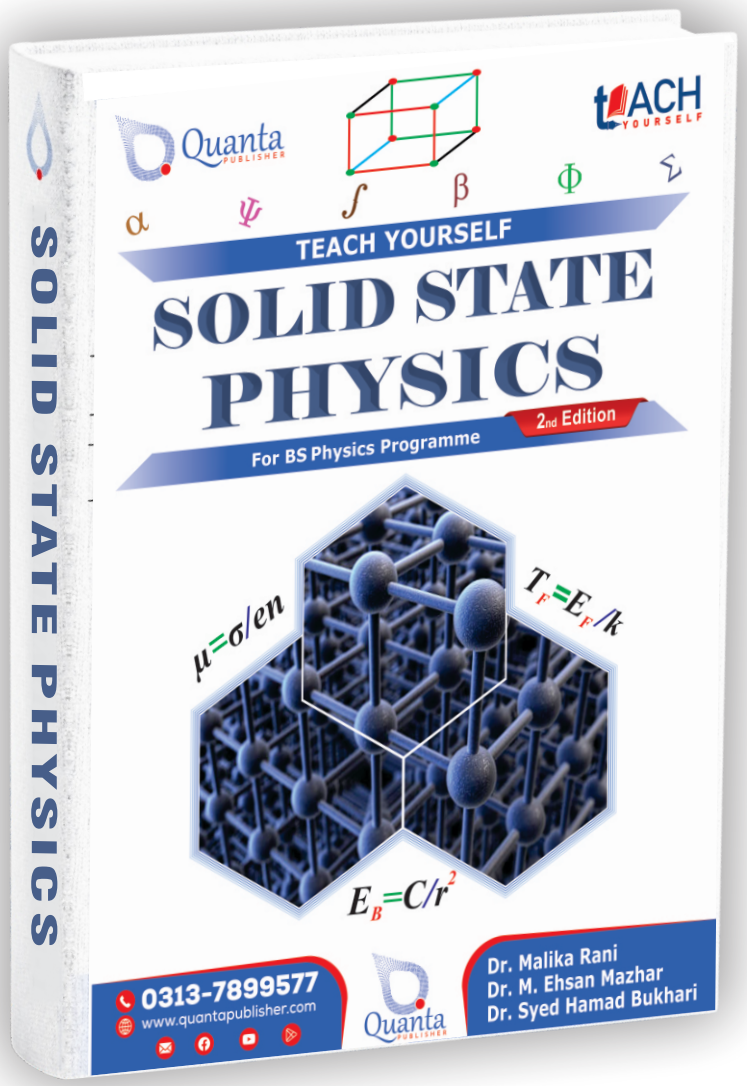
Quanta PUBLISHER

BS Physics

PAST PAPERS



GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD.

External Semester Examinations Fall 2021-22

Subjective Part

Degree/ Discipline: BS Physics (7th Semester)
Course Code: PHY-605
Course Title: Solid State Physics-I

Time: 2:30 Hours

Marks: 80
Credit Hours: 3(3-0)

Note: Attempt all questions. All questions carry equal marks.

Q.NO.2

a) Draw the structure of Diamond crystal. Find its packing density. (6 Marks)

b) Draw and Compute the packing fraction of FCC cubic crystal. (6 Marks)

c) Draw the structure of Sodium chloride structure. Calculate the packing efficiency and density of sodium chloride from the following data: (8 Marks)

Radius of sodium ion= 0.98 A^0 Radius of chloride ion=1.81A^0

Atomic mass of sodium=22.99 amu Atomic mass of chlorine=35.45 amu

Q.No.3

a) Define X-ray diffraction in crystal and its different method. Explain powder method of X-ray diffraction. (6 Marks)

b) What is Brillouin Zones? Define the construction of the first two Brillouin zones for a square lattice. (8 Marks)

c) Draw and Prove that reciprocal lattice to BCC is FCC. (6 Marks)

Q.NO .4

a) What is lattice energy of ionic crystal? Explain Born -Madelung theory of lattice energy in NaCl. (10 Marks)

b) Determine the value of Madelung constant of ionic crystal NaCl. (5 Marks)

c) Explain and differentiate between Ionic and Covalent bonding in crystal. (5 Marks)

Q.No.5

a) Find the dispersion relation for a linear monatomic lattice and explain its group and phase velocity. (10 Marks)

