Seat No.	

Set P

M.Sc. Physics (Applied Electronics) (Semester - I) (New) (NEP CBCS)
Examination: March/April - 2025
Mathematical Physics (2323101)

Day & Date: Thursday, 15-May-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) Which of the following is NOT an algebraic operation in complex numbers?
a) Addition b) Exponential
c) Multiplication d) Division

2) Cauchy's Integral Theorem states that:
a) The integral of a function along a closed contour is zero
b) The integral of a function along a closed contour is nonzero
c) The integral of a function along a contour depends on the contour itself
d) The integral of a function along a contour is infinity

3) The Fourier transform of a Gaussian distribution in the time domain results in a:
a) Gaussian distribution in the frequency domain
b) Sine function in the frequency domain
c) Cosine function in the frequency domain
d) Delta function in the frequency domain

4) In the Fourier series representation of a square wave, the coefficients corresponding to odd harmonics are:
a) Zero b) Non-zero
c) Constant d) Negative

5) The number of arbitrary constants in the general solution of differential equation of second order is ____.
a) 1 b) 0
c) 2 d) 4

6) The non-zero Particular Integral can be found out for _____ differential equation.
a) Homogeneous b) Non-Homogeneous
c) Second order Homogeneous d) None of these

7) In Hilbert space, which property does the inner product satisfy?

a) Anticommutativity b) Distributivity

c) Additivity d) Associativity

8) The rank of the zero matrix?

a) 0 b) 1

c) -1 d) The rank is undefined

B) Write True or False. **04**

a) A set of functions is a complete orthogonal set if any function in the set can be expressed as a linear combination of the others.

b) The Wronskian of a set of solutions to a second-order homogeneous equation with constant coefficients is always zero.

c) Cauchy's Integral Formula expresses the value of a function at a point in terms of its contour integral.

d) The Fourier series expansion of a square wave contain only cosine terms.

Q.2 Answer the following question (Any Six) **12**

a) Show that given matrix is unitary matrix $A = \begin{bmatrix} i & 0 \\ 0 & 1 \end{bmatrix}$

b) Find the Norms of given equation $f(t) = t + 2$

c) Define De-Moivre's theorem by exponential function.

d) Solve $f(z) = \frac{\sin z}{z}$

e) Solve $4\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + y = 0$

f) Find $L(te^{2t})$

g) Define in a_0, a_n *and* b_n in Fourier series.

h) Find, the Residue of $f(z) = \frac{z^2}{Z^2+a^2}$

Q.3 Answer the following question (Any Three) **12**

a) Consider the function $f(z) = \oint \frac{e^z}{Z^2-2Z+2}\, dz$

i) Determine the singular points of $f(z)$.

ii) Calculate the residues at each of the singular points

b) Describe Argand Diagram.

c) Determine linear independence of following Set
$S = \{(1,-1,2),(1,-2,1),(1,1,4)$

d) Solve $9\frac{d^2y}{dx^2} + 12\frac{dy}{dx} + 29y = 0$

Q.4 Answer the following question (Any Two) **12**

a) Solve the differential equation $\frac{dy}{dx} + ycotx = \cos x$

b) Evaluate the integral $f(z) = \oint \frac{\sin(z)}{Z^2+4}\, dz$ where, C is the circle $|Z| = 3$ traversed counterclockwise.

c) Determine whether the following in R^3 is linearly independent.

$\{(1,-2,1),(2,1,1),(7,-4,1)\}$

Q.5 Answer the following (Any Two) **12**

a) Find $L(te^{-2t}\sin 2t \sin 3t)$

b) Solve $\frac{d^2y}{dx^2} - 10\frac{dy}{dx} + 25y + 0$

c) Find the inverse of a matrix $A = \begin{bmatrix} 7 & 2 & 1 \\ 0 & 3 & -1 \\ -3 & 4 & -2 \end{bmatrix}$

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Set P

M.Sc. Physics (Applied Electronics) (Semester - I) (New) (NEP CBCS)
Examination: March/April - 2025
Solid State Physics (2323102)

Day & Date: Saturday, 17-May-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) The Bloch theorem is crucial for understanding_____
a) Dielectric properties b) Band structure in solids
c) Superconductivity d) Paramagnetism

2) The Meissner effect demonstrates_____
a) Perfect diamagnetism in superconductors
b) Magnetic susceptibility in ferrites
c) Curie-Weiss behavior in paramagnetism
d) None of the above

3) The Neel temperature is associated with ____.
a) Superconductivity b) Antiferromagnetism
c) Ferrimagnetism d) Ferroelectricity

4) Which type of polarization is due to the distortion of the electron cloud?
a) Ionic b) Orientational
c) Electronic d) Dielectric

5) The Kronig-Penney model explains:
a) The energy gap in semiconductors
b) Susceptibility in magnetic materials
c) Polarization mechanisms
d) None of the above

6) Superconductivity is destroyed at ____.
a) Low temperatures b) High magnetic fields
c) Room temperature d) Low pressures

7) Ferrimagnetic materials are characterized by ____.
a) Equal and opposite spins b) Unequal opposing spins
c) Random spin alignment d) None of the above

8) The Clausius-Mossotti equation relates
a) Magnetic permeability and susceptibility
b) Polarizability and dielectric constant
c) Electrical conductivity and temperature
d) None of the above

B) Fill in the blanks: **04**
1) The energy bands in solids arise due to the ____ potential.
2) Superconductors exhibit perfect diamagnetism due to the ____ effect.
3) Antiferromagnetic materials have a critical temperature called the ____.
4) The ____ equation is used to calculate the internal field in a dielectric.

Q.2 Answer the following (Any Six). **12**
a) Explain the motion of electrons according to band theory.
b) Discuss the significance of the Meissner effect in superconductors.
c) What is the Curie point?
d) Explain the electronic polarization in dielectrics.
e) Write about the energy gap in semiconductors.
f) Differentiate between Type I and Type II superconductors.
g) Classify the magnetic materials.
h) Explain the Bloch wall.

Q.3 Answer the following (Any Three). **12**
a) Derive the London equations in superconductivity.
b) Describe the electrical conductivity in metals.
c) Write about the Langevin theory of paramagnetism.
d) Discuss the Brillouin zones.

Q.4 Answer the following (Any Two). **12**
a) Derive the Clausius-Mossotti equation.
b) Explain the dipole theory of ferroelectricity.
c) Write a note on saturation magnetization and its temperature dependence.

Q.5 Answer the following (Any Two). **12**
a) Describe the Josephson effect and its applications.
b) Discuss the thermodynamics of superconductors.
c) Write a detailed note on ferrimagnetic materials.

SLR-ZQ-3

Seat No.	

Set P

M.Sc. Physics (Applied Electronics) (Semester - I) (New) (NEP CBCS)
Examination: March/April - 2025
Analog and Digital Electronics (2323106)

Day & Date: Monday, 19-May-2025 Max. Marks: 60
Time: 03:00 AM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) If a signal passing through a gate is inhibited by sending a LOW into one of the inputs, and the output is HIGH, the gate is a(n):
   a) AND b) NAND
   c) NOR d) OR

2) Which of the following is true about microprocessors?
   a) It has an internal memory
   b) It has interfacing circuits
   c) It contains ALU, CU, and registers
   d) It uses Harvard architecture

3) What is a shift register that will accept a parallel input, or a bidirectional serial load and internal shift features, called?
   a) tristate b) end around
   c) universal d) conversion

4) The output of an AND gate with three inputs. A, B, and C, is HIGH when _____.
   a) A = 1, B=1, C=0 b) A=0, B=0, C=0
   c) A=1, B=1, C=1 d) A=1, B=0, C=1

5) An ideal operational amplifier has _____.
   a) infinite output impedance b) zero input impedance
   c) infinite bandwidth d) All of the above

6) A series dissipative regulator is an example of a _____.
   a) linear regulator b) switching regulator
   c) shunt regulator d) dc-to-dc converter

7) The output of a NOR gate is HIGH if _____.
   a) all inputs are HIGH b) any input is HIGH
   c) any input is LOW d) all inputs are LOW

8) Which of the following logical operations is represented by the + sign in Boolean algebra?
   a) inversion b) AND
   c) OR d) Complementation

B) Fill in the blanks or Write True/False. **04**

1) The output voltage of a voltage buffer is _____ with the input voltage.
2) Op-amp circuits are used in _____ voltmeters.
3) A microprocessor with the necessary support circuits will include at least two memory ICs: ROM or EPROM, and a RAM. True/ False
4) Programs written for the 8080A must have slight modifications to run on the 8085A.True/False

Q.2 Answer the following. (Any Six) **12**

a) Define the term common mode rejection ratio.
b) What are the operations performed by ALU of 8085.
c) What is instrumentation amplifier.
d) Define slew rate.
e) What is Input bias current.
f) Define voltage regulator.
g) What is opcode fetch cycle.
h) Define differential gain related to a differential amplifier

Q.3 Answer the following. (Any Three) **12**

a) Draw the circuit diagram of an Op-amp based Wein bridge oscillator?
b) List the Software and Hardware interrupts of 8085?
c) Describe some of the characteristics of practical Op-amp?
d) Show the logic diagram of SR flip-flop with four NAND gate?

