NEPWT—1001—2024

FACULTY OF SCIENCE AND TECHNOLOGY

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

NOVEMBER/DECEMBER, 2024

(NEP-2020)

RESEARCH METHODOLOGY

(Tuesday, 10-12-2024)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 *Hours*   *Maximum Marks*—60

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

(*ii*)   Of the remaining solve any *three* questions.

(*iii*)   Calculator and log table is allowed.

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

(*a*)   Motivation in research

(*b*)   Need for research designing

(*c*)   ANOCOVA

(*d*)   Statistical measure in research.

2.   (*a*)   What do you mean by research ? Describe the different steps involved in a research process.   8

(*b*)   Discuss the observation method as a technique of data collection. 7

P.T.O.

3. (*a*) Calculate the mean, median and mode of the following data : 8

3, 6, 3, 7, 4, 3, 9

(*b*) Draw the flow diagram for hypothesis testing. 7

4. (*a*) What is Sampling ? Explain steps in sample design. 8

(*b*) Calculate the chi-square value of the following data : 7

Fully Agree	Not Sure	Not Agree	Total
102	108	75	285

5. (*a*) Define case study. Give their characteristics. 8

(*b*) Explain dependent and independent variables. 7

6. Write short notes on : 15

(*a*) Fundamental type of research

(*b*) Parametric test

(*c*) Secondary data sources.

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

NEPWT—339—2024

FACULTY OF SCIENCE

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

NOVEMBER/DECEMBER, 2024

(NEP 2020 Pattern)

PHYSICS

Paper SPHYE401

(Electronic Devices)

(Thursday, 19-12-2024)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 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 carries **5** marks) :   15

(*a*) Explain *p* and *n*-type semiconductor.

(*b*) Explain in brief IV characteristics of solar cell.

(*c*) Draw block diagram of 4 : 1 multiplexer and explain in brief.

P.T.O.

2. (*a*) What is SCR ? Explain its structure and characteristics. 8

    (*b*) Explain principle and working of MOSFET. 7

3. (*a*) What are photoconductive cell ? Explain in brief its working. 8

    (*b*) Explain working and applications of photodiode. 7

4. (*a*) Explain how op-amp can be used as inverting amplifier and give the equation of voltage gain. 8

    (*b*) With neat circuit diagram explain op-amp as integrator. 7

5. (*a*) Define counters. Explain in brief 2-bit synchronous counter. 8

    (*b*) Draw the symbols and truth tables for AND, OR and NOT gates. 7

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

    (*a*) Gunn diode

    (*b*) Op-amp as high pass filter

    (*c*) LED.

NEPWT—61—2024

FACULTY OF SCIENCE

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

NOVEMBER/DECEMBER, 2024

PHYSICS

Paper SPHYC-401

(Mathematical Methods in Physics)

(Thursday, 12-12-2024)   **Time : 10.00 a.m. to 1.00 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 :   20

(*a*) Symmetric and skew-symmetric with suitable examples.

(*b*) Rodrigues formula and Laguerre's polynomial.

(*c*) Fourier series for discontinuous function.

(*d*) Complex function and relation between circular and hyperbolic function.

P.T.O.

2.   (*a*)   Discuss inverse of a matrix and find the inverse of the following matrix :   20

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

  (*b*)   Find the eigen values and eigen vectors of the following matrix :

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 0 \\ 0 & 4 & 5 \end{bmatrix}$$

3.   (*a*)   Show that :   20

    (*i*) $J_{\frac{1}{2}}(x) = \sqrt{\dfrac{2}{\pi x}} \sin x$

    (*ii*) $J_{\frac{-1}{2}}(x) = \sqrt{\dfrac{2}{\pi x}} \cos x$

  (*b*)   Obtain the orthogonality condition of Legendre polynomial.

4.   (*a*)   Define the Fourier series and Fourier coefficient and find the values of a_0, a_n and b_n in the interval 0 to 2π.   20

  (*b*)   Explain the change of scale property of Laplace transform and find the Laplace transform of :

    (*i*) $f(t) = e^{at} \cosh bt$

    (*ii*) $f(t) = e^{-at} \sinh bt.$

5. (a) Show that the sufficient condition for a function $f(z) = u + iv$ to be analytic at all points in the region 'R' are : 20

(i) $\dfrac{\partial u}{\partial x} = \dfrac{\partial v}{\partial y}$

(ii) $\dfrac{\partial u}{\partial y} = -\dfrac{\partial v}{\partial x}$

(iii) $\dfrac{\partial u}{\partial x}, \dfrac{\partial u}{\partial y}, \dfrac{\partial v}{\partial x}, \dfrac{\partial v}{\partial y}$

are continuous functions of x and y in the region 'R'.