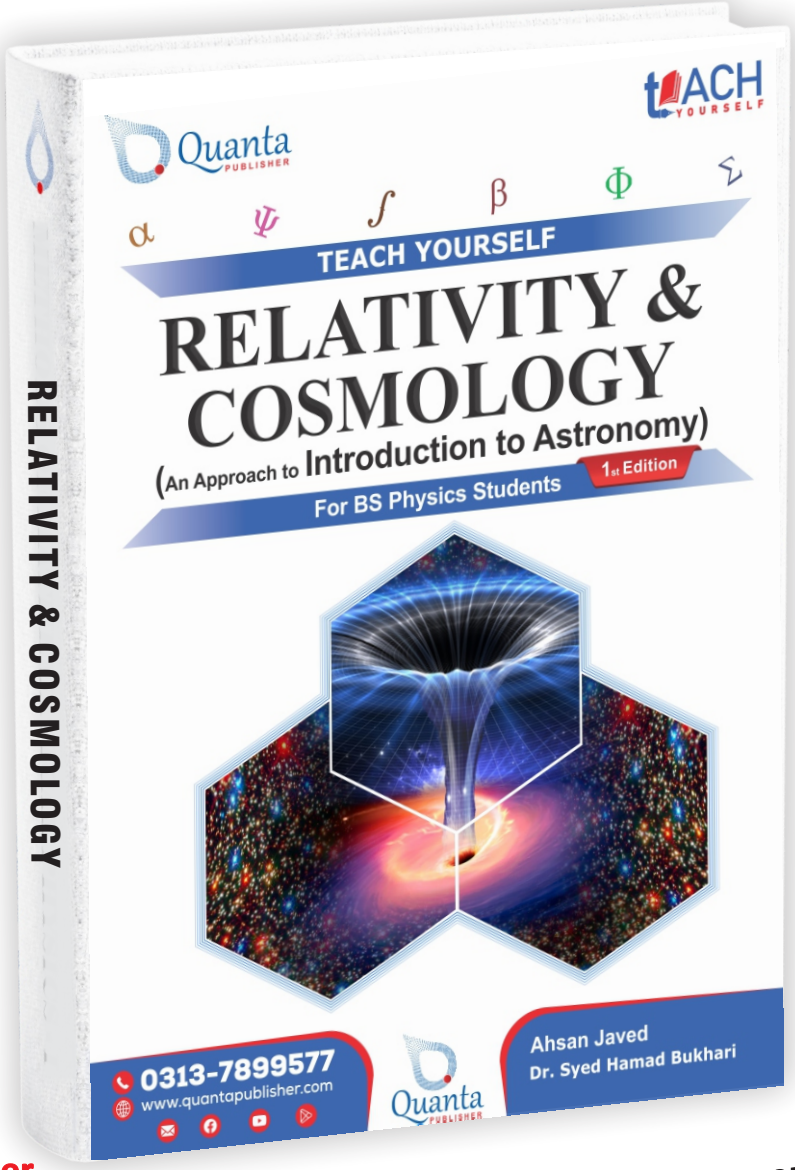
b) How does the Debye model differ from the Einstein model of lattice heat capacity? Discuss the consequence of this difference explaining the low temperature behavior of specific heat in each case. (6 Marks)

c) What are phonons and its characteristics. (4 Marks)

Quanta PUBLISHER

BS Physics

PAST PAPERS



GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD.

External Semester Examinations Fall 2021-22

Degree/ Discipline: BS Physics (7Th Semester) — **Objective Part**
Course Code: PHY-605 — Time: 30 minutes — Marks: 20
Course Title: Solid State Physics-I — Credit Hours: 3(3-0)