Q.4 Answer the following. (Any Two) **12**

a) What is switching regulator? What are the types of switching regulator? Explain them in details with suitable figure?
b) Draw the circuit of summing amplifier using inverting amplifier configuration.
Write an equation for the output voltage for this circuit
c) Explain briefly about bus structure of 8085.

Q.5 Answer the following. (Any Two) **12**

a) What is comparator? How it can be used to produce a square -wave at the output from a Sine-wave?
b) Draw and explain the architecture of 8085 microprocessor.
c) Explain the difference between combinational & Sequential circuits.

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Set **P**

M.Sc. Physics (Applied Electronics) (Semester - I) (New) (NEP CBCS)
Examination: March/April - 2025
Research Methodology in Physics (2323105)

Day & Date: Saturday, 24-May-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose the correct alternative. **08**

1) The main problem in questionnaire is _____.
a) Accessible to Diverse Respondent
b) Greater Anonymity
c) Shows an inability of respondent to provide information
d) None of these

2) UV-V is spectroscopy cannot analyze compounds that _____ with light.
a) don't interact b) interact
c) merge d) none of the above

3) By selecting laser operating conditions, control over microstructure is _____.
a) possible b) impossible
c) not defined d) both a) and b)

4) In DC sputtering, _____ bias is applied to the target material.
a) Negative b) Positive
c) No d) All of the above

5) Resistive thermal deposition can deposit materials with low _____ points.
a) boiling b) decimal
c) melting d) none of the above

6) HRTEM provides _____ images.
a) medium resolution b) poor resolution
c) low resolution d) high resolution

7) Qualitative methods are probably the oldest of all the scientific techniques, the method of Qualitative research is _____.
a) Questionnaire b) Attitude Scales
c) Depth Interview d) Observation

8) Electronic interview can be conducted by _____.
a) Telephonic b) Fax
c) Personal d) All of the above

B) Fill in the blanks OR write True / False: **04**

1) In PLD, kinetic energies of ablated particles are high enough to promote surface diffusion. (True/False)
2) In thermal evaporation, films in the thickness range of angstroms to microns are obtained. (True/False)
3) _____ sampling is a probability sampling method.
4) In _____ sputtering, magnets behind cathode trap electrons.

Q.2 Answer the following. (Any Six) **12**

a) What are the applications of UV-Vis Spectroscopy?
b) State the physical conditions of DC and RF sputtering.
c) Define Quantitative research method.
d) State the various tools for data analysis.
e) Draw the neat labeled diagram of electrodeposition method.
f) What are the applications of FTIR Spectroscopy.
g) Enlist the Data Processing strategies.
h) Write the applications of Pulsed Laser Deposition.

Q.3 Answer the following. (Any Three) **12**

a) Write a note on Patents.
b) Draw the neat labeled diagram of HRTEM instrument.
c) Define physical and chemical vapour deposition.
d) Write a note on Applied Vs. Fundamental research methods.

Q.4 Answer the following. (Any Two) **12**

a) Explain different techniques and methods of good sampling.
b) Write in detail about the concept of Chemical Bath Deposition.
c) Write in detail about the construction and working of SEM.

Q.5 Answer the following. (Any Two) **12**

a) Write a note on Review of Literature.
b) What is Research Methodology? What are the requisites for Good Scientific Research?
c) Explain the construction and working of Fourier Transform Infrared Spectroscopy.

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Set P

M.Sc. Physics (Applied Electronics) (Semester - II) (New) (NEP CBCS)
Examination: March/April - 2025
Quantum Mechanics (2323201)

Day & Date: Wednesday, 14-May-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) Raising operator is defined as _____.
a) $L_x + iL_y$ b) $L_x - iL_y$
c) $iL_z - iL_y$ d) $iL_x - iL_z$

2) Momentum of particle by de-Broglie relation is _____ to its wavelength.
a) inversely proportional b) directly proportional
c) in phase d) out of phase

3) Potential energy of a particle in harmonic oscillator having mass m is _____.
a) $m\omega^2 x^2$ b) $(1/2)m\omega^2 x^2$
c) $mr\omega^2$ d) $(1/2)mv^2$

4) If Ψ_a and Ψ_b are said to be orthogonal to each other, then which of the following is true.
a) $\langle \Psi_a | \Psi_b \rangle = 1$ b) $\langle \Psi_a | \Psi_b \rangle = \infty$
c) $\langle \Psi_a | \Psi_b \rangle = \sqrt{1/2}$ d) $\langle \Psi_a | \Psi_b \rangle = 0$

5) The commutation relation between $[x, P_x]$ and $[\partial/\partial x, x]$ is _____.
a) $i\hbar, 0$ b) $0, i\hbar$
c) $-i\hbar, 1$ d) $i\hbar, 1$

6) The eigen value of L^2 is _____.
a) $l(l+1)\hbar^2$ b) $l(l-1)\hbar$
c) $l(l^2+1)\hbar^2$ d) $l(l+1)\hbar$

7) The minimum energy of particle confined to one dimensional rigid box is by substituting n equal to _____.
a) one b) zero
c) half d) two

8) The eigen value of spin matrices are _____.
a) ± 2 b) 0
c) ± 1 d) ∞

B) Fill in the blanks OR write true/false. **04**

1) Inner product of bra and ket in Quantum Mechanics is always 1. (True/False)
2) Probability density is always positive. (True/False)
3) For a free particle the potential energy $V(x) =$ _____.
4) The linear momentum operator is given by _____.

Q.2 Answer the following. (Any Six) **12**

a) Define Hamiltonian operator.
b) Write about the energy of harmonic oscillator.
c) What is the probability density?
d) Define the orthogonality and normalization.
e) Write in short about the Dirac delta function.
f) What is Compton effect?
g) What is meant by rigid box?
h) What is a complex function? Give an example.

Q.3 Answer the following. (Any Three). **12**

a) State and prove Ehrenfest theorem Part II.
b) Prove that group velocity (V_g) is equal to velocity of material of particle (V).
c) Define the different postulate of Quantum mechanics.
d) Explain unitary transformation.

Q.4 Answer the following. (Any Two) **12**

a) What is Schrodinger wave equation? Write in detail about Schrodinger time independent wave equation.
b) State and explain Heisenberg uncertainty principle in Quantum Mechanics with an example.
c) Discuss eigen values and eigen functions for a particle in three-dimensional infinite potential well.

