

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
1st Internal Assessment 2022-2023

Semester: I Subject: Mathematical Methods in Physics Subject Code: A420010

Duration: 45 Min Date: 13th March 2023 Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Verify whether following matrices are Hermitian or not (4 x 2 marks)

$$\begin{bmatrix} 2 & 3+4i \\ 3-4i & 1 \end{bmatrix} \text{ and } \begin{bmatrix} 1 & i \\ 2 & 3 \end{bmatrix} \quad \text{= 8marks)}$$

b. i) Show that Inverse of a Unitary matrix is Unitary.

ii) If U and H are Unitary and Hermitian Matrix respectively then show that $U=e^{iH}$.

2. a. Obtain Eigen Values and Eigen Vectors of Matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$ (8 marks)

b. Show that i) $kA^\dagger = k^* A^\dagger$ ii) $(AB)^\dagger = B^\dagger A^\dagger$ iii) $(A+B)^\dagger = A^\dagger + B^\dagger$ iv) $(A^\dagger)^\dagger = A$ (4 marks)

OR

3. a. Show that every square matrix can be uniquely expressed as the sum of symmetric and skew symmetric matrices. (6 marks)

b. Diagonalize given matrix $\begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$ (6 marks)

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS

1st Internal Assessment 2022-2023

Semester: I

Subject: Classical Mechanics

Subject Code:A420020

Duration: 45 Min

Date: 13th March 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. What are constraints? Give two examples. (4 x 2 marks
b. State and explain De-Alembert's Principle. = 8marks)
 2. a. Derive Lagrange's equation of motion from De-Alembert's principle. (8 marks)
b. Explain one application of Lagrangian equation of motion. (4 marks)
- OR
3. a. Show that the linear momentum is conserved. (6 marks)
b. Derive Lagrangian equation of motion using Hamiltonian principle. (6 marks)

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS

1st Internal Assessment 2022-2023

Semester: I

Subject: Nuclear and Particle Physics

Subject Code:A420030

Duration: 45 Min

Date: 14th March 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Explain Neutron Scattering (4 x 2 marks
b. Derive stability against spontaneous fission = 8marks)
 2. a. Explain Nuclear Radius by High Energy Electron Scattering (8 marks)
b. Explain Semi-empirical Mass Formula (4 marks)
- OR
3. a. With Neat Diagram Explain Rabis Atomic Beam Method (8 marks)
b. Explain Fermi Gas Model (4 marks)

B. L. D. E. Association's
S. B Arts and K. C. P Science College, Vijayapur
Department of PG Studies in PHYSICS
1st Internal Assessment 2022-2023

Semester: I

Subject: Condensed Matter Physics

Subject Code:A420040

Duration: 45 Min

Date: 14th March 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Explain the terms lattice, basis and unit cell. (4 x 2 marks
b. Explain the crystal structure of CsCl. = 8marks)
2. a. Explain Crystal plane, directions and Miller Indices. (8 marks)
b. Draw neat diagrams to show the (100), (110), (111) and (200) planes in a (4 marks)
cubic unit cell.

OR

3. a. Discuss the classification of seven crystal systems. And also explain (8 marks)
diamond structure with neat diagram.
b. Distinguish between primitive and non-primitive cells. (4 marks)

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
Department of PG Studies in PHYSICS
2nd Internal Assessment 2022-2023

Semester: I **Subject: Mathematical Methods in Physics** **Subject Code: A420010**

Duration: 45 Min **Date: 12th April 2023** **Maximum Marks: 20**

Instruction: Question Number 1 is compulsory.

4. a. Separate Helmotz Equation in Spherical Co-ordinate. **(4 x 2 = 8M)**

b. Obtain Rodrigue's Formula for Laguerre's Polynomial & Find first 3 Polynomial.

.

