S.S Jain Subodh P.G. College, Jaipur
M.Sc. (Physics) II Sem
Paper Code: DSC MPHY 201
Paper Name: Electronics
Assignment March 2025

Instructions to Students: Assignment consist of 8 questions. Students are required to attempt 4 Questions (1 from each Unit). Write questions in at least 500 Words with good presentation.

UNIT 1

Q 1   What do you mean by an input bias current. Derive an expression for output –offset voltage due to input bias current.

Q 2. Draw the circuit of Operational Amplifier as an integrator and explain its working with the help of suitable Waveform Chart for the input and output signals.

UNIT II

Q 3 Draw the circuit diagram of Wein bridge oscillator. Describe its   functioning and derive the expression for the frequency of sustained oscillations

Q 4. Draw circuit diagram of square wave generator using a comparator and an integrator and explain its working.

UNIT III

Q 5 What do you mean by Multiplexer. Write the expression for the data output and also write the truth table for 8:1 multiplexer.

Q 6. What is a ROM. Write different types of ROM's and explain each of them briefly.

UNIT IV

Q 7. Draw the circuit diagram of J-K Flip – Flop. Discuss its functioning with truth table, characteristic table and excitation table.

Q 8. What is a Photo-Transistor? Write its construction and operation.

S.S Jain Subodh P.G. College, Jaipur
M.Sc. (Physics) II Sem
Paper Code: DSC MPHY 202
Paper Name: Atomic & Molecular Physics
Assignment March 2025

Instructions to Students: Assignment consist of 8 questions. Students are required to attempt 4 Questions (1 from each Unit). Write questions in at least 500 Words with good presentation.

UNIT –I

Q1. (a) Calculate the polarizability for hydrogen atom in the ground state and explain your answer.

(b) Write and explain linear stark effect for hydrogen atom on the basis of degenerate perturbation theory.

Q2. (a) Explain normal and anomalous Zeeman effect quantum mechanically.

(b) Explain the Fine Structures and its cause.

UNIT –II

Q3. (a) Discuss variational method and its use in calculation of ground state energy of hydrogen molecule.

(b) Explain the meaning of Spectroscopic term $^{2S+1}L_J$

Q4. (a) Write down the conditions under which the WKB method can be used for one dimensional problem

(b) What do you mean by Ortho and Para Helium?

(c) Obtain Spectroscopic terms for nitrogen atom.

UNIT –III

Q5 (a) Discuss vibrational – rotational spectrum of a diatomic molecule. What are P, Q and R branches in this spectrum. Explain their origin.

(b) Give general features of alkali spectra.

Q6. (a) Explain Raman Effect on the basis of quantum theory. Explain origin of Stoke and Anti – Stoke lines in Raman Spectra.

(b) State and explain Franck – Condon principle for intensity of spectral lines.

UNIT –IV

Q7. Explain in detail the principle and mechanism of Sisyphus Cooling Technique and its limitations.

Q8. Write short note on any of the two:

(a) Atom Laser

(b) Chirp Cooling

(c) Scattering Force.

Instructions to Students: Assignment consist of 8 questions. Students are required to attempt 4 Questions (1 from each Unit). Write questions in at least 500 Words with good presentation.

UNIT –I

Q.1 Explain Frequency dispersion characteristics of dielectrics and conductors. What is dissipative medium?

Q.2 Explain superposition of waves in one dimension. What is casualty connection between D and E?

UNIT –II

Q.3 Explain MHD equations in Magneto hydrodynamics. What is Pinch effect?

Q.4 Explain instabilities in pinched plasma column. What is Debye shielding distance?

UNIT –III

Q.5 Explain Invariance of electric charge covariance of electrodynamics. Derive Transformatioof electromagnetic field.

Q.6 Derive Lienard-Wiechert Potential for a point charge. Explain Larmour's formula.

UNIT –IV

Q.7 Explain Radiative reaction force from conservation of energy. What is Abraham Lorentz evaluation of the self-force?

Q.8 Explain Line Breadth and level shift of an oscillator. Discuss about Scattering and absorption of radiation by an oscillator.

Instructions to Students: Assignment consist of 8 questions. Students are required to attempt 4 Questions (1 from each Unit). Write questions in at least 500 Words with good presentation.

Unit –I

Q.1 a) Explain Lagrange's Interpolation Formula.

b) Discuss different sources which give rise to error. Define round off error and round – off the following given numbers to four significant figures: -

(i) 1.6583   (ii) 30.0567

Q.2. a) Find the real root of the equation $x^3 + x^2 - 1 = 0$ using iterative method, correct to three decimal places.

b) Find the Eigen values and eigenvectors of the matrix-

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

c) Derive a formula for errors in polynomial interpolation.

UNIT –II

Q.3 a) Derive the general formula for numerical integration. Deduce Trapezoidal and Simpson's $\frac{1}{3}$ rule.

b) Using Newton's Raphson method find real root of equation: -
$$x^2 + y = 11, y^2 + x = 7$$

Q.4 a) Using Trapezoidal and Simpson's rule evaluate the integral

$$I = \int_0^1 \frac{dx}{1+x}$$

Correct to three decimal places with h = 0.5

b) Find the root of the equation $f(z) = z^3 + 1 = 0$ with the help of Newton's method for complex root.

Unit –III

Q.5. a) Explain the Runge- Kutta method for solving differential equations.

b) Find the least squares approximations to $\sqrt{x}$ on [0, 1] of degree one, two and three.

Q.6   a) Given $\frac{dy}{dx} = 1 + y^2$ where $y = 0$ when $x = 0$. Find y (0.2) and $y(0.4)$ using Runga – Kutta method.

    b)   Explain Predictor-Corrector method. Obtain expressions for Predictor-Corrector formulae using forward differences.

