*) Give various medicinal and industrial applications of LASER. 10

6. Write short notes on the following : 20

(*a*) Acceptance angle

(*b*) Liquid Phase (Melting) technique of fiber synthesis

(*c*) Neodymium laser

(*d*) Lasers in communication.

This question paper contains **3** printed pages]

HR—257—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Second Year) (Third Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(New/CBCS Pattern)

INORGANIC CHEMISTRY

Paper XVI (CH-534/1)

(Analytical Chemistry)

(Monday, 22-12-2025) **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 *Hours* *Maximum Marks*—75

N.B. :— (1) *All* questions are compulsory.

(2) Figures to the right indicate full marks.

1. Solve any *three* of the following : 15

(*a*) Explain the determination of Fat from foods.

(*b*) What is Octane number ? Explain the method to determine it.

(*c*) Give the classification of drugs with examples.

P.T.O.

(*d*) Give the importance of starch in daily diet and mention the method to analyse it.

(*e*) Discuss the determination of radioactive waste from water.

2. Answer any *three* of the following : 15

(*a*) Explain the principle and functioning of chronopotentiometry.

(*b*) What is Flash point ? Give a method to determine it.

(*c*) Explain Hardness of water and discuss a method to determine it.

(*d*) Comment on enzyme catalysed reaction.

(*e*) Give the composition of blood.

3. Solve the following :

(*a*) Explain the method to determine blood urea nitrogen. 8

Or

Discuss the methods to determine the alkalinity of water.

(*b*) What are Amperometric titrations ? Give applications of it. 7

Or

Discuss Proximate analysis of fuels.

4. Answer the following :

(*a*) Explain anodic and cathodic stripping voltametry and state its applications. 8

Or

Describe in detail the method to determine BOD.

(*b*) Discuss the method to determine total nitrogen from soil. 7

Or

Explain what is Aniline point and give a method to determine it.

5. Write short notes on any *three* : 15

(*a*) Food adulteration

(*b*) Narcotic drugs

(*c*) COD

(*d*) Randle's Sevick equation.

This question paper contains **2** printed pages]

NEPHR—312—2025

FACULTY OF SCIENCE

M.Sc. (Second Year) (Third Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP 2020)

PHYSICS

Paper–SPHYE-501

(Astrophysics-I)

(Monday, 22-12-2025) **Time : 2.00 p.m. to 4.30 p.m.**

Time—2½ *Hours* *Maximum Marks*—60

N.B. *:—* (*i*) *All* questions carry equal marks.

(*ii*) Question No. **1** is compulsory.

(*iii*) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. **6**).

(*iv*) Figures to the right indicate full marks.

1. Solve the following questions (each question carries **5** marks) : 15

(*a*) Discuss VLA and VLBI technique.

(*b*) Explain Synchrotorn emission for single electron.

(*c*) Solar neutrino puzzle.

P.T.O.

2. (*a*) Explain horizon and equatorial co-ordinate system. 8

(*b*) Explain X-ray detector and Chandra telescope. 7

3. (*a*) Define flux density. Obtain Wien's displacement law. 8

(*b*) Discuss emission and absorption coeffcient in radiative mechanism. 7

4. (*a*) What is H-R diagram ? Discuss its salient features. 8

(*b*) Define the terms intensity, flux, colour index, stellar temperature and luminosity. How are flux, intensity and luminosity relate one another ? 7

5. (*a*) What are open and globular clusters ? How to they differ ? Explain their properties with the help of H-R diagram. 8

(*b*) Discuss in detail sunspots and sunspot cycle. 7

6. Write short notes on (each question carries **5** marks) : 15

(*a*) Various focusing methods in optical telescope

(*b*) Formation of spectral lines in stars

(*c*) Degeneracy pressure.

Total No. of Printed Pages:01

SUBJECT CODE NO- NEPHR-313-2025

FACULTY OF SCIENCE AND TECHNOLOGY

EXAMINATION WINTER 2025

M.SC (SECOND YEAR) (SEM-III)

PHYSICS

MATERIAL SCIENCE-I

[Time: 3:00 Hours] **[Max.Marks:80]**

"Please check whether you have got the right question paper."