(b) Show that the function $u(x, y) = \dfrac{1}{2}\log(x^2 + y^2)$ is harmonic and find its conjugate harmonic and also check the given function is analytic or not :

$$f(z) = \sin z.$$

6. Write short notes on : 20

(a) Gram-Schmidt's orthogonalization process

(b) Generating function of Bessel polynomial

(c) Fourier complex integral

(d) Types of singularity.

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

NEPWT—127—2024

FACULTY OF SCIENCE AND TECHNOLOGY

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

NOVEMBER/DECEMBER, 2024

(NEP-2020 Pattern)

PHYSICS

SPHYC-402

(Classical Mechanics)

(Saturday, 14-12-2024)   **Time : 10.00 a.m. to 1.00 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 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) :   20

(*a*) Explain conservative and non-conservative forces.

(*b*) Write Gauge transformation for Lagrangian.

(*c*) What is Poisson's Brackets ? Write its properties.

(*d*) What is stable and unstable equilibriams ?

P.T.O.

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

   (*a*) Explain in detail Galilean Transformations.

   (*b*) What is Cyclic-Coordinates and degree of freedom ?

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

   (*a*) Derive Lagrangian equation of motion from D'Alembert's principle.

   (*b*) Derive Lagrangian equation from variational principle.

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

   (*a*) Explain Derivation of Hamiltonian equations of motion from Hamiltonian principle.

   (*b*) Explain reduction of two body problem in one body problem.

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

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

   (*b*) What are normal coordinates ? Also explain normal modes and normal frequencies of vibrations.

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

   (*a*) D'Alembert's principle

   (*b*) Jacobi Integral

   (*c*) Poisson Brackets

   (*d*) Rotational K.E. of a body.

NEPWT—194—2024

FACULTY OF SCIENCE

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

NOVEMBER/DECEMBER, 2024

PHYSICS

SPHYC–403

(Numerical Techniques and C-Programming)

(Tuesday, 17-12-2024)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 Hours   *Maximum Marks—80*

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

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

(*iii*)   Each question carries equal marks.

(*iv*)   Use of scientific calculator is allowed.

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

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

(*a*)   Discuss synthetic division method to obtain roots of a polynomial equation

(*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 $e^4 = 54.6$)

(*c*)   Find the inverse of $A = \begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$ by Gauss-Jordan method.

P.T.O.

  (*d*) What are random numbers ? How are random numbers generated in C-programming ?

2. (*a*) Find a root of the equation $x^3 - 4x - 9 = 0$, using the bisection method correct to three decimal places. **10**

  (*b*) Describe principle of least square fit method to fit the data into a straight line. **10**

3. (*a*) Obtain an expression for Newton Core's formula for the numerical integration. **10**

  (*b*) Use Euler's method to solve the differential equation $\dfrac{dy}{dx} = x + y$, $y(0) = 0$ to find the value of y at $x = 1.0$ taking $h = 0.2$. **10**

4. (*a*) On the basis of classification of Partial differential equation, discuss the solution for the elliptic equation. **10**

  (*b*) Solve the following equations using Gauss-Seidel iteration method starting from (1, 1, 1) : **10**

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

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

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

5.   (*a*)   Discuss about compilers and interpreters in C-programming.   10

       (*b*)   Write a C-program for the addition of two 5×5 matrix.   10

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

       (*a*)   Linear interpolation

       (*b*)   Taylor series method

       (*c*)   Power method

       (*d*)   Executable and non-executable functions in C-programming.

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

NEPWT—297—2024

FACULTY OF SCIENCE

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

NOVEMBER/DECEMBER, 2024

PHYSICS

SPHYE-451

(Atomic and Molecular Physics)

(Wednesday, 18-12-2024)　　　　　　　　　　**Time : 10.00 a.m. to 1.00 p.m.**

Time—3 Hours　　　　　　　　　　　　　　　　　　*Maximum Marks—60*

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

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

　　　　(*iii*) Solve any *three* of the remaining five questions (Q. **2** to Q. **6**).

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

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

　(*a*) Explain Lande *g* factor in detail.

　(*b*) Microwave spectrometer.

