

Total No. of Questions : 4]

SEAT No. :

PE4427

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[6509]-1

F.Y.M.Sc.

PHYSICS

**PHY-501-MJ : Mathematical Methods for Physics
(2023 Credit Pattern) (NEP 2020) (Semester - I) (2 Credits)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt/solve any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log tables and non-programmable electronic Calculator is allowed.
- 6) Neat diagram must be drawn wherever necessary.

Q1) a) Solve any four of the following. **[8]**

- i) Show that the vectors $X_1 = (1, 2, 3)$, $X_2 = (3, -1, 4)$ and $X_3 = (4, 1, 7)$ are linearly dependent.
- ii) Write any four axioms of vector space.
- iii) Find the Laplace transform of Dirac delta function.
- iv) Write any two conditions for convergence of the Fourier series.
- v) If $A = \begin{pmatrix} 1 & 2 \\ 3 & -4 \end{pmatrix}$ then find A^2 .

b) If A is unitary matrix then show that A^{-1} is also unitary. **[3]**

Q2) a) i) If $A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$ Find A^{-1} . **[4]**

ii) Find the Fourier series representing $f(x) = x$, $0 < x < 2\pi$ **[3]**

b) Find the Fourier cosine transform of e^{-ax} . **[5]**

P.T.O.

Q3) a) Find a matrix P which diagonalizes the matrix $\begin{pmatrix} 4 & 1 \\ 2 & 3 \end{pmatrix}$. Also verify $P^{-1}AP = D$, where D is the diagonal matrix. [7]

b) Obtain the Fourier series expansion for $f(x) = x^3$ for $-\pi < x < \pi$. [5]

Q4) Solve any three of the following. [12]

a) If $A = \begin{pmatrix} 1 & -2 & 3 \\ 2 & 3 & -1 \\ -3 & 1 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 1 & 2 \\ 1 & 2 & 0 \end{pmatrix}$ Then find the products AB and BA . Also show that $AB \neq BA$.

b) Find the Laplace transform of $\sin at$.

c) If $L\{f(t)\} = F(s)$ then show that $L\{f(at)\} = \frac{1}{a} F\left(\frac{s}{a}\right)$

d) Find the eigen values of $A = \begin{pmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{pmatrix}$.



Total No. of Questions : 4]

SEAT No. :

PE4428

[Total No. of Pages : 2

[6509]-2

F.Y.M.Sc.

PHYSICS

PHY-502 MJ : Statistical Physics

(2023 Credit Pattern) (NEP 2020) (Semester - I) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Question 1 is compulsory.
- 2) Attempt or solve any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4. carry equal marks.
- 4) Figures to the right indicates full marks.
- 5) Use of log table and non programmable electronic calculator is allowed.
- 6) Neat diagram must be drawn wherever necessary.

Q1) a) Attempt any four of the following.

- i) What is ensemble? Give different types of ensembles. [2]
- ii) The energy state of a particle moving in a rigid cubical box is specified by the eqⁿ. [2]

$$n_x^2 + n_y^2 + n_z^2 = \frac{2mL^2E}{\pi^2\hbar^2} = 14.$$

Determine the number of microstates accessible to the particle.

- iii) For an ideal gas show that the specific heat at constant volume is $\frac{3}{2}NK$. [2]
- iv) Explain the term photon gas. [2]
- v) What is fermi energy? [2]
- b) Derive an expression for classical partition function for an ideal monoatomic gas. [3]

P.T.O.

- Q2) a) i)** Explain, what do you mean by Bose - Einstein condensation. [4]
ii) Obtain the curie law of paramagnetism on the basis of canonical distribution. [3]

b) The partition function for an ideal gas is given by $Z = \frac{V^N}{N!h^{3N}} \left(\frac{2\pi m}{\beta} \right)^{3N/2}$.
 Show that Sackur-Tetrode eqⁿ for the entropy is

$$S = NK \left[\ln \left(\frac{v}{N} \right) + \frac{3}{2} \ln \left(\frac{2\pi m}{\beta h^2} \right) + \frac{5}{2} \right] \quad [5]$$

- Q3) a)** Discuss the behaviour of sharpness of probability curve and show that the fractional width of the maximum in P(E) is given by $\frac{\Delta E}{E} = \frac{1}{\sqrt{7}}$. [7]
b) The molar mass of Lithium is 0.00694 and density is $0.53 \times 10^3 \text{ kg/m}^3$. Calculate the fermi-energy and fermi temperature of the electrons. [5]

Q4) Write short note on any three of the following. [12]

- Gibbs paradox
- Physical interpretation of α .
- Bose-Einstein condensation.
- Phase space trajectory of a particle performing linear Harmonic oscillations.



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SEAT No. :

PE4429

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[6509]-3

F.Y.M.Sc.

PHYSICS

PHY-503 MJ : CLASSICAL PHYSICS

(2023 Credit Pattern) (NEP - 2020) (Semester - I) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Question 1 is compulsory.
- 2) Attempt/solve any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4. carry equal marks.
- 4) Figures to the right indicates full marks.
- 5) Use of log table and non-programmable electronic calculator is allowed.
- 6) Neat diagram must be drawn wherever neccessary.

Q1) A) Attempt any four of the following.

[8]

- a) What are constraints? classify given example
 - i) Simple pendulum with variable length.
 - ii) Particle moving on or outside of surface of sphere.
- b) With the help of example define cyclic co-ordinates.
- c) State D'Alembert's principle
- d) Write short note on Generating function
- e) Prove that $[F, GS] = [F, G]S + G[F, S]$.

B) Define-

[3]

- a) Phase space
- b) Configuration space
- c) Canonical Transformation

P.T.O.

- Q2)** a) i) State and prove the theorem of Total Energy. [3]
 ii) State and prove Jacobi's Identity [4]
 $[F, [G, K]] + [G, [K, F]] + [K, [F, G]] = 0$
- b) Show that for spherical surfaces, geodesics are great circles [5]
- Q3)** a) Using Variational principle, Explain Brachistochrone problem. [7]
 b) Describe the Hamiltonian & Hamilton's equation for an ideal spring mass arrangement. [5]
- Q4)** Write a short note on any three of the following.
- a) Explain two types of constraints in detail. [4]
 b) Shortest Distance between 2-points in a plane is a straight line, Explain. [4]
 c) State & Explain principle of Virtual work. [4]
 d) Give Lagrangian equation of motion for simple Harmonic oscillator. [4]

* * *

Total No. of Questions : 7]

SEAT No. :

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PE4430

[6509]-4

First Year M.Sc.

PHYSICS

PHY - 504 MJ : Quantum Physics

(2023 Credit Pattern) (Semester - I) (NEP - 2020) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logtables and non-programmable electronic calculator is allowed.*
- 6) *Neat diagram must be drawn wherever necessary.*

Q1) Solve any five of the following :

[10]

- a) What is transition amplitude?
- b) Give the physical interpretation of eigen values.
- c) What are ladder operators?
- d) What is meant by degenerate states?
- e) Define Dirac - Delta function.
- f) Explain Unitary operator.

Q2) a) Explain in detail postulates of quantum mechanics.

[7]

b) State and prove variational method of approximation.

[5]

Q3) a) Obtain matrix representation of J in $|j,m\rangle$ basis for $J = \frac{1}{2}$.

[7]

b) Discuss transition amplitude for constant perturbation $H'(t) = V(r)$. **[5]**

P.T.O.

Q4) a) Determine the first and second order correction to the allowed energies of infinite square well potential of width a . The perturbation $H' = V_0$ for $0 < x < a$, $V_0 = \text{constant}$. [7]

b) Consider a wave function $\psi(x) = xe^{-\beta x}$, $x \geq 0$ [5]
 $= 0$ $x < 0$

β is a constant.

Normalise the wave function and calculate $\langle x \rangle$.