Q.1: Encircle the correct answer. **Marks: (20×1=20)**

1. Interplanar spacing in BCC crystal in (111) planes
   a. a/√2 b. a/2 c. a/2√3 d. Infinite
2. Laue equation solved for crystal axes
   a. Parallel b. Orthogonal c. Horizontal d. None of these
3. Packing density of NaCl structure
   a. 50.40% b. 60.10% c. 70.60% d. 66.30%
4. Laue's technique θ is fixed while .....varies
   a. λ b. lattice constant c. unit cell d. θ
5. Debye -Scherrer formula used to determine the unit cell
   a. Volume b. size c. area d. surface
6. First Brillouin zone of BCC Lattice
   a. Rhombic b. Tetrahedral c. rhombic dodecahedron d. Dodecahedron
7. Hydrogen bond is formed between oppositely charged ends of two
   a. Temporary dipoles b. permanent dipoles c. Dipoles d. electric dipoles
8. Wigner Seitz cell is the volume enclosed by normal
   a. largest b. medium c. Smallest d. parallelepiped
9. Reciprocal lattice vector having magnitude equal to reciprocal of
   a. Interplanar spacing b. parallel c. perpendicular d. lattice constant
10. Hydrogen bond is special type of bond
    a. Metalic bond b. Ionic c. Covalent d. Van der Waals
11. The total heat transferred through a solid
    a. Electron b. Phonon c. Phonon and electron d. None of these
12. The combination of vacancy and interstitial imperfection
    a. Frenkel b. Schottky c. Point d. None of these
13. Metallic bonding electron behave as
    a) Molecular nature b. Bound nature c. Shared nature d. Free nature
14. The colour appear in crystal due to the
    a. Line defects b. Surface defects c. Point defects d. Grain boundry
15. Monoatomic lattice, the dispersion effects are negligible at
    a. high frequency b. low frequency c. medium frequency d. high and low frequency
16. Dispersion curves for Diatomic lattice separated by
    a. Phonon b. acoustical c. optical d. Forbidden band
17. Diatomic lattice forbidden band acts as
    a. band pass filter b. low pass filter c. high pass filter d. optical filter
18. Dulong and Petitis law, molar heat capacity of all solids at all temperature
    a. $N_a k_B$ b. $7N_a k_B$ c. $4N_a k_B$ d. $3N_a k_B$
19. Einstein model does not explain well molar heat capacity at temperature near
    a. −5k b. 10 K c. 7 K d. 0K
20. Debye law, C_v approaches classical value
    a. 10 R b. 0R c. 5R d. 3R

GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD.

ROLL No. 4432

Degree/ Discipline: BS Physics (7th Semester M&E)
Course Code: PHY-606 **Time:** 1 Hour **Total Marks:** 18
Course Title: Solid State Physics-I **Exam:** Mid Term Fall 2022 **Credit Hours:** 3(3-0)

Note: Attempt all questions.

Q. No. 1

A).Show that c/a ratio for an ideal HCP structure is √8/√3. (4 Marks)

B).Draw the structure of NaCl and find its packing density from the following data:

Radius of Sodium ion=0.98 A^0 Radius of Chloride ion=1.81 A^0 (3 Marks)

C).A plane makes intercepts of 1,2 and 0.5 A^0 on the crystallographic axes of an orthorhombic crystal with a:b:c=3:2:1. Determine the Miller indices of this plane. (2 Marks)

Q.No.2

A).Draw the structure of Diamond and find its packing density. (4 Marks)

B).Copper (FCC) has density of 8960 kgm^{-3}. Calculate the unit cell dimension and radius of Cu atom, given the atomic mass of Cu as 63.54 amu. (3 Marks)

C).Calculate the distance between the adjacent parallel planes of the type (100) and (111) in an FCC lattice of lattice constant a. (2 Marks)

ROLL No.....

GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD.

External Semester Examinations Fall 2022-23

Degree/ Discipline: BS Physics (7Th Semester) **Objective Part**
Course Code: PHY-607 /605 Time: 30 minutes Marks: 20
Course Title: Solid State Physics-I Credit Hours: 3(3-0)

