



TAMIL NADU OPEN UNIVERSITY

Chennai - 15
School of Science

ASSIGNMENT -I

Programme Code No : 281
Programme Name : M.Sc., Physics
Course Code & Name : MPHY-11: CLASSICAL AND STATISTICAL MECHANICS
Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Using canonical transformations solve the harmonic oscillator problem
2. Define Poisson bracket and state its properties and obtain the equations of motion in Poisson bracket formalism.
3. Discuss the problem of one dimensional harmonic oscillator by the Hamilton Jacobi method.
4. Evaluate the J_q integral in the Kepler problem by the method of complex contour integration.

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. Discuss Euler's angles as the generalized coordinates for a rigid body motion. Obtain an expression for the angular velocity in terms of Euler's angles.
2. Obtain Euler's equation of motion for a rotating rigid body.
3. Explain in detail various generating functions and the related transformation equations.



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ASSIGNMENT -II

Programme Code No	: 281
Programme Name	: M.Sc., Physics
Course Code & Name	: MPHY-11: CLASSICAL AND STATISTICAL MECHANICS
Batch	: AY 2018-19
No.of Assignment	: One Assignment for Each 2 Credits
Maximum Marks	: 100
Weightage	: 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. A rigid bar of mass 'm' and length 'l' is suspended from a rigid support by means of two springs of force constants 'k' each. Derive and solve the differential equation of motion.
2. A thin rod of length 2b and mass m is suspended by its two ends with two identical vertical springs with force constant k that are attached to the horizontal ceiling. Assuming that the whole system is constrained to move in just one vertical plane, find the normal frequencies and normal modes of small oscillations. Describe and explain the normal modes.
3. A mass particle moves in a constant vertical gravitational field along the curve defined by $y=ax^4$, where y is the vertical direction. Find the equation of motion for small oscillations about the position of equilibrium.
4. A uniform horizontal rectangular plate rests on four similar springs at the corners. Investigate the small oscillations for which the plate remains rigid.

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. Consider two identical plane pendulums that are joined by a massless spring. The pendulum's position is specified by the angles θ_1 and θ_2 . The natural length of the spring is equal to the distance between the two supports, so the equilibrium position is at $\theta_1 = \theta_2 = 0$ with the two pendulums vertical. Write down the total kinetic energy and the gravitational and spring potential energies. Write down the Lagrange equations of motion. Find and describe the normal modes for these two coupled pendulums.
2. For small oscillations we write potential energy V as a quadratic function of displacements and neglect the linear and higher order terms. Explain why.
3. Two identical harmonic oscillators having mass M and force constants k each are coupled by means of a spring of force constant k. Find the eigen frequencies corresponding to the symmetric and antisymmetric modes of vibration. Also calculate the eigenvectors and the normal coordinates.



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ASSIGNMENT -III

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Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Explain quantum mechanical ensemble theory.
2. Derive an expression for equation of motion for density matrix.
3. Explain the term quantum mechanical ensemble average.
4. Derive an expression for *Fermi-Dirac distribution law*.

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. Derive an expression for equation of state of an ideal Fermi gas
2. Explain in detail in bose-einstein condensation and its critical conditions.
3. Explain bose – einstein condensation in ultracold atomic gases



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ASSIGNMENT -I

Programme Code No : 281
Programme Name : M.Sc., Physics
Course Code & Name : MPHY-12: MATHEMATICAL PHYSICS
Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Explain the terms Eigen Values and Eigen Vectors
2. Explain the properties of matrices with example.
3. Explain Beta function and evaluate it.
4. Derive Bessel Function.

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. State and verify Cayley – Hamilton Theorem
2. Derive Legendre function.
3. Find solution for the following equation $d^2y/dx^2 - 2x dy/dx + 2ny = 0$ Where n is positive integer.



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ASSIGNMENT -II

Programme Code No : 281
Programme Name : M.Sc., Physics
Course Code & Name : MPHY-12: MATHEMATICAL PHYSICS
Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Find the Fourier transform of Gaussian function $f(x) = e^{-x^2}$
2. Explain the properties of Fourier Transform.
3. Find the Fourier transform of the slit function $f(x)$ defined as

$$f(x) = \begin{cases} \frac{1}{\epsilon}, & |x| \leq \epsilon \\ 0, & |x| > \epsilon \end{cases}$$

Determine the limit of this transform as $\epsilon \rightarrow 0$ and discuss the result.

4. Derivative Problems: Evaluate the following using Laplace Transform of derivatives

$$(i) \mathcal{L}\{1\} = \frac{1}{s} \quad (ii) \mathcal{L}\{t\} = \frac{1}{s^2} \quad \text{and} \quad (iii) \mathcal{L}\{e^{at}\} = \frac{1}{s-a}$$

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. Explain the following
(i) Derivative of Fourier Transform, (ii) Fourier transform of a Derivative,
(iii) Fourier sine and cosine Transform of Derivatives
(iv) Find the Fourier transform of $e^{-|t|}$
2. What is Laplace Transform? Explain first and second shifting theorem & Laplace Transform of derivatives.
3. What is Inverse Laplace Transform? Explain with example.



