Total No. of Questions : 4]

SEAT No. : ☐

PC4081

[Total No. of Pages :2

[6335]-1001

First Year M.Sc.

PHYSICS

PHY-501 MJ : Mathematical Methods for Physics

(2023 Credit Pattern) (Semester- I) (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-table or non-programmable electronic calculator is allowed.***

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

i) If $f(t) = 3t - 5$ and $g(t) = t^2$ in the polynomial space P(t) with inner product $\langle f, g \rangle = \int_0^1 f(t)g(t)dt$ .Find $\langle f, g \rangle$

ii) Explain the concept of Hilbert space.

iii) If $L\{f(t)\} = F(s) = \int_0^\infty f(t)e^{-st}dt$ then prove that $L\{t\} = \frac{1}{s^2}$

iv) Define Fourier series. Where it is used?

v) Let u = (1, 3, –4, 2), v = (4, –2, 2, 1), w = (5, –1, –2, 6) in R^4. Show that $\langle 3u - 2v, w\rangle = 3\langle u, w\rangle - 2\langle v, w\rangle$.

b) If A is a Hermitian matrix, then show that it's eigen values are real numbers. **[3]**

Q2) a) i) Find the Fourier series representing $f(x) = x, 0 < x < 2\pi$. **[4]**

ii) If $A = \begin{pmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{pmatrix}$ then find A^{-1}. **[3]**

b) Find the Fourier sine transform of $\frac{1}{x}$. **[5]**

P.T.O.

Q3) a) Find the eigen values and eigen vectors of matrix $\begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$. **[7]**

b) Obtain the Fourier series of function $f(x) = x \quad -\pi < x < 0$

$= -x \quad 0 < x < \pi$ **[5]**

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

a) Find the Laplace transform of sin s*t*, if $L\{\sin t\} = \frac{1}{s^2+1}$.

b) If $f(t)$ and $g(t)$ are complex Fourier transform of F(w) and G(w) respectively then prove that $\int_{-\infty}^{\infty} F(w)G^*(w)\,dw = \int_{-\infty}^{\infty} f(t)g^*(t)dt$.

c) Prove that the product of two matrices $A = \begin{pmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{pmatrix}$ and $B = \begin{pmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{pmatrix}$ is zero when θ and ϕ differ by an odd multiple of $\frac{\pi}{2}$.

d) Explain Gram-Schmidt orthogonalization process steps.

Total No. of Questions : 4]

SEAT No. :

PC4082

[Total No. of Pages : 2

[6335]-1002
M.Sc. - I
PHYSICS
PHY-502-MJ : Statistical Physics
(Credit 2023 Pattern) (Semester-I)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

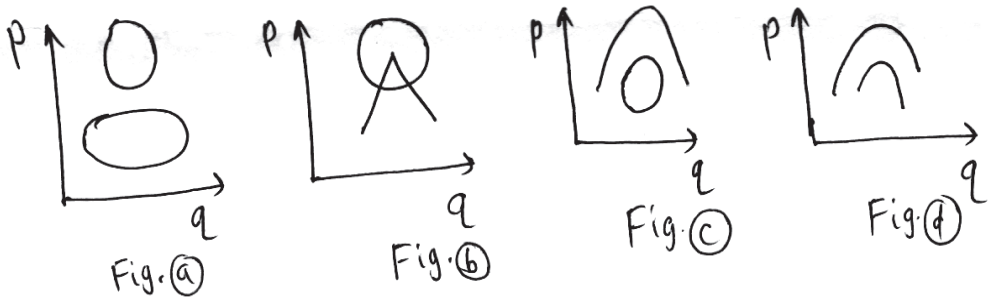
1) ***Q1 is compulsory.***
2) ***Attempt/solve any two questions from Q.2 to Q.4.***
3) ***Q.2 to Q.4 carry equal marks.***
4) ***Figures to the right indicate full marks.***
5) ***Use of log table and non-programmable electronic calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Attempt any FOUR of the following:

i) What is meant by micro-cannonical ensemble. **[2]**

ii) Find the most probable state for the distribution of three particles in 2-cells. **[2]**

iii) Which of the following phase-space trajectory is not possible for a particle obeying Hamilton's eq^{n} of motion? **[2]**



iv) Write short note on "Photon gas". **[2]**

v) Explain the term phase space. **[2]**

P.T.O.

b) Derive an expression for the probability of cannonical ensemble $P_r = \frac{e^{-\beta\varepsilon_r}}{z}$, where z is partition function in cannonical ensemble. **[3]**

Q2) a) i) On the basis of cannonical distribution prove the law of atmosphere. **[4]**

ii) Give the physical interpretation of α **[3]**

b) State and explain Gibbs paradox. **[5]**

Q3) a) State and prove the equipartition theorem and apply it to find mean kinetic energy of a molecule in a gas. **[7]**

b) A system is composed of nine identical particles having different velocities. The velocity distribution among the particles is given as follows.

Number of particles	Velocity in m/s
2	5
3	7
4	8

Calculate the average velocity. **[5]**

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

a) Postulate of equal ä priori ä probability.

b) Radiation pressure for photon gas.

c) Liouvilles theorem.

d) Quantum distribution function.

Total No. of Questions : 4]

SEAT No. :

PC4083

[Total No. of Pages : 2

[6335]-1003
M.Sc. (Part - I)
PHYSICS
PHY-503-MJ : Classical Physics
(2023 Credit Pattern) (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 : **[8]**

i) State D' Alembert's principle.

ii) What is Legendre transformation?

iii) State Poisson's theorem.

iv) Define and classify constraints.

v) Show that the generating transformation $F=\Sigma q_k p_k$ generates identity transformation.

b) A Hamiltonian of one degree of freedom has the form $H=\frac{p^2}{2m}+\frac{1}{2}kq^2$.

Find the Lagrangian corresponding to this Hamiltonian. **[3]**

Q2) a) i) Prove that poisson's brackets are invariant under canonical transformation. **[4]**

ii) Explain generalised coordinates and momenta. **[3]**

b) Show that the transformation defined by $q=\sqrt{2p}\sin Q$ and $p=\sqrt{2p}\cos Q$ are canonical. **[5]**

P.T.O.