Q.1: Encircle the correct answer. **Marks: (20×1=20)**

1. Laue's method is mostly used for
   a. Wavelength b. Crystal lattice c. Crystal symmetry d. None of these
2. Interplanar spacing in BCC crystal in (111) planes
   a. a/√2 b. a/2 c. a/2√3 d. Infinite
3. 2-D square lattice has rotation symmetry
   a. 1- fold b. 2-fold c. 4 fold d. 5-fold
4. space lattice of Diamond structure
   a. BCC b. FCC c. Cubic d. none of these
5. Miller indices of plane intercepts a,b,c equal to 3A, 4A, and 3A in tetragonal (a=b≠c) crystal with c/a ratio 1.5 is
   a. (4 2 1) b. (4 3 6) c. (3 2 1) d. None of these
6. The Density of atoms in crystal plane (110) of SC system
   a. $1/a^2\sqrt{2}$ b. $1/a^2\sqrt{3}$ c. $1/a^2$ d. None of these
7. Van der Waals forces arises in Molecular bond due to
   a. Ionic b. Covalent c. Dipole interaction d. Hydrogen bonding
8. The bond angles in carbon sp3 hybridization
   a. $102^0\ 15'$ b. $104^0\ 31'$ c. 109.5^0 d. $120^0\ 8'$
9. Hydrogen bond is special type of bond
   a. Metallic bond b. Ionic c. Covalent d. Van der Waals
10. The total heat transferred through a solid
    a. Electron b. Phonon c. Phonon and electron d. None of these
11. Cohesive energy of ionic crystal NaCl was first calculated by
    a. Heisenberg b. Madelung c. Lennard- Jones d. Born and Mayer
12. Covalent bonding follow principle
    a. Heisenberg b. Schrodinger c. Pauli exclusion d. Newton
13. Madelung constant of NaCl crystal
    a. 1.50 b. 1.89 c. 1.74 d. 2.0
14. Monoatomic lattice, the dispersion effects are negligible at
    a. high frequency b. low frequency c. medium frequency d. high and low frequency
15. Dispersion curves for Diatomic lattice separated by
    a. phononb b. acoustical c. optical d. Forbidden band
16. Dulong and Petitis law, molar heat capacity of all solids at all temperatur
    a. N_ak_B b. $7N_ak_B$ c. $4N_ak_B$ d. $3N_ak_B$
17. Einstein considered the atoms of a crystal as identical and 3-D Quantum
    a. coupled oscillator b. Damped oscillator c. Harmonic Oscillators d. uniform oscillator
18. Einstein model does not explain well molar heat capacity at temperature near
    a. −5k b. 10 K c. 7 K d. 0K
19. Debye explain specific heat capacity for complete temperature range by considering
    a. Uniform Oscillator b. Damped Oscillator c. Harmonic Oscillator d. Coupled harmonic oscillator
20. Debye law, C_v approaches classical value
    a. 10 R b. 0R c. 5R d. 3R

ROLL No.....

GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD.

External Semester Examinations Fall 2022-23

Subjective Part

Degree/ Discipline: BS Physics (7Th Semester) Time: 2:30 Hours Marks: 80

Course Code: PHY-607/605 Credit Hours: 3(3-0)

Course Title: Solid State Physics-I

Note: Attempt all questions. All questions carry equal marks.

Q.No.2'

a) Draw Hexagonal Close Packed structure. Prove that c/a ratio for an ideal hcp structure is 1.633 find its packing density. **(10 Marks)**

b) Draw and Compute the packing fraction of FCC cubic crystal. **(5 Marks)**

c) Draw the structure of Diamond crystal. Find its packing density. **(5 Marks)**

Q.NO.3

a) Derive Bragg's law for the diffraction of X-rays from a crystal. Explain why visible light can not used for determination of crystal structure. **(7 Marks)**

b) Draw and Prove that reciprocal lattice to FCC is BCC. **(5 Marks)**

c) What is Brillouin Zones? Draw and explain the construction of the first two Brillouin zones for a square lattice. **(8 Marks)**

Q.NO.4

a) What is lattice energy of ionic crystal? Explain Born -Madelung theory of lattice energy in NaCl. **(10 Marks)**

b) Explain van der Waals bond in crystal and its characteristics. **(5 Marks)**

c) Determine the value of Madelung constant of ionic crystal NaCl. **(5 Marks)**

Q.No.5

a) Find the dispersion relation for a linear diatomic lattice. Show that its vibrational spectrum consists of two branches, optical and acoustical. **(10 Marks)**

b) Describe the Einstein model of lattice heat capacity. Discuss the successes and failure of this model. **(6 Marks)**

c) What are phonons and its characteristics. **(4 Marks)**

GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD.

Degree/ Discipline: BS (7th Semester M&E)
Course Code: PHY-606
Course Title: Solid State Physics-I

Time: 2 Hour
Exam: Final Term Fall 2023

ROLL No[redacted]

Total Marks: 30
Credit Hours: 3(3-0)

Note: Attempt all questions.