　(*c*) Describe electronic spectra of diatomic molecule.

2. (*a*) Explain co-relation between Zeeman and Paschen Back effect.　8

　(*b*) Explain L-S and J-J coupling.　　　　　　　　　　　7

P.T.O.

3. (a) Explain pure rotational spetra of symmetric top molecule.   8

   (b) Explain the effect of isotopic substitution on rotational spectra of diatomic molecule.   7

4. (a) Give the complete theory of vibrational-rotational spectra of diatomic molecule.   8

   (b) Explain Frank-Condon principle.   7

5. (a) Describe experimental set up to observe Raman spectra in detail. 8

   (b) Describe structure determination from Raman and IR spectroscopy.   7

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

   (a) Molecular polarizability

   (b) Pauli's exclusion principle.

   (c) IR spectrometer.

NEPWT—42—2024

FACULTY OF SCIENCE

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

NOVEMBER/DECEMBER, 2024

PHYSICS

Paper-(SPHYC-451)

(Quantum Mechanics)

(Wednesday, 11-12-2024)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—Three Hours   *Maximum Marks*—80

Note :—   (*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) :   20

   (*a*)   State and explain the properties of Dirac-delta function.

   (*b*)   Describe the orbital angular momentum.

   (*c*)   Explain adiabatic approximation.

   (*d*)   Discuss on symmetric and asymmetric wave functions.

            P.T.O.

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

(*a*) Describe the completeness of eigen function and state the physical significance of wave function. 10

(*b*) Explain unitary transformation in detail. 10

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

(*a*) Discuss in detail Clebsch-Gorden coefficient for the addition of two angular momenta. 10

(*b*) What is eigen values of an operator ? Deduce the eigen values for angular momentum operator : 10

$$L^2, \ L_y \ J^2, \ J_z$$

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

(*a*) Explain variational method and use it to obtain the ground state energy of a two electron system. 10

(*b*) Describe the time dependent perturbation theory for a quantum mechanical system and deduce the Fermi-Golden rule. 10

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

(*a*) Derive an expression for the integral equation of scattering. 10

(*b*) Deduce the relations between angles and cross-section in the laboratory and centre of mass frame of a reference. 10

6. Write short notes on : 20

    (*a*)   Ket and Bra notations

    (*b*)   Ladder operators

    (*c*)   WKB-approximation classical limit

    (*d*)   Collision of identical particles.

NEPWT—108—2024

FACULTY OF SCIENCE

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

NOVEMBER/DECEMBER, 2024

PHYSICS

Paper SPHYC-452

(Statistical Mechanics)

(Friday, 13-12-2024)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 Hours   *Maximum Marks*—80

N.B. :— (1)   Each question carries equal marks.

(2)   Figures to the right indicate full marks.

(3)   *First* question is compulsory.

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

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

(*i*)   Calculate entropy of a perfect gas in microcanonical ensemble

(*ii*)   Free electron model

(*iii*)   Black body radiation

(*iv*)   Brownian motion.

2.   (*a*)   Define ensemble and ensmble average. Distinguish between Microcanonical, Canonical and Grand canonical ensembles.   10

P.T.O.

    (*b*) Derive an expression for M-B distribution law for velocity of particle. **10**

3.   (*a*) Derive F-D distribution law for the distribution of particle obeying F-D statistics. **10**

    (*b*) Obtain energy and pressure of a weakly degenerate Fermi gas. **10**

4.   (*a*) Explain Tisza's two fluid model. **10**

    (*b*) Explain the phenomenon of B-E condensation using B-E distribution law at $T < T_0$. **10**

5.   (*a*) Discuss Ising model in one dimension. **10**

    (*b*) Derive an expression for virial equation of state and obtain virial coefficients. **10**

6.   Write short notes on : **20**

    (*i*) Photon Statistics

    (*ii*) White Dwarf star

    (*iii*) Langevin's theory

    (*iv*) Discuss about phase space, phase trajectory and phase volume.

NEPWT—295—2024

FACULTY OF SCIENCE AND TECHNOLOGY

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

NOVEMBER/DECEMBER, 2024

(NEP-2020 Pattern)

MATHEMATICS

Paper SMATE-453

(Dynamics and Continuum Mechanics-II)

(Wednesday, 18-12-2024)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 Hours   *Maximum Marks—80*

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

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

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

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

1.   Answer the following :   20

(*a*)   Given $T_{ij} = \begin{vmatrix} 1 & 2 & 3 \\ 4 & 2 & 1 \\ 1 & 1 & 1 \end{vmatrix}$

decompose the tensor into symmetric and an antisymmetric part.