Q3) a) i) Using variational principle, discuss the shortest distance problem. **[4]**

ii) Using Lagrangian prove conservation of energy. **[3]**

b) Obtain Lagrangian equation of motion of a simple pendulum of length L. **[5]**

Q4) Attempt any three : **[12]**

a) Write a brief note on configuration space.

b) Explain principle of virtual work.

c) Discuss condition of canonical transformation.

d) Explain degrees of freedom with suitable examples.

Total No. of Questions : 7]

SEAT No. :

PC4084

[Total No. of Pages : 2

[6335]-1004

M.Sc. -I

PHYSICS

PHY 504 MJ : Quantum Physics

(2023 Credit Pattern) (Semester - I)

Time : 3 Hours] **[Max. Marks : 70**

Instructions to the candidates:

1) ***Question no.1. is compulsory.***
2) ***Solve any five Questions from Q.No.2. to Q.No.7.***
3) ***Q. 2 to Q. 7 carry equal marks.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table and non programmable electronic calculator is allowed.***
6) ***Neat diagram must be drawn wherever necessary.***

Q1) Attempt any Five of the following. **[10]**

a) Discuss Heisenberg's uncertainity relation.

b) Explain eigen equation of Hamiltonian operator.

c) What is meant by degenerate states?

d) What is unitary operator?

e) Define singlet and triplet eigen states of spin angular momentum operator.

f) State variational theorem of approximation.

Q2) a) Obtain wave function and energy of one dimensional infinite square well potential system. **[7]**

b) Obtain Pauli's spin matrices σ_x, σ_y and σ_z of S_x, S_y and S_z for spin half system. **[5]**

Q3) a) Obtain first order correction to the time dependent perturbation system of two energy levels. **[7]**

b) Determine the ground state energy of one dimensional square well potential using variational method of approximation. **[5]**

P.T.O.

Q4) a) Obtain Clebsh-Gordan coefficients for a system with total angular momentum operators $j_1 = ½$ and $j_2 = ½$ **[7]**

b) Explain in detail Hilbert space and its properties. **[5]**

Q5) a) Using WKB approximation obtain the wave function of a particle in classical region (E >V) and tunneling region (E < V). **[7]**

b) Determine the first order correction to the ground state energy of 1-D simple harmonic oscillator if the time independent perturbation is $H' = \varepsilon \frac{1}{2} kx^2$, Where K is spring constant of oscillator and ε is a constant. **[5]**

Q6) a) Discuss postulates of quantum mechanics. **[7]**

b) Discuss the orbital angular momentum operators Lz, L^2 and $L\pm$. **[5]**

Q7) Attempt any three of the following. **[12]**

a) Explain projection operator and unit operator.

b) Prove that :

i) $\left[Lz, L\pm\right] = i\hbar L\pm$

ii) $\left[L^2, L\pm\right] = 0$

c) Discuss in brief transition amplitude in constant perturbation system $H'(t) = V\left(\vec{r}\right)$

d) Explain phase velocity and group velocity of wave packet.

e) Explain Dirac-Delta function.

Total No. of Questions : 4]

SEAT No. : ____

PC4085

[Total No. of Pages : 2

[6335]-1005
M.Sc.-I
PHYSICS
PHY - 510 MJ : Industrial Electronics
(2023 Credit Pattern) (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) ***Neat diagrams must be drawn whenever necessary.***

Q1) a) Attempt any four of the following.

i) What is EEPROM? What is its purpose? **[2]**

ii) What is band rate? **[2]**

iii) What are 'things' in IoT. **[2]**

iv) State trans receiver? **[2]**

v) What are principles of open source embedded platforms? **[2]**

b) State and explain different IoT issues and challenges. **[3]**

Q2) a) i) Describe physical design of IoT. **[4]**

ii) What is Digital communication. **[3]**

b) Explain IoT enabling technologies. **[5]**

P.T.O.

Q3) a) i) Describe types of communication Models in IoT. **[4]**

ii) Write a program for LM35 Temperature sensor code for Arduino. **[3]**

b) Write a program to interface an external LED to Arduino and blink it with ON and OFF for 5 sec. **[5]**

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

a) Explain Digital Input and output functions in Arduino. **[4]**

b) Program for LED light with a push Button on an Arduino. **[4]**

c) Variables and its scope **[4]**

d) IDE and its features **[4]**

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Total No. of Questions : 4]

SEAT No. :

PC4086

[Total No. of Pages : 2

[6335]-1006
First Year M.Sc.
PHYSICS
PHY - 511 MJ : Computational Physics
(2023 Credit Pattern) (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 non-programble calculator is allowed.***
6) ***Neat diagrams/flow charts must be drawn wherever necessary.***

Q1) Attempt any four of the following.

a) Mention advantages of using modules in fortran. **[2]**

b) What are rules to write integer constants. **[2]**

c) What is the significance of linking and compiling in fortran. **[2]**

d) Name two intrinsic data types used in fortran. **[2]**

e) Write general form of Lagrange polynomial. **[2]**

f) Write algorithm for Simpson's rule. **[3]**

Q2) a) i) What is Newton-Raphson method to solve the equations. **[4]**

ii) Explain character set in fortran. **[3]**

b) Write a fortran programme and draw flow chart to simulate a simple harmonic oscillator. **[5]**

P.T.O.

Q3) a) Solve following simultaneous equations using Gauss elimination method.

$2x_1 + 3x_2 - x_3 = 5$

$3x_1 + 2x_2 + x_3 = 10$

$x_1 - 5x_2 + 3x_3 = 0$ **[7]**

b) What are four classes of functions in fortran? Explain intrinsic function with examples. **[5]**

Q4) Attempt any three of the following.

a) Explain use of conditional statements in fortran with example. **[4]**

b) What is strings and which functions are used to manipulate strings? **[4]**

c) Explain Lagrange interpolation method. **[4]**

d) Explain Runge-Kutta method to solve differential equation. **[4]**

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Total No. of Questions : 7]

SEAT No. :

PC4087

[Total No. of Pages : 2

[6335]-1007
First Year M.Sc.
PHYSICS
PHY - 512 MJ : Space Weather and Technology
(2023 Credit Pattern) (Semester - I) (Elective)

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 whenever necessary.***

Q1) Solve any five of the following.

a) What is the sunspot? **[2]**

b) Define solar Cycle. **[2]**

c) What do you mean by Aurorae? **[2]**

d) Define the term thermosphere. **[2]**

e) What are the geomagnetic activity indices? **[2]**

f) State any two applications of space weather? **[2]**

Q2) a) Explain in detail solar flares and coronal mass Ejections. **[7]**

b) Explain the geomagnetic activity indices. **[5]**

Q3) a) Explain in detail Magnetic storms and Aurorae. **[7]**

b) Explain the propagation of coronal Mass Ejections in the interplanetary medium. **[5]**

P.T.O.

