

PGIS-N 1001 B-2K13**M.Sc. Ist Semester(CBCS) Degree Examination****Physics****(Classical Mechanics)****Paper -HCT-1.1****(New)**

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

Answer all the questions of **15** marks each and any **two** questions of **10** marks each.

1. a) Describe the mechanics of a single particle and its associated conservation laws of angular momentum and energy. **(10+5)**
- b) Describe the motion of a particle under a force which depends on time only.

OR

2. Derive Rutherford's formula for scattering of alpha particles. **(15)**
3. a) What are the generalized coordinates?
- b) Derive Lagrange's equation of motion using D'Alembert's Principle. **(5+10)**

OR

4. a) Obtain the Lagrangian for a charged Particle moving in an electromagnetic field.
- b) State and explain Hamilton variational principle. **(10+5)**
5. a) Describe the equivalence of Lagranges and Newton's equations.
- b) Obtain the Hamilton's principle using Newton's equation. **(6+9)**

OR

6. a) Discuss harmonic oscillator as an example of canonical transformations.
b) Define Poisson brackets and explain their properties. (7+8)
7. Discuss the four dimensional formulation of relativistic mechanics. (15)

OR

8. a) Explain the basic concepts of continuum mechanics.
b) Obtain an expression for the equation of continuity. (7+8)
9. Explain the two body problem as equivalent one body problem. (10)
10. Describe the cyclic coordinates and symmetry associated conservation laws. (10)
11. Give comments on the Hamiltonian formulation. (10)
12. Explain the Lorentz covariant form of equation of motion. (10)
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PGIS-N 1007 B-2K13**M.Sc. Ist Semester(CBCS) Degree Examination****Physics****(Mathematical Physics)****Paper -SCT-1.1****(New)**

Time : 3 Hours

Maximum Marks : 80

Instructions:

Answer all the questions of 15 marks each and **any two** questions of 10 marks each.

1. a) Describe the general solution of the first order linear differential equation.
b) Solve the equation $y' + x = y/x$ (8+7)

OR

2. a) Obtain the Legendre's differential equation using power series method.
b) Give the classification of partial differential equations. (10+5)
3. a) Define cauchy's sequence. Explain Hilbert's space of n-dimension. (8+7)
b) Determine which of the following are symmetric and which are antisymmetric.

$$\begin{bmatrix} 1 & 2 & -5 \\ 2 & 2 & -1 \\ 5 & 1 & -3 \end{bmatrix}$$

OR

4. a) Describe the matrix representation of linear operators.
b) Write a note on hermitian and unitary matrices. (8+7)
5. a) Explain contravariant and covariant tensor.
b) State and explain quotient rule of tensors.
c) Write a note on curvilinear coordinates. (5+5+5)

OR

6. a) Define christffel symbol of first kind. (5+4+6)
b) Explain contraction and outer product operations with an example for both.
c) Explain rising and lowering of indices in tensors.
7. a) Explain the basic concept of a group.
b) State the properties the a set of elements need to be satisfied in order to form a group.
c) If a group H of order h is a subgroup of a group G of order g, show that g is an integral multiple of G. (4+5+6)

OR

8. a) Define homomorphism and isomorphism of groups.
b) If $\Phi(g) = g'$ is a homomorphism of G and e, e' are identity element in G and G' , show that $\Phi(e) = e' \Phi(g^{-1}) = (g^{-1})^{-1}$
c) Prove that $A = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ is a element of SU(2). (4+5+6)

9. Explain the Bessel function and their properties. (10)
10. Explain the diagonalization and spectral theory in vector spaces. (10)
11. Discuss the Einstein summation convention used in tensors. Give two examples of physical quantities which are tensors. (10)
12. Give an account of applications of group theory in physics. (10)

PGIS-O 1002 B-2K13**M.Sc. Ist Semester Degree Examination****Physics****(Classical Mechanics)****Paper -1.1****(Old)**

Time : 3 Hours

Maximum Marks : 80

Note: Answer any **Six** questions of **12** marks and **two** questions of **4** marks each.

1. Distinguish between a single Particle and many particle systems. Prove the laws of conservation of angular momentum and energy of a many particle system. (12)
2. Discuss two body central force-field motion. (12)
3. What is meant by virtual work? Explain Obtain lagrange's equation of motion starting from D'Alembert's Principle. (12)
4. State Hamilton's variational Principle and obtain Lagrange's equation of motion using from variational principle. (12)
5. What are canonical transformations? Obtain canonical equations of motion in Poisson bracket notation. (12)
6. Set up Hamilton-Jacobi equations of motion. (12)
7. Discuss the salient features of relativistic mechanics and describe their four dimensional formulation. (12)
8. a) Derive the Lorentz covariant form of the equation of motion.

- b) Briefly explain the basic concepts of continuum mechanics. (8+4)
9. Write a note on Kepler's laws of planetary motion. (4)
10. Discuss the symmetry and cyclic coordinates. (4)
11. Explain briefly Poisson brackets. (4)
12. Write a note on Four vectors, four force and four momentum. (4)
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PGIS-N 1003B-2K13**M.Sc. Ist Semester(CBCS) Degree Examination****Physics****(Electrodynamics)****Paper -HCT-1.2****(New)**

Time : 3 Hours

Maximum Marks : 80

Instructions :

Answer all the questions of **15** marks each and any **two** question of **10** marks each.

1. a) Set up Laplace and Poisson's equations in electrostatics. (5+10)
b) Obtain the multi-pole expansion for electrostatic potential of an arbitrary localized charge distribution.