Q5) a) Discuss in detail WKB approximation and its necessary conditions. [7]

b) Discuss Pauli's spin matrices for spin half system. Prove that $[\sigma_x, \sigma_y] = 2i\sigma_z$. [5]

Q6) a) Explain [7]

i) projection operator

ii) unit operator

iii) adjoint operator

b) Obtain eigen value and eigen function of L^2 and L_z operators. [5]

Q7) Attempt any three of the following : [12]

a) Give the properties of Hilbert space in bra-ket notation.

b) Discuss in brief time dependent perturbation theory.

c) Explain completeness and closure property in quantum mechanics.

d) Discuss Clebsch-Gordan coefficient in addition of two angular momentum operators $j_1 = j_2 = \frac{1}{2}$.

e) Discuss WKB approximation in one dimensional potential well with two vertical walls.

x x x

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PE4431

[6509]-5

M.Sc.-I

PHYSICS

PHY510MJ : Industrial Electronics

(2023 Credit Pattern) (NEP 2020) (Semester - I) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.*
- 2) Attempt/Solve any two questions from Q.2 to Q.4.*
- 3) Q.2 to Q.4 carry equal marks.*
- 4) Figures to the right indicate full marks.*
- 5) Neat diagram must be draw wherever necessary.*

Q1) a) Attempt any four of the following.

- i) State bits, bit rate. [2]
- ii) What is microcontroller and microprocessors? [2]
- iii) What is baud rate and m-ary coding? [2]
- iv) What is sketch? Give its structure. [2]
- v) State trans receiver. [2]

b) What is principles of open source embedded platforms? [3]

Q2) a) i) Describe types of communication Models in IoT. [4]

ii) What is IDE? State its features? [3]

b) Write a program, how to turn on, LED light with a push Button on an Arduino. [5]

P.T.O.

- Q3)** a) i) Describe physical design of IoT. [4]
ii) Explain digital input & output functions in Arduino. [3]
b) Write a program to interFace stepper motor. [5]

Q4) Write a short note on any three of the following.

- a) Zigbee [4]
b) Digital Communication [4]
c) Write a program for LM35 Temperature sensor code for Arduino [4]
d) Open source embedded platForms. [4]



Total No. of Questions : 4]

SEAT No. :

PE4432

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[6509]-6

F.Y. M.Sc.

PHYSICS

PHY 511 MJ : Computational Physics

(2023 Credit Pattern) (2 Credits) (Semester - I) (NEP 2020)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt/Solve any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of non-programmable calculator is allowed.*
- 6) *Neat diagrams/flow charts must be drawn wherever necessary.*

Q1) a) Attempt any four of the following :

- i) What is the difference between arithmetic and logical operators in Fortran. [2]
- ii) Explain the use of IMPLICIT NONE declaration in Fortran. [2]
- iii) What is the role of the Do loop in Fortran. [2]
- iv) How do we declare a variable in Fortran. [2]
- v) What is Monte Carlo simulation? [2]
- b) Write algorithm for Lagrange interpolation. [3]

Q2) a) i) What is Runge - Kutta method to solve differential equation? [4]

ii) Explain difference between recursive and Non-recursive subroutines.[3]

- b) Write Fortran program and draw flow chart to find the factorial of a number. [5]

P.T.O.

Q3) a) Solve using Euler method [7]

$$\frac{dy}{dx} + xy = 0, \quad y(0) = 1$$

from $x = 0$ to $x = 0.25$, $h = 0.05$

b) Write a Fortran program to compute the kinetic energy of a moving object given its mass and velocity. [5]

Q4) Attempt any three of the following :

a) Explain count controlled Do loop with example. [4]

b) Explain difference between real and integer data types with example. [4]

c) Explain Gauss elimination method to solve simultaneous equations. [4]

d) Write a short note on Weddle's rule. [4]

x x x

Total No. of Questions : 7]

SEAT No. :

PE4433

[Total No. of Pages : 2

[6509]-7

F.Y.M.Sc.

PHYSICS

PHY - 512 - MJ : Space Weather and Technology

(2023 Credit Pattern) (Semester - I) (4 Credits) (Elective) (NEP 2020)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Question 1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non - programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any five of the following.

- a) What is the solar wind? [2]
- b) Define solar Flares. [2]
- c) What do you mean by magnetic storms? [2]
- d) Define the term mesosphere. [2]
- e) What do you mean by GPS? [2]
- f) What is the Earth's Magnetosphere? [2]

Q2) a) Explain with the neat diagram the structure of the sun. [7]

b) Define the terms Bow shock & the Magnetopause. [5]

Q3) a) Explain with neat diagram the Earth's magnetosphere. Explain the concept of Aurorae. [7]

b) Define the term solar cycle and solar atmosphere. [5]

Q4) a) Explain in detail the composition morphology & general properties of ionosphere. [7]

b) What is GPS? Explain the effect of space weather on GPS. [5]

P.T.O.

- Q5)** a) What is space weather? Explain any one application of space weather. **[6]**
b) What is mesosphere? Explain the properties of mesosphere. **[6]**
- Q6)** a) Explain in detail the ring current. **[6]**
b) What is satellite? Explain the effect of space weather on satellite. **[6]**
- Q7)** Write short note on any three of following.
- a) Cosmic Rays. **[4]**
b) Magnetic Storms **[4]**
c) Solar Radiation **[4]**
d) Remote Sensing. **[4]**



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 2

PE4434

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F.Y. M.Sc.

PHYSICS

PHY-513-MJ : Atmospheric Physics

(2023 Credit Pattern) (2 Credits) (NEP 2020) (Semester - I)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Attempt any four of the following:

- i) Explain the polar orbit of satellite. [2]
- ii) What are the real forces? [2]
- iii) What is the MST radar? [2]
- iv) Define the vorticity. [2]
- v) Define the LIDARs. [2]
- b) What do you mean by launch vehicles? [3]

Q2) a) i) Explain the general principle of surface metrological measurements. [4]

ii) Write a short note on thermal wind. [3]

b) What are the pilot balloons? Explain the role of pilot balloons in atmospheric research. [5]

P.T.O.

- Q3)** a) Describe the working principle of multi - scanner radiometers and their applications in observing weather parameters. [7]
- b) Discuss in details about the atmosphere as a heat engine. [5]

Q4) Write a short note on any three of the following:

- a) The kinetic energy cycle [4]
- b) Primitive equations [4]
- c) Microwave radiometer [4]
- d) Drop sonde [4]



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 1

PE4435

[6509]-9

F.Y. M.Sc.

PHYSICS

PHY-514-MJ : Communication Physics

(2023 Credit Pattern) (Semester - I) (NEP 2020) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Question 1 is compulsory.*
- 2) *Attempt/Solve any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Neat diagrams must be drawn whenever necessary.*

Q1) a) Attempt any four of the following :

- i) Explain PRT & PRF in Radar. [2]
- ii) Explain the different Noise in data transmission. [2]
- iii) What is eco supressors? [2]
- iv) What is transmission path? [2]
- v) Redundant codes. [2]
- b) A 50 MHz Radar has a PRF of 5000 Hz, Average power of 30 KW and a pulse width of 3 micro sec. Calculate the peak power of this Radar. [3]

Q2) a)

- i) Explain satellite system. [4]
- ii) Explain basic pulsed radar. [3]

b) Describe Radar systems. [5]

Q3) a) Describe three different codes used for data transmission and discuss their merits & demerits. [7]
b) Describe satellite frequencies & orbits station keeping. [5]

Q4) Write a short note on any three of the following :

- a) Distortion equalizer [4]
- b) Constant ratio codes [4]
- c) Transmission path [4]
- d) Radar range equation [4]



Total No. of Questions : 4]

SEAT No. :

PE4436

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[6509]-10

First Year M.Sc.

PHYSICS

PHY 541 MN : Research Methodology

(2023 Credit Pattern) (2 Credits) (Semester - I)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt/solve any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table & non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Attempt any four of the following :

- i) What do you mean by literature review? [2]
- ii) What is primary data. [2]
- iii) Define & explain the term Impact Factor. [2]
- iv) What do you mean by literature survey. [2]
- v) Explain the term : Hypothesis. [2]
- b) Explain the significance of Research report writing. [3]

Q2) a) i) What is research methodology? Define the scope of research methodology in different fields. [4]

ii) Describe main objectives of questionnaires. [3]

b) Explain in details the main objectives of report writing. [5]

P.T.O.

- Q3)** a) i) Distinguish between quantitative and qualitative research. [4]
ii) Explain the components of research proposal. [3]
b) Describe the various methods of data collection & it's relative merits. [5]

Q4) Write a short note on any three of the following : [12]

- a) Analysis of quantitative data.
- b) Research problem.
- c) Characteristics of research method's.
- d) Objectives of research.