Q4) a) Explain in detail the composition and structure of the thermosphere and mesosphere. **[7]**

b) Explain the interaction of the solar wind with the Terrestrial magnetic field. **[5]**

Q5) a) What is remote sensing? Explain in details the effect of space weather on remote sensing systems. **[6]**

b) What is stratosphere? Explain the properties of stratosphere. **[6]**

Q6) a) Explain with neat diagram the Earth's magnetosphere. Explain the concept of Magnetopause. **[6]**

b) What is GPS? Explain the effect of space weather on GPS. **[6]**

Q7) Write short note on any three of following.

a) Magnetospheric cavity. **[4]**

b) Electric and power grid **[4]**

c) Solar wind **[4]**

d) Satellite **[4]**

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Total No. of Questions : 4]

SEAT No. : ____

PC4088

[Total No. of Pages : 2

[6335]-1008
First Year M.Sc.
PHYSICS
PHY - 513 MJ : Atmospheric Physics
(2023 Credit Pattern) (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 and non-programble electronic calculator is allowed.***
6) ***Neat diagrams must be drawn whenever necessary.***

Q1) a) Attempt any four of the following.

i) What are the real forces? **[2]**

ii) Define the GPS sonde. **[2]**

iii) What is the SODAR? **[2]**

iv) Define the hydrostatic balance. **[2]**

v) What is the orbit optimization? **[2]**

b) Explain the types of orbits. **[3]**

Q2) a) i) What are the primitive equations? Discuss the applications of primitive equations. **[4]**

ii) Explain the concept of atmosphere as a heat engine. **[3]**

b) Write a short note on launch vehicle and spacecraft. **[5]**

P.T.O.

Q3) a) What are the LIDARS? Explain in detail the working principle and application of LIDARS. **[7]**

b) Explain the concept of suppression of vertical motions by planetary rotation. **[5]**

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

a) Pilot Ballons **[4]**

b) Geostrophic wind **[4]**

c) Vorticity and Divergence **[4]**

d) Ozone sonde **[4]**

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Total No. of Questions : 4]

SEAT No. : ____

PC4089

[Total No. of Pages : 2

[6335]-1009
First Year M.Sc.
PHYSICS
PHY - 514 MJ : Communication Physics
(2023 Credit Pattern) (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) ***Neat diagrams must be drawn whenever necessary.***

Q1) a) Attempt any four of the following.

i) What is Error detection? **[2]**

ii) What is angle of elevation? **[2]**

iii) Explain parity check codes. **[2]**

iv) What is transmission path? **[2]**

v) What is satellite attitude? **[2]**

b) Calculate the capacity of a standard 4 kHz telephone channel has 3100Hz bandwidth with a 30dB signal to noise ratio. **[3]**

Q2) a) i) Explain Network organization. **[4]**

ii) Explain the ASCII code used in digital communication. **[3]**

b) What are fundamentals of digital communication system? **[5]**

P.T.O.

Q3) a) Describe three different codes used for data transmission and discuss their merits and demerits. **[7]**

b) Describe radar systems. **[5]**

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

a) Satellite frequencies. **[4]**

b) Basic pulsed radar system. **[4]**

c) Digital codes. **[4]**

d) Constant ratio codes. **[4]**

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Total No. of Questions : 4]

SEAT No. : ____

PC4090

[Total No. of Pages :2

[6335]-1010

First Year M.Sc.

PHYSICS

PHY-541 MN : Research Methodology

(2023 Credit Pattern) (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) Solve any four of the following: (2 marks each) **[8]**

i) Define Questionari.

ii) What is report writing?

iii) What do you mean by review article?

iv) What is main purpose of data analysis?

v) What is research methodology?

b) Explain the process of data analysis in research. **[3]**

Q2) a) i) What do you mean by survey? Discuss the main types of survey. **[4]**

ii) Distinguish between research methods and methodology. **[3]**

b) Briefly explain the significance of data processing. What are the problems associated with data processing? **[5]**

Q3) a) What is research proposal? Explain the components of research proposal. **[7]**

b) Explain the importance of review of literature in research. **[5]**

P.T.O.

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

a) Primary and secondary data

b) Uses of data collection

c) Research ethics and plagiarism.

d) Characteristics of research methods.

Total No. of Questions : 7]

SEAT No. : ____

PC4091

[Total No. of Pages : 2

[6335]-2001
First Year M.Sc.
PHYSICS
PHY - 551 MJ : Solid State Physics
(2023 Credit Pattern) (Semester - II) (4 Credits)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question 1 is compulsory.***
2) ***Attempt / Solve any five questions from Q.2 to Q.7.***
3) ***Q.2 to Q.7 carry equal marks.***
4) ***Figure to the right indicate full marks.***
5) ***Use of log tables & 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 cyclotron resonance?

b) What are type - I & type - II superconductor?

c) What is piezoelectricity? Give its example.

d) State Hund's Rule.

e) Define

i) Crystal lattice

ii) Unit cell

f) A superconducting tin has a critical temprature of 3.7k at zero magnetic field & a critical field of 0.0306 tesla at 0k. Find critical field at 2k.