Q. No.1

a). What is X-ray Diffraction? Derive Bragg's law for the diffraction of X-rays from a crystal. Explain w visible light can not used for determination of crystal structure. (6 Marl

b). Describe the powder method for x-ray diffraction. Discuss the formation of diffraction pattern on photographic film. (4 Mar

Q. No.2

a). What are Brillouin Zones? Draw and explain the construction of the first two Brillouin zones for a squar lattice. (5 Mar

b). Define reciprocal lattice. Draw and Prove that reciprocal lattice to BCC is FCC. (5 Mar

Q. No.3

a). Explain and differentiate between Ionic and Covalent bonding in crystal. (5 Ma

b) Explain Hydrogen bonding in crystal. (5 Ma

UNIVERSITY OF THE PUNJAB

Roll No. .....

Fifth Semester 2018

Examination: B.S. 4 Years Programme

PAPER: Electronic Devices and Circuits TIME ALLOWED: 30 mins.

Course Code: PHY-304-A MAX. MARKS: 10

Attempt this Paper on this Question Sheet only.

OBJECTIVE TYPE

Q.1

1. In a PNP transistor, the P region are
   a) Base and Emitter c) Emitter and Collector
   b) Base and Collector d) both a &b
2. If the output of a transistor is 5Vrms and the input is 100Vrms, the voltage gain is
   a) 5 c) 50
   b) 500 d) 100
3. In a transistor amplifier, if the base- emitter junction is open , the collector voltage is
   a) V_{cc} c) floating
   b) 0V d) 0.2V
4. A small signal amplifier is
   a) Use only a small portion of its load line
   b) Always has an output signal in the mV rang
   c) Goes into saturation once on each input cycle
   d) Is always common Emitter Amp.
5. The input resistance of a common-base amplifier
   a) Very low c) the same as in CE
   b) Very high d) the same as in CC
6. The differential amplifier
   a) Is used in OP-amp c) has two output
   b) Has one input and one output d) a&c
7. In a certain emitter follower circuit, the current gain is 50. The power gain is approximately
   a) 50 Av c) 1
   b) 50 d)a& b
8. Voltage divider bias
   a) Cannot be independent of β_{Dc}
   b) Can be independent of β_{DC}
   c) Is not widely used
   d) Require fewer components than all the others
9. The input resistance at the base of the biased transistor depends mainly on
   a) β_{DC} c) R_E
   b) R_B d) β_{DC} & R_E
10. In a Digital Multi meter (DMM) measuring an open transistor junction shows
    a) 0V c) OL
    b) 0.7V d) v_{cc}

UNIVERSITY OF THE PUNJAB

Sixth Semester - 2018

Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Solid State Physics-II **TIME ALLOWED: 15 Mints.**

Course Code: PHY-308 Part – I (Compulsory) **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

Please encircle the correct option. Each MCQ carries 1 Mark. This Paper will be collected back after expiry of time limit mentioned above.

Q.1. Encircle the best answer for each question. (10)

i. Ohm's law relates to the electric field 'E' conductivity 'δ' and current density 'J' as

a. $J = \frac{E}{\sigma}$ c. $J = \frac{\sigma}{E}$

b. $J = \sigma E^2$ d. $J = \sigma E$

ii. The cyclotron frequency is

a. $\omega_c = 2\pi f$ c. $\omega_c = \frac{eB}{m}$

b. $\omega_c = eB$ d. None

iii. In an intrinsic semiconductor, the Fermi level lies almost midway in the forbidden gap.

a. True b. False

iv. Relaxation time for the electron is independent of

a. Amplitude of electron c. both

b. Velocity d. None of these

v. The wave vector 'k' is related to wavelength 'λ'

a. $K = 2\pi\lambda$ c. $K = \frac{2\pi f}{\lambda}$

b. $K = \frac{2\pi}{\lambda}$ d. $K = \frac{2\pi}{\lambda f}$

vi. The classical value of molar lattice specific heat is

a. $\frac{3R}{2}$ b. R c. $3R$

d. $\frac{R}{2}$

vii. At lower temperatures, the lattice specific heat varies as

a. T^3 c. T

b. $\frac{1}{T^3}$ d. $\frac{1}{T}$

viii. The highest point in the conduction band is called the conduction band edge.

a. True b. False

ix. 'P' and 'As' are added in silicon to make it

a. P-type d. conductor

b. N-Type

c. Insulator

x. The value of effective mass is

a. $\frac{1}{\hbar}\frac{d^2E}{dk^2}$ c. $\frac{1}{\hbar^2}\frac{d^2E}{dk^2}$

b. $-\frac{1}{\hbar}\frac{d^2E}{dk^2}$ d. $-\frac{1}{\hbar^2}\frac{d^2E}{dk^2}$

UNIVERSITY OF THE PUNJAB

Fifth Semester 2018
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Solid State Physics-1
Course Code: PHY-303

TIME ALLOWED: 2 hrs. & 30 min
MAX. MARKS: 50

Attempt this Paper on Separate Answer Sheet provided.