Q.5 Answer the following. (Any Two) **12**

a) Obtain eigen values of operators L^2 and Lz.
b) Describe the Pauli spin matrices.
c) Explain
i) Schartz's Inequality
ii) State vector
iii) Span
iv) Basis

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Set **P**

M.Sc. Physics (Applied Electronics) (Semester - II) (New) (NEP CBCS)
Examination: March/April - 2025
Electrodynamics (2323202)

Day & Date: Friday, 16-May-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) The electrostatic energy in an electric field does not depend on which of the following?
   a) Magnitude of charges b) Permittivity
   c) Applied electric field d) Flux lines

2) If the electric potential is given, which of the following cannot be calculated?
   a) Electrostatic energy b) Electric field intensity
   c) Electric flux density d) Permittivity

3) Electric field intensity is a _____ quantity.
   a) Scalar b) Vector
   c) Both (a) and (b) d) None of the above

4) The skin effect is a phenomenon observed in _____.
   a) Insulators b) Dielectrics
   c) Conductors d) Semiconductors

5) Lorentz electric force has direction_____.
   a) Similar to electric field b) Opposite to electric field
   c) Scalar quantity d) None of these

6) Electric intensity at any point in an electric field is equal to the at that point.
   a) Electric flux b) Magnetic flux density
   c) Potential gradient d) None of the above

7) The Biot-Savart's law is a general modification of _____.
   a) Kirchhoff’s law b) Lenz's law
   c) Ampere's law d) Faraday's laws

8) The skin depth is used to find which parameter?
   a) DC resistance b) AC resistance
   c) Permittivity d) Potential

B) Write True/False. **04**

1) The work done in moving a test charge from one point to another in an equipotential surface is zero.
2) When curl of a path is zero, the field is said to be conservative.
3) In static magnetic field only magnetic dipole exist.
4) The magnetic field intensity will be zero inside a conductor.

Q.2 Answer the following. (Any Six) **12**

a) State Biot-Savart law.
b) Explain the electromagnetic force.
c) How electromagnetism works?
d) Define Poynting vector.
e) What is an electric field?
f) Write Maxwell equation derived from Faradays law.
g) What is an electromagnetic wave?
h) Define Skin effect.

Q.3 Answer the following. (Any Three) **12**

a) Explain differential form of Ampere's law.
b) Explain energy stored in electric field.
c) State the boundary condition for an electrostatic field $\bar{E}$.
d) Explain Maxwell displacement current.

Q.4 Answer the following. (Any Two) **12**

a) What is gauss law? Explain differential form of its.
b) Discuss electromagnetic plane waves in stationary medium.
c) Explain the concept of Thomson cross section.

Q.5 Answer the following. (Any Two) **12**

a) Explain boundary condition between conductor and free space.
b) State and prove Poynting theorem.
c) Explain in short radiation from a half wave antenna.

SLR-ZQ-8

Seat No.	

Set P

M.Sc. Physics (Applied Electronics) (Semester - II) (New) (NEP CBCS)
Examination: March/April - 2025
Classical Mechanics (22323206)

Day & Date: Tuesday, 20-May-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) _____ the constraints are independent of time.
   a) Holonomic b) Non-holonomic
   c) Scleronomous d) Rheonomous

2) The phase space refers to _____.
   a) Position coordinates
   b) Momentum coordinates
   c) Both Position and Momentum coordinates
   d) Cyclic coordinates

3) Which is true mathematical statement of 2nd law of Newtonian mechanics?
   a) F=m/a b) F=ma
   c) F=m+a d) F=m-a

4) _____ for circular orbit the value of eccentricity.
   a) $\in > 1$ b) $\in < 1$
   c) $\in = 1$ d) $\in = 0$

5) Newton's laws of motion are _____ under Galilean transformation.
   a) Invariant b) Variant
   c) changes its form d) changes its sign

6) Degrees of freedom for fly wheel _____.
   a) 0 b) 1
   c) 3 d) 5

7) Which of the following is true for Poisson bracket?
   a) [X,Y]= [Y,X] b) [X,Y]=2[Y,X]
   c) [X, Y]= -[Y,X] d) [X,X]=[Y,Y]=1

8) The generating function F1(q,Q,t) generates _____ transformation.
   a) Identity b) Exchange
   c) Zero d) Infinite

B) Fill in the blank OR true /False. **04**

1) The motion of the planets around the sun is the example of the motion under central force field. (True/False)
2) In Lagrange's equation, the motion of the system has been described by force. (True/False)
3) The equation of Jacobi's Identity is _____.
4) As per Kepler's third law of planetary motion, square of a time period is directly proportional to cube of a _____.

Q.2 Answer the following. (Any Six) **12**

a) Define central force and give its characteristics?
b) How to analyse the orbits?
c) What is the Jacobi integral?
d) Define the conservation of linear and angular momenta.
e) Write in short about the open system.
f) What is Euler-Lagrangian differential equation?
g) Write the condition for transformation to be canonical.
h) What is the constant of motion?

Q.3 Answer the following. (Any Three) **12**

a) Give an account about conservation of energy in case of mechanics of particles.
b) What are constraints? Explain in detail about their types with suitable examples.
c) Check whether the transformation defined as $Q=1/p$, $P=qp^2$ is canonical or not.
d) State Hamilton's variational principle and derive the Lagrange's equation of motion form it?

Q.4 Answer the following. (Any Two) **12**

a) Explain
1) Gauge invariance of Lagrangian equation
2) Gyroscopic forces
b) Explain and prove the principle of least action.
c) Derive an equivalent equation for reduction to one body problem from two body problem.

Q.5 Answer the following. (Any Two) **12**

a) Elaborate the differences between Classical Mechanics and Quantum Mechanics.
b) Apply the Hamilton's equations to derive the equations of motion for simple pendulum and linear harmonic oscillator.
c) Write short note on
1) Artificial Satellite
2) Rutherford scattering

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Set P

M.Sc. Physics (Applied Electronics) (Semester - III) (New) (NEP CBCS)
Examination: March/April - 2025
Statistical Physics (2323301)

Day & Date: Thursday, 15-May-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All questions are compulsory.
2) Figure to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) First and second law of thermodynamics are related by the relation
a) dU=TdS-VdP b) dU=TdS+PdV
c) dU=PdV-TdS d) dU=TdS-PdV

2) Helmholtz function is the amount of useful work done by a thermodynamic system at constant ____.
a) pressure
b) temperature and volume
c) temperature and pressure
d) pressure and volume

3) "At absolute zero the entropy of pure crystal is zero" is the statement of which law of thermodynamics?
a) First law b) Second law
c) Third law d) Fourth law

4) In a grand canonical ensemble, a system A of fixed volume is in contact with a large reservoir B. Then ____.
a) A can exchange neither energy nor particles with B
b) A can exchange only energy with B
c) A can exchange both energy and particles with B
d) A can exchange only particles with B

5) In which process the pressure of the system remains constant?
a) isothermal process b) isobaric process
c) isometric process d) isochoric process

6) In Maxwell relations, $(\partial \mathrm{T}/\,\partial \mathrm{V})s = ?$
a) $-(\partial \mathrm{V}/\,\partial S)_{\mathrm{T}}$ b) $-(\partial \mathrm{P}/\,\partial S)_{\mathrm{V}}$
c) $(\partial S/\,\partial \mathrm{P})_{\mathrm{T}}$ d) $(\partial S/\,\partial \mathrm{V})_{\mathrm{T}}$

7) What does occur at a critical point in critical phenomenon?
a) phase transition b) symmetry breaking
c) universality d) scaling laws

8) Electron is an example of which statistics?

a) Bose Einstein statistics b) Maxwell Boltzmann statistics

c) Fermi Dirac statistics d) None

B) Fill in the blanks OR write true/false: **04**

1) Entropy and temperature are the canonical pair. (True/False)
2) During a phase change, the temperature of a substance remains constant. (True/False)
3) The average K.E. of a harmonic oscillator is ____.
4) In BE statistics particles have ____ spin.

Q.2 Answer the following question (Any Six). **12**

a) Which physical quantity remains constant during the process of phase transition?
b) Write one example of first order phase transition.
c) Name the statistics obeyed by photon and electron.
d) What is thermodynamic potential?
e) Write about statistical ensemble.
f) What is phase space?
g) What is the entropy of system?

Q.3 Answer the following (Any Three). **12**

a) Write a note on chemical potential.
b) Discuss about the thermodynamic system.
c) Write about the condition for phase equilibrium.
d) Write a note on probability calculation.

Q.4 Answer the following (Any Two). **12**

a) Write a note of Black body radiation and Planck distribution.
b) Draw and discuss the diagram of an oscillator in phase space.
c) Define and explain the laws of thermodynamics with examples.

Q.5 Answer the following (Any Two). **12**

a) State and discuss the Ehrenfest equations.
b) Write in detail about the Maxwell-Boltzmann statistics.
c) Explain about the statistical ensembles and their types.

Seat No.	