Q2) Attempt the following.

a) What is ferromagnetism? Explain in detail with the help of Weiss molecular theory? **[7]**

b) What is Meissner effect? Explain with neat labelled diagram. **[5]**

Q3) Attempt the following questions.

a) On the basis of band theory of solids distinguish between a metal. Semiconductor and insulator. **[7]**

P.T.O.

b) A flux quantum (Fluxoid) is approximately equal to 2×10^{-7} gauss cm^2 a type - II superconductor is placed in a small magnetic field which is then slowly increased till the field starts penetrating the superconductor. The strength of the field at this point is $\frac{2}{\pi}\times10^5$ gauss then calculate the penetration depth of this superconductor. **[5]**

Q4) Attempt the following questions.

a) State and prove Bloch theorem. **[7]**

b) Explain Josephson effect in superconductor. **[5]**

Q5) Attempt the following questions.

a) i) A narrow beam of x-ray with wavelength 1.5Å is reflected from an ionic crystal with an FCC lattice structure with a density of 3.32 gcm^{-3}. The molecular weight is 108 amu (1 amu = 1.66×10^{-24}g). Then find lattice constant? **[4]**

ii) Explain with neat diagram's reduced, periodic & extended zone schemes. **[3]**

b) Obtain Clausius - Mossotti relation. **[5]**

Q6) Attempt the following questions.

a) Discuss the origin of paramagnetism in free atom obtain Langevin's paramagnetic equation for paramagnetic susceptibility. **[7]**

b) The critical temperature T_c for mercury with isotopic mass 199.5 is 4.185k. Calculate its critical temperature when its isotopic mass changes to 203.4.**[5]**

Q7) Attempt any three of the following questions. **[12]**

a) Dielectric behaviour in $BaTiO_3$

b) Superconductivity on the basis of BCS theory

c) Quantum theory of Paramagnetism.

d) Cooper pairs

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Total No. of Questions : 4]

SEAT No. : ____

PC4092

[Total No. of Pages : 2

[6335]-2002

M.Sc. - I

PHYSICS

PHY-552-MJ : Electrodynamics

(2023 Credit Pattern) (Semester - II)

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 electronic calculator is allowed.***
6) ***Neat diagram must be drawn whenever necessary.***

Q1) a) Solve any four of the following :

i) What is meant by linear quadrapole? **[2]**

ii) State Differential form of maxwell's equations. **[2]**

iii) Write Lorentz condition for magnetic vector potential A. **[2]**

iv) State Eienstein's postulates of special theory of relativity. **[2]**

v) Define the D'Alembertian operator formula. **[2]**

b) Two point charges 6q and –2q are separted by a distance 'a'. Find the monopole moment. **[3]**

Q2) a) i) Obtain an expression for Lorentz force on charge particle. **[4]**

ii) Discuss the negative results of Michelson - morle experiment. **[3]**

b) Explain the term gauge transformation. **[5]**

P.T.O.

Q3) a) Derive innomogeneous wave equation in terms of scalar potential ϕ and vector potential A. **[7]**

b) Obtain an expression for electromagnetic field tensor $F_{\mu\nu}$. **[5]**

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

a) Maxwell's displacement current. **[4]**

b) Lorentz's and coulomb's gague. **[4]**

c) Minkowskis space - time diagram. **[4]**

d) Michelson - Morley Experiment. **[4]**

Total No. of Questions : 4]

SEAT No. : [ ]

PC4093

[Total No. of Pages : 2

[6335]-2003

M.Sc. - I

PHYSICS

PHY 553 MJ : Atomic and Molecular Physics

(2023 Credit Pattern) (Semester - II)

Time : 2 Hours] ***[Max. Marks : 35***

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 wherever necessary.***

Q1) a) Attempt any four of the following.

i) Calculate the total number of electrons in a shell if principle quantum number 'n' is 4. **[2]**

ii) What is Raman Effect? Hence explain the meaning of stokes and antistokes line. **[2]**

iii) What is Paschen - Back effect. **[2]**

iv) Define dissociation energy for a diatomic molecule. **[2]**

v) An electron is placed in a magnetic field of strength 1.3T. Calculate the resonance frequency if g = 2.0023. **[2]**

b) What is rotational quantum number? Explain the selection rule for rigid diatomic rotator. **[3]**

Q2) a) Explain the principle construction and working of infrared spectrometer with the help of neat diagram. **[7]**

b) For exciting line with λ = 5000Å, the stokes Raman line for a substance falls at 5100Å. For the same substance with exciting line at λ = 4000Å, find the wavelength of anti - stokes line. **[5]**

P.T.O.

Q3) a) Explain the construction and working of microwave spectrometer. **[7]**

b) Explain the vibrational energy levels of diatomic molecules with the help of Morse curve. **[5]**

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

a) Zeeman effect and its significance. **[4]**

b) Explain the resonance condition in NMR spectroscopy. **[4]**

c) Resonance condition in ESR. **[4]**

d) State and explain Frank - condon Principle. **[4]**

Total No. of Questions : 4]

SEAT No. : ____

PC4094

[Total No. of Pages : 2

[6335]-2004

M.Sc. - I

PHYSICS

PHY-554-MJ : Basic Electronics

(2023 Credit Pattern) (Semester - II)

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

i) What are the application of SCR as a half wave rectifier and a full wave rectifier. **[2]**

ii) Discuss the role of operational amplifiers in the implementation of multivibrator and precision rectifier. **[2]**

iii) Describe working principle of DIAC and TRIAC. **[2]**

iv) Explain the concept of an instrumentation amplifer using three operational amplifier. **[2]**

v) Define DC-DC Converter and SMPS. Provide an example of their application. **[2]**

b) In a forward converter, if the input voltage is 48V and output voltage is 12V, and the primary winding has 100 turns, calculate the number of turns required on the secondary winding assuming ideal transformer operation. **[3]**

P.T.O.

Q2) a) i) Discuss the construction and working of a half wave rectifier using SCR, Give its advantages and limitations. **[4]**

ii) In a buck converter, the input voltage is 12V, and output voltage is 5V if the load current is 2A and switching frequency is 100 kHz, calculate the efficiency of the converter assuming negligible losses.**[3]**

b) Explain the working principle of a TRIC and its role in fan regulators.**[5]**

Q3) a) Describe block diagram, working principles and applications of phase locked loop (IC565) as a detector. Discuss its advantages and limitations compared to other detection method, and provide examples of its usage in practical system. **[7]**

b) Briefly explain the block diagram of IC723 voltage regulator and discuss its applications as a low and high voltage regulator. **[5]**

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

a) Concept of SMPS and its advantages. **[4]**

b) Describe principles of pulse Amplitude modulation. **[4]**

c) Application of DIAC and TRIAC as a fan regulator. **[4]**

d) Construction and working principle of Timer IC 555. **[4]**

Total No. of Questions : 4]

SEAT No. :

PC4095

[6335]-2005

[Total No. of Pages : 2

First Year M.Sc.