P.T.O.

(*b*) Derive an equation of conservation of mass.

(*c*) If $\phi = x_1 x_2 + 2x_3$ find a unit vector $\bar{n}$ normal to the surface of constant passing through point (2, 1, 0).

(*d*) Show that there is no shearing stress on any plane containing the point. If the state of stress at a certain points is $\bar{T} = -P\bar{I}$ where P is scalar.

2. Answer the following : 20

(*a*) Verify the following :

$$\in_{ijm} \in_{klm} = \delta_{ik} \delta_{jl} - \delta_{jl} \delta_{ik}$$

(*b*) Find the eigen values and eigen vector for tensor $[T] = \begin{vmatrix} 2 & 0 & 0 \\ 0 & 3 & 4 \\ 0 & 4 & 3 \end{vmatrix}$.

3. Answer the following : 20

(*a*) Show that :

(*i*) $\dfrac{d}{dt} (T + S) = \dfrac{dT}{dt} + \dfrac{dS}{dt}$

(*ii*) $\dfrac{d}{dt} (\alpha \, (t) \, T) = \dfrac{d\alpha}{dt} T + \alpha \, \dfrac{dT}{dt}$

(*iii*) $\dfrac{d}{dt} (T^{T}) = \left(\dfrac{dT}{dt} \right)^{T}$.

(*b*) Discuss divergence of a vector field, divergence to tensor field and curl of vector field.

4. Answer the following : 20

(a) If $d\bar{x} = (ds)\,\hat{n}$, where is $\hat{n}$ is a unit vector in the direction of $d\bar{x}$, then show that, $\dfrac{1}{ds}\dfrac{D}{Dt}(ds) = \hat{n}\,D\,\hat{n} = Dn \times n$.

(b) Derive an expression to find scalar invariants of tensor.

5. Answer the following : 20

(a) Discuss the principal stress.

(b) Define stress tensor and show that :

$$T\left(n_1\,\overline{e_1} + n_2\,\overline{e_2} + n_3\,\overline{e_3}\right) = n_1\,T\left(e_1\right) + n_2\,T\left(e_2\right) + n_3\,T\left(e_3\right)$$

6. Answer the following : 20

(a) Let ϕ and φ, be scalar fields v and w be vectors fields, then verify the following identities :

(i) $\nabla(\phi + \omega) = \nabla\phi + \nabla\omega$

(ii) $\mathrm{div}(\phi v) = (\nabla\phi)\,v + \phi\,(\mathrm{div}.v)$

(iii) $\mathrm{div}(v + \omega) = \mathrm{div}\,v + \mathrm{div}\,\omega$

(iv) $\mathrm{div}(\mathrm{curl}\,v) = 0$

(b) Define strain tensor. Write its components.

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

NEPWT—175—2024

FACULTY OF SCIENCE

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

NOVEMBER/DECEMBER, 2024

PHYSICS

Paper-SPHYC-453

(Condensed Matter Physics-I)

(Monday, 16-12-2024)   **Time : 10.00 a.m. to 1.00 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.

1. Solve the following questions :   20

   (*a*) Discuss fourteen types of three-dimensional Bravais lattices in the tabular format with the parameters. (System, no. of lattices in the system, space lattice, lattice symbol, axial length and inter-axial angle)

   (*b*) Show that the volume of a unit cell of a reciprocal lattice is inversely proportional to the volume of a unit cell of the crystal lattice.

   (*c*) Derive an expression for the density of states using momentum space.

   (*d*) Discuss in brief Fermi surface and Brillouin zones.

P.T.O.

2. (*a*) Show that five fold rotation axis is not compatible with a lattice. 10

   (*b*) What do you understand by packing fraction ? Compute the packing factor for simple cubic and body centred cubic structure.   10

3. (*a*) Describe rotating crystal method for X-ray diffraction. How do layer lines form ?   10

   (*b*) Show that reciprocal lattice to a bcc lattice is fcc lattice.   10

4. (*a*) State and explain Bloch theorem.   10

   (*b*) Discuss the formation of allowed and forbidden energy bands on the basis of Kronig-Penny model.   10

5. (*a*) Describe the phenomenon of cyclotron resonance in metals and state its applications.   10

   (*b*) What is a Fermi surface ? Give its importance.   10

6. Write short notes on :   20

   (*a*) Characteristics of Fermi surface

   (*b*) Distinction among metal, insulator and semiconductor

   (*c*) Point defect

   (*d*) Structure of diamond.