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Total No. of Questions : 7]

SEAT No. :

PE4437

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[6509]-21

First Year M.Sc.

PHYSICS

PHY-551-MJ : Solid State Physics
(2023 Credit Pattern) (NEP 2020) (Semester - II)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Solve any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log tables and non-programmable electronic Calculator is allowed.
- 6) Neat diagram must be draw wherever necessary.

Given : Plank's constant = 6.626×10^{-34} Js

Mass of electron = 9.11×10^{-31} kg

Boltzmann constant = 1.38×10^{-23} J/k

Avogadro's Number = 6.023×10^{26} /kmole

Permeability of full space = $4\pi \times 10^{-7}$ Henry/m

Charge on electron = 1.6×10^{-19} C

Bohr magnetron = 9.27×10^{-24} A/m²

Q1) Solve any five of the following.

[5×2=10]

- a) Sketch [0, 1, 1] plane in simple cubic cells.
- b) Explain the concept of hole.
- c) What is ferroelectricity?
- d) Identify the crystal structure of metal showing [1, 1, 1], [2, 2, 2] and [2, 0, 0], hkl miller indices reflections in x-ray diffraction pattern, Give reason.
- e) Calculate the paramagnetic susceptibility at 350 K of a substance having $4 \times 10^{28}/\text{m}^3$ number of atoms, If magnetic moment of each atom = 1.8×10^{-23} Am².
- f) Sketch the variation of magnetic susceptibility with temperature for ferromagnetic substance.

Q2) a) Derive the expression of London penetration depth. Write its significance.[7]

- b) What is the polarizability of an argon (at.wt = 22.4) atom, if relative permittivity of argon at NTP is 1.000435? [5]

P.T.O.

- Q3)** a) Explain geometrical structure factor. Obtain an expression of structure factor for BCC lattice. [6]
- b) Obtain an expression of local electric field at an atom in dielectric at general lattice site. [6]
- Q4)** a) Discuss the origin of diamagnetism in a free atom. Obtain Langevin's diamagnetism equation for the diamagnetic susceptibility. [7]
- b) The atomic weight and density of iron are 55.85 and 7870 kg/m³ respectively. If iron has magnetic moment of 2.4 Bohr magneton, determine the spontaneous magnetization. [5]
- Q5)** a) Explain BCS theory of superconductivity with the help of Cooper pair. [6]
- b) What is packing fraction? Obtain packing fraction of BCC & FCC structure. [6]
- Q6)** a) Explain qualitatively the Kronig-Penney model in brief. Plot the function for $P = 6\pi$ and interpret. [6]
- b) Explain ferromagnetism and antiferromagnetism in detail. [6]
- Q7)** Write a short note on the following. (Any three)
- a) Meissner effect [4]
- b) Type I and Type II superconductor [4]
- c) Dielectric behaviour of BaTiO₃ [4]
- d) Anisotropy energy [4]



Total No. of Questions : 4]

SEAT No. :

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PE4438

[6509]-22

M.Sc.-I

PHYSICS

PHY552 MJ : Electrodynamics

(2023 Credit Pattern) (NEP 2020) (Semester-II) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt /Solve any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4 carry equal marks.
- 4) Use of log tables and non-programmable electronic calculator is allowed.
- 5) Figures to the right indicate full marks.
- 6) Neat diagrams must be drawn wherever necessary.

Q1) a) Attempt any four of the following: **[8]**

- i) What are Lorentz and coulomb Gauges?
- ii) Write Maxwell's equation in Integral form.
- iii) State the postulates of Einstein's theory of relativity.
- iv) Explain the term multiple moments.
- v) How fast does a light approach Earth if sent from a spaceship travelling at $0.500c$?

b) The rest mass of an e^- is $9.1 \times 10^{-28} \text{g}$. What will be its mass if it were moving with $4/5^{\text{th}}$ the speed of light. **[3]**

Q2) a) i) Obtain an expression for electromagnetic field tensor. **[4]**

ii) Describe Lorentz force on a charged particle. **[3]**

b) Draw a neat labelled diagram of Michelson-Morlay experiment. Hence obtain the formula for fringe shift. **[5]**

P.T.O.

Q3) a) If a medium is moving with a velocity $\bar{u}$, then show that Faraday's law has the form $\bar{\nabla} \times (\mathbf{E}' - \bar{u} \times \bar{\mathbf{B}}) = -\frac{\partial \bar{\mathbf{B}}}{\partial t}$. [7]

b) Derive Lorentz relativistic transformation equation. [5]

Q4) Write short note on any three of the following. [12]

- a) Explain Minkowski's Space-time diagram.
- b) Derive an expression for potential at a point due to a small linear quadrupole.
- c) Show that $\bar{\mathbf{E}} \cdot \bar{\mathbf{B}}$ is invariant under Lorentz transformation.
- d) Explain time dilation and length contraction.



Total No. of Questions : 4]

SEAT No. :

PE4439

[Total No. of Pages : 2

[6509]-23

M.Sc. - I

PHYSICS

PHY-553-MJ : Atomic And Molecular Physics
(2023 Credit Pattern) (Semester - II) (2 Credits) (NEP 2020)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Question 1 is compulsory.*
- 2) *Attempt/Solve any two questions from Q.2 to Q.4.*
- 3) *Questions 2 to 4 carry equal marks.*
- 4) *Figurs to the right indicate full marks.*
- 5) *Use to non-programmable calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Attempt any four of the following :

- i) Explain the term symbol $(2S+1)_{L_J}$. [2]
 - ii) What is hunds principle. Explain it's significance. [2]
 - iii) What is molecular spectra hence state it's types. [2]
 - iv) Why Electron Spin Resonance (ESR) is called as Electron Paramagnetic Resonance (EPR). [2]
 - v) What is Raman Effect hence explain stokes and antistokes hines. [2]
- b) Calculate the strength of the magnetic field required to give a precessional frequency of 100MHz for O^{17}_- nucleus.

Given : $g_N = 0.757, \mu_N = 5.051 \times 10^{-27} \text{ J/T}, I = \frac{5}{2}$. [3]

- Q2) a)**
- i) Give the physical significance of lande's g-factor. Calculate it for $^3D_3$ - state. [4]
 - ii) The term symbol for a particular atomic state is quoted as $^4D_{5/2}$. What are the values of L, S & J for this state. [3]
- b) Explain Raman scattering phenomenon on the basis of classical theory. [5]

P.T.O.

- Q3)** a) State and explain the difference between normal and anomalous zeeman effect. Draw the normal zeeman splitting for transitions from $l = 1$ ($^1P_1$) to $l = 2$ ($^1D_2$) without & with magnetic fields. [7]
- b) Explain Paschen-Back effect hence illustrate it in the principal series of lithium ($^2P-^2S$) state using selection rule $\Delta(m_l + 2M_s) = 0, \pm 1$. [5]

Q4) Attempt any three of the following :

- a) State and explain Frank-Condon principle with suitable energy level diagrams in absorption & emission. [4]
- b) The vibrational structure of the absorption spectrum of O_2 becomes a continuum at 5686cm^{-1} . If the upper electronic state dissociates into one ground state atom & one excited atom with excitation energy 15875cm^{-1} . Estimate the dissociation energy of the ground state : in cm^{-1} & kJ/mole .

Given : $1\text{cm}^{-1} = 11.958\text{J/mol}$. [4]

- c) Explain the phenomenon of Nuclear Magnetic Resonance (NMR) hence discuss the magnetic properties of nuclear based on its intrinsic spin angular momentum (I).

Calculate the magnetic field if the resonance frequency of 9530MHz is observed in some ESR expt.

Given = $g = 2.0023$, $\mu_B = 9.274 \times 10^{-24} \text{ J/T}$. [4]

- d) Discuss the sample handling techniques in Raman spectrometer.

Irradiation of carbon-tetrachloride by $4358\text{\AA}$. Radiation gives Raman lines at $4400\text{\AA}$. Calculate the Raman shift of the line in cm^{-1} . [4]



Total No. of Questions : 4]

SEAT No. :

PE4440

[Total No. of Pages : 2

[6509]-24

M.Sc. - I

PHYSICS

PHY-554-MJ : Basic Electronics

(2023 Credit Pattern) (NEP-2020) (Semester - II) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt / Solve any two questions from 2 to 4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Attempt any four of the following.