PHYSICS

PHY 560 MJ : Fiber Optics and Photonics

(2023 Credit Pattern) (Semester-II)

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 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: **[8]**

i) What is the basic of Fibre optics?

ii) Where is optical fiber used?

iii) What is the acceptance core of optical fiber?

iv) What is the study of numerical aperture?

v) What is the difference between skew rays and meridional rays?

vi) What are the modes of propagation of light?

vii) What are different Fiber Losses?

b) Describe the basic principle of optical Fibres. **[3]**

Q2) a) Answer the following questions.

i) What is Grating in Photonics Technology? What are its different types? **[4]**

ii) Explain the principle of Isolators and Circulators. **[3]**

b) Explain various applications of OFC Technology. **[5]**

P.T.O.

Q3) a) Answer the following questions.

i) What is a directional coupler?Where are directional couplers used? **[4]**

ii) Explain Materials or Impurity Fiber Losses. **[3]**

b) Describe Fabry-Perot Filters. **[5]**

Q4) Attempt any THREE of the following: **[12]**

a) What is the acceptance angle?

b) How to measure Refractive Index?

c) What is graded-index fibre?

d) What are the applications of numerical aperture?

e) What is the classification of fiber?

■■■■

Total No. of Questions : 4]

SEAT No. :

PC4096

[Total No. of Pages : 1

[6335]-2006
First Year M.Sc.
PHYSICS
PHY - 561 - MJ : Experimental Techniques for Material Characterization
(Credit 2023 Pattern) (Semester-II)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***Q1 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 electronic calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Solve any four of the following.

i) What is the effect of strain on crystallite size? **[2]**

ii) How does elemental analysis (EDS) works? **[2]**

iii) State different types of microscopes. **[2]**

iv) Write down the principle of photoluminescence (PL). **[2]**

v) Give the importance of four probe method. **[2]**

b) For certain BCC crystal, the (110) plane have separation of 1.181 Å. These (110) planes are irradiated with X-rays of wavelength 1.54 R. How many order of Bragg's reflection can be observed? **[3]**

Q2) a) i) State and prove the Bragg's law of Diffraction. **[4]**

ii) Distinguish between SEM and TEM. **[3]**

b) Explain the principle, construction and working of UV-visible spectrometer. **[5]**

Q3) a) Derive the Debye-Scherrer equation. **[7]**

b) Explain the principle, construction and working of X-ray photoelectron spectroscopy(XPS). **[5]**

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

a) Advantages and disadvantage of TEM. **[4]**

b) Hall Effect **[4]**

c) Filter's and monochromators in XRD. **[4]**

d) Resistivity by four probe method. **[4]**

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P.T.O.

Total No. of Questions : 4]

SEAT No. :

PC4097

[Total No. of Pages : 2

[6335]-2007
First Year M.Sc.
PHYSICS
PHY-562-MJ : Industrial Physics
(Credit 2023 Pattern) (Semester-II)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***Q1 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 electronic calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

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

i) What is PV in solar panels?

ii) Where are semiconductor devices used?

iii) What is the principle of vacuum sealing?

iv) What are the units used in different parts of the world to measure vacuum pressure.

v) What are the various methods available to detect charged particles?

vi) Define mean-life or average life of a radioactive sample.

b) The Mass defect for a $_{2}^{4}He$ nucleus is 0.0305 amu (1 J = 1 kg.m^2/s^2). Determine BE in Joule per nuclide using mass energy equivalence equation. **[3]**

Q2) a) Answer the following questions.

i) Write a short note on "Work Ethics and Industrial Working Conditions". **[4]**

ii) Explain different methods for Industrial vacuum creation? **[3]**

b) Explain the different electrical instruments used in Industries. **[5]**

Q3) a) Answer the following questions.

i) Explain the Radiation Protection in Medical Applications. **[4]**

ii) What is a Synchroton? State its working principle. **[3]**

b) Explain how to write Scientific Working Reports. **[5]**

P.T.O.

Q4) Attempt any THREE of the following: **[12]**

a) Write a short note on "Basic structure of a particle accelerator".

b) Explain the various types of "Uses of semiconductor devices".

c) Write a short note on "Different types of vacuum sealing machines".

d) Write a short note on "Work Ethics and Industrial Working Conditions".

e) Explain various the essential components of a particle accelerator?

f) Write a short note on "Safety Issues in Industry".

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Total No. of Questions : 4]

SEAT No. :

PC4098

[6335]-2008

[Total No. of Pages : 2

M.Sc. -I

PHYSICS

PHY-563-MJ : Semiconductor Technology

(2023 Credit Pattern) (Semester-II)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***Q1 is compulsory.***
2) ***Attempt any two questions from Q2 to Q4.***
3) ***Q2 to Q4 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: **[11]**

i) What is Fermi - Dirac distribution function? **[2]**

ii) What do you mean by conductivity and mobility of charge carrier? **[2]**

iii) What are contact potentials? **[2]**

iv) Calculate built in or contact potential for silicon p-n junction with $N_A = 10^{18}$ cm^{-3} and $N_D = 10^{15}$ cm^{-3} at 300 K. (Given n_i for sillicon $= 9.65 \times 10^9$ cm^{-3}) **[2]**

v) What is diffusion capacitance in p-n junction? **[2]**

b) What are direct and indirect semiconductors? **[3]**

Q2) a) i) A sample of Si is doped with 10^{16} phosphorus atoms/cm^3. Find Hall voltage in sample with W = 500 μm, A = 2.5×10^{-3} cm^2, I = 1 mA and $B_z = 10^{-4}$ wb/cm^2. **[4]**

ii) Derive Einstein's equation which gives relation between diffusivity and mobility of charge carries in semiconductor. **[3]**

b) Explain quantum tunneling phenomenon with a neat diagram in semiconductors. **[5]**

P.T.O.