SUBJECTIVE

Note: Attempt all questions. Write to the point answer of theoretical part of each question.

Q.2 Give to the point answer / short description of each question. **(4 × 5 = 20)**

a) Draw (100), (200), (101) and (110) crystallographic planes in cubic unit cell.

b) What kind of anharmonic crystal interactions exist in solids. Discuss briefly.

c) Discuss how diffraction of waves by crystals is analogous to diffraction of waves through grating. Is there any difference?

d) What are Van der Waals interactions in crystals? Discuss their origin.

e) Calculate the packing fraction of hexagonal close-packed (HCP) structure.

Q.3

a) Derive dispersion relation for a linear monoatomic chain of atoms with mass m and separation a by taking into account nearest neighbor interactions only. **(7)**

b) Plot a dispersion curve and discuss behavior of wave propagation at zone boundaries? **(3)**

Q.4

Define cohesive energy of a solid. Derive an expression for cohesive energy of an inert gas crystal containing N atoms at equilibrium separation R_o. **(2+8)**

Q.5

Derive an expression for lattice heat capacity of solids on the basis of Debye model. Explain graphically the discrepancies in classical and Einstein model and discuss how Debye model fits well with experimental observations. **(6+4)**

UNIVERSITY OF THE PUNJAB

Sixth Semester - 2018

Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Solid State Physics-II **TIME ALLOWED: 2 Hrs. & 45 Mints.**

Course Code: PHY-308 Part – II **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

Question No.2: Answer the following short questions. (10x2=20)

i. What factors affect the resistivity of metals.

ii. What is Bloch function? What does it represent physically.

iii. Differentiate between direct and indirect band gap materials.

iv. What is the origin of energy gaps.

v. What type of changes appear in band structure of semiconductor after doping with pentavalent impurity.

vi. State wiedeman Franz law and also write down expression for Lorentz number.

vii. Plot the optical absorption curves for the direct gap and indirect gap materials.

viii. Plot the distribution of probability density $'\rho'$ in the lattice for $|\Psi -|^2, |\Psi +|^2$ and for a pure travelling wave.

ix. What are significances of Hall co-efficient?

x. What is cyclotron resonance and how it can be measured experimentally.

Section-III

Question No.3: Answer the following questions. (3x10=30)

1 Show that the effective mass of an electron in a crystal depends on the curvature of energy band. Discuss the physical basis for the effective mass of an electron in a crystal.

2 Derive the energy expressions for the electron in one dimensional potential box and discuss the important conclusions from this equation.

3 What are intrinsic semiconductors and drive an expression from intrinsic carrier concentration in a semiconductor.

UNIVERSITY OF THE PUNJAB

Roll No. .....

Seventh Semester 2018

Examination: B.S. 4 Years Programme

PAPER: Solid State Physics-II **TIME ALLOWED: 30 mins.**

Course Code: PHY-421 **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

OBJECTIVE TYPE

Q-1 Four possible answers A, B, C, and D to each question are given. Encircle the correct answer. Cutting and overwriting is not allowed. **(1×10=10)**

I. One of the most well-known crystalline ceramics is Quartz, what is its chemical formula?
(A) NaCl (B) SiO_2 (C) H_2SO_4 (D) C_2H_4

II. What types of materials usually exhibit piezoelectric effect?
(A) metals (B) polymers (C) ceramics (D) composites

III. In the molecular crystals, ---------- excitons exist.
(A) Mott-Wannier (B) Frenkel (C) tightly bound (D) both b and c

IV. The basic mechanism responsible for the optical properties in a dielectric is
(A) Orientation polarization (B) Ionic polarization (C) Electronic polarization (D) None

V. Excitonic absorption occurs ---------- the absorption edge of the semiconductors.
(A) well below (B) very close to (C) exactly at (D) above