N.B.
i) All questions are carry equal marks.
ii) Question 1 is compulsory.
iii) Solve ANY THREE of the remaining Five Questions (Q.2 to Q.6).
iv) Figures to the right indicates full marks.

Q1 Solve the following questions (Each question carries 5 marks) **20**

a) Define phase, component, and degree of freedom with examples.
b) Discuss the effect of temperature and concentration on diffusion in solids.
c) Explain the working principle of a Penning gauge and its applications.
d) Describe the Czochralski crystal pulling method.

Q2 a) Draw and explain the Fe-Fe3C phase diagram. **10**

b) Explain Silver-Copper system in detail. **10**

Q3 a) Describe Freundlich and Langmuir adsorption isotherms. **10**

b) Explain physical and chemical adsorption with examples. **10**

Q4 a) Explain the working principle of a turbo-molecular pump. **10**

b) Describe Dip coating and Spin coating deposition techniques for thin films. **10**

Q5 a) Explain nucleation and growth stages in solution growth techniques. **10**

b) Discuss the hydrothermal and flux growth techniques. **10**

Q6 Write short notes on the following (Each question carries 5 marks) **20**

a) Binary eutectic system (Pb-Sn)
b) Fick's first and second laws of diffusion
c) Physical vapour deposition (PVD) advantages
d) Verneuil flame fusion method

This question paper contains **3** printed pages]

NEPHR—314—2025

FACULTY OF SCIENCE

M.Sc. (NEP) (Second Year) (Third Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

PHYSICS

Paper-SPHYE–501

(Nano Physics)

(Monday, 22-12-2025) **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 *Hours* *Maximum Marks*—80

N.B. *:—* (*i*) *All* questions carry equal marks.

(*ii*) Question No. **1** is compulsory.

(*iii*) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. **6**).

(*iv*) Figures to the right indicate full marks.

1. Solve the following questions (Each equation **5** marks) : 20

(*a*) Explain nanoscience and nanotechnology.

(*b*) Discuss stresses in thin films.

(*c*) Explain thermal evaporation method.

(*d*) Explain *four* probe resistivity techniques.

P.T.O.

2. Solve the following questions (Each subquestion **10** marks) : 20

(*a*) Explain one-dimensional nanostructures in detail.

(*b*) Discuss physical and chemical properties of two-dimensional nanostructures.

3. Solve the following questions (Each subquestion **10** marks) : 20

(*a*) Describe the optical properties of nanomaterials.

(*b*) Explain in detail quantum size effect in semiconductor.

4. Solve the following questions (Each subquestion **10** marks) : 20

(*a*) What is Thin Film Deposition ? Explain different thin film deposition techniques.

(*b*) Explain the hydrothermal and solvothermal synthesis methods.

5. Solve the following questions (Each subquestion **10** marks) : 20

(*a*) What are the principles of X-ray diffraction ? How can crystalline size be determined using the Deby-Scherrer equation ?

(*b*) What is Transmission Electron Microscope (TEM), and how does it work ? Discuss its key features and applications in various fields.

6. Write short notes on (Each **5** marks) : 20

(*a*) Carbon Fullerence

(*b*) Surface plasmon resonance in metal nanoparticles

(*c*) Spray pyrolysis

(*d*) Scanning electron microscope.

Total No. of Printed Pages:1

SUBJECT CODE NO:- NEPHR-44-2025
FACULTY OF SCIENCE & TECHNOLOGY
EXAMINATION WINTER 2025
M.Sc.(SECOND YEAR) (SEM –IV)
(COMMON PAPER)
RESEARCH PUBLICATION ETHICS (NEPPE - 1002)

[Time: 2:00 Hours] **[Max.Marks:40]**

"Please check whether you have got the right question paper."

N.B. i) Question number 1 is compulsory.
ii) Solve any three questions from Question NO.2 to 6.

Q1 Explain: **5×2=10**
a) Nature of philosophy
b) Intellectual honesty
c) World association of medical editor's.
d) Open access publications.
e) Web of Science

Q2 a) What do you mean by philosophy? Gives the IR branches. **2x5=10**
b) Write an essay on scientific misconduct.

Q3 a) Define publication ethics? Why publication of research paper is important. Explain. **2x5=10**
b) SHERPA / ROMEO is an excellent online resource. Explain.