Set P

M.Sc. Physics (Applied Electronics) (Semester - III) (New) (NEP CBCS)
Examination: March/April - 2025
Atomic & Molecular Physics (2323302)

Day & Date: Saturday, 17-May-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) The singlet system of helium for S = 0 is called ____.
a) Para-helium b) a positively helium ion
c) Ortho-helium d) a negatively helium ion

2) Which of the following cannot be conserved during Raman scattering?
a) Total Energy b) Momentum
c) Kinetic Energy d) Electronic Energy

3) Transition of an electron from various s levels to lowest p level gives____
a) sharp series b) principle series
c) diffuse series d) fundamental series

4) In case of LS coupling l_1= 1, l_2 = 2, then J = ____.
a) 1,2,3,4 b) 0,1,2,3
c) 2,3,4 d) 0,1,2,3,4

5) With increasing quantum number, energy difference between adjacent levels in atoms ____.
a) decreases b) increases
c) remain constant d) zero

6) Atomic spectra is an example of ____
a) line spectra b) continuous spectra
c) band spectra d) both a and b

7) The orientation of atomic orbitals depends on their ____.
a) Spin quantum number
b) Magnetic quantum number
c) Azimuthal quantum number
d) Principal quantum number

8) Symmetric top molecules have _____.

a) $I_A=I_B=I_C$ b) $I_A=I_B\neq I_C$

c) $I_A\neq I_B=I_C$ d) $I_A=O$, $I_B\neq I_C$

B) Write true/false. **04**

1) Splitting of spectral lines in an atom in presence electric field is called Stark effect. (True/False)
2) If Q value of nuclear reaction is positive the reaction is Exothermic. (True/False)
3) Spin angular momentum depends on s. (True/False)
4) The electronic spectra are observed in far IR region. (True/False)

Q.2 Answer the following (Any Six). **12**

a) What are the quantum states of an electron in an atom?
b) Define interaction energy of an atom.
c) Write about the Paschen back effect.
d) Define covalent interaction.
e) What is meant by diatomic molecule?
f) Define dissociation energy.
g) Write about the binding energy of an atom.

Q.3 Answer the following (Any Three) **12**

a) Write in brief on two valence electron spectra.
b) Discuss about origin of spectral line.
c) State and explain Pauli's Exclusion Principle.
d) Write a note on the vibrating diatomic molecule.

Q.4 Answer the following (Any Two) **12**

a) Write in detail about the jj coupling.
b) Discuss about the X-ray and Auger transition.
c) Write a note on Raman spectra.

Q.5 Answer the following (Any Two). **12**

a) What is hyperfine structure? Elaborate.
b) Explain in detail about anharmonic oscillator.
c) Discuss in detail about the spectrum of a non-rigid rotator.

Seat No.	

Set **P**

M.Sc. Physics (Applied Electronics) (Semester - III) (New) (NEP CBCS)
Examination: March/April - 2025
Microcontrollers & Interfacing (2323306)

Day & Date: Monday, 19-May-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) On power up, the 8051 uses which RAM locations for register RO- R7 _____.
   a) 00-2F b) 00-07
   c) 00-7F d) 00-0F

2) How many bytes of bit addressable memory is present in 8051 based microcontrollers?
   a) 8 bytes b) 32 bytes
   c) 16 bytes d) 128 bytes

3) Which of the ports act as the 16 bit address lines for transferring data through it?
   a) PORT 0 and PORT 1 b) PORT 1 and PORT 2
   c) PORT 0 and PORT 2 d) PORT 1 and PORT 3

4) Which instruction is used to check the status of a single bit?
   a) MOV A,P0 b) ADD A,#05H
   c) JNB PO.0, label d) CLR P0.05H

5) Which addressing mode is used in pushing or popping any element on or from the stack?
   a) immediate b) direct
   c) indirect d) register

6) Which of the following comes under the indexed addressing mode?
   a) MOVX A, @DPTR b) MOVC @A+DPTR,A
   c) MOV A,R0 d) MOV @R0,A

7) If we say microcontroller is 8-bit then here 8-bit denotes size of ____.
   a) Data Bus b) ALU
   c) Control Bus d) Address Bus

8) What is the file extension that is loaded in a microcontroller for executing any instruction?
   a) .doc b) .c
   c) .txt d) .hex

B) Fill in the blank OR True/False **04**

1) Upon power-up, the I/O pins are configured as output port. True/ False
2) All registers of the 8051 are bit addressable. True/False
3) _____ devices are specifically being used for converting serial to parallel and from parallel to serial respectively.
4) 8051 series has _____16 bit registers.

Q.2 Answer the following. (Any Six) **12**

a) What are the uses of accumulator register?
b) What is mean by SFR in 8051 Microcontroller?
c) What is the range of unsigned int in embedded C?
d) What is the memory' size of sbit in embedded C
e) What is the purpose of using instruction register?
f) What is the notion for right shift in embedded C?
g) What is mean by SP and PC in 8051?

Q.3 Answer the following. (Any Three) **12**

a) Name the special functions registers available in 8051.
b) Explain interrupt priority register of the 8051 microcontroller.
c) Explain RS-232 standards.
d) What are the microcontroller and what are its applications.

Q.4 Answer the following. (Any Two) **12**

a) With a neat interface diagram write an embedded C code for LED.
b) Draw 8051 architecture block diagram.
c) What are the timer and counters? Explain the operations of the same.

Q.5 Answer the following. (Any Two) **12**

a) Interface 16×2 LCD to 8051. Write a program to display “Welcome” at the centre of the first line.
b) Discuss Interrupt and Serial Communication.
c) Discuss in detail data types in embedded C.

Seat No.	

Set P

M.Sc. Physics (Applied Electronics) (Semester - III) (New/Old) (CBCS)
Examination: March/April - 2025
Semiconductor Physics (MSC5301)

Day & Date: Thursday, 15-May-2025 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Question 1 & 2 is compulsory.
2) Attempt any three questions from Q. No. 3 to Q. No. 7.
3) Figure to the right indicate full marks.

Q.1 A) Choose the correct alternative. **10**

1) At 0 K the Fermi-Dirac distribution function takes _____.
a) the exponential form b) the simple rectangular form
c) the linear form d) the circular form

2) For a semiconductor in thermal equilibrium _____.
a) the intrinsic level E_i is in the valence band
b) the intrinsic level E_i is near the valence band edge
c) the intrinsic level E_i is at the middle of the band gap
d) the intrinsic level E_i is near the conduction band edge

3) In semiconductors, the Fermi function $f(E)$ is symmetrical about ____.
a) Fermi level E_F b) conduction band edge Ec
c) valence band edge Ev d) conduction band (C.B.)

4) A semiconductor absorbs photons with energies _____.
a) Smaller than band gap energy only
b) equal to the band gap energy only
c) equal to the band gap or larger
d) equal to the band gap or smaller

5) When trapping is present in the material:
a) $\tau_n \neq \tau_p$ b) $\tau_n = \tau_p$
c) $\tau_n = 0$ d) $\tau_p = 0$

6) To get _____ the junction must be constructed so that there is either no barrier between the metal and the semiconductor, or any barrier that is present is so thin that charge carriers readily tunnel through it.
a) an ohmic contact
b) a rectifying
c) both an ohmic contact and a rectifying
d) clipper

7) If $(a+b)$ is period of potential, then for such periodic potential; $V(x)$ = _____.

a) $V[x+(a+b)]$ b) $V[x/(a+b)]$

c) $V[x+(a-b)]$ d) $V[x*(a+b)]$

8) _____ is initial process that occurs in the formation of a crystal.

a) Growth b) Nucleation

c) atomic bonding d) Clusters

9) In case of crystal growth process the term LPE means _____.

a) Lower Potential Energy b) Local Potential Energy

c) Liquid Phase Epitaxy d) Laser phase Epitaxy

10) In case of crystal growth process the abbreviation VPE means _____.

a) Volume Phase Epitaxy b) Vapor Phase Epitaxy

c) Variable Potential Energy d) Vapor Pressure Energy

B) Fill in the blank OR Write True/False **06**

1) The high-field excitation of electrons into the indirect minima leads to the _____ effect.
2) Semiconductor silicon (Si) has band gape energy; $E_g =$ _____ eV.
3) Drift of charge carriers in a semiconductor is caused by _____.
4) The particle inside a box in a finite potential well can never be at rest, as it will violate _____ Uncertainty Principle.
5) The inverse effective-mass tensor is a symmetric tensor of the _____ rank.
6) The crystal growth technique MBE means _____.