Q3) a) Obtain an expression for contact potential (or built-in potential) in terms of width of p-n junction.

$$V_0 = \frac{1}{2}\frac{q}{\in}\left[\frac{\text{Na Nd}}{\text{Na} + \text{Nd}}\right]\text{W}^2$$

Here symbols are with their usual meaning. **[7]**

b) Derive an expression for electron and hole concentration in semiconductor at thermal equillibrium and also show that, $n_0 p_0 = n_i^2$. **[5]**

Q4) Attempt any three of the following: **[12]**

a) Explain carrier diffusion process in the semiconductor material and obtain an expression for net rate of carrier how through material. **[4]**

b) Explain zener and Avalanche breakdown in p-n junction of semiconductor. **[4]**

c) Explain Haynes-shockley experiment for the carrier distribution with and without electric field in semiconductor. **[4]**

d) For silicon one sided abrupt junction with $N_A = 10^{19}$ cm^{-3} and $N_D = 10^{16}$ cm^{-3}, calculate the depletion layer width and the maximum field at zero bias (T = 300 K, n_i for S_i = 9.65 J × 10^9 Cm^{-3}) ($\in_s = 0.119 \in_0$). **[4]**

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Total No. of Questions : 4]

SEAT No. :

PC4099

[Total No. of Pages : 2

[6335]-2009

First YearM.Sc.

PHYSICS

PHY-564-MJ : Laser Physics

(2023 Credit Pattern) (Semester-II)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***Q1 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 to 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 do you mean by spontaneous emission? **[2]**

ii) Define the term of metastable state. **[2]**

iii) What do you mean by pumping? **[2]**

iv) What do you mean by population inversion? **[2]**

v) Define active medium. What is active medium used in Ruby laser. **[2]**

b) Find the ratio of spontaneoas emission to stimulated emission for a cavity of temperature 50k and wavelength 10^{-5}m. **[3]**

Q2) a) Answer the following questions.

i) What are the Einstein's coefficiants? Discuss in detail. **[4]**

ii) Illustrate basic difference between spontaneous emission and stimulated emission of radiation. **[3]**

b) Explain four level laser system with energy level diagram. Why it is more efficient than other system? **[5]**

P.T.O.

Q3) Answer the following questions.

a) Explain with the help of an appropriate energy level diagram, how stimulatated emission results from electron impact pumping in He-Ne gas laser. **[7]**

b) Explain different type of pumping & give methods of pumping briefly. **[5]**

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

a) Ruby lasers **[4]**

b) Properties of laser **[4]**

c) Semi conductor laser **[4]**

d) Line broadening mechanisms **[4]**

Total No. of Questions : 7]

SEAT No. : ____

PC4100

[Total No. of Pages : 2

[6335]-3001

S.Y.M.Sc.

PHYSICS

PHY-601-MJ: Nuclear Physics

(2023 Credit Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question No.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.***

Q1) Solve any five of the following.

a) Draw BE/A versus A curve. **[2]**

b) Define the unit of radiactivity Curie. **[2]**

c) Write any two limitations of shell model. **[2]**

d) Give the examples of even parity and odd parity of quarks. **[2]**

e) Distinguish between nuclear fission & nuclear fusion. **[2]**

f) What is conserved during Lepton decay? **[2]**

Q2) a) Explain working principle of scintillation detector in detail. Write it's advantages and limitations. **[7]**

b) Describe the decay scheme and half life of ^{60}Co gamma source. **[5]**

Q3) a) Derive the four-factor formula for steady-state chain reaction. **[7]**

b) What is Q-value of nuclear reaction? Explain it's cases. **[5]**

Q4) a) Explain the construction and working of Betatron. Prove that the betatron condition $\frac{d\phi}{dt} = 2\pi R^2 \frac{dB}{dt}$. **[7]**

b) Calculate the BE/nuclear of ^{7}Li and ^{56}Fe. [M_{Li} = 7.016 amu and M_{Fe} = 55.935 amu] **[5]**

P.T.O.

Q5) a) State the law of radioactive disintegration. The half life of Radon is 3.82 days. What fraction of freshely prepared sample of Radon will disintegrate in 10 days? **[6]**

b) Describe any method for measuring nuclear size. **[6]**

Q6) a) Discuss the details of the evidences for the existance of magic number in shell model. **[6]**

b) A cyclotron has a magnetic field of $1.5 Wb/m^2$. The extraction radius is 0.5m. Calculate frequency of the oscillater necessary for accelerating deuterons and the energy of the extracted beam accelerating deuterons and the energy of the extracted beam ($mp = 1.67 \times 10^{-27}$ kg) **[6]**

Q7) Write short notes on any three of the following. **[12]**

a) Classification of elementary particles

b) Alpha decay

c) Cloud chamber

d) Magnetic dipole moments and electric quadrapole moment of nuclei

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Total No. of Questions : 7]

SEAT No. :

PC4101

[Total No. of Pages : 2

[6335]-3002

S.Y.M.Sc.

PHYSICS

PHY 602 MJ : Fundamental Physics of Thin Films

(2023 Credit Pattern) (Semester - III)

Time : 3 Hours] **[Max. Marks : 70**

Instructions to the candidates:

1) ***Question no.1. is compulsory.***
2) ***Solve any five Questions from Q.No.2. to Q.No.7.***
3) ***Q. 2 to Q. 7 carries equal marks.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table and non programmable electronic calculator is allowed.***
6) ***Neat diagram must be drawn where necessary.***

Q1) Solve any Five of the following. **[10]**

a) State the various steps followed in SILAR method of thin film deposition.

b) Define stokes and anti-stokes lines.

c) Define the condensation meunanism in thin film growth.

d) Explain the resistive heating phenomenon in thermal evaporation method.

e) Which technique is utilized for elemental analysis of thin films? State its working principle.

f) Enlist the mechanical properties of thin films.

Q2) a) What is the CVD method? Explain various chemical reactions involved in it. Also explain in detail the different stages of thin film growth. **[7]**

b) What is the necessity of vacuum during thin film preparation? Distinguish between thick and thin film. **[5]**

Q3) a) State the different techniques of thin film coatings. Explain the construction and working principle of spray pyrolysis technique. **[7]**

b) How to calculate strain produced in thin films? Explain the mechanical properties of thin films. **[5]**

P.T.O.

Q4) a) Enlist methods to measure the thickness of thin film. **[7]**

b) State me factors affecting on thin film nucleation and growth by physical method. **[5]**

Q5) a) Explain the construction and working principle of molecular beam Epitaxy with, Schematic diagram. **[6]**

b) Which theory is suitable for electron transport process in thin films? Explain in detail. **[6]**

Q6) a) Why capillarity model is suitable for homogeneous growth of thin films? Explain in detail. **[6]**

b) Explain in detail. Pulse Laser Deposition. **[6]**

Q7) Answer any three of the following. **[12]**

a) Optical properties of thin films.

b) Microbalance method.

c) Atomic force Microscopy.

d) Volmer-Weber model.