Q4 a) What are predatory Journals? How to identify a predatory Journals! **2×5=10**
b) What is impact Factor? How it calculate? Explain it with suitable example.

Q5 a) Give an account on violation of publications ethics. **2x5=10**
b) What is plagiarism? Describe different software of plagiarism.

Q6 Write short notes on: **4×2.5=10**
a) Scope of ethics
b) Salami slicing
c) Springer
d) h-index

This question paper contains **3** printed pages]

NEPHR—135—2025

FACULTY OF SCIENCE

M.Sc. (NEP) (Second Year) (Fourth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

PHYSICS

Paper-SPHYC–551

(Energy Studies)

(Tuesday, 16-12-2025) **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 *Hours* *Maximum Marks*—80

N.B. :— (*i*) *All* questions carry equal marks.

(*ii*) Question No. **1** is compulsory.

(*iii*) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. **6**).

(*iv*) Figures to the right indicate full marks.

1. Solve the following questions (Each question **5** marks) : 20

(*a*) What are conventional energy sources ? Explain in detail with example.

(*b*) Explain the basic principles behind tidal energy generation.

(*c*) Discuss the concept of mini and micro-hydropower systems.

(*d*) Discuss the importance of habitat preservation in natural resource management.

P.T.O.

2. Solve the following questions (Each sub-question **10** marks) : 20

(*a*) Explain the process of nuclear energy generation. What are the challenges and benefits of using nulear energy for power generation ?

(*b*) What are thin-film solar cells, and how to they differ from silicon solar cells in terms of material usage, efficiency and manufacturing processes ?

3. Solve the following questions (Each sub-question **10** marks) : 20

(*a*) Explain the basic principle of working of a fuel cell. Discuss how the electrochemical process in a fuel cell converts chemical energy into electrical energy.

(*b*) Discuss the construction and design of a typical wave power device. How are the components such as buoys, turbines, and generators integrated to harness and convert wave energy into electrical energy ?

4. Solve the following questions (Each sub-questions **10** marks) : 20

(*a*) Describe the various types of biomass conversion processes. How do physical, chemical and biological processes contribute to transforming biomass into usable energy ?

(*b*) Explain the classification of water turbines.

5. Solve the following questions (Each sub-question **10** marks) : 20

(*a*) Discuss the different types of natural resources. Explain the importance of each type in the context of energy production and sustainability.

(*b*) Explain the role of bio-based resources in sustainable development. Discuss how biofuels, biomass, and plant-based products can replace fossil fuels in energy production, transportation and industry.

6. Write short notes on (Each question **5** marks) : 20

(*a*) Non-conventional energy sources

(*b*) Barrage and Non-Barrage Tidal power systems

(*c*) Geothermal Electricity

(*d*) Energy conservation legislation and energy policy.

This question paper contains **3** printed pages]

NEPHR—417—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Second Year) (Fourth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

Paper-SPHYE-551A

(Astrophysics-II)

(Tuesday, 23-12-2025) **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 *Hours* *Maximum Marks*—80

N.B. :— (*i*) *All* questions carry equal marks.

(*ii*) Question No. **1** is compulsory.

(*iii*) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. 6).

(*iv*) Figures to the right indicate the full marks.

1. Solve the following questions (each question carries **5** marks) : 20

(*a*) Explain shape and size of the Milky Way. 5

(*b*) Explain Hubble law of expanding universe. 5

P.T.O.

(*c*) Explain metric tensor and its properties. 5

(*d*) Explain the concept of Gravitational wave. 5

2. Solve the following questions (each question carries **10** marks) : 20

(*a*) Explain the physics of spectroscopic binaries. Discuss how their study enables us to estimate mass of the stars. 10

(*b*) Discuss different components of the Milky Way. Explain characteristics of its different components. 10

3. Solve the following questions (each question carries **10** marks) : 20

(*a*) Explain Hubble tuning fork diagram. 10

(*b*) Explain extra-galactic distance scale. 10

4. Solve the following questions (each question carries **10** marks) : 20

(*a*) Explain Ricci and Einstein tensor. 10

(*b*) Derive an Einstein Field Equations. 10

5. Solve the following questions (each question carries **10** marks) : 20

(*a*) Calculate the luminosity distance for the Einstein de Sitter universe. 10

(*b*) Derive the Friedmann's equations for flat Universe. 10

6. Write short notes on (**5** marks each) : 20

(*a*) Explain eclipsing binary 5

(*b*) Write a note on elliptical galaxy 5

(*c*) Explain the concept of curved space and space time 5

(*d*) Explain the principle of generation of gravitational wave 5

This question paper contains **3** printed pages]