Unit –IV

Q.7 a) Write a note on sample space.

    b) Write a note on random variable.

Q.8 Write short note on –
    a) Poisson Distribution

    b) Normal Distribution

    c) Binomial Distribution

S.S Jain Subodh P.G. College, Jaipur
M.Sc. (Physics) IV Sem
Paper Code: DSC MPHY 401
Paper Name: Introductory Quantum Field Theory
Assignment March 2025

Instructions to Students: Assignment consist of 8 questions. Students are required to attempt 4 Questions (1 from each Unit). Write questions in at least 500 Words with good presentation.

Unit I

Q.1 What are Scalar and Vector fields? Explain Euler Lagrange's equation and Lagrangian density for electromagnetic field.

Q.2 What is second quantization of identical bosons? Explain second quantization of the real Klein Gordon Field and Complex Klein-Gordon field.

Unit II

Q.3 Explain the occupation number representation for fermions. What is the fermion propagator?

Q.4 Explain second quantization of the Dirac field. What is the EM interaction and gauge invariance?

Unit III

Q.5 What is S-matrix and its expansion. Explain Wick's theorem?

Q.6 Explain Feynman diagrams of basic processes. What are Feynman rules of QED?

Unit IV

Q.7 Explain the Coulomb scattering and Bhabha scattering.

Q.8 Explain the Moller scattering and Compton scattering.

Instructions to Students: Assignment consist of 8 questions. Students are required to attempt 4 Questions (1 from each Unit). Write questions in at least 500 Words with good presentation.

UNIT –I

Q.1(a) What are important interatomic forces?Explain their importance in lattice dynamics.
  (b) Deduce the dispersion relation for one dimentional mono atomic crystal.

Q.**2.** Discuss the interaction of electron and phonons with photons and also discuss inelastic scattering of neutrons. What important results can be find with it?

UNIT –II

Q.**3.** (a) Derive expressions for the density of charge carriers in conduction band and valence bands of a semiconductor and hence deduce the Law of Mass – Action.

  (b) What is Half Effect? Derive formula for Hall Coefficient.

 Q.**4.** (a) Discuss the recombination mechanism with the help of Schockely – Read Theory of Recombination.
  (b) Discuss F –centre in alkali halides crystals.

UNIT –III

Q.**5.** (a) What is paramagnetism? Discuss Langevin Theory of Paramagnetism and obtain an expression for susceptibility. Also discuss it's drawbacks.

Q.**6.** Discuss Heisenberg's exchange interaction as the Quantum theory of Ferromagnetism.

UNIT –IV

Q.**7** (a) What is Meissner Effect? Prove that in a superconductor, Meissner effect and resistivity properties are independent phenomenon.
  (b) Write short notes on Ultrasonic Attenuation and Infrared & Microwave properties of superconductors.

Q.**8.** (a) Define the term Gaiver's tunneling and Josephson tunneling for superconductors
  (b) What are DC and AC Josephson Effect? Explain Quantum Mechanical Theories on these Effects.

S.S Jain Subodh P.G. College, Jaipur
M.Sc. (Physics) IV Sem
Paper Code: DSC MPHY 403
Paper Name: Nuclear Physics – II
Assignment March 2025

Instructions to Students: Assignment consist of 8 questions. Students are required to attempt 4 Questions (1 from each Unit). Write questions in at least 500 Words with good presentation.

UNIT – I

Q 1.Define single particle model in detail. Define shell model predictions for ground state parity, angular momentum, magnetic dipole and electric quadrupole moments.

Q2. What is configuration mixing ? Define single particle transition probability as per the shell model. Define selection rules. What is nuclear isomerism ?

UNIT – II

Q 3. Define collective nuclear model in terms of rotational spectra. Give a brief description of collective model Hamiltonian.

Q 4. Define vibrational collective model, collective modes of a deformed even-even nucleus and moments of inertia.

UNIT – III

Q 5. Explain electric and magnetic multipole moments, gamma decay probabilities in nuclear system and selection rules.

Q 6. Explain Fermi theory of beta decay with special reference to parity conserved selection rules Fermi and Gamow-Teller for allowed transitions.

UNIT - IV

Q 7. Write in detail the theories of nuclear reactions. Describe in detail the partial wave analysis of reaction cross section, compound nucleus formation and breakup. Explain statistical theory of nuclear reactions.

Q 8. What is Optical model? Explain PWBA and its shortcomings.

S.S Jain Subodh P.G. College, Jaipur
M.Sc. (Physics) IV Sem.
Paper Code: DSC MPHY 404
Paper Name: Microwave Electronics- II
Assignment March 2025

Instructions to Students: Assignment consist of 8 questions. Students are required to attempt 4 Questions (1 from each Unit). Write questions in at least 500 Words with good presentation.

UNIT-I

Q.1. What are Avalanche transit time devices? Explain the operation, construction and application of IMPATT oscillator.

Q.2. Explain Gunn Effect. Discuss the two valley model theory.

UNIT-II

Q.3. Explain the operation of a Varactor diode. Discuss the constructional details, equivalent circuit and figure of merit. Mention its applications.

Q.4. What are Manely Rowe relations? By considering a suitable circuit obtain these relations.

UNIT-III

Q.5. What are Microstrip Wave Guides? Discuss the characteristic impedance and losses in microstrip wave guide.

Q.6. What is a Huygen's source? Obtain expression for radiated fields for a Huygen's source using aperture theory.

UNIT-IV

Q.7 (a). Obtain expression for field strength of tropospheric wave.

(b). Derive expression for LOS communication range under practical conditions.

Q.8 Write in brief on:-

(a) Synchronous Satellite
(b) Satellite Orbits
(c) Satellite's Look Angle
(d) Earth Coverage and Slant Range