NEPWT—228—2024

FACULTY OF SCIENCE

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

NOVEMBER/DECEMBER, 2024

PHYSICS

Paper–SPHYE-501

(Astrophysics–I)

(Tuesday, 17-12-2024)   **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 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 (Question Nos. **2** to **6**).

(iv)   Figures to the right indicate full marks.

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

(a)   Explain photographic plate and photometer.

(b)   Explain Synchrotron emission for single electron.

(c)   Write a short note on *r* and *s* processes.

P.T.O.

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

(b) Explain multi-wavelength astronomy in ASTROSAT telescope. 7

3. (a) Define luminosity. Obtain Stefan's law. 8

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

4. (a) Explain population-I and population-II stars. 8

(b) Explain solar interior and energy transport mechanism in it. 7

5. (a) What are black holes ? Discuss their properties. Obtain Schwarzschild relation for it. 8

(b) Explain neutron star and pulsar. 7

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

(a) Stellar Parallax method

(b) Magnetic activity in the Sun

(c) P-P chain reaction.

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

NEPWT—229—2024

FACULTY OF SCIENCE

M.Sc. (Third Semester) EXAMINATION

NOVEMBER/DECEMBER, 2024

(NEP-2020)

PHYSICS

Paper–SPHYE-501B

(Material Science–I)

(Tuesday, 17-12-2024)   **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 Hours   *Maximum Marks—60*

N.B. :— (*i*) *All* are 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*) Explain Gibb's phase rule and its significance in phase diagrams.

    (*b*) Describe Fick's first and second laws of diffusion with their physical meaning.

    (*c*) Explain the working principle of a rotary pump and its application in vacuum systems.

P.T.O.

2. (a) Explain the Copper-Nickel binary isomorphous phase diagram and discuss microstructure formation under equilibrium solidification of an alloy. 8

   (b) Discuss the solidification of eutectic, hypo-eutectic, and hyper-eutectic alloys under equilibrium cooling. 7

3. (a) Describe the mechanisms of diffusion and discuss the factors influencing diffusion in solids. 8

   (b) Explain Langmuir adsorption isotherm and its applications. 7

4. (a) Explain the working principle of an oil diffusion pump and its rule in creating a high vacuum. 8

   (b) Discuss the physical vapor deposition (PVD) method for thin film formation. 7

5. (a) Explain the Czochralski crystal pulling method and its significance in crystal growth. 8

   (b) Describe the steps involved in the process of crystallization. 7

6. Write short notes on the following (Each question carries **5** marks) : 15

   (a) Lever rule and its application in determining phase fractions

   (b) Hydrothermal crystal growth technique

   (c) Sputtering process in thin film deposition.

NEPWT—13—2024

FACULTY OF SCIENCE

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

NOVEMBER/DECEMBER, 2024

PHYSICS

Paper–(SPHYC-501)

(Electrodynamics)

(Tuesday, 10-12-2024) **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* questions of the remaining five questions (Question Nos. **2** to **6**).

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

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

(*a*) Define skin depth. Obtain an expression for skin depth.

(*b*) Explain total internal restection.

(*c*) Discuss the fields due to linear centre fed half wave antenna.

(*d*) Explain the length contraction as special theory relativity.

P.T.O.

2. (*a*) Discuss the propagation of plane electromagnetic wave in conducting media. 10

   (*b*) State Maxwell's field equations for the electromagnetic field and obtain the wave equation for E and B at a plane interface. 10

3. (*a*) Derive an expression for the wave guide wavelength of TE Mode propagating in rectangular wave guide. 10

   (*b*) Derive an expression for Fresnel's equation in case of the incident wave polarized with its vector E normal to the plane of incidence in conducting medium. 10

4. (*a*) Show that the radiation resistance of half wave antenna is much higher than the dipole antenna. 10

   (*b*) Discuss the array of antennae in detail. 10

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

   (*b*) Express Maxwell's field equations in tensor form and thereby define electromagnetic field in tensor form. 10

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

   (*a*) Gauge transformation

   (*b*) Brewester's angle

   (*c*) Full wave antenna

   (*d*) 4-Vector.