Total No. of Questions : 7]

SEAT No. : ____

PC4102

[Total No. of Pages : 2

[6335]-3003

S.Y.M.Sc.

PHYSICS

PHY-603-MJ: Fundamental Biophysics

(2023 Credit Pattern) (Semester - III) (Special - I)

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 table and non-programmable electronic calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

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

a) Define Biophysics.

b) What are eukaryotic organisms?

c) What is protoplasm?

d) Define Liposomes.

e) What is Ramchandran plot?

f) State applications of Positron Emission Tomography (PET) technique.

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

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

Q3) a) Derive Nernst-Plank equation from fundamental principles, and explain its significance. **[7]**

b) Describe the different types of neurons based on their functions with examples. **[5]**

Q4) a) Explain in detail MRI technique and its application. **[7]**

b) Define and explain the concept of electrical resistance in neurons. **[5]**

P.T.O.

Q5) a) State and explain structure and function of water and carbohydrates. **[7]**

b) Explain α and β–helix in proteins and difference between them. **[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. **[12]**

a) Structure of Animal cell.

b) Lipid model systems.

c) Types of DNA.

d) Genetic code symmetry.

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Total No. of Questions : 7]

SEAT No. : ____

PC4103

[Total No. of Pages : 2

[6335]-3004

S.Y.M.Sc.

PHYSICS

PHY-604-MJ: Fundamental Astronomy and Astrophysics

(2023 Credit Pattern) (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 diagrams must be drawn wherever necessary.***

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

a) State the virial Theorm.

b) What is the dark matter?

c) Explain the concept of comets.

d) What are the supernovae?

e) What are the asteroids?

f) Define the types of planet.

Q2) a) Explain the concept of radiative equilibrium and how it applies to the energy balance of planetary atmospheres. **[7]**

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

Q3) a) Explain the concept of galactic rotation and its implications for the distribution of matter in galaxies. **[7]**

b) Describe the evolution of protoplanetary disks and how they lead to planet formation. **[5]**

Q4) a) State and explain the virial theorem and its application to the stability of stars. **[7]**

b) What is the dark matter? Explain the role of dark matter in the formation and evolution of galaxies. **[5]**

P.T.O.

Q5) a) Discuss the primary process of nuclear energy generation in stars and their dependance on temperature and density. **[6]**

b) Write a short note on Cosmological Puzzles. **[6]**

Q6) a) Define mechanical, thermal and nuclear time scales in the context of stellar astrophysics. **[6]**

b) Describe the standard model of cosmology. What are its key components and assumptions? **[6]**

Q7) Write short note on any three of the following. **[12]**

a) Milky Way Galaxie.

b) Minor planets

c) Chandra Sekhar limit.

d) Dark Energy.

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Total No. of Questions : 7]

SEAT No. :

PC4104

[Total No. of Pages : 2

[6335]-3005

S.Y.M.Sc.

PHYSICS

PHY 605 MJ : Fundamental Energy Physics

(2023 Credit Pattern) (Semester - III)

Time : 3 Hours] **[Max. Marks : 70**

Instructions to the candidates:

1) ***Question no.1. is compulsory.***
2) ***Solve any five Questions from Q.No.2. to Q.No.7.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic table and non programmable electronic calculator is allowed.***
5) ***Neat diagram must be drawn wherever necessary.***

Q1) Attempt any Five of the following. **[10]**

a) Define the term "Solar constant"?

b) What are the various forms of energy?

c) What do you mean by thermal conductivity of material?

d) Define sensible heat storage.

e) What is Solar pond?

f) Write any two reasons behind global warming.

Q2) a) i) Explain fourier's low and Stefans-botlzman relation. **[4]**

ii) Explain 1st low of thermodynamics with real life example. **[3]**

b) Draw neat diagram of pyranometer & explain in brief it's working and principle. **[5]**

Q3) a) What is global warming? Explain in brief about essential factor for sustainable development. **[7]**

b) What are different types of heat transfer? Define each type, Explain basic unit's of heat. **[5]**

P.T.O.

Q4) a) Explain the working principle of pyrheliometer with neat diagram. How this instrument used to measure solar radiation. **[7]**

b) What is solar pond? Describe it's structure and Explain how it is used for energy storage. **[5]**

Q5) a) What are the electrical & chemical energy systems? Explain in brief. **[6]**

b) Explain the role of energy in economic development & how it is influences social transformations. **[6]**

Q6) a) Draw Schematic diagram of sunshine recorder & explain in brief it's principle. **[6]**

b) Explain 1^{st} & 2^{nd} low of thermodynamics with real life examples. **[6]**

Q7) Write a short note on any three of the following. **[12]**

a) Geothermal energy & it's application.

b) Latent heat storage system.

c) Various types of energy sources.

d) Pyranometer.

Total No. of Questions : 4]

SEAT No. :

PC4105

[Total No. of Pages : 2

[6335]-3006
S.Y. M.Sc.
PHYSICS
PHY-606-MJ : Physics of Nanomaterials
(2023 Credit Pattern) (Semester - III)

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) ***Neat diagrams must be drawn wherever necessary.***
5) ***Figures to the right indicate full marks.***
6) ***Use of log table and non-programmable electronic calculator is allowed.***

Q1) a) Attempt any four of the following :

i) What is Top-down approach? **[2]**

ii) Write any two application of carbon nanotubes. **[2]**

iii) Enlist the various fields of applications of nanomaterials. **[2]**

iv) What are the advantages of chemical vapour deposition? **[2]**

v) What is the principle behind the sputtering method. **[2]**

b) Draw a neat labelled diagram of chemical bath deposition. **[3]**

Q2) a) i) Explain nucleation and growth phenomena for nanomaterials synthesis. **[4]**

ii) Calculate the optical energy band gap of wave length 500nm. **[3]**

b) Explain Top-down and Bottom-up approach with neat diagram. **[5]**

P.T.O.

Q3) a) Describe step by step the physical vapour deposition with suitable diagram. **[7]**

b) What are carbon nanotubes? Explain various properties of it. **[5]**

Q4) Write short notes on any three of the following : **[12]**

a) Graphene

b) Optoelectronic application

c) Mechanical properties

d) Application of Energy generation and storage

Total No. of Questions : 4]

SEAT No. :

PC4106

[Total No. of Pages : 2

[6335]-3007

S.Y.M.Sc.