NEPHR—418—2025

FACULTY OF SCIENCE

M.Sc. (Second Year) (Fourth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

Paper-SPHYE-551

(Material Science-II)

(Tuesday, 23-12-2025) **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 *Hours* *Maximum Marks*—80

N.B. :— (*i*) *All* questions carry equal marks.

(*ii*) Question No. **1** is compulsory.

(*iii*) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. 6).

(*iv*) Figures to the right indicate the full marks.

P.T.O.

1. Solve the following questions : 20

(*a*) What is the quantum size effect and how does it influence the properties of nanomaterials ?

(*b*) Explain the different types of ceramics and their applications in various industries.

(*c*) Explain the degree of polymerization (DP) and its effect on the physical properties of a polymer.

(*d*) Explain the working principle of Scanning Electron Microscopy (SEM). What are its advantages and limitations in terms of sample analysis ?

2. (*a*) Explain the different synthesis methods for nanoparticles and discuss their various applications. 10

(*b*) What are nanomaterials ? Explain the different classifications of nanomaterials along with their properties. 10

3. (*a*) Explain the ZrO_2-CaO phase diagram, highlighting the key phases, transition and applications of this system. 10

(*b*) Explain Griffith's theory of ceramics in detail. How does it describe the relationship between cracks and the fracture of ceramics ? 10

4. (*a*) What are thermoplastic polymers and thermosetting polymers ? Compare and contrast their properties, applications and behavior upon heating. 10

(*b*) Describe the applications of polymers in coatings, adhesives, films and foams. How do these polymers improve the functionality of these products ? 10

5. (*a*) Explain Bragg's law in X-ray Diffraction (XRD) and discuss its various applications. 10

(*b*) What is Atomic Absorption Spectroscopy (AAS) used for ? Explain the principle and working of Atomic Absorption Spectroscopy (AAS). 10

6. Write short notes on : 20

(*a*) Magic Numbers

(*b*) Biosensors

(*c*) Describe the mechanisms of Polymerization

(*d*) Explain Electron Spin Spectroscopy (ESR).

This question paper contains **3** printed pages]

NEPHR—419—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Second Year) (Fourth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2025

(NEP-2020)

PHYSICS

Paper-SPHYE-551

(Electronics Instrumentation)

(Tuesday, 23-12-2025) **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 *Hours* *Maximum Marks*—80

N.B. :— (*i*) *All* questions carry equal marks.

(*ii*) Question No. **1** is compulsory.

(*iii*) Solve any *three* of the remaining five questions (Q. No. **2** to Q. No. 6).

(*iv*) Figures to the right indicate full marks.

P.T.O.

1. Solve the following questions (each question carries **5** marks) : 20

   (*a*) What do mean by error ? Give its types.

   (*b*) Explain the photoelectric transducer.

   (*c*) Describe Digital Multimeters (DMM).

   (*d*) Explain the sample and hold circuit.

2. Solve the following questions (each question carries **10** marks) : 20

   (*a*) State and explain the static instrument characteristics.

   (*b*) Discuss the importance of measurements.

3. Solve the following questions (each question carries **10** marks) : 20

   (*a*) Explain in detail thermistor temperature transducer with suitable neat diagram.

   (*b*) Define transducer and give its types. Explain the classification of transducers.

4. Solve the following questions (each question carries **10** marks) : 20

   (*a*) Explain the pH measurements and pH meter.

   (*b*) Discuss in detail the digital storage oscilloscope.

5. Solve the following questions (each question carries **10** marks) : 20

(*a*) Describe the X-Y recorder in detail with neat digram.

(*b*) Explain in detail basic elements of acquisition system.

6. Write short notes on (**5** marks each) : 20

(*a*) Purpose of instrumentation

(*b*) Inductive transducer

(*c*) Lock in amplifier

(*d*) Magnetic tape recorder.