- i) What is the latching and holding current of SCR? [2]
- ii) What is holding current in DIAC? [2]
- iii) State any two advantage of SMPS power supply. [2]
- iv) Define Astable multivibrator. [2]
- v) What is meant by duty cycle? [2]

b) Draw the circuit diagram of monostable multivibrator using IC 741. [3]

Q2) a) i) Draw internal block diagram of IC 723. Explain function of each block. [4]

ii) What is the difference between DIAC and TRIAC? [3]

b) What is PLL? Explain the functional block diagram of PLL (IC565). [5]

P.T.O.

Q3) a) Determine the free-running frequency f_0 , the lock range f_L , and the capture range f_C . **[7]**

Given : $V = 10\text{V}$, $R_1 = 12\text{k}\Omega$, $C_1 = 0.01\mu\text{F}$, $C_2 = 10\mu\text{F}$.

b) Explain with neat circuit diagram, the use of IC555 as PWM. **[5]**

Q4) Write a short note on any three of the following. **[12]**

- a) Instrumentation amplifier using three Op-amp.
- b) Voltage controlled oscillator.
- c) DC-DC converter.
- d) Precision rectifiers using Op-amp.



Total No. of Questions : 4]

SEAT No. :

PE4441

[Total No. of Pages : 2

[6509]-25

First Year M.Sc.

PHYSICS

PHY-560-MJ : Fiber Optics and Photonics

(2023 Credit Pattern) (Semester - II) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Neat diagram must be drawn wherever necessary.*

Q1) A) Attempt any four of the following. [8]

- a) Define
 - i) Bending loss
 - ii) Absorption loss
- b) What is the working principle of Bragg grating?
- c) Two applications of optical time domain reflectometer?
- d) What is optical fiber? One example in daily usage.
- e) What are conditions of population inversion?

B) What is fiber optics? Write any two types. [3]

Q2) a) What is fiber grating? [7]

Explain working principle and detail working with diagram.

b) Explain fabry perot filters with diagram. [5]

P.T.O.

- Q3)** a) i) Explain optical fiber communication technology. [4]
ii) State & explain principle of coherent detection. [3]
b) State and explain modified chemical vapor deposition. [5]
- Q4)** Write short note on any three of the following. [12]
a) (VAD) vapor axial deposition. [4]
b) Radiation induced losses. [4]
c) Isolators & circulators. [4]
d) Multiplexers and filters grating. [4]



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 2

PE4442

[6509]-26

M.Sc. - I

PHYSICS

**PHY-561-MJ : Experimental Techniques for Material Characterization
(2023 Credit Pattern) (Semester - II) (2 Credits) (NEP 2020)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Attempt any four of the following:

- i) State the applications of photoluminescence spectroscopy. [2]
 - ii) What is the four probe method. [2]
 - iii) What is the FTIR? [2]
 - iv) Write the Bragg's diffraction condition. [2]
 - v) State the applications of UV - Visible spectroscopy. [2]
- b) Explain the basic principle of photoluminescence spectroscopy. [3]

Q2) a) i) Explain the principle of scanning electron microscope (SEM). [4]

ii) Write the merits of Diffuse Reflectance Spectroscopy (DRS). [3]

b) In the X-ray diffraction experiment FWHM is 0.4° corresponding to angle 30° . Calculate wavelength of X-ray if crystalline size is $146\text{\AA}$. [5]

P.T.O.

Q3) a) What is the UV - Visible spectroscopy? Explain the principle, instrumentation and working of UV - Visible spectroscopy. [7]

b) What is the scherrer formula? Drive the scherrer formula for crystallite size determination. [5]

Q4) Write a short note on any three of the following:

a) Transmission electron microscope (TEM). [4]

b) Hall effect experiment. [4]

c) X-ray diffraction. [4]

d) Electron Spin Resonance (ESR). [4]



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 1

PE4443

[6509]-27

F.Y. M.Sc.

PHYSICS

PHY-562-MJ : Industrial Physics

(2023 Credit Pattern) (Semester - II) (2 Credits) (Elective)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Neat diagrams must be drawn wherever necessary.

Q1) a) Attempt any four of the following:

- i) Define radioactivity. [2]
- ii) Define industrial vacuum. [2]
- iii) What is particle accelerator? [2]
- iv) Define work ethics. [2]
- v) What is solar cell? [2]
- b) What are the scaling techniques in vacuum? [3]

Q2) a) i) Explain the guidelines for writing safety reports. [4]

- ii) What are the principles of radiation detectors. [3]
- b) Describe the design of solar cell. [5]

Q3) a) i) What are the essential elements of a scientific report? [4]

- ii) Write a short note on types of radiation monitoring equipment. [3]
- b) Define binding energy and its significance in nuclear physics. [5]

Q4) Write notes on any three of the following:

- a) Bipolar Junction Transistor (BJT) [4]
- b) Radiation monitoring equipment [4]
- c) Scientific report [4]
- d) Signal generator [4]



Total No. of Questions : 4]

SEAT No. :

PE4444

[Total No. of Pages : 2

[6509]-28

First Year M.Sc.

PHYSICS

PHY-563-MJ : Semiconductor Technology

(2023 Credit Pattern) (Semester - II) (2 Credits) (Elective)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Draw diagrams wherever necessary.*

Q1) a) Attempt any four of the following.

- i) Explain junction breakdown. [2]
- ii) Write expressions for resistivity and conductivity of p-type & n-type semiconductors. [2]
- iii) Draw current components. [2]
- iv) What is diffusion length? [2]
- v) Define emitter injection efficiency. [2]
- b) Explain continuity equation. [3]

Q2) a) i) Explain Hall effect with neat diagram. [4]

ii) Explain p-n junction formation. [3]

b) Explain shottky effect in detail with the help of neat labelled diagram. [5]

P.T.O.

- Q3)** a) i) Explain diffusion capacitance of p-n junction. [4]
ii) Write a short note on ON and OFF state of BJT. [3]
b) Derive Shockley equation. [5]

Q4) Write a short note on any three of the following.

- a) Excess carriers in semiconductors. [4]
b) Photo conductive devices. [4]
c) Optical absorption in semiconductors. [4]
d) Tunneling effect. [4]



Total No. of Questions : 4]

SEAT No. :

PE4445

[Total No. of Pages : 2

[6509]-29

F.Y.M.Sc.

PHYSICS

PHY-564-MJ : Laser Physics

(2023 Credit Pattern) (NEP - 2020) (Semester - II) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log tables and non - programmable electronic calculator is allowed.
- 6) Neat diagram must be drawn necessary.

Q1) a) Attempt any four of the following.

- i) Define metastable state. [2]
- ii) Explain stimulated emission? [2]
- iii) What is Beam divergence? [2]
- iv) Explain pumping mechanism. [2]
- v) State condition for population inversion. [2]
- b) Derive the relation between Einstein coefficient relation. [3]

Q2) a) i) Distinguish between the spontaneous and stimulated emission. [4]

- ii) Calculate the intensity of a He-Ne laser beam having emissive power 1mW and wavelength 6328Å. [3]

b) Explain construction and working of ruby laser with neat energy level diagram. [5]

P.T.O.

Q3) a) Explain construction and working of He-Ne laser with appropriate energy level diagram. [7]

b) Explain the working mechanism of semiconductor diode laser with appropriate diagram. [5]

Q4) Write short note on following (any three). [12]

- a) Threshold pump power
- b) Properties of laser
- c) Line broadening mechanism
- d) Four level pumping mechanism.



Total No. of Questions : 7]

SEAT No. :

[Total No. of Pages : 2

PE4446

[6509]-31

S.Y.M.Sc.

PHYSICS

PHY 601 MJ : Nuclear Physics

(2023 Credit Pattern) (NEP 2020) (4-Credits) (Semester-III)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Question No.1 is compulsory.*
- 2) *Solve any 5 questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicates full marks.*
- 5) *Use of log tables and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn whenever necessary.*

Q1) Solve any five of the following. [10]

- a) Define mass defect and packing fraction. [2]
- b) Write down any two limitation of Fermi Gas Model. [2]
- c) What are elementary particles? [2]
- d) Define fission and fusion of nuclear reaction. [2]
- e) What are magic numbers? What are their significance? [2]
- f) Using shell model calculate spin-parity of $^{14}_7\text{N}$. [2]

Q2) a) Describe decay scheme of ^{60}Co and ^{137}Cs gamma source in details. [7]

- b) A cyclotron has magnetic field of 1.5 Wb/m^2 . The extraction radius is 0.5m . Calculate the frequency of the oscillator necessary for accelerating deuterons and the energy of extracted beam.