VI. In London Equation, the drift velocity is current density per unit ----------
(A) length (B) area (C) volume (D) mass

VII. Inter-band absorption of a photon will occur at all the points within---------- for which energy conservation is satisfied.
(A) upper band (B) intra-band (C) B.Z (D) all are true

VIII. In-direct transition cannot occur without involvement of
(A) electron (B) photon (C) proton (D) phonon

IX. According to the Nernst theorem, entropy of the body at absolute zero is ----------
(A) high (B) very high (C) low (D) zero

X. Raman effect is made possible by the strain-dependence of the ---------- polarizability.
(A) electronic (B) ionic (C) dipolar (D) orientational

UNIVERSITY OF THE PUNJAB

Seventh Semester 2018
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Solid State Physics-II **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-421 **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

SUBJECTIVE TYPE

Q-2 Write short answers to the following questions: (2×10=20)

I. Why the electron pairs in the superconductors are called as bosons?
II. Discuss the exciton condensations into electron-hole-drops (EHD).
III. What are the steps used to prepare $Al/Al_2O_3/Sn$ sandwich?
IV. Elaborate leakage probability and activation barrier factor for a superconductor.
V. Describe various ways to measure the binding energy of excitons.
VI. Differentiate reflectivity coefficient and reflectance.
VII. Define total polarizability. Plot the frequency dependence of its several contributions.
VIII. Differentiate Fullerenes and Hall number?
IX. What do you mean by the thermodynamics of the superconducting phase transition?
X. What are the ferroelectric domains?

Long Questions:

Q-3 Discuss Landau theory and elaborate the (i) 1st order and (ii) 2nd order phase transition. **(10)**

Q-4 Consider an electromagnetic wave in the vacuum with field components of the form

$$E_y = B_z\,(\text{inc}) = Ae^{i(kx-\omega t)} \quad ,$$

Let the wave be incident upon a medium of dielectric constant ϵ and permeability $\mu = 1$, that fills the half-space $x > 0$. Show that the reflectivity coefficient $\mathbf{r}(\omega)$ as defined by $\mathbf{E(refl) = r(\omega)E(inc)}$ is given by

$$\mathbf{r}(\omega) = \frac{n+iK-1}{n+iK+1} \quad ,$$

Where $\mathbf{n+ik} = \epsilon^{1/2}$, with n and K real. Show further that the reflectance is

$$R(\omega) = \frac{(n-1)^2+K^2}{(n+1)^2+K^2} \qquad \textbf{(10)}$$

Q-5 Discuss flux quantization in a superconducting ring. **(10)**

DEPARTMENT OF PHYSICS

Government College University, Faisalabad

Mid Terminal Exam (spring, 2018)

Class: MSc-Physics 4th semester
Subject: Solid State Physics-II
Instructor: Dr. Muhammad Imran

Course code: PHY-656
Total Time: 1:00 hour
Total Marks: 18

Name: Waseem Saleem Roll No: 8828

Instructions:

- Attempt all questions.
- Draw diagrams where necessary
- State the unit of each quantity where applicable

Q. No. 1: Write short answer to the following question? Avoid unnecessary details and Provide to the point answer.

i). How can you justify that spacing between consecutive energy levels in a one-dimensional potential well is not equal? 2

ii) How can you find the lowest energy of an electron confined to move in a three-dimensional potential box of length 0.5 Å? 3

iii) Calculate the Hall coefficient of sodium based on free electron model. Sodium has bcc structure and the side of the cube is 4.28 Å. 3

iv). How can you briefly differentiate between extended and reduced zone schemes to represent E-k relationship? 2

Q. No. 2

(a) Why we need periodic potential in lattice? Explain Block theorem in detail for an electron moving in a periodic potential. 4

(b) What do you understand about density of state? Derive a relationship for number of electrons N at absolute zero temperature. Also draw N(E) vs. E relationship. 4

Government College University, Faisalabad.

(FINAL TERM EXAMINATION Spring-2019)

Subject: SOLID STATE PHYSICS-II (PHY-656) **Class:** M.Sc (Physics) (4th Semester)

Instructions
(i) Question paper consists of two parts (objective & subjective)
(ii) Understanding of the question is the part of paper
(iii) Don't write anything except your name and roll No on question paper
(iv) Answer the respective questions according to the given sequence otherwise credit will not be given

Name: M. ALi

Roll No: 129807

SUBJECTIVE PART

Marks: 30 **Allowed time: 150 Minutes**

Q. No. 2: Why we need periodic potential in lattice? Explain Block theorem in detail for an electron moving in a periodic potential.