5. a. Obtain the general solution for Hermite Polynomial using Power series solution Method. **(8 marks)**

b. i) Prove that $xJ'_n(x) = nJ_n(x) - xJ_{n+1}(x)$ **(4 marks)**

ii) Prove that $(n+1)P_n(x) = P'_{n+1}(x) - xP'_n(x)$

OR

6. a. Obtain general solution for Bessel Function using Power series solution method. **(8 marks)**

b. Derive the expression for Orthonormalization condition for Legendre Polynomial. **(4 marks)**

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
2nd Internal Assessment 2022-2023

Semester: I

Subject: Classical Mechanics

Subject Code:A420020

Duration: 45 Min

Date: 12th April 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Show that the linear momentum is conserved. (4 x 2 marks
b. Write the physical significance of Hamiltonian. = 8marks)
 2. a. Derive Hamiltonian equation by using variational principle. (8 marks)
b. Obtain the equation of motion in Poisson bracket. (4 marks)
- OR
3. a. Prove that $\Delta A=0$ (8 marks)
b. Define Poisson and Lagrange brackets. (4 marks)

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS

2nd Internal Assessment 2022-2023

Semester: I

Subject: Nuclear and Particle Physics

Subject Code:A420030

Duration: 45 Min

Date: 13th April 2023

Maximum Marks: 20

Part A

Answer any two of the following

1. Explain semi empirical mass formula (4 Marks)
2. Discuss Neutrino Hypothesis (4 Marks)
3. Explain Internal Conversion (4 Marks)
4. What is Hindrance Factor explain with formula(4 Marks)

Part B

Answer any one of the following

5. Derive Gamow's Theory of Alpha Decay and also write relation between Mean Life and Decay Energy(12 Marks)

OR

6. A .With Neat Diagram Explain Fermi gas model -Fermi Energy and Kinetic Energy
B. Explain types of Gamma Transition in Nuclei and Classification (6 + 6 Marks)

B. L. D. E. Association's
S. B Arts and K. C. P Science College, Vijayapur
Department of PG Studies in PHYSICS
1st Internal Assessment 2022-2023

Semester: I

Subject: Condensed Matter Physics

Subject Code:A420040

Duration: 45 Min

Date: 13th April 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. **a.** Explain various chemical bonds that are possible in solids. **(4 x 2 marks**
 b. Explain the lattice thermal conductivity. **= 8marks)**
2. **a.** What are ionic solids? Evaluate Madelung constant for linear chain of **(6 marks)**
 ionic crystal to be $2 \ln 2$.
 b. Explain the nature of inter atomic forces in solids. **(6 marks)**
- OR**
3. **a.** Discuss in details lattice vibrations in one dimensional monoatomic **(8 marks)**
 lattice.
 b. What are Phonons? Explain the properties of Lattice waves. **(4 marks)**

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
1st Internal Assessment 2022-2023

Semester: I

Subject: Quantum Mechanics-I

Subject Code:B420010

Duration: 45 Min

Date: 04th August 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a Derive Schrodinger time dependent wave equation. (4 x 2 marks
b. Find the commutator relation of the following = 8marks)

(i). $[Z, P_z]$ (ii). $[X, P_x^n]$

2. a. State and Prove the Ehrenfest theorem. (8 marks)

- b. Define Dirac Notations with properties. (4 marks)

OR

3. a. Derive Schrodinger time independent wave equation. (6 marks)

- b. State and Prove Orthonormalization of Eigen function. (6 marks)

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
1st Internal Assessment 2022-2023

Semester: I

Subject: Atomic, Molecular and Optical
Physics(General)

Subject Code: B420020

Duration: 45 Min

Date: 04th August 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. **a.** Explain the terms Absorption and Emission of light. **(4 x 2 marks**
b. What are the use of laser in different fields? **= 8marks)**
2. **a.** What are Einstein's Co-efficient? Obtain the relation between them. **(8 marks)**
b. Write a note on Three level and four level laser systems. **(4 marks)**

OR

3. **a.** Write a note on CO₂ Laser. **(6 marks)**
b. Discuss the properties of laser. **(6 marks)**

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
1st Internal Assessment 2022-2023

Semester: I

Subject: Electronics (General)

Subject Code:B420030

Duration: 45 Min

Date: 05th August 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. **A.** Explain Number System **(4 x 2 marks**
= 8marks)
 - b.** What is Propagation Delay Explain
2. **a.** Explain Half Adder with neat Diagram. **(6 marks)**
 - b.** Explain Full Adder with neat Diagram. **(6 marks)**

OR

3. What is K Map Explain POS and SOP form with Neat Diagram **(6+6 marks)**

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
2nd Internal Assessment 2022-2023