PHYSICS

PHY 610 MJ : Physics of Diagnostic Instruments

(2023 Credit Pattern) (Semester - III)

Time : 2 Hours] **[Max. Marks : 35**

Instructions to the candidates:

1) ***Question no.1. is compulsory.***
2) ***Solve any two questions from Q.No.2. to Q.No.4.***
3) ***Q.No.2. to Q.No.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.

i) Distinguish between EEG and EMG? **[2]**

ii) Define transducer and give its example. **[2]**

iii) What is Doppler ultrasound? **[2]**

iv) What are different types of blood flow meters? **[2]**

v) What is the wavelength range of X-rays used in medical uses? **[2]**

b) What is mean by Bio-potential electrode? **[3]**

Q2) a) i) Which therapy is used to treat prostate or breast cancers? Explain brief. **[4]**

ii) How the specific electron retino graphical signals in human retina are assessed? Explain brief. **[3]**

b) Explain the working principle of MRI. **[5]**

P.T.O.

Q3) a) State and explain the working principle of Light LET radiation theraphy with the help of neat labelled schematic diagram. Give its uses. **[7]**

b) Calculate the distance of the object if an acoustic burst is sent in the air and received after 1.5 seconds. Also, What would be the propagation delay if the medium water and the distance was same? Assume the speed of sound in air and water is 340 m/s and 180 m/s, respectively. **[5]**

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

a) Electroneurograph **[4]**

b) Computed Tomography Scanning **[4]**

c) Skin Electron Therapy **[4]**

d) ECG **[4]**

Total No. of Questions : 4]

SEAT No. : ____

PC4107

[Total No. of Pages : 2

[6335]-3008

S.Y.M.Sc.

PHYSICS

PHY-611-MJ: Radiation Physics

(2023 Credit Pattern) (Semester - III)

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 wherever necessary.***

Q1) a) Attempt any four of the following:

i) What is LET and KERMA? **[2]**

ii) Draw the Decay scheme of the ^{60}Co Gamma source. **[2]**

iii) States the Inverse-square Law. **[2]**

iv) Enlist rules promulgated by AERB. **[2]**

v) Define the term Effective Dose Equivalent (H_E). **[2]**

b) Write atleast three uses of CT-scan machine. **[3]**

Q2) a) i) How do X-Ray Baggage Scanner work? **[4]**

ii) Write down the full form of ICRP, AERB and TLD. **[3]**

b) Describe the Neutrons interaction with matter. **[5]**

Q3) a) What is Radiotherapy? Explain in details of Tele-cobalt therapy machine. **[7]**

b) Convert the following term: **[5]**

i) 1 curie is equal to how much Becquerel?

ii) 2 Gray (Gy) is equal to how much RAD?

iii) 0.1 RAD is equal to how much Gray (Gy)?

iv) 1 sievent is equal to how much rem?

v) 0.01 Gray (Gy) is equal to how much RAD?

P.T.O.

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

a) Personal Monitoring system - TLD. **[4]**

b) Uses of Radiation in food preservation. **[4]**

c) Nuclear power plant. **[4]**

d) G-M Counter. **[4]**

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Total No. of Questions : 4]

SEAT No. : ____

PC4108

[Total No. of Pages : 2

[6335]-3009

S.Y.M.Sc.

PHYSICS

PHY-612-MJ: Physics of Data Science

(2023 Credit Pattern) (Semester - III)

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 wherever necessary.***

Q1) a) Attempt any four of the following.

i) What is the purpose of defining goals in the data science? **[2]**

ii) What is unsupervised learning? **[2]**

iii) Explain concept of max pooling in convolutional Neural Network with suitable example? **[2]**

iv) What type of visualization is useful for showing relationships between categorical variables? **[2]**

v) How list, tuple, dictionary and set are defind in python? **[2]**

b) Write a python program that defines a function to calculate the factorial of number. The function should take one argument (number) and return it's factorial. **[3]**

Q2) a) i) Describe the key characteristics of data science. **[4]**

ii) Describe the purpose of syntax of the break and continue statements in python with example. **[3]**

b) Discuss the architecture and training of Recurrent Neural Networks (RNNs) and thier applications in natural language processing and time series forecasting. **[5]**

P.T.O.

Q3) a) What is artificial Neural network. Explain the basic architecture in detail. **[7]**

b) What is superwised machine learning. Explain different types of superwised machine learning with suitable examples. **[5]**

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

a) Explain the process of data extraction and preparation. **[4]**

b) What is the role of regularization technique. **[4]**

c) Discuss the application of deep feedforword networks in real-world problems. **[4]**

d) Explain the importance of data visualization in data analysis and decision-making. Discuss various data visualization techniques. **[4]**

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Total No. of Questions : 4]

SEAT No. :

PC4109

[6335]-3010

[Total No. of Pages : 2

M.Sc. -II

PHYSICS

PHY-613-MJ : Basic Industrial Instrumentation

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

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***Q1 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 to log table and non-programmable electronic calculators are allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

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

i) Define accuracy and precision.

ii) What are the characteristics of data acquisiton system (DAS).

iii) What is working principle of resistive type of stain gauges.

iv) Draw a block daigram of multichannel DAS.

v) For LVDT, input=6.3v, output=5.2v and operating range = ± 0.5 inch, calculate output voltages for core movement going from + 0.45 inch to - 0.30 inch.

b) Explain ratiometric conversion in details. **[3]**

Q2) a) i) For a certain thermistor, β =3140k and resistance at 27ºC is known to be 1050Ω. The thermistor is used for temperature measurment and the resistance measured is as 2330Ω. Find the measuerd temperature.**[4]**

ii) Explain bonded and unbonded strain gauges in details. **[3]**

b) Draw circuit for instrumentation amplifier and derive expression for output voltage. **[5]**

P.T.O.

Q3) a) Explain the multiplexing of outputs of S/H circuit in multichannel data acquisition system. **[7]**

b) Explain principle, construction and working of platinum resistance thermometer using wheatstone's bridge. **[5]**

Q4) Attempt any three of the following: **[12]**

a) Explain capacitive displacement sensors.

b) Explain cold junction compensation using thermocouple amplifier.

c) Explain selective type of optical pyrometer in details.

d) Write a note on 'data loggers'.