(mass of proton = $1.67 \times 10^{-27} \text{ kg}$) [5]

Q3) a) Describe principle, construction and working of G.M. counter and gives its importance. [7]

- b) Calculate the binding energy per nucleon of ^7Li and ^{56}Fe

($M_{\text{Li}} = 7.016 \text{ amu}$, $M_{\text{Fe}} = 55.935 \text{ amu}$) [5]

P.T.O.

- Q4)** a) Explain skeleton of classification of elementary particles in details. [7]
 b) Write down the principle, construction and working of High Purity Germanium Detector. [5]
- Q5)** a) Derive the four factor formula of nuclear reactor. [6]
 b) Which of the following reaction are allowed or forbidden under the conservation of strangeness, baryons number and charge. [6]
- i) $\Pi^+ + n \rightarrow k^0 + k^+$
 ii) $\Pi^- + p \rightarrow \lambda^0 + k^0$
- Q6)** a) Explain the construction and working of Betatron. Prove that the betatron condition, $\frac{d\phi}{dt} = 2\pi R^2 \frac{dB}{dt}$ [6]
 b) Write a note on Higgs-Bosons particles in details. [6]
- Q7)** Write short note on any three of the following.
- a) Bubble chamber [4]
 b) Types of reactors in India [4]
 c) Low energy Neutron-Proton scattering [4]
 d) Nuclear forces [4]



Total No. of Questions : 7]

SEAT No. :

[Total No. of Pages : 2

PE4447

[6509]-32

S.Y. M.Sc.

PHYSICS

**PHY 602 MJ : Fundamental Physics of Thin Films
(2023 Credit Pattern) (NEP - 2020) (4 Credits) (Semester - III)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Question 1 is compulsory.*
- 2) *Attempt any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table or non-programmable calculator is allowed.*
- 6) *Neat diagram must be drawn wherever necessary.*

Q1) Solve any five questions of the following :

- a) What is crystallite size? [2]
- b) Define principles of photolithography. [2]
- c) What is mean by Island layer? [2]
- d) Write the application of thin films [any four]. [2]
- e) Define capillary model. [2]
- f) Define steps involved in Dip coating. [2]

Q2) a) Explain the principles, construction and working of Transmission Electron Microscopy (TEM). [7]

b) Explain mechanism of thin film formation : Condensation and Nucleation.[5]

P.T.O.

- Q3)** a) What is Chemical vapour deposition? Explain various chemical reactions involved in it. [7]
b) Explain stylus thickness measurement method. [5]
- Q4)** a) What are the merits of chemical bath deposition method. Discuss deposition of compound thin film by chemical bath deposition method.[7]
b) Describe various steps involved in growth process of thin film formation.[5]
- Q5)** a) Write principles, construction and working of X-ray photoelectron spectroscopy (XPS). [6]
b) What is capillary model and Atomistic model? What is the difference between capillary and Atomistic model. [6]
- Q6)** a) Explain Frank-Vander Merwe model of thin film formation. [6]
b) Explain magnetic properties of thin films. [6]
- Q7)** Write a short notes on the following (any three)
- a) SILAR method. [4]
b) Interference method of film thickness measurement. [4]
c) Superconductivity in thin films. [4]
d) Electron Beam deposition. [4]

x x x

Total No. of Questions : 7]

SEAT No. :

[Total No. of Pages : 2

PE4448

[6509]-33

S.Y.M.Sc.

PHYSICS

PHY 603 MJ : Fundamental Biophysics

(2023 Credit Pattern) (NEP-2020) (Semester-III) (4-Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Question No.1 is compulsory.***
- 2) Solve any 5 questions from Q.2 to Q.7.***
- 3) Q.2 to Q.7 carry equal marks.***
- 4) Figures to the right indicates full marks.***
- 5) Use of log tables and non-programmable electronic calculator is allowed.***
- 6) Neat diagrams must be drawn whenever necessary.***

Q1) Solve any five of the following.

- a) What prokaryotic organisms. [2]
- b) Define Liposomes. [2]
- c) Any two functions of Ribosomes. [2]
- d) What are the main components of Protoplasm? [2]
- e) Define hydrogen bonding. [2]
- f) What is a neuron? [2]

Q2) a) With diagram explain different components of plant cell. [7]

b) Define and explain Resting membrane potential and action potential. [5]

Q3) a) Derive Hodgkin-Huxley equation and give its significance. [7]

b) Describe in detail voltage clamp technique. [5]

Q4) a) Describe computed Tomography (CT) with its neat labeled diagram. [7]

b) Describe various forms of protein structure. [5]

P.T.O.

- Q5)** a) Explain the role of sodium (Na^+) and potassium (K^+) ions contributes to the rising and falling phases of the action potential. [7]
- b) State and explain structure and properties of RNA. [5]
- Q6)** a) Explain the principles and methods used to determine the primary structure of a polypeptide. [6]
- b) Describe the role of phosphate groups in the formation of the nucleic acid backbone. [6]
- Q7)** Write a short note on any three of the following.
- a) MRI technique [4]
- b) Nernst-Planck equation [4]
- c) Properties of RNA [4]
- d) Genetic code symmetry [4]



Total No. of Questions : 7]

SEAT No. :

PE4449

[Total No. of Pages : 2

[6509]-34

S.Y. M.Sc.

PHYSICS

**PHY 604 MJ : Fundamental Astronomy and Astrophysics
(2023 Credit Pattern) (NEP - 2020) (Semester - III) (4 Credits)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non - programmable electronic calculator is allowed.*
- 6) *Neat diagram must be drawn wherever necessary.*

Q1) Solve any five of the following.

- a) Define the cosmology. [2]
- b) What are the asteroids? [2]
- c) Define the types of planet. [2]
- d) Explain the concept of comets. [2]
- e) What is the Chandrasekhar limit? [2]
- f) What are the minoz planets? [2]

Q2) a) What are the giant planets? Explain the process invovled in the formation of giant planets. [7]

b) What is the moon? With neat diagram explain the phases of the moon. [5]

Q3) a) Explain the concept of radiative equilibrium and how it applies to the energy balances of planetary atmospheres. [7]

b) Describe the differences between terrestrial and gas giant planets. [5]

P.T.O.

- Q4)** a) What is the dark matter? Explain the role of dark matter in the formation and evolution of galaxies. [7]
- b) State and explain the virial theorem and its application to the stability of stars. [5]
- Q5)** a) Discuss the primary process of nuclear energy generation in stars and their dependence on temperature and density. [6]
- b) Explain in detail concept of cosmological puzzles. [6]
- Q6)** a) What are the planetary nebulae? Explain in detail the formation of planetary nebulae. [6]
- b) Discuss the concept of the accelerating universe. What is the evidence for this acceleration? [6]
- Q7)** Write short note on any three of following.
- a) White dwarfs [4]
- b) Milky way galaxie [4]
- c) Supernovae [4]
- d) The big bang [4]



Total No. of Questions : 7]

SEAT No. :

[Total No. of Pages : 2

PE4450

[6509]-35

S.Y. M.Sc.

PHYSICS

PHY-605-MJ : Fundamental Energy Physics
(CBCS 2023 Pattern) (NEP 2020) (Semester - III)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Figures to the right indicates full marks.*
- 4) *Use of logtable and non-programmable electronic calculator is allowed.*
- 5) *Neat diagram must be drawn wherever necessary.*

Q1) Attempt any five of the following:

- a) What is mean by Energy crisis? [2]
- b) What is diffuse radiation? [2]
- c) Define latent heat storage. [2]
- d) Name the three types of heat transfer. [2]
- e) What are the green house gases? [2]
- f) What do you mean by forced convection? [2]

Q2) a) Explain green house effect. Write its advantages and disadvantages. [7]

b) How does the position of sun affect solar radiation on earth? [5]

Q3) a) i) Write difference between renewable and non-renewable energy. [4]

ii) Explain Stefan's-Boltzman relation and Fourier's Law. [3]

b) How does energy consumption contribute to environmental climate change. [5]

P.T.O.