Q.2 Answer the following question **16**

a) Calculate the probability of an electron being thermally excited to an energy level which is 0.01 eV above the Fermi level. (Given: the Boltzmann constant, $k = 8.625 \times 10^{-5}$ eV/K, temperature, $T = 300\ K$ and value of exponent base, $e = 2.71$).

b) Discuss electrical conductivity and mobility in a semiconductor.

c) Calculate band gap energy of a semiconductor germanium (Ge), in electron volt, if it absorbs a photon of wavelength 1.77 micro meters.

d) How trapping of charges carries occurs in semiconductors?

Q.3 Answer the following question **16**

a) Write a note on "group velocity of electrons." Obtain necessary expression.

b) Describe in detail nucleation and growth theory of crystal growth process.

Q.4 Answer the following question **16**

a) Discuss bonding forces in semiconductors.

b) Discuss in detail formation energies of liquid nuclei and crystalline nuclei.

Q.5 Answer the following question **16**

a) Write a note on direct and indirect band gap materials.

b) Explain how electric field is Built up by diffusion and drift of carries in the in semiconductor.

Q.6 Answer the following question **16**

a) Discuss in detail “The Haynes-Shockley Experiment.”

b) Describe dynamics of electrons and holes inside a semiconductor.

Q.7 Answer the following question **16**

a) Write a note on Fermi level pining.

b) Explain Czochralski and liquid encapsulation techniques.

SLR-ZQ-21

Seat No.	

Set P

M.Sc. Physics (Applied Electronics) (Semester - III) (New/Old) (CBCS)
Examination: March/April - 2025
Atomic, Molecular Physics (MSC5302)

Day & Date: Saturday, 17-May-2025 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Question No. 1 and 2 are compulsory.
2) Attempt any 3 questions from Q. No.3 to Q. No. 7.
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternatives: **10**

1) Two electron spectra always show ____.
a) Singlet and doublets b) singlet and triplets
c) doublets and triplets d) all of these

2) In Raman spectroscopy, the radiation lies in the ____.
a) Microwave Region b) X-ray Region
c) UV Region d) Visible Region

3) Splitting of spectral lines in an atom in presence magnetic field is called___
a) Zeeman effect b) Stark effect
c) Photoelectric effect d) Compton effect

4) Spherical top type of molecules has ____.
a) $I_A=I_B=I_C$ b) $I_A=I_B\neq I_C$
c) $I_A\neq I_B=I_C$ d) $I_A=0, I_B\neq I_C$

5) If Q value of nuclear reaction is positive the reaction is ____.
a) Exothermic b) Endothermic
c) Endergonic d) None of these

6) Transition rule for the vibrational-rotational spectra are ____.
a) $\Delta\upsilon = \pm1, \pm2$ b) $\Delta\upsilon = \pm1$
c) $\Delta\upsilon = \pm1, \pm2, \pm3$ d) none of these

7) In case of jj coupling l_i* of each electron is quantized with respect to ____ to form resultant j_i*.
a) its own l_i* b) Its own s_i*
c) another electron's l_i* d) another electron's s_i*

8) The electronic spectra are observed in____
a) far IR region b) near IR region
c) visible and UV region d) both a & c

9) Raman effect is scattering of ____.

a) Atoms b) Molecules
c) Protons d) Photons

10) The reduced mass of a diatomic molecule as a rigid rotator is ____.

a) $(m_1+m_2)/(m_1.m_2)$ b) $(m_1.m_2)/(m_1 - m_2)$
c) $m_2/(1+m_2/m_1)$ d) $m_1/(1+m_2/m_1)$

Q.1 B) Fill in the blanks OR write true/false: **06**

a) The Nuclear magnetic resonance (NMR), spectrum of a molecule is observed in radio frequency range. (True/False)
b) The principal quantum number determines the orientation and energy of the orbital. (True/False)
c) The spectrum of radiation emitted by a black body at a temperature 1000 K peaks in the visible range of the frequencies. (True/False)
d) If Q value of nuclear reaction is positive the reaction is Exothermic. (True/False)
e) For l=2, ml has ____ Possible values.
f) Hyperfine structure is due to ____ interaction of valence electrons.

Q.2 Answer the following. **16**

a) Write in brief on two valence electron spectra.
b) Write a short note on Pauli's Exclusion Principle.
c) Explain about the Stark effect.
d) State and discuss the Frank-Condon principle.

Q.3 Answer the following: **16**

a) Discuss in detail about nuclear magnetic resonance (NMR).
b) Explain Raman spectra in detail.

Q.4 Answer the following: **16**

a) Obtain an expression for rotational energy level of rigid diatomic molecule.
b) Discuss vibrational-rotational spectra in detail.

Q.5 Answer the following: **16**

a) Explain LS coupling scheme for two valence electron system using neat vector diagram.
b) State and explain Lande interval rule. Represent it graphically for ^3D term.

Q.6 Answer the following: **16**

a) What is Zeeman effect? Distinguish between normal and anamolous Zeeman effect.
b) What is Pachen-Back effect? Explain in detail.

Q.7 Answer the following:

a) Discuss about the X-ray and Auger transition.

b) Write an explanation of Born-Oppenheimer approximation.

SLR-ZQ-22

Seat No.	

Set P

M.Sc. Physics (Applied Electronics) (Semester - III) (New/Old) (CBCS)
Examination: March/April - 2025
Communication System (MSC5306)

Day & Date: Friday, 19-May-2025 Max. Marks: 80
Time: 11:00 PM To 02:00 PM

Instructions: 1) Q.Nos.1 and 2 are compulsory.
2) Attempt any three questions from Q.No.3 to Q.No.7.
3) Figure to right indicate full marks.

Q.1 A) Choose correct alternative. **10**

1) Which of the following circuits is used in a Class C AM transmitter?
a) Push-pull amplifier b) Power amplifier
c) Frequency modulator d) Balanced modulator

2) What is the function of a VCO in an FM transmitter?
a) To modulate the audio signal
b) To generate the carrier frequency
c) To amplify the RF signal
d) To detect the frequency deviation

3) Which type of modulation is used in FM radio?
a) Phase modulation
b) Amplitude modulation
c) Frequency modulation
d) Pulse modulation

4) The sampling theorem states that a signal can be completely represented by its samples if the sampling rate is:
a) Half of the signal frequency
b) Equal to the signal frequency
c) Greater than twice the signal frequency
d) Equal to zero

5) Which of the following is a characteristic of a balanced modulator?
a) It produces a double-sideband suppressed carrier signal
b) It amplifies the carrier frequency
c) It uses a single input signal
d) It only works with low-frequency signals

6) In which system is Frequency Division Multiplexing (FDM) used?
a) In Time Division Multiplexing
b) In Digital Signal Processing
c) In Analog Signal Transmission
d) In Communication Systems with multiple channels

7) Which modulation technique is used in Digital Communication for Phase Modulation?

a) ASK b) FSK
c) PSK d) QAM

8) The phase shift keying technique is generally used in:

a) Analog systems b) Digital systems
c) Audio modulation d) Video modulation

9) What is the primary advantage of using TDMA in communication?

a) It reduces interference
b) It increases signal strength
c) It allows multiple users to share the same frequency
d) It minimizes signal noise

10) In a Class B audio amplifier, the power output is:

a) Linear b) Non-linear
c) Amplified d) Distorted

B) Fill in the blanks or write true/false **06**

a) The FM transmitter frequency band typically ranges from _____ MHz to _____ MHz.
b) In a balanced modulator, the output is a _____.
c) TDM stands for _____.
d) In Class A amplifiers, the efficiency is approximately _____.
e) TDM allows multiple signals to be transmitted over the same _____.
f) A basic characteristic of CDMA is _____.

Q.2 Answer the following: **16**

a) Explain the block diagram of a High-Level AM transmitter.
b) Discuss the working principle of a Class C modulated power amplifier circuit.
c) What are the sidebands in AM transmission? How are they formed?
d) Describe the block diagram of an AM receiver and discuss the AM detector circuit.