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

NEPWT—79—2024

FACULTY OF SCIENCE

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

NOVEMBER/DECEMBER, 2024

PHYSICS

SPHYC-502

(Nuclear and Particle Physics)

(Thursday, 12-12-2024)   **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 Hours   *Maximum Marks*—80

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

       (2)   Attempt any *three* questions from Q. Nos. **2** to **6**.

       (3)   *All* questions carry equal marks.

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

1.   Solve the following questions :   20

   (*a*)   Explain mirror nuclei with suitable examples.

   (*b*)   Describe Semiconductor detector.

   (*c*)   Explain Bohr-Wheeler theory of fission process.

   (*d*)   Explain proton-proton cycle.

2.   (*a*)   Discuss of electric quadrupole moment of the nucleus.   10

   (*b*)   Discuss the semi-empirical mass formula for a nucleus and explain the different terms in it.   10

P.T.O.

3. (a) Derive the expression for the stopping power of heavy charged particles. 10

(b) Explain classification of elementary particles in detail. 10

4. (a) Write down the shell model configuration and assign for spin and parties to ground state of the nuclei : $_{28}Fe^{57}$, $_{30}Zn^{67}$, $_{21}Sc^{41}$. 10

(b) Explain the characteristics on Nuclear forces. 10

5. (a) Discuss law of successive transformation in detail. 10

(b) Discuss the C-N cycle. 10

6. Write short notes on the following : 20

(a) Average binding energy

(b) Quark theory

(c) Spin orbital coupling

(d) Neutrino hypothesis.

NEPWT—146—2024

FACULTY OF SCIENCE AND TECHNOLOGY

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

NOVEMBER/DECEMBER, 2024

(NEP-2020 Pattern)

PHYSICS

Paper–(SPHYC-503B)

(Fiber Optics and Lasers–I)

(Saturday, 14-12-2024)　　　　　　　　**Time : 2.00 p.m. to 5.00 p.m.**

Time—3 Hours　　　　　　　　　　　　　　　_Maximum Marks—80_

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

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

(iii)　_All_ questions carry equal marks.

(iv)　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)　Explain the modified chemical vapour deposition technique

(c)　Explain the quantum theory of radiations

(d)　Give the applications of lasers in meteorology.

P.T.O.

2. (*a*) What is acceptance angle of a fiber ? Find out the acceptance angle of a fiber if refractive index of the core and cladding is 1.55 and 1.50 respectively.   10

   (*b*) Explain mode field diameter and spot size of an optical fiber.   10

3. (*a*) Describe in detail the vapour phase deposition technique for fiber synthesis.   10

   (*b*) Write a note on liquid phase technique of fiber drawing.   10

4. (*a*) What are the properties of LASER light ?   10

   (*b*) Write a note on Ruby laser.   10

5. (*a*) Explain the applications of LASER in optical communication.   10

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

6. Write short notes on the following :   20

   (*a*) Numerical aperture

   (*b*) Plasma activated CVD

   (*c*) Optical Pumping

   (*d*) Applications of lasers in ranging and navigation.

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

NEPWT—145—2024
FACULTY OF SCIENCE
M.Sc. (Second Year) (Third Semester) EXAMINATION
NOVEMBER/DECEMBER, 2024
PHYSICS

Paper–SPHYC–503

(Electronics-I : Microwave Devices)

(Saturday, 14-12-2024)   **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 :   20

   (*a*)   Discuss applications of Smith chart.

   (*b*)   Explain in brief velocity modulation in Klystron tube.

   (*c*)   Give structure of microwave bend and discuss in brief.

   (*d*)   Explain factors affecting range of radar.

2.   (*a*)   Discuss distribution parameters in case of two conductor transmission line. Establish transmission line equation.   10

   (*b*)   What do you mean by standing waves ? Explain voltage standing wave ratio.   10

                                                       P.T.O.

3. (*a*) What are transferred electron devices ? Explain Gunn effect in brief.

10

(*b*) With neat structure explain working of travelling wave tube (TWT)

10

4. (*a*) State various types of microwave T-junctions and explain construction and working of magic tee. 10

(*b*) With neat schematic diagram explain construction and working of directional coupler. 10

5. (*a*) Draw the block diagram of pulsed radar systems and explain in brief.

10

(*b*) Derive the expression for Radar range. 10

6. Write short notes on : 20

(*a*) Reflection coefficient

(*b*) Microwave solid state devices

(*c*) Wave guide termination

(*d*) Scanning with Radar.