- Q4)** a) Explain electric energy storage system. [7]
b) Explain the concept of radiative & convective heat transfer. [5]
- Q5)** a) Write difference between terrestrial and extra terrestrial solar radiation. Explain sun as a fusion reactor. [6]
b) Explain the structure of the sun with neat diagram. Calculate zenith angle for air mass 1.5. [6]
- Q6)** a) With neat diagram, describe Hydrostorage system. [6]
b) What are fossile fuels? What are the impact of excessive use of fossile fuels. [6]
- Q7)** Write a short note on any three of the following:
- a) Sun shine recorder [4]
b) Energy security [4]
c) Solar pond as a energy storage [4]
d) Major harmful effects of acid rain [4]



Total No. of Questions : 4]

SEAT No. :

PE4451

[Total No. of Pages : 2

[6509]-36

M.Sc. - II

PHYSICS

PHY-606 MJ : Physics of Nanomaterials

(2023 Credit Pattern) (Semester - III) (NEP 2020) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any two questions from Q.2 to Q.4.*
- 3) *Figures to the right indicate full marks.*
- 4) *Q.2 to Q.4. carry equal marks.*
- 5) *Use of non programmable calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Attempt any four of the following.

[4×2=8]

- i) What do you mean by nucleation?
 - ii) State any two applications of nanotechnology.
 - iii) What is sputtering?
 - iv) The energy of photon is 3 ev. Convert the energy of photon in Joule.
 - v) State the advantages of synthesis of nanoparticles by using biological synthesis method.
- b) Draw neat labelled diagram of Hydrothermal method of synthesis of nanomaterial. **[3]**

Q2) a) i) Explain sol-gel method of synthesis of nanomaterial. **[4]**

ii) The maximum wavelength absorbed by a nanomaterial is 500 nm. Calculate its energy band gap in electron volt and joules. **[3]**

b) Write a short note on carbon nanotubes. State its advantages and disadvantages. **[5]**

P.T.O.

- Q3)** a) What is nanotechnology? Explain the effect of reduction of dimension of bulk material, along with confinement on structure with example. [7]
- b) What is graphene? Give its uses in technology. [5]

Q4) Write a short notes on any Three of the following. [3×4=12]

- a) Opto electronic properties of nanomaterials.
- b) Biomedical applications of nanomaterials.
- c) Chemical vapour deposition.
- d) Physical vapour deposition.



Total No. of Questions : 4]

SEAT No. :

PE4452

[Total No. of Pages : 2

[6509]-37

M.Sc. (Part - II)

PHYSICS

PHY-610-MJ : Physics of Diagnostic Instruments
(2023 Credit Pattern) (Semester - III) (NEP 2020) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log-tables and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Solve any four of the following :

- i) Distinguish between ENG and EMG? [2]
 - ii) What are the methods of blood flow measurements? [2]
 - iii) What is Doppler ultrasound? [2]
 - iv) State the different uses of image guided radio therapy. [2]
 - v) Write down the human audible frequency range and calculate its value in terms of energy in eV. [2]
- b) What is mean by Bio-potential transducer? Give its examples. [3]

Q2) a) i) Differentiate between CT scan and MRI scan. [4]

- ii) Which therapy is used to treat prostate or breast cancers? Explain in brief. [3]

b) Explain the working principle of USG. [5]

P.T.O.

Q3) a) What is conventional radiation therapy? Explain SBRT differs from conventional method. Describe its working principle. [7]

b) An electro magnetic flow meter is used to measure the blood flow in a vessel. The diameter of vessel is 15mm and the flux density across the electrode is 1.571mm. If the output voltage for a particular flow rate is 1.5mv then flow rate in mm^3/s is? [5]

Q4) Write a short notes on any three of the following :

a) Thermography. [4]

b) Electro cardiography. [4]

c) Skin electron therapy. [4]

d) X-rays working principle. [4]



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 2

PE4453

[6509]-38

S.Y. M.Sc.

PHYSICS

PHY-611-MJ : Radiation Physics

(2023 Credit Pattern) (Semester - III) (NEP 2020) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt/Solve any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log-tables and non-programmable electronic calculator is allowed.
- 6) Neat diagrams must be drawn whenever necessary.

Q1) a) Attempt any four of the following :

- i) Define the term Radiation. [2]
 - ii) What do you mean by tissue weighting factors? [2]
 - iii) Draw the decay scheme of ^{137}Cs gamma source. [2]
 - iv) What is Radiation shielding? [2]
 - v) Enlist the uses of C-T scan machine. [2]
- b) Write down the applications of radioactive nuclei used in diagnostic applications. [3]

Q2) a) i) Enlist ICRP recommended dose limits for occupational and public purposes. [4]

ii) Convert the following terms : [3]

- 1) 1 Gray = ____ RAD?
- 2) 1 Curie = ____ Becquerel?
- 3) 0.01 RAD = ____ Gray?

b) Describe the concept of range and penetration depth. [5]

P.T.O.

Q3) a) What is ionizing radiation? Explain the electron interaction with matter in detail. [7]

b) Describe the principle, construction and working of Computed Tomography (C-T) scan machine. [5]

Q4) Write a short note on any three of the following :

a) Advantages and disadvantages of G-M counter. [4]

b) Mechanism of thermoluminescence. [4]

c) Uses of radiation in insects disinfestation. [4]

d) X-Ray Baggage Scanner. [4]



Total No. of Questions : 4]

SEAT No. :

PE4454

[Total No. of Pages : 2

[6509]-39

S.Y.M.Sc.

PHYSICS

PHY-612-MJ : Physics of Data Science

(2023 Credit Pattern) (NEP - 2020) (Semester - III) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt/Solve any two questions from Q.2 to Q.4.
- 3) Question 2 to 4 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log tables and non-programmable electronic calculator is allowed.
- 6) Neat diagrams must be drawn wherever necessary.

Q1) a) Attempt any four of the following.

- i) What is the primary goal of data science? [2]
- ii) What is supervised learning? [2]
- iii) What is deep learning? [2]
- iv) What is the purpose of filters in data visualization? [2]
- v) Explain list and tuple in python? [2]

b) Write a python program that defines a function to calculate the area of rectangle. The function should take two arguments (length and width) and return calculated value of area. [3]

Q2) a) i) In convolutional Neural Network explain kernel, filter and stride with suitable examples. [4]

ii) Explain the difference between the for loop and while loop in python.[3]

b) What is unsupervised machine learning. Explain different types of unsupervised machine learning with suitable example? [5]

P.T.O.

- Q3)** a) Describe in detail how machine learning algorithm works. [7]
- b) Explain feedforward neural network in detail. [5]

Q4) Write a short note on any three of the following.

- a) Explain the importance of setting goals in data science project. [4]
- b) Discuss the advantages and disadvantages of linear regression. [4]
- c) Describe the role of regularization in deep feedforward network. [4]
- d) Describe the primary purpose and applications of pandas and matplotlib python libraries. [4]



Total No. of Questions : 4]

SEAT No. :

PE4455

[Total No. of Pages : 2

[6509]-40

M.Sc. - II

PHYSICS

PHY-613-MJ : Basic Industrial Instrumentation

(2023 Credit Pattern) (NEP 2020) (Semester - III) (2 Credits) (Elective)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q1 is compulsory.
- 2) Attempt/Solve any two questions from Q2 to Q4.
- 3) Q2 to Q4 carries equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log table and nonprogrammable electronic calculators are allowed.
- 6) Neat labelled diagram must be drawn wherever necessary.

Q1) a) Attempt any four of the following. **[8]**

- i) Define accuracy and precision.
- ii) Draw a block diagram of single channel data acquisition system.
- iii) For LVDT, input = 6.3v, o/p = 5.2v and the operating range = ± 0.5 in, calculate output voltages for core movement going from + 0.45 in to – 0.30 in.
- iv) What are signal conditioners?
- v) What is seeback effect?

b) Draw a circuit diagram of sample and hold (S/H) unit, explain it's working. **[3]**

Q2) a) i) For a certain thermistor, $\beta = 3140k$ and resistance at $27^{\circ}C$ is known to be 1050Ω . The thermistor is used for temperature measurement and the resistance measured is as 2330Ω . Find the measured temperature. **[4]**

ii) Explain step input response of first order instrument in details. **[3]**

b) Obtain an expression for the gain of an instrumentation amplifier. **[5]**

P.T.O.