Q.3 Answer the following: **16**

a) Explain the concept of FM modulation and describe the block diagram of an FM transmitter.
b) Describe the working of a Frequency Doubler and Frequency Tripler in FM transmission systems.

Q.4 Answer the following **16**

a) What is Pulse Amplitude Modulation (PAM)? Explain its advantages and disadvantages.
b) Discuss Delta modulation and explain its basic principle with a diagram.

Q.5 Answer the following **16**

a) Discuss the role of PLL as an FM detector with a block diagram.

b) Describe the basic operation of Frequency Shift Keying (FSK) and its applications in digital communication.

Q.6 Answer the following **16**

a) What are the differences between TDM and FDM? Discuss with suitable examples.

b) Explain the working of a simple amplitude shift keying (ASK) modulator and demodulator.

Q.7 Answer the following **16**

a) Describe the different transmission modes: Simplex. Half-Duplex, and Full-Duplex with examples.

b) Explain the concept of Unipolar and Bipolar transmission and the differences between RZ and NRZ encoding schemes

Seat No.	

Set P

M.Sc. Physics (Applied Electronics) (Semester - IV) (New) (NEP CBCS)
Examination: March/April - 2025
Physics of Semiconductor Devices (2323401)

Day & Date: Wednesday, 14-May-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose the correct alternative. **08**

1) For an electron, the sum of the probability of occupancy and non-occupancy of an energy level is _____.
a) 1 b) 0.5
c) less than 1 d) greater than 1

2) When a piece of pure silicon is doped with indium, then _____.
a) The doped silicon piece will become n-type semiconductor
b) The doped silicon piece will become p-type semiconductor
c) The conductivity of the doped silicon piece will remain the same
d) The resistivity of the doped silicon piece will increase

3) How much should be minimum energy of the photon in joule that can be absorbed by semiconductor having band gap of 1 eV?
a) 2 joule b) 1.6×10^{-19} joule
c) 3.2×10^{-19} joule d) 0.8×10^{-19} joule

4) In the case of direct recombination, the excess carriers' decay _____.
a) at exactly the same rate as the minority carriers.
b) at a less rate as the minority carriers.
c) at a greater rate than the minority carriers.
d) at a double rate as the minority carriers.

5) A Schottky diode is a _____ diode with a low forward voltage drop and a very fast switching speed.
a) p-n junction b) n-p junction
c) metal-semiconductor d) M-I-S

6) A metal is heated to a sufficient temperature, to enable the free electrons to come out of its surface. This type of emission is called _____.
a) High field emission b) Secondary emission
c) Photoelectric emission d) Thermionic emission

7) Which of the following semiconductor devices converts optical energy into electrical energy?
   a) solar cells
   b) photodiodes and solar cells
   c) light-emitting diodes (LEDs)
   d) Silicon Controlled Rectifier (SCR)

8) The minimum input current that can turn on a thyristor is called the _____.
   a) Holding current
   b) Breakover current
   c) Trigger current
   d) low-current drop-out

B) Fill in the blanks OR Write true/false. **04**

1) Even at elevated temperature, the Fermi level lies at the middle of the band gap for intrinsic materials. (True/False)
2) A semiconductor with a band gap of about 2 eV wide, allows only long wavelengths (infrared) and the red part of the visible spectrum to transmit through it. (True/False)
3) In a dynamic equilibrium, there is no continual diffusion of electrons from the n to the p side (and holes from p to n). (True/False)
4) The _____ is a bidirectional device.

Q.2 Answer the following question (Any Six) **12**

a) The probability of occupancy of an energy level is 0.6. Calculate the probability of non-occupancy of the same energy level.
b) What are Indirect semiconductor materials?
c) How does the trapping of charge carriers occur in semiconductors?
d) Distinguish between drift and diffusion currents.
e) What is a depletion Layer?
f) What is Schottky barrier?
g) A Silicon solar cell has an open-circuit voltage; V_{oc} = 0.8 V, a short-circuit current; I_{sc} = 100 x 10^{-3} A, maximum voltage; V_m = 0.5 V and maximum current; I_m = 80 x 10^{-3} A. Calculate the fill factor of the solar cell.
h) Define the efficiency of a solar cell

Q.3 Answer the following question (Any Three) **12**

a) Write a note on the effective mass of an electron/hole.
b) Discuss intrinsic and extrinsic materials.
c) Explain Optical absorption in semiconductors.
d) Discuss the Diffusion and Drift of carriers and built-in fields that occur in the semiconductor.

Q.4 Answer the following question (Any Two) **12**

a) Effects of temperature and doping on mobility.
b) Discuss the Forward characteristics and reverse characteristics of the Schottky barrier.
c) Explain the principle, working, and characteristics of a light-emitting diode (LED).

Q.5 Answer the following question (Any Two) **12**

a) Derive the continuity equation.

b) Write a note on Gunn diode.

c) Write a note on a Solar Cell.

Seat No.	

Set P

M.Sc. Physics (Applied Electronics) (Semester - IV) (New) (NEP CBCS)
Examination: March/April - 2025
Nuclear and Particle Physics (2323402)

Day & Date: Friday, 16-May-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) Nuclei having same number of neutrons are called _____.
a) isobars b) isotopes
c) isotones d) isomers

2) The series that contain magic numbers is _____.
a) 2, 8, 20, 28, 50 b) 2, 8, 18, 28, 50
c) 2, 8, 10, 28, 50, 82 d) 8, 18, 20, 28

3) The _____ have explained the magic numbers.
a) Liquid drop model b) Fermi gas model
c) Shell model d) All of these

4) Two-neutron separation energy is designated as _____.
a) S_2 b) S_{2n}
c) $2nS$ d) S^{2n}

5) If Q value of nuclear reaction is positive the reaction is _____.
a) exoergic b) endothermic
c) endoergic d) direct reaction

6) The inverse process of the stripping reaction is _____ reaction.
a) compound b) clipping
c) fusion d) pickup

7) The nuclear process in which one or more particles may be liberated when the target nucleus absorbs γ -ray is called _____.
a) Photodisintegration b) photoelectric effect
c) Compton absorption d) $\gamma - \text{decay}$

8) Cyclotrons are specially used to accelerate _____.
a) negative ion b) positive ion
c) neutron d) electron

B) Write True/False. **04**

1) High binding energy means more stability of the nucleus. (True/False)
2) Gravitational interaction is of greater strength than electromagnetic interaction. (True/False)
3) The electric quadrupole moment is negative; shape of the nuclei is oblate. (True/False)
4) The Rutherford scattering experiment may not be called a nuclear reaction. (True/False)

Q.2 Answer the following. (Any Six) **12**

a) Write a note on composition of nucleus.
b) Write the series of magic numbers.
c) Why the neutron well is deeper than the proton well in nuclear potential?
d) What is the meaning of Fermi gas in Fermi gas nuclear model?
e) Write fission reaction upon bombarding a neutron on uranium.
f) What is elastic and inelastic scattering?
g) What is convenient unit of nuclear cross section and convert it into SI system?
h) What is the name of hypothetical particle exchanged in the gravitational interaction?

Q.3 Answer the following. (Any Three) **12**

a) Explain meson theory of nuclear force.
b) Give detailed account on liquid drop model.
c) Explain the nuclear fusion with the example of the Sun.
d) Write a note on linear accelerators.

Q.4 Answer the following. (Any Two) **12**

a) Explain in detail alpha, beta and gamma decay.
b) How shell model explained the existence of all magic numbers with the help of different nuclear potentials?
c) Give detailed account on cosmic rays and explain how geomagnetic-latitude effect on distribution of cosmic rays.

Q.5 Answer the following. (Any Two) **12**

a) Explain any six conservation law s of nuclear reactions.
b) Give detailed account on nuclear forces and its properties.
c) Explain idea of quantum chromo dynamics and different types of quarks charge.

Seat No.	

