Code No. 16139/Core

FACULTY OF SCIENCE

M.Sc. I Semester (CBCS) Examination, September 2021

Subject: Astrophysics/Physics & Applied Electronics

Paper – I : Mathematical Physics

Time: 2 Hours **Max. Marks: 80**

PART – A

Note: Answer any five questions. **(5 x 7 = 35 Marks)**

1 Write the Rodrigue's formula for Legendre's differential equation.

2 Define the Beta and Gamma functions.

3 Prove the recurrence relation of $H_n(-x) = (-1)^n H_n(x)$ for Hermite polynomials.

4 Show that Bessel's function of the first kind $J_{-n}(x) = (-1)^n J_n(x)$.

5 Find the Fourier transform of the function $f(x) = e^{i\omega x}$.

6 Write the properties of Inverse Laplace Transforms.

7 Determine the eigen value of the matrix $\begin{bmatrix} 2 & -2 & 2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$.

8 What is Transpose of a matrix? Show that $(AB)^T = B^T A^T$; A and B being comfortable for multiplication.

PART – B

Note: Answer any three questions. **(3 x 15 = 45 Marks)**

9 Write Legendre's differential equation and find it's solution by power series method.

10 (a) Obtain Generating function for Bessel's function of the first kind.
(b) Discuss orthogonality of Bessel's function of the first kind.

11 solve the Hermite differenting equation $\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2ny = 0$ and find its polynomials solution, 'n' being a positive integer.

12 Obtain Generating function and Rodrigue's formula for Laguerre differential equation.

13 What are Fourier Sine and Cosine transforms? Find the Fourier Sine and Cosine transform of second derivative of the function f(t).

14 (a) Define the Lapalace Transform and write any five properties of Laplace Transform.
(b) Obtain the Laplace Transform of $\sin x$.

15 (a) Describe the Eigen values and Eigen vectors.
(b) Write the characteristic equation of a matrix by Cayley-Hamilton's theorem.

16 Explain Co-variant, Contra variant and mixed tenson with suitable examples.

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FACULTY OF SCIENCE

M.Sc. I – Semester (CBCS) Examination, September 2021

Subject: ASTROPHYSICS/PHYSICS AND APPLIED ELECTRONICS

Paper –II: Classical Mechanics

Time: 2 Hours **Max. Marks: 80**

PART – A

Note: Answer any five questions. **(5x7 = 35 Marks)**

1 What is Minkowski space? Describe the different zones of a Space-time diagram?

2 Explain what is meant by a pseudo force with an example

3 Obtain the Lagrangian' s equations of motion for an L-C circuit.

4. Explain the Principle of Virtual work with examples.

5 Define Principle of least Action

6 Evaluate the Poisson bracket [P_y^2 , L_x]

7 What are normal modes? Explain their significance

8 Define Stable, unstable and neutral equilibrium

PART – B

Note: Answer any three questions. **(3x15 = 45 Marks)**

9 Describe the transformation from the space set of axes to the body set of axes in terms of Euler angles

10 Explain the Lorentz Transformation in a four-space vectors and write about four velocity, energy-momentum vectors with few examples.

11 State the D'Alembert's Principle and deduce the Lagrangian equation of motion from D'Alembert's equation

12 Obtain Lagrargian equation for a charged particle in an electro-magnetic field.

13 (a) Deduce the Hamilton's equations

(b) Write the Hamilton's equations for a Projectile motion of a body

14 Define Canonical Transformation and write four generating functions

15 Describe the Vibrations in a Linear-triatomic molecule.

16 Explain normal coordinates Lagrangian formulation for continuous systems.

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Code No. 16143/Core

FACULTY OF SCIENCE

M.Sc. I – Semester (CBCS) Examination, September 2021

Subject: PHYSICS/ Atrophysics/Appl.Electronics

Paper – III: Quantam Mechanics-I

Time: 2 Hours **Max. Marks: 80**

PART – A

Note: Answer any five questions. **(5x7 = 35 Marks)**

1 Define Parity operator and Projection operator

2 What is Hermitian operator and comment on the statement that " Hermitian operators have real eigenvalues".

3 What are rising and Lowering operators?

4 Explain the properties of stationary states in detail.

5 Discuss space and time displacements with suitable examples.

6. Explain in detail about space inversion and unitary inversion operators.

7. Obtain Eigen values and Eigen functions of L^2

8. Discuss about Pauli spin matrices and their properties.

PART – B

Note: Answer any three questions. **(3x15 = 45 Marks)**

9 Discuss the representation of the wave functions and operators in matrix form with suitable examples.

10 Describe normalization and orthogonality of wave functions in matrix form.

11 Discuss the Schrodinger and Heisenberg representations for describing the dynamical behaviour of a system.

12 Solve the Schrodinger's wave equation for the Hydrogen atom and discuss the radial wave function.

13 Obtain equation of motion for a state function and for an operator in each representation.

14 Describe the time reversal operator for Spin zero and non-zero Spin particles.

15 Derive the expression for Clebsch-Gordon coefficients for $J_1 = ½$ and $J_2 = 1$.

16 Prove that no two of the three components of angular momentum "L" commutes with each other but all of them commute with 'L^2'.

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Code No. 16145/Core

FACULTY OF SCIENCE

M.Sc. I – Semester (CBCS) Examination, September 2021

Subject: PHYSICS /ASTROPHYSICS& APPLIED ELECTRONICS

Paper- IV: General Solid State Physics

Time: 2 Hours **Max. Marks: 80**

PART – A

Note: Answer any five questions. **(5x7 = 35 Marks)**

1 Distinguish between point and space groups
2 Explain why fivefold rotation axis is not possible in crystals
3 What is lattice thermal conductivity ?
4 State and explain the Gruneisen relation
5 Obtain E Vs K relation using Kronig-Penny model.
6 Explain the significance of negative effective mass of an electron
7 What are line defects in a crystal? Explain it indetail.
8 Explain the Fick's laws of diffusion

PART – B

Note: Answer any three questions. **(3x15 = 45 Marks)**

9 Explain FCC, BCC structures. Obtain an expression for inter planar spacing in cubic crystal.

10 Explain the method of lattice constants determination of a cubic crystal using powder method.

11 Describe the vibrational spectra of diatomic lattice with necessary theory

12 Explain the Debye's theory of lattice heat capacities and comment on results obtained.

13 Describe the lattice potentials. State and prove Bloch's theorem and comment on its significance.

14 Explain an experimental set up for Hall effect. What are its applications?

15 Explain the classification of point defects. Obtain an expression for equilibrium concentration of Frenkel defects

16 What are colour centers? Explain any two methods for creation of colour centes

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