- Q3)** a) Explain the multichannel data acquisition system in details. [7]
- b) Explain principle, construction and working of LVDT displacement sensor. [5]

Q4) Attempt any three of the following. [12]

- a) Obtain an expression for gauge factor for strain gauges.
- b) Explain capacitive displacement sensor.
- c) Write a note on 'data logger's.
- d) Write a note on 'Preamplification' in data acquisition system.



Total No. of Questions : 7]

SEAT No. :

[Total No. of Pages : 2

PE4456

[6509]-41

S.Y. M.Sc.

PHYSICS

**PHY-651-MJ : Advanced Functional Materials
(2023 Credit Pattern) (NEP 2020) (Semester - IV) (4 Credits)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any five of the following:

- a) What is $\text{Ge}_{20}\text{Te}_{80}$? [2]
- b) Name two protein-based biodegradable polymers derived from animals.[2]
- c) What is an organic solar cell? [2]
- d) What are conjugated polymers? [2]
- e) How do reactive oxygen species (ROS) help in the degradation of pollutant's? [2]
- f) What are magnetostrictive materials? Give one example. [2]

Q2) a) What are the various applications of self-healing polymers across different industries? Discuss with examples. [7]

b) Distinguish between the lithium ion-batteries and sodium ion-batteries.[5]

Q3) a) Explain the working principle and application of magnetostrictive materials with an example. [7]

b) Explain the types of Hydrogen storage Materials. [5]

P.T.O.

- Q4)** a) Explain in detail the various strategies for enhancing the photocatalytic activity of TiO_2 for environmental applications. [7]
b) Write down the various environmental applications of zeolite materials. [5]
- Q5)** a) Explain the structure and properties of mesoporous silica nanoparticles (MSNs). [6]
b) Write down the applications of biodegradable polymers for drug Delivery. [6]
- Q6)** a) Distinguish between the perovskite solar cell's and Traditional silicon solar cells. [6]
b) Write down the applications of shape memory polymers. [6]
- Q7)** Write a short note on any three of the following:
- a) Galvanol [4]
b) Conducting polymer [4]
c) Natural Fiber-Reinforced Composites (NFRCs) [4]
d) Sustainable Energy materials. [4]



Total No. of Questions :7]

PE4457

SEAT No. :

[Total No. of Pages : 2

[6509]-42

S.Y.M.Sc.

PHYSICS

**PHY-652 MJ : Advanced Physics for Thin Films
(2023 Credit Pattern) (Semester-IV) (NEP-2020) (4 Credits)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any five of the following:

- a) Mention two key advantages of CdTe solar cells. [2]
- b) Define photoconductive detectors and give one example. [2]
- c) What is a thin-film resistor? [2]
- d) Name two advantages of microwave integrated Circuits (MICs.) [2]
- e) Define a bolometer [2]
- f) Name two applications of self-healing thin films. [2]

Q2) a) Describe the evolution and advancements in thin-film solar cells. [7]
b) How do microwave integrated circuits (MICs) differ from conventional circuits? [5]

Q3) a) How do magnetic heads work in data storage devices? [7]
b) Discuss the differences between thin-film batteries and supercapacitors. [5]

P.T.O.

- Q4)** a) Explain the working and fabrication of Thin film Transistors (TFTs). [7]
b) Describe the working of a CIGs thin-film solar cell [5]
- Q5)** a) Discuss the differences between pressure sensors and strain sensors. [6]
b) Discuss the various types of surface acoustic wave (SAW) devices. [6]
- Q6)** a) Discuss the concept and applications of thermal imaging. [6]
b) Discuss the importance of optoelectronic information storage devices. [6]
- Q7)** Solve any three of the following: [12]
a) How do radar-absorbing materials (RAM) and radar-reflective materials (RRM) differ?
b) Describe the working principle of a pyroelectric detector
c) Explain the electrical behaviour of metal films.
d) Differentiate between photoconductive and photoemissive detectors.



Total No. of Questions : 7]

SEAT No. :

PE4458

[Total No. of Pages : 2

[6509]-43

S.Y. M.Sc.

PHYSICS

PHY 653 MJ : Advanced Biophysics

(2023 Credit Pattern) (Semester - IV) (4 Credits) (NEP 2020)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Question 1 is compulsory.*
- 2) *Solve any five questions from question 2 to question 7.*
- 3) *Question 2 to 7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any five of the following.

- a) Explain principle of UV-spectroscopy. [2]
- b) Explain the terms fluorescence and phosphorescence. [2]
- c) What is the difference between secondary electrons and back scattered electrons in SEM? [2]
- d) What type of information can Raman spectroscopy provide about biomolecules? [2]
- e) What is Chi-square test? [2]
- f) What are the different types of microscopy? [2]

Q2) a) Explain the principle and working of atomic absorption spectroscopy with neat labelled diagram. [7]

b) Describe the basic components of a flow cytometry and their functions. [5]

Q3) a) Describe principle and working of UV-Visible spectroscopy with neat labelled diagram. [7]

b) Explain principle and working of NMR. [5]

P.T.O.

- Q4)** a) Explain Scanning Electron Microscopy (SEM) in detail with neat labelled diagram. [7]
b) Explain the interaction of radiation with cells and biological systems. [5]
- Q5)** a) Describe IR spectroscopy with neat labelled diagram. [6]
b) Explain confocal microscopy with neat labelled diagram. [6]
- Q6)** a) Describe fluorescence microscopy and its applications. [6]
b) Describe the principle and applications of centrifugation technique in biology. [6]
- Q7)** Write short notes on any three of the following.
- a) MALDI - TOF. [4]
 - b) Bioluminescence [4]
 - c) Raman spectroscopy [4]
 - d) Radiotherapy [4]



Total No. of Questions :7]

SEAT No. :

[Total No. of Pages : 2

PE4459

[6509]-44

S.Y.M.Sc.

PHYSICS

**PHY 654 MJ : Advanced Astronomy and Astrophysics
(2023 Credit Pattern) (Semester-IV) (NEP 2020) (4 credits)**

Time :3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is Compulsory.*
- 2) *Solve Any Five questions from Q.2 to Q.7*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non- programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever neccessary.*

Q1) Solve any Five of the following:

- a) What is dark matter? [2]
- b) State Kirchhoff's Law of thermal radiation. [2]
- c) Name two methods used for root finding in numerical analysis. [2]
- d) Define vector space with an example. [2]
- e) State the cauchy - Riemann conditions for analyticity. [2]
- f) What are neutrinos, and how are they detected in astronomy. [2]

Q2) a) Explain the working principle of gamma-ray telescopes and their importance in detecting high-energy cosmic events. [7]

b) Derive and explain the plank radiation law for black body emission. [5]

Q3) a) Explain the Monte-Carlo method its principles and applications in astrophysics. [7]

b) Explain how poynting flux describes the energy flow in an electromagnetic wave. [5]

Q4) a) Describe and explain the cauchy residue theorem and its applications in contour integration. [7]

b) Explain the series expansion method for solving second-order differential equations. [5]

P.T.O.

- Q5)** a) Describe the main techniques used to detect dark matter and dark energy. [6]
- b) Discuss how Maxwell's equations describe electromagnetic waves and their propagation. [6]

- Q6)** a) Explain how least squares fitting is used to analyze astronomical data.[6]
- b) Discuss the convergence tests used in infinite series. [6]

Q7) Solve any three of the following:

- a) Explain the working principle of infrared telescope. [4]
- b) Describe briefly Thomson Scattering and its importance in astrophysics.[4]
- c) Discuss the significance of hydrodynamics simulations in astrophysics.[4]
- d) Explain the importance of Bessel functions in physics. [4]



Total No. of Questions :7]

SEAT No. :

[Total No. of Pages : 2

PE4460

[6509]-45

S.Y.M.Sc.