Set **P**

M.Sc. Physics (Applied Electronics) (Semester - IV) (New) (NEP CBCS)
Examination: March/April - 2025
Communication System (2323405)

Day & Date: Tuesday, 20-May-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) In high-level AM, modulation occurs at:
   a) Low power stage
   b) Audio stage
   c) Power output stage
   d) None of the above

2) The carrier suppression in balanced modulators leads to _____
   a) Better fidelity
   b) Lower noise
   c) Reduced power loss
   d) All of the above

3) In FM, modulation index is the ratio of _____
   a) Frequency deviation to modulating frequency
   b) Carrier frequency to modulation frequency
   c) Carrier amplitude to modulating amplitude
   d) None of the above

4) In delta modulation, the step size _____
   a) Is fixed b) Is variable
   c) Can't be controlled d) Is random

5) A transponder is used in _____
   a) Radio broadcasting
   b) Satellite communication
   c) Mobile towers
   d) TV receivers

6) RZ encoding is characterized by _____
   a) Constant voltage b) Return to zero level
   c) Dual logic d) Bipolar pulses

7) PLL is mainly used in ____
   a) Power supply b) Detectors
   c) RF Amplifiers d) Filters

8) Full duplex mode allows _____
   a) Two-way communication, one at a time
   b) One-way communication only
   c) Simultaneous two-way communication
   d) None of these

B) Fill in the blanks OR write true/false **04**

1) AM bandwidth is _____ the modulating frequency.
2) T/F: FSK stands for Frequency Shift Keying.
3) _____ Modulation shifts the frequency according to signal amplitude.
4) T/F: In simplex transmission, both sender and receiver can communicate.

Q.2 Answer the following (Any Six) **12**

a) What is the fiinction of an AM detector?
b) Write two differences between high and low level modulation.
c) Explain any two pulse modulation techniques.
d) What are the applications of PLL?
e) Define modulation index in FM.
f) State any two advantages of multiplexing.
g) Define TDMA.
h) What is the need of modulation?

Q.3 Answer the following (Any Three) **12**

a) Draw and explain FM transmitter block diagram.
b) Explain the concept of pulse code modulation.
c) Draw and explain high level AM transmitter.
d) Explain pulse code modulation.

Q.4 Answer the following (Any Two) **12**

a) Explain the working of a superheterodyne receiver.
b) Describe the principle of time division multiplexing.
c) Compare simplex, half duplex and full duplex communication.

Q.5 Answer the following (Any Two) **12**

a) Describe working of ASK, FSK and PSK modulation schemes.
b) State and prove sampling theorem.
c) Explain generation and demodulation of PPM.

Seat No.	

Set P

M.Sc. Physics (Applied Electronics) (Semester - IV) (New/Old) (CBCS)
Examination: March/April - 2025
Semiconductor Devices (MSC5401)

Day & Date: Wednesday, 14-May-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Q. Nos (1) and (2) are compulsory.
2) Attempt any three questions from Q. No (3) to Q. No. (7)
3) Figures to the right indicate full marks.

Q.1 A) Choose the correct alternative. **10**

1) In a heterojunction LASER, _____ materials are present.
a) n-type b) p-type
c) both (a) and (b) d) only n-type

2) When a _____ voltage is applied to the gate, the NMOS will conduct.
a) breakdown b) low
c) high d) both (a) and (b)

3) After biasing MIS structure, in case of accumulation, there is _____ of majority charge carriers.
a) addition b) removal
c) both (a) and (b) d) none of these

4) Flat-Band refers to the biasing condition in which there is _____ voltage drop.
a) little b) no
c) not defined d) all of these

5) When the current can be conducted in both directions of the MS contact, the contact is defined as the _____ contact.
a) Rectifying b) Ohmic
c) Resistive d) none of these

6) The point in the gate voltage sweep, when significant current begins to flow is called as _____.
a) cut-off voltage b) contact potential
c) threshold voltage d) all of these

7) The readout circuits of CCD perform a _____ conversion.
a) parallel to series b) series to parallel
c) parallel to parallel d) all of these

8) Dark charge is defined as the number of charge electrons that leaks into a pixel during the exposure time in the _____ of light.
a) absence b) presence
c) not defined d) both (a) and (b)

9) To increase fringing field, CCD gate length needs to be _____.
a) reduced b) enhanced
c) unchanged d) all of these

10) The negative differential resistance is the concept explained by _____ theory.
a) RWH b) Hall effect
c) quantum confinement d) both (b) and (c)

B) Fill in the blanks or State True/False. **06**

1) NMOS works faster than PMOS. (True False)
2) Fermi-level pinning is lowered potentially by the insulator layer at the metal-semiconductor junction. (True/False)
3) A higher electron energy is represented by the higher position in the energy band diagram. (True/False)
4) When the SCR is turned from forward blocking to forward conduction state is called as _____.
5) Photodiodes operate after _____ biasing.
6) The number of photoelectrons produced divided by the number of impinging photons is called as _____.

Q.2 Answer the following question **16**

a) Write in brief about concept of the dark current.
b) Draw a neat labelled diagram showing construction of Gunn diode.
c) Write the difference between in depletion and enhancement MOSFET.
d) Draw a labelled diagram showing construction of Solar Cell.

Q.3 Answer the following question

a) Elaborate the IV characteristics of solar cell. Deduce an expression for quantum efficiency of solar cell. **08**
b) Elaborate in detail about the charge trapping concept in MOSFET. **08**

Q.4 Answer the following question

a) What are light emitting diodes? Explain the principle of construction and working of LEDs. **08**
b) Explain in brief about dv/dt and di/dt characteristics of SCR. **08**

Q.5 Answer the following question

a) What are Schottky diodes? Give the detailed explanation of working mechanism in Schottky diode. **08**
b) Explain the concept of flat band condition? Give the detailed explanation of basic equations flat band condition. **08**

Q.6 Answer the following question

a) Elaborate in detail about the basic construction and charge transfer mechanism in two phase CCD. **08**

b) Write in detail about LSA mode of operation. **08**

Q.7 Answer the following question

a) Give detailed explanation about the construction and working of p-n junction LASER. **08**

b) What are Photoconductors? Write in brief about photocurrent gain. **08**

Seat No.	

Set **P**

M.Sc. Physics (Applied Electronics) (Semester - IV) (New/Old) (CBCS)
Examination: March/April - 2025
Nuclear and Particle Physics (MSC5402)

Day & Date: Friday, 16-May-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Q. Nos. 1 and 2 are compulsory.
2) Attempt any three questions from Q. No. 3 to Q. No. 7.
3) Figures to the right indicate full marks.

Q.1 A) Choose the correct alternative. **10**

1) The binding energy per nucleon is highest for which of the following elements?
   a) Helium b) Iron
   c) Uranium d) Hydrogen

2) The theory explaining alpha decay is based on which phenomenon?
   a) Quantum tunnelling
   b) Gravitational force
   c) Electromagnetic interaction
   d) Thermal diffusion

3) The quark composition of a proton is: _____.
   a) uuu b) uud
   c) udd d) ddu

4) Which nuclear model considers the nucleus as a drop of incompressible nuclear fluid?
   a) Shell model b) Fermi gas model
   c) Liquid drop model d) Superconductivity model

5) The primary component of cosmic rays is: _____.
   a) Electrons b) Neutrons
   c) Protons d) Gamma rays

6) Yukawa's theory describes nuclear forces as mediated by which type of particle?
   a) Electron b) Neutrino
   c) Meson d) Photon

7) The half-life of a radioactive substance is the time taken for its activity to: _____.
   a) Reduce to zero b) Double
   c) Reduce to half d) Become constant

8) Magic numbers are associated with which nuclear property?
   a) Nuclear spin b) Nuclear stability
   c) Decay constant d) Isotopic mass

9) The conservation law not obeyed in weak interactions is: _____.
   a) Charge conservation b) Parity conservation
   c) Energy conservation d) Baryon number conservation

10) A synchrotron is used to: _____.
   a) Accelerate particles in a straight line
   b) Detect cosmic rays
   c) Accelerate particles in a circular path
   d) Measure binding energy

B) Fill in the blanks OR write true/false. **06**

1) The energy released during nuclear fusion is due to the conversion of _____ into energy.
2) The shell model explains the concept of _____ numbers for stable nuclei.
3) In beta decay, a neutron converts into a _____ and emits a beta particle and an antineutrino.
4) Cosmic rays are primarily composed of heavy nuclei. True/False
5) The binding energy per nucleon decreases for elements heavier than iron. True/False
6) Alpha particles have higher penetration power than beta particles. True/False:

Q.2 Answer the following. **16**

a) Explain the concept of nuclear binding energy and its relation to nuclear stability.
b) Describe the liquid drop model and its applications in predicting nuclear masses.
c) What is Yukawa's hypothesis of nuclear forces? Explain the role of mesons.
d) Discuss the process of radioactive dating and its applications.