Semester: II

Subject: Quantum Mechanics I

Subject Code: B420010

Duration: 45 Min

Date: 09th September 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Express the angular momentum L_z in Spherical polar coordinates. (4 x 2 marks
b. Define angular momentum & write operator form of its components. = 8marks)
2. a. Discuss the theory of Eigen values of the square & z-component of angular (8 marks)
momentum.
b. Solve the following commutation relations $[L_x, y]$, $[L^2, L_z]$. (4 marks)

OR

3. Find the radial equation for the Hydrogen atom and also give the wave (12 marks)
functions of H-like atom.

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
2nd Internal Assessment 2022-2023

Semester: II

**Subject: Atomic, Molecular
and Optical Physics(General)**

Subject Code: B420020

Duration: 45 Min

Date: 09th September 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Why do we need relativity correction for the term shift of fine structure of spectra? **(4 x 2 marks = 8marks)**
b. Discuss Electric dipole selection rules.
 2. a. Discuss Spin-Orbit Interaction in Single electron system. **(8 marks)**
b. What are Equivalent and non-equivalent electron systems? **(4 marks)**
- OR
3. a. Explain the Coupling Schemes. **(8 marks)**
b. Discuss Quantum states of an electron in an atom. **(4 marks)**

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
2nd Internal Assessment 2022-2023

Semester: II

Subject: Electronics (General)

Subject Code: B420030

Duration: 45 Min

Date: 11th September 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Explain Biasing (4 x 2 marks = 8marks)
b. Explain PMOS,NMOS and CMOS
2. a. With neat diagram explain MOSFET (08 marks)
b. Explain Latches and Flip Flop (04 marks)
- OR
3. a Define JFET as an amplifier? Explain (6 marks)
b. With neat diagram explain SR and JK Flip Flop (6 marks)

B. L. D. E. Association's

S. B. Arts and K. C. P. Science College, Vijayapur

Department of PG Studies in PHYSICS

1st Internal Assessment 2022-2023

Semester: III

Subject: Statistical Mechanics

Subject Code:C420010

Duration: 45 Min

Date: 09th January 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Derive Quasi static Processes. (4 marks)
b. Derive Quasi static work done by pressure. (8marks)
2. a. Explain Reversible and Irreversible Processes (4 marks)
b. Explain heat reservoir. (8 marks)

OR

3. a. Define probability and explain sharpness of probability distribution. (8 marks)
b. Derive dependence of density of state on the external parameters. (4 marks)

B. L. D. E. Association's

S. B. Arts and K. C. P. Science College, Vijayapur

Department of PG Studies in PHYSICS

1st Internal Assessment 2022-2023

Semester: III

Subject: Classical Electrodynamics

Subject Code:C420020

Duration: 45 Min

Date: 09th January 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. State and explain Coulomb's Law. (4 marks)
b. Write a note on Method of images. (8marks)
2. a. Explain the multipole expansion of Potential energy. (8 marks)
b. Write a note on Electrostatic field and Electric flux. (4 marks)

OR

3. a. Explain Scalar Potential in Electrostatics. (8 marks)
b. Obtain the differential and integral form of Gauss Law. (4 marks)

B. L. D. E. Association's

S. B. Arts and K. C. P. Science College, Vijayapur

Department of PG Studies in PHYSICS

1st Internal Assessment 2022-2023

Semester: III

Subject: Condensed Matter Physics-I

Subject Code:C420210

Duration: 45 Min

Date: 10th January 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. State and Prove Bloch Theorem. (4 marks)
- b. Explain Hysteresis curve. (4marks)
2. Explain Tight binding model with its applications. (12marks)

OR

3. Discuss Dispersion relation of magnons. (12marks)

B. L. D. E. Association's

S. B. Arts and K. C. P. Science College, Vijayapur

Department of PG Studies in PHYSICS

2nd Internal Assessment 2022-2023

Semester: III

Subject: Statistical Mechanics

Subject Code:C420010

Duration: 45 Min

Date: 06th March 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Derive Maxwell - Boltzmann Statistics. (4 marks)
- b. Explain Quantum States of a single Particle. (4marks)
2. Derive an Electromagnetic radiation in thermal equilibrium inside an enclosure. (12 marks)