OR

2. a) Derive expression for Electric field in terms of a scalar potential.
b) Deduce the electric potential and fields due to dipole and quadrupole. (8+7)
3. a) Using Biot-Savart's law calculate the magnetic field due to a straight current carrying wire.
b) Deduce the laws of magnetostatic field in integral and differential forms (8+7)

OR

4. a) State Ampere's circuital law in magneto-statics and show that magnetic field of a current is non-conservative.
b) Explain the magnetostatic boundary conditions. (8+7)

5. a) Discuss Maxwell's electromagnetic field laws in integral and differential forms.
b) Explain the law of Lorentz force in electromagnetic. (10+5)

OR

6. a) What are Gauge transformations? Explain. Discuss the relevance of coulomb and Lorentz gauges. (10+5)
b) Derive an expression for energy in electromagnetic field.
7. a) Discuss the propagation of electromagnetic waves in conducting media. (7+8)
b) Derive expression for reflection and transmission of electromagnetic wave incident normally on a dielectric boundary.

OR

8. a) Discuss the energy flux in a plane wave.
b) What are the four vectors in electrodynamics? Explain the covariant formulation of the laws of electrodynamics. (5+10)
9. Explain the concept of skin depth. Calculate the skin depth of copper with conductivity 10^7 mhos/m for a frequency of 150 MHz. (10)
10. Obtain an expression for the electrostatic energy in dielectric media. (10)
11. Describe Faraday's laws of electromagnetic induction. (10)
12. Explain the principle of invariance in relativistic electrodynamics. (10)
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PGIS-O 1004 B-2K13**M.Sc. Ist Semester Degree Examination****Physics****(Quantum Mechanics-I)****Paper -1.2****(Old)**

Time : 3 Hours

Maximum Marks : 80

Note: Answer any **Six** questions of **12** marks and **two** questions of **4** marks each.

1. a) Define uncertainty Principle. Prove the uncertainty principle for a group wave.
b) Show that the electron does not exist in nucleus using uncertainty principle. (6+6)
2. Develop the one dimensional Schrodinger equation for free particle and in a force field.
Extend it to three dimension. (12)
3. Give the physical interpretation of eigen values and eigen functions. With detail theory, arrive at the expression for energy eigen values of simple harmonic oscillator. (12)
4. A particle travelling with energy (E) along X-axis is incident on a single step potential barrier of height V_0 . Solve the Schrodinger equation for a particle and calculate the reflection and transmission coefficient through the single step barrier. (12)
5. a) Define Bra and Ket notation for vectors with their properties.
b) Obtain the equation of motion in Heisenberg picture. (6+6)
6. a) Work out the commutation $[X, P_x^n]$ (5+7)
b) Distinguish between the Schrodinger picture, Heisenberg picture and interaction

7. Discuss the basic principle of variation method and Illustrate it for a Hydrogen atom.(12)
8. Give the theory of scattering by square well potential using Born approximation method and briefly discuss the validity of Born approximation for the case of square well potential.. (12)

9. Find expectation values of position and momentum of a particle whose normalized wave

function is $\varphi(x) = Ne^{-\frac{x^2}{2a^2} + ikx}$. (4)

10. Show that the wave functions of a particle in a box are orthogonal. (4)
11. Show that if two Hermitian operators commute, then their product is also Hermitian operator. (4)
12. Explain the scattering of particle moving in spherical symmetric potential and express the amplitude in terms of phase shift. (4)
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PGIS-O 1008 B-2K13

M.Sc. Ist Semester Degree Examination

Physics

(Mathematical Physics and Computer Applications-I)

Paper - 1.4

(Old)

Time : 3 Hours

Maximum Marks : 80

*Instructions to Candidates:**Answer any six questions of 12 marks and two questions of 4 marks each.*

1. Find the general solution of the equation $\frac{d^2x}{dt^2} + k^2x = \phi(t)$. (12)
2. Solve the Bessel's equation $x^2 \frac{d^2x}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$ by Frobenius method. (12)
3. a) Give a brief account of classification of partial differential equations.
b) Solve the differential equation $\frac{\partial^2 z}{\partial x^2} = \frac{2}{k} \frac{\partial z}{\partial x}$ by separation of variable method. (4+8)
4. a) Show that if $g(\omega)$ is the Fourier transform of $f(x)$, then $g^*(-\omega) = g(\omega)$ is a necessary and sufficient condition for $f(x)$ to be real.
b) If $g(s) = \frac{k^2}{s(s^2 + k^2)}$, find the inverse Laplace transform of $g(s)$. (8+4)
5. a) Obtain Fourier series expression of the periodic function $f(t)$ with T as its period and the form of which within the first period. i.e, $0 \leq t \leq T$ is given by $f(t) = t(T-t)$.
b) Find an even function $f(x)$ of x defined as .

$$f(x) = kx \text{ for } 0 \leq x \leq l/2$$

$$= kx \text{ for } l/2 \leq x \leq l$$

(8+4)

6. a) Explain with an example the difference between arithmetic operations and logical operations.
- b) What are the primary functions that an operating system performs?
- c) What purpose would a “shall” serve in unix? (4+4+4)
7. a) Explain the usage of “switch” statement used in C program’s with an example.
- b) With a suitable example compare “While” and “For” statement in C Language. (6+6)
8. a) Give algorithm, flow chart and C program code for trapezoidal rule of solving area under curve.
- b) Write a C program to find all prime numbers less than 100. (7+5)
9. Evaluate $\int_0^{0.6} e^x \sin x dx$ using Simpson’s 1/3rd rule. (4)
10. Explain briefly input and output statements in C programs. (4)
11. Mention some applications of periodic function in physics. (4)
12. Discuss the properties of Bessel’s function. (4)
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