Q.3 Answer the following. **16**

a) Explain the Fermi gas model and how it applies to the nucleus.
b) Describe the shell model of the nucleus with an emphasis on the spin-orbit interaction.

Q.4 Answer the following. **16**

a) Derive the Breit-Wigner formula for nuclear resonance reactions.
b) Discuss the theory of alpha decay and the concept of quantum tunnelling.

Q.5 Answer the following. **16**

a) Classify elementary particles based on their interactions. Explain with examples.

b) What are cosmic rays? Discuss their origin and effects on the Earth's atmosphere.

Q.6 Answer the following. **16**

a) Explain nuclear fission and fusion with suitable examples.

b) Describe the functioning of a cyclotron and its application in nuclear physics.

Q.7 Answer the following **16**

a) Discuss the conservation laws in nuclear reactions with examples.

b) Explain the working principle of scintillation detectors and their applications.

Seat No.	

Set **P**

M.Sc. Physics (Applied Electronics) (Semester - IV) (New/Old) (CBCS)
Examination: March/April - 2025
Microwave Devices & Circuits (MSC5403)

Day & Date: Tuesday 20 May 2025 Max. Marks: 80
Time: 3:00P.M.To 6:00PM

Instructions: 1) Q.1 and Q .2 are compulsory.
2) Attempt any three questions from Q. No. 3 to Q. No. 7.
3) Figure to the right indicate full marks.

Q.1 A) Choose correct alternatives (MCQ) **10**

1) Reflex klystron is a _____
a) Low power generator b) High power oscillator
c) Low gain amplifier d) Not an oscillator

2) Microwaves travel in a _____
a) Distorted line b) Curves
c) Straight lines d) None of the above

3) A _____ is a connection that sends energy from one location to another.
a) Transmission line b) Cable lines
c) Fibre cable lines d) Modem line

4) _____ types of transmission lines are there.
a) 3 b) 2
c) 4 d) 8

5) _____ is a microwave source with a cross field Theory.
a) TWT b) Reflex Klystron
c) Magnetron d) Double cavity klystron

6) _____ is the standard form of TWT.
a) Travelling White Tube
b) Travelling Wave Tube
c) Travelling Wave Tire
d) Travelling Weight Tube

7) The gain bandwidth product of Gunn diode is around ____-decibels.
a) <10dB b) >10dB
c) > 200 dB d) infinite dB

8) _____ mode of propagation is supported by a strip line.
a) TEM b) TM
c) TE d) TE, TM

9) The klystron tube used in a klystron amplifier is a _____ type beam amplifier.
a) Linear beam b) Crossed field
c) Parallel field d) None of the

10) _____ is not Microwave device.
a) IC b) Transistor
c) LED d) Varacter diode

B) Fill in the blanks OR write true/false **06**

1) The frequency range from 8 to 12 GHz is designated as X band.
2) Klystron amplifiers have high noise output as compared to crossed field amplifiers.
3) The structure of Gunn diode has 3 layers.
4) The frequency range from 4 to 8 GHz is designated as L band.
5) A Klystron amplifier device uses a helix.
6) Large size is the advantages of Gunn diode.

Q.2 Answer the following. **16**

a) Discuss about the differences between a Reflex Klystron and two cavities Klystron.
b) Describe Ridley- Watkins- Hilsum theory in short.
c) Explain in short the Maxwell's equations.
d) Write a short note on coaxial line.

Q.3 Answer the following

a) Describe the Various modes of operation of Reflex klystron **10**
b) Discuss how the microwave spectrum is categorized into different bands. **06**

Q.4 Answer the following.

a) With the help of velocity diagram explain principle of two-cavity Klystron amplifier. **10**
b) Write down the various Microwave applications. **06**

Q.5 Answer the following.

a) What is Gunn Effect? Explain Gunn diode in detail **10**
b) Write short notes on wave modes. **06**

Q.6 Answer the following

a) Explain the possibility of oscillations in a TWT amplifier. **08**

b) Derive the expressions for the field components due to TM waves in rectangular wave guide. **08**

Q.7 Answer the following

a) Why TEM modes are not possible in hollow rectangular waveguide? Prove it. **08**

b) For a wave guide having cross section 3cm x 2cm, compute the cut-off frequency in the TE01 mode. Also, calculate the phase velocity and guide wavelength at a frequency equal to 50% above the cut-off frequency **08**

SLR-ZQ-32

Seat No.	

Set P

M.Sc. PHYSICS (APPLIED ELECTRONICS) (Semester - IV) (New/Old)
(CBCS) Examination: March/April - 2025
Microcontrollers & Interfacing (MSC5406)

Day & Date: Thursday, 22-May-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Q.Nos 1 and 2 are compulsory.
2) Attempt any three from Q. No. 3 to Q. No. 7.
3) Figure to the right indicates full marks.

Q.1 A) Multiple choice questions: **10**

1) The internal ROM memory of the 8051 is _____.
a) 8K b) 128K
c) 256K d) 4K

2) The 8051 has ____ 16-bit registers.
a) 1 b) 2
c) 3 d) 4

3) The 8051 can handle ____ bit data at the same time.
a) 8 b) 4
c) 2 d) 6

4) The 8051 IC can be available in ____ pin DIP package.
a) 40 b) 28
c) 30 d) 20

5) The D7 bit in PSW from D0-D7 is ____ flag.
a) Carry b) Zero
c) Parity d) Overflow

6) ____ used to select the register banks in 8051.
a) PC b) RS0-RS1
c) SP d) ALU

7) ____ instruction will load the value 35H immediate in the accumulator.
a) MOV A #35H b) MOV A, 35H
c) MOV A, #35H d) MOV #35H, A

8) When 8051 wakes up then 0x00 is loaded to ____ register.
a) SP b) PC
c) DPTR d) PSW

9) The 16-bit address bus allows access to an address range of.

a) 000 to FFFH b) 00 to FFH
c) 0000 to FFFFH d) 0 to FH

10) The bits of the register PSW affected if we select Bank2 of 8051 is ____.

a) PSW.5 =0 and PSW.4 =1 b) PSW.2 =0 and PSW.3 =1
c) PSW.3 =1 and PSW.4 =1 d) PSW.3 =0 and PSW.4 =1

B) State true or false: **06**

1) PSW register is 8 bits wide in size.
2) 8051 series microcontroller family has six register banks.
3) 8051 microcontrollers has 8 bits unidirectional data bus.
4) On power up, the 8051 uses 00-07 RAM locations for register R0-R7.
5) 16 bytes of bit addressable memory is present in 8051 based microcontrollers.
6) Auxiliary carry is set when carry is generated from D4 to D3.

Q.2 Answer the following: **16**

a) Write a short note on TCON SFR for 8051 Microcontroller.
b) Describe SCON register for serial communication.
c) Explain oscillator and clock of 8051 microcontroller.
d) What is common anode and common cathode 7-segment display?

Q.3 Answer the following:

a) Explain how to interface push button with 8051 microcontrollers with C program. **08**
b) Explain different modes of Timer for 8051 microcontroller. **08**

Q.4 Answer the following:

a) What is the memory organization of the 8051? Explain in details. **10**
b) What are the addressing modes of 8051 microcontroller? **06**

Q.5 Answer the following:

a) Draw an internal architecture diagram of 8051 Microcontroller. Describe each block in detail. **10**
b) Write the features of 8051 microcontroller. **06**

Q.6 Answer the following:

a) Draw 40- pin diagram of 8051 microcontroller. Explain the function of each pin in detail. **10**
b) Explain how to interface LED with 8051 microcontrollers with C program. **06**

Q.7 Answer the following:

a)	Describe the data transfer instructions and arithmetic instructions of 8051 microcontroller with examples.	**10**
b)	Explain the port programming in 8051 microcontrollers.	**06**