PHYSICS

PHY 655 MJ : Advanced Energy Physics

(2023 Credit Pattern) (Semester-IV) (NEP 2020) (4 credits)

Time :3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is Compulsory.*
- 2) *Solve Any Five questions from Q.2 to Q.7*
- 3) *Q.2 to Q.7 carry equal marks.*

Q1) Solve any Five of the following:

- a) What are the different types of wind mills. [2]
- b) How does solar cell works? [2]
- c) What are the types of selective coatings? [2]
- d) What is Fuel cell? [2]
- e) What are the biofuel applications. [2]
- f) What is Hydrogen Fuel. [2]

Q2) Solve the following:

- a) What are the different types of solar cell materials? Write down the different solar cell parameters and characteristics. [7]
- b) What is biomass gasification? Describe various types of biomass gasifiers [5]

Q3) Solve the following:

- a) What are the types of geothermal resources? How geothermal electric power plant works. [7]
- b) Explain the importance of Hydrogen as a future fuel. What are the different sources of hydrogen fuel? [5]

P.T.O.

Q4) Solve the following:

- a) Explain wind turbine types and their construction. [7]
- b) Explain the aerobic and anaerobic bio conversion process. [5]

Q5) Solve the following:

- a) What are the ideal characteristics of selective coating for various applications. [6]
- b) What is a biomass? How is biomass used to produce electric power. [6]

Q6) Solve the following:

- a) Explain with neat diagram the construction and working of domestic hot water system. [6]
- b) What are the different parameters require to extract the maximum power from wind energy. [6]

Q7) Write a short note on any three of the following:

- a) Merits and Demerits of wind mill. [4]
- b) Solar Pond [4]
- c) Biogas- pyrolysis and gasification. [4]
- d) Ethanol as a Bio-fuel. [4]
- e) Direct electrolysis of water. [4]



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 2

PE4461

[6509]-46

M.Sc.-II

PHYSICS

PHY-660-MJ : Energy Storage Devices

(2023 Credite Pattern) (NEP 2020) (Semester - IV) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt/solve any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non-programmable electronic Calculator is allowed.*
- 6) *Neat diagram must be draw wherever necessary.*

Q1) a) Attempt any four of the following.

- i) What is fuel cell? [2]
- ii) Define a super capacitor. [2]
- iii) List two types of energy storage technologies. [2]
- iv) Define energy storage. [2]
- v) What is a fuel cell? [2]

b) Draw and label the working principle of a battery. [3]

Q2) a) i) A super capacitor of 2.5 v and 50 F is charged. How much energy (in Joules) does it store? [4]

ii) A lithium-ion battery has capacitor of 40 kwh and an Ev consumes 150 Wh/Km. Calculate the estimated driving range. [3]

b) Describe the role of hydrogen fuel cells in electric vehicles. [5]

P.T.O.

Q3) a) Discuss the scope, needs and opportunities in energy storage with examples. [7]

b) Describe the different type of super capacitor and their applications.[5]

Q4) Write a short note on any three of following.

a) Scope of energy storage. [4]

b) Fuel cell. [4]

c) Lithium-Ion Batteries. [4]

d) Lead-acid battery. [4]



Total No. of Questions : 4]

SEAT No. :

PE4462

[Total No. of Pages : 2

[6509]-47

S.Y.M.Sc.

PHYSICS

**PHY-661-MJ : Data Interpretation and Analysis
(2023 Credit Pattern) (NEP 2020) (Semester - IV) (2 Credits)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.*
- 2) Attempt/solve any two questions from Q.2 to Q.4.*
- 3) Q.2 to Q.4 carry equal marks.*
- 4) Figures to the right indicate full marks.*
- 5) Use of log table and non programmable Calculator is allowed.*

Q1) a) Attempt Any Four of the following.

- i) Define data cleaning and its significance. **[2]**
- ii) What is the difference between mean, median and mode? **[2]**
- iii) Name any four popular data visualization tools. **[2]**
- iv) What is the significance level α ? **[2]**
- v) Name two types of factor analysis. **[2]**

b) A dataset contains the following values: 1, 2, 3, 4, 5. Calculate the variance and standard deviation of the data set. **[3]**

Q2) a) i) What do you mean by interpreting statistical results? Explain key concept in short that are used in interpreting statistical results. **[4]**

ii) Explain the concept of measures of shapes and describe different types. **[3]**

b) Describe different methods of handling missing data, including listwise deletion mean/median imputation and regression models. **[5]**

P.T.O.

Q3) a) Explain the concept of factor analysis and its purpose in data reduction. Describe the different types of factor analysis, including exploratory factor analysis (EFA) and confirmatory factor analysis. **[7]**

b) Explain the importance of creating meaningful visualization in data analysis. Describe the key elements of a well designed visualization, including clarity, simplicity and accuracy. **[5]**

Q4) Write a short note on Any Three of following.

a) Cluster analysis method and its types. **[4]**

b) Concept of outliers and their impact on data analysis. **[4]**

c) Characteristics to be focused for effective presentation of data analysis results. **[4]**

d) Different types of chart types and their uses. **[4]**



Total No. of Questions : 7]

SEAT No. :

[Total No. of Pages : 2

PE4463

[6509]-48

S.Y. M.Sc.

PHYSICS

PHY-662-MJ : Ocean Physics

(2023 Credit Pattern) (Semester - IV)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q. 1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Q. 2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any five of the following :

- a) Define physical oceanography. [2]
- b) Define wind stress and explain its relevance to oceanography. [2]
- c) Define reflection, scattering and refraction in ocean physics. [2]
- d) What is radiative transfer in the ocean? [2]
- e) What is remote sensing in oceanography? [2]
- f) Define sound propagation in seawater. [2]

Q2) a) Analyze the effects of pressure forcing on coastal ocean dynamics and storm surges. [7]

b) Describe the role of scattering in determining ocean color. [5]

Q3) a) Explain how ocean optics contributes to remote sensing and marine ecosystem studies. [7]

b) Describe the factors affecting sound transmission in seawater. [5]

P.T.O.

Q4) a) Explain how sound speed profile are used in underwater navigation and oceanographic studies. [7]

b) Discuss how pressure forcing influences large-scale oceanic circulation. [5]

Q5) a) Discuss how variations in sound speed create the SOFAR (Sound Fixing And Ranging) channel. [6]

b) Explain the significance of the acoustic wave equation in under water sound modeling. [6]

Q6) a) Discuss the main application of underwater acoustics in oceanography. [6]

b) Describe the impact of atmospheric pressure variation on sea level changes. [6]

Q7) Solve any three of the following :

a) Short note on characteristics of sound in the sea. [4]

b) Explain the relationship between windstress and ocean currents. [4]

c) Explain the role of solar radiation in ocean optics. [4]

d) Differentiate between scalar and vector irradiance. [4]



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 2

PE4464

[6509]-49

S.Y. M.Sc.

PHYSICS

**PHY-663-MJ : Advance Industrial Instrumentation
(2023 Credit Pattern) (Semester - IV) (2 Credits) (NEP 2020)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Question No. 1 is compulsory.*
- 2) *Attempt/Solve any two questions from Q.2 to Q.4.*
- 3) *Question 2 to Question 4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Attempt any four of the following :

- i) What is process equation? [2]
- ii) How error detector works in process control system. [2]
- iii) Draw symbol of switches and O/P device uses in ladder diagram. [2]
- iv) What is two position mode controller? [2]
- v) Write the answer for the MATLAB command [2]

$$>>A = [\text{zeros}(0, 7); 2 : 2 : 14; 10 : -1 : 4]$$

- b) What is integral controller mode? Explain it's response to the error as a input signal. [3]

Q2) a) i) State and explain control system objectives in process control system. [4]

- ii) Explain damped and cyclic response by the process control system to changes in pet point. [3]

- b) Write a note on proportional 'controller mode'. [5]

P.T.O.

Q3) a) Draw a circuit diagram for proportional integral mode controller and explain its response to the changes in error with time. [7]

b) Write narrative statement and explain ladder diagram to perform start and stop sequences of the elevator. [5]

Q4) Attempt any four of the following : [12]

a) Explain action of relay sequencer using suitable example.

b) A process control system has a temperature range of 300 to 400 k and set point at 384k. Find percent of span error when temperature is 379k?

c) Explain response of derivative mode controller action to the rate of change of error occurred.

d) Write a note on “Three mode controller” (PID).