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ASSIGNMENT -III

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Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Explain the properties of modulus with example
2. Derive Cauchy-Riemann Conditions.
3. Explain Permutation groups.
4. What is group?explain its basic properties and various types of group.

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. State and verify Cauchy's integral theorem and cauchy's intergral formula.
2. Which of the following are analytic functions of complex variable, $z=x+iy$ (i) Z (ii) Z^{-1} (iii) $e^{\sin z}$.
3. How to Representation of a group and explain Reducible and irreducible representation with example



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ASSIGNMENT -I

Programme Code No : 281
Programme Name : M.Sc., Physics
Course Code & Name : MPHY-13: ELECTROMAGNETIC THEORY
Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Derive Poisson's and Laplace equation
2. Derive an expression for Energy associated to an electrostatic field.
3. Explain application of Ampere's law.
4. What is Magnetic vector potential? Explain with special cases.

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. State and explain Gauss law and its applications
2. State and prove Electrostatics Uniqueness Theorems.
3. Explain Magnetic force due to Volume distribution of current and derive Continuity equation



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ASSIGNMENT -II

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Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Derive an expression for Force on a point charge embedded in a dielectric.
2. Derive the relation between Electric susceptibility and dielectric constant.
3. What is "wave impedance" of free space and derive the expression for the same.
4. What is "skin depth" and derive the expression for the same

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. Derive Boundary conditions on the field vectors
2. Derive Maxwell's equations and their physical significance
3. State and prove work-energy theorem and derive its integral form



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Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Derive an expression for Force on a point charge embedded in a dielectric.
2. Derive the **Fresnel's Equations**
3. Derive an equation for rectangular wave guide.
4. Explain total internal reflection and critical angle

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. Derive Boundary Conditions For The Electromagnetic Field Vectors: B, E, D, And H,
(At The Interface Between Two Media)
2. Explain General Treatment of Reflection and Refraction
3. Define reflection coefficient and derive the relation of Transmission coefficient
between two nonconducting media.



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ASSIGNMENT -I

Programme Code No : 281
Programme Name : M.Sc., Physics
Course Code & Name : MPHY-14: NUCLEAR PHYSICS
Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. With a neat diagram explain Bainbridge and Jordan mass spectrograph
2. Discuss different theories of Nuclear composition. What is Tensor force?
3. Explain the salient features of the liquid drop model and give the various assumptions made.
4. Derive Bohr-Wheeler theory of Nuclear

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. (a) How are the nuclear spin, orbital Angular momentum and parity of nucleus predicted from the shell model.
(b) Explain collective model of Nucleus.
2. Discuss different types of exchange forces.
3. (a) What are magic and semi-magic numbers? Give experimental evidences in support of magic numbers and shell structure of nucleons in nuclei.
(b) Write a note on Nuclear Isomerism.



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Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Derive Gamow's theory of α -decay.
2. With a neat diagram explain DuMond Bent crystal spectrometer for the determination of γ -ray energies?
3. What is meant by Fine structure of α -rays?
4. State and explain Geiger –Nuttal law? and What is Internal conversion in γ -decay?

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. (i) Derive Fermi's theory of β -decay? (ii) Write a note on β -ray spectrum?.
2. List out the properties of α , β γ rays
3. State and explain Radioactive displacement law and Selection rules for β -decay



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PART A (4 x 10 = 40)

Answer all the Questions

1. Explain Quadrupole moment of Deuteron
2. Explain Meson theory of nuclear force.
3. Give the charge and quantum number associated with each quark. How do the quarks combine to form baryons and mesons?
4. What are “baryon and lepton number”? show, wit examples, that in any nuclear reaction, they are conserved.

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. Derive Breit - Wigner Single level formula for scattering
2. Explain the following (i) Neutron -Proton scattering at low energies (ii) Proton - Proton scattering at low energies.
3. What you mean by an elementary particle? How are the elementary particles Classified on the basis of their masses, interaction



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No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Explain the construction of TWO variable K-Map with example.
2. What are universal gates. Explain with NAND and NOR
3. What is full adder?.explain full adder using AND - OR
4. Explain decoder and encoder with circuit diagram and truth table.

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. Explain QUNE. MCCLUSKEY METHOD with example.
2. What is Multiplexer and DeMultiplexer. Explain with example.
3. Explain full subtractor, Parallel Binary subtractor and Serial Binary subtractor



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ASSIGNMENT -II

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Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

PART A (4 x 10 = 40)

Answer all the Questions

1. Explain the concept of sequential logic.
2. Explain in detail RS Latch.
3. Draw and explain Block diagram of 4 bit Universal shift register.
4. Explain sequential circuit design.

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. Explain the construction and working of JK Master flip-flop
2. Explain the term shift register and its types in detail.
3. What is Counters? Explain its types.



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PART A (4 x 10 = 40)

Answer all the Questions

1. Explain the construction and working of Astable multivibrator.
2. Explain D/A converter
3. Explain various types of ROM and RAM
4. Explain the term Flash memory and charge coupled device (CCD)

Part – B (2 x 30 = 60 Marks)

Answer **any two** of the questions.

1. Explain in detail of A/D converter
2. Explain EPROM floating gate transistor characteristic theory.
3. Explain D/A converter Architecture