OR

3. Define Bose - Einstein Statistics and Derive. (12 marks)

B. L. D. E. Association's

S. B. Arts and K. C. P. Science College, Vijayapur

Department of PG Studies in PHYSICS

2nd Internal Assessment 2022-2023

Semester: III

Subject: Classical Electrodynamics

Subject Code:C420020

Duration: 45 Min

Date: 06th March 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Discuss Maxwell's correction to Ampere's law. **(4 marks)**
b. Write a note on potentials of electromagnetic fields and hence **(4 marks)**

discuss about Poisson's equation in Electrodynamics.

2. State and explain Maxwell's equations. **(12 marks)**

OR

3. a. Obtain electromagnetic wave Equations in conducting medium. **(8 marks)**
b. Explain Lorentz Gauge. **(4 marks)**

B. L. D. E. Association's

S. B Arts and K. C. P Science College, Vijayapur

Department of PG Studies in PHYSICS

2nd Internal Assessment 2022-2023

Semester: III

Subject: Condensed Matter Physics-I

Subject Code:C420210

Duration: 45 Min

Date: 07th March 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Set up Boltzman transport equation. (4 x 2 marks
b. State and prove Matthesian rule. = 8marks)
2. Deduce the linearized Boltzman transport equation for transport of electrons in metals. (12 marks)

OR

3. a. Obtain electrical conductivity of metals using BTE. (8 marks)
b. Discuss about Seeback effect. (4 marks)

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
1st Internal Assessment 2022-2023

Semester: IV

Subject: Quantum Mechanics-II

Subject Code:D420010

Duration: 45 Min

Date: 04th August 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

- .
1. a. Discuss briefly Schrodinger and Heisenberg picture (4 x 2 marks
b. Write a note on coordinate and momentum representation. = 8marks)
 2. a. Derive the generalized Uncertainty principle in Quantum Mechanics. (8 marks)
b. Discuss the superposition principle in Quantum mechanics. (4 marks)

OR

3. a. Write a note on quantum Poisson bracket. (4 marks)
b. Prove that (8 marks)
 - (i) Eigen values of a real dynamical variable are always real.
 - (ii) Eigen values of Hermitian operator belonging to different Eigen values are orthogonal to each other.

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
1st Internal Assessment 2022-2023

Semester: IV

Subject: AMMP

Subject Code:D420020

Duration: 45 Min

Date: 04th August 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Derive the diffusion or Heat flow equation. **(4 x 2 marks**
b. Derive the Wave equation or Vibrating String. **= 8marks)**
2. a. Write a note on Laplace equation for steady state temperature in a Rectangular Plate. **(4 marks)**
b. A long rectangular metal plate has its 2 long sides and the far end at 0°C and the base at 100°C. The width of the Plate is 10cm. Find the steady state temperature distribution inside the plate. **(8 marks)**

OR

3. a. Discuss the Schrodinger equation. **(4 marks)**
b. A bar of 10cm long with insulated sides is initially at 100°C starting at $t=0$ the ends are held at 0°C. Find the temperature distribution in the bar at time 't'. **(8 marks)**

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
1st Internal Assessment 2022-2023

Semester: IV

Subject: Condensed Matter Physics-II

Subject Code:D420210

Duration: 45 Min

Date: 05th August 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Explain Elemental and Compound Semiconductors. (4 x 2 marks
b. write a note on Fermi energy of Semiconductor. = 8marks)
2. a. Explain Population of impurity levels. (4 marks)
b. Discuss band structure of real semiconductors and direct and indirect band gaps. (8 marks)

OR

3. a. Explain Fermi energy in n-type semiconductors. (4 marks)
b. Derive an expression for carrier concentration in n-type semiconductors (8 marks)

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
1st Internal Assessment 2022-2023

Semester: IV

Subject: Condensed Matter Physics-III

Subject Code:D420220

Duration: 45 Min

Date: 05th August 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Explain Flux Quantization in superconducting Ring. (4 x 2 marks
= 8marks)
b. Explain Metal insulator Tunneling.
2. a. Explain Type I and Type II Superconductors (6 marks)
b. Derive A C Josephson Effect (6 marks)

