

(DPHY01)

ASSIGNMENT - 1

M.Sc. DEGREE EXAMINATION, MARCH 2023

First Year

Physics

MATHEMATICAL PHYSICS

MAXIMUM : 30 MARKS

ANSWER ALL QUESTIONS

1. (a) What are Legendre's polynomials?

(b) Solve that $p_n(-x) = (-1)^n p_n(x)$.

2. Find the series solution if the equation

$$2x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + (1 - x^2)y = 0.$$

3. (a) Evaluate by Cauchy's integral formula $\oint_c \frac{z}{z^2 - 3z + 2} dz$ where c is

$$|z - 2| = 1/2.$$

(b) Find the analytic function, where real part is $\frac{\sin 2x}{\cosh 2y - \cos 2x}$.

4. (a) Show that $\oint_c \frac{z}{(9 - z^2)(z + 1)} dz = \frac{\pi}{5}$ where c is the circle $|z| = 2$, using Cauchy integral formula.

(b) State and prove Moreira's theorem.

5. (a) Discuss the classification of Cartesian tensors.

(b) Explain the algebraic operations on general tensors.

(DPHY01)

ASSIGNMENT - 2

M.Sc. DEGREE EXAMINATION, MARCH 2023

First Year

Physics

MATHEMATICAL PHYSICS

MAXIMUM : 30 MARKS

ANSWER ALL QUESTIONS

1. (a) Find the components of the first and second fundamental tensors in spherical polar coordinators.
(b) Discuss Quotient law.
2. (a) Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2 & \text{if } |x| \leq 1 \\ 0 & \text{if } |x| > 1 \end{cases}$.
(b) Find the Fourier cosine transform of $f(x) = \begin{cases} \cos x & \text{if } 0 < x < a \\ 0 & \text{if } x \geq a \end{cases}$.
3. (a) Find the Laplace transform of the function $f(t) = \begin{cases} t-1; & 1 < t < 2 \\ 3-t; & 2 < t < 3 \end{cases}$.
(b) Find inverse Laplace transform of $\log \left[\frac{s+1}{s-1} \right]$.
4. Write all of the following
 - (a) What are recursion relations?
 - (b) Discuss harmonic functions.
 - (c) Write a note on derivatives of tensors.
 - (d) Find $L(f(t)) = \begin{cases} e^t & 0 < t < 1 \\ 0 & t > 1 \end{cases}$

(DPHY02)

ASSIGNMENT - 1

M.Sc. DEGREE EXAMINATION, MARCH 2023

First Year

Physics

CLASSICAL MECHANICS AND STATISTICAL MECHANICS

MAXIMUM : 30 MARKS

ANSWER ALL QUESTIONS

1. (a) Discuss about mechanics of a system of particle constraints.
(b) Explain potential dissipation function.
2. (a) Obtain the Force and energy equations in relativistic mechanics.
(b) Define Lagrange and Poisson brackets and explain their canonical invariance.
3. (a) Discuss Hamilton's equations of motion.
(b) Explain the conservation theorem.
4. (a) Explain Eulerian angles.
(b) Discuss Euler equation of motion.
5. (a) Discuss in detail Lorentz transformation.
(b) Explain the Lagrangian formulation of relativistic mechanisms.

(DPHY02)

ASSIGNMENT – 2
M.Sc. DEGREE EXAMINATION, MARCH 2023

First Year

Physics

CLASSICAL MECHANICS AND STATISTICAL MECHANICS
MAXIMUM : 30 MARKS

ANSWER ALL QUESTIONS

- 1 (a) Discuss canonical transformations.
(b) Give a brief note on simple examples of Lagrange and Poisson brackets.
- 2 (a) Discuss Hamilton's principle and characteristics functions.
(b) What is Kepler problem.
- 3 (a) Explain about the formulation of the small oscillation problem.
(b) What are eigenvalue equations.
- 4 Write all of the following
 - (a) Cyclic coordinates.
 - (b) Transformation matrix.
 - (c) Potential dissipation function.
 - (d) Action-angle variables

(DPHY03)

ASSIGNMENT - 1

M.Sc. DEGREE EXAMINATION, MARCH 2023

First Year

Physics

QUANTUM MECHANICS

MAXIMUM : 30 MARKS

ANSWER ALL QUESTIONS

1. (a) Define Dirac's Bra and Ket notations. Discuss uncertainty principle.
(b) State and prove Ehrenfest Theorem.
2. (a) Describe the solution of a wave equation for a particle moving in one dimension in a constant potential field with finite and infinite walls.
(b) Explain the equation of wave for hydrogen atom.
3. (a) Describe the application of perturbation theory to normal helium atom and discuss stark effect in helium atom.
(b) Discuss ground state of helium atom.
4. (a) Explain general perturbations and variations of constants.
(b) Discuss sudden and adiabatic approximation.
5. (a) Explain spin angular momentum.
(b) Discuss Paulis spin matrices.

(DPHY03)

ASSIGNMENT - 2

M.Sc. DEGREE EXAMINATION, MARCH 2023

First Year

Physics

QUANTUM MECHANICS

MAXIMUM : 30 MARKS

ANSWER ALL QUESTIONS

- 1 (a) Explain CG coefficients.
- (b) State and prove Wigner-Eckart Theorem.
- 2 (a) Explain the equations of motion in Schrodinger's and in Heisenberg's picture.
- (b) Write down the application of Heisenberg's picture to Harmonic oscillator.
- 3 (a) Discuss Dirac metrics and free particle solutions.
- (b) Derive Dirac's equation in the presence of a electromagnetic field.
- 4 Write all of the following
 - (a) Eigen values and Eigen functions.
 - (b) Stark effect in Hydrogen atom.
 - (c) Explicit matrices for J_x , J_y and J_z .
 - (d) Probability and current densities.

(DPHY04)

ASSIGNMENT - 1

M.Sc. DEGREE EXAMINATION, MARCH 2023

First Year

Physics

ELECTRONICS

MAXIMUM : 30 MARKS

ANSWER ALL QUESTIONS

1. (a) What is a differential amplifier?
(b) How does a voltage follower work?
2. (a) Discuss about square wave and triangular wave generators.
(b) Explain the operational principle of class A power amplifiers.
3. (a) Discuss the propagation of TM waves in a rectangular wave guide.
(b) Explain the working of Klystron.
4. (a) Explain amplitude modulation and generation of amplitude modulation waves.
(b) Discuss frequency modulation.
5. (a) Explain how an encoder works?
(b) Discuss the working of demultiplexer.

(DPHY04)

ASSIGNMENT - 2

M.Sc. DEGREE EXAMINATION, MARCH 2023

First Year

Physics

ELECTRONICS

MAXIMUM : 30 MARKS

ANSWER ALL QUESTIONS

1. Discuss how synchronous and asynchronous counters work with neat diagram.
2. Give the architecture and pin diagram of 8085 with a neat diagram.
3. Draw the Architecture of 8086 and explain the addressing modes of 8086.
4. Write all of the following :
 - (a) Effect of feedback on Closed loop gain and band width.
 - (b) Microwave resonators.
 - (c) Decoder.
 - (d) Addressing modes of 8085.