OR

3. a. Derive D C Josephson Effect. (6 marks)
b. Derive an London Equation (6 marks)

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
2nd Internal Assessment 2022-2023

Semester: IV

Subject: Quantum Mechanics-II

Subject Code:D420010

Duration: 45 Min

Date: 09th September 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. Discuss the interpretation Klein-Gordan Equation, by deriving the expression position probability density and probability current density. (4 x 2 marks = 8marks)
b. Derive an expression for probability density associated with Dirac equation for relativistic free particle.
 2. a. Setup Klein Gordan equation for relativistic free particle. (6 marks)
b. Discuss the properties of Dirac notation (6 marks)
- OR
3. a. By using Dirac wave equation show that existence of the spin angular momentum in case of motion of an electron in a central field. (8 marks)
b. Discuss in brief the Dirac theory of the positive and negative energy state of the electron. (4 marks)

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
2nd Internal Assessment 2022-2023

Semester: IV

Subject: AMMP

Subject Code:D420020

Duration: 45 Min

Date: 09th September 2023

Maximum Marks: 20

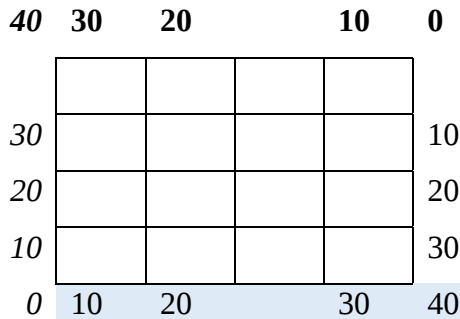
Instruction: Question Number 1 is compulsory.

1. a. Explain the Finite Difference Approximations to Derivatives. **(4 x 2 marks)**

b. Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, $0 < x < 1$, $0 < y < 1$ given that $u(0,y)=0$, $u(x,0)=0$, $u(1,y)=100$, $u(x,1)=100$ & $h=1/3$. **= 8marks)**

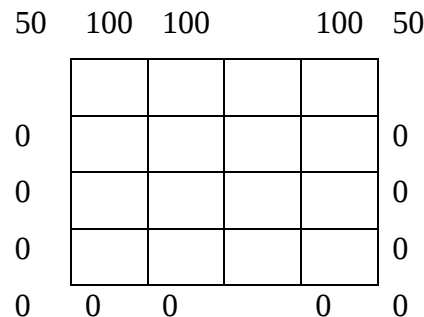
2. a. Briefly explain the finite difference method for the solution of Laplace equation. **(4 marks)**

b. Solve the Laplace equation for below figure. **(8 marks)**



OR

3. a. Find the first iteration of the Laplace equation for below figure. **(4 marks)**



b. Solve the partial differential equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides $x=0=y$, $x=3=y$ with $u=0$ on the boundary & mesh length = 1. **(8 marks)**

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
2nd Internal Assessment 2022-2023

Semester: IV

Subject: Condensed Matter Physics-II

Subject Code:D420210

Duration: 45 Min

Date: 11th September 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. What are Debye equations? (4 x 2 marks = 8marks)
b. Derive Clausius- Mossotti relation.
2. a. Obtain the relation for Local Electric field in a dielectric material. (8 marks)
b. Describe is Ionic polarization. (4 marks)

OR

3. a. Briefly explain sources of polarizability. (8 marks)
b. Explain quantum mechanical treatment for electronic polarization. (4 marks)

B. L. D. E. Association's
S. B. Arts and K. C. P. Science College, Vijayapur
Department of PG Studies in PHYSICS
2nd Internal Assessment 2022-2023

Semester: IV

Subject: Condensed Matter Physics-III

Subject Code:D420220

Duration: 45 Min

Date: 11th September 2023

Maximum Marks: 20

Instruction: Question Number 1 is compulsory.

1. a. What is MOSFET? Explain (4 x 2 marks =
b. Define Super Lattice? Explain 8marks)
 2. a. What is Spray Paralysis with neat diagram explain its Construction (08marks)
Working Principle
b. Derive Quantum Hall Effect (04 marks)
- OR
3. Derive an expression for Quantum Dot also derive its density of states (6+6marks)