(6 Marks)

Q. No. 3: (3+3 Marks)

(a)What do you understand about the electrical resistivity of metals on the basis of free electron theory?

(b)Calculate the pereentage increase in resistivity of Nichrome when it is heated from 300 K to 1000 K. The temperature coefficient of resistance of Nichrome is 0.0001.

Q. No. 4: What do you understand about the semiconductor-semiconductor junction? Draw and Explain energy level diagram before biasing and under various biasing conditions. Derive a relationship for the currents involving under various biasing conditions and draw its IV-characteristic curve.

(6 Marks)

Q. No. 5: What is Paramagnetism? Explain in detail the classical langiven's theory of paramagnetism in detail showing and derive a relationship for intensity of magnetization in terms of langevin's function.

(6 Marks)

Q. No. 6: What do you understand about superconductivity? Write down unique properties of superconductors; also provide the brief results of experimental survey carried out on superconducting materials.

DEPARTMENT OF PHYSICS

Government College University, Faisalabad

Final Terminal Exam (spring, 2019)

Class: MSc-Physics 4th semester
Subject: Solid State Physics-II
Instructor: Dr. Muhammad Imran

Course code: PHY-656
Total Time: 2:00 hour
Total Marks: 30

Name: Shahbaz

Roll No: 8805

Instructions:

- Attempt all questions.
- Draw diagrams where necessary
- State the unit of each quantity where applicable

Q. No. 1: [3+3=6]

(a) What do you understand about the electrical resistivity of metals on the basis of free electron theory?

(b) Calculate the percentage increase in resistivity of Nichrome when it is heated from 300 K to 1000 K. The temperature coefficient of resistance of Nichrome is 0.0001.

Q. No. 2 [3+3=6]

What do you understand about the following terms relating to semiconductors? Provide brief explanation.
(i) Donor and acceptor states
(ii) Law of Mass action

Q. No. 3 [6]

What do you understand about the semiconductor-semiconductor junction? Draw and Explain energy level diagram before biasing and under various biasing conditions. Derive a relationship for the currents involving under various biasing conditions and draw its IV-characteristic curve.

Q. No. 4 [4+2=6]

(a) What is Paramagnetism? Explain in detail the classical langiven's theory of paramagnetism in detail showing and derive a relationship for intensity of magnetization in terms of langevin's function.

(b) Approximately how large must be the magnetic induction for the orientation energy to be comparable to the thermal energy at room temperature? Assume $\mu_m = 5\mu_B$.

Q. No. 5 [6]

What do you understand about superconductivity? Write down unique properties of superconductors; also provide the brief results of experimental survey carried out on superconducting materials.

GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD

Final Terminal Examination Spring 2020

M.Sc. Physics (4th Semester M+E)

Course Code: PHY-656
Course Title: Solid State Physics -II
Subjective

Maximum Marks: 30 (12+18)
Cr. Hr.: 3(3-0)
Subjective Marks: 18

Time Allowed: 1 hr 30 Minutes.

ROLL No.:---5846---

Name:---M. Danish---

Q. No. 2: (3 Marks)

How can you find the position of Fermi level in Intrinsic and extrinsic semiconductors?

Q. No. 3: (5 Marks)

What do you understand about the Kronig-Penny model? Provide Its detailed description. Discus the existence of energy gap and its characteristic by drawing suitable diagram.

Q. No. 4: (5 Marks)

What do you understand about density of state? Derive a relationship for number of electrons N at absolute zero temperature. Also draw N(E) vs. E relationship.

Q. No. 5: (5 Marks)

What do you understand about the semiconductor-Metal junction? Draw and Explain energy level diagram before biasing and under various biasing conditions. Explain in detail.

GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD.

ROLL No. 13038

Degree/ Discipline: BS (8th Semester M&E)
Course Code: PHY-606
Course Title: Solid State Physics-II

Time: 2 Hour
Exam: Final Term Spring 2022

Total Marks: 30
Credit Hours: 3(3-0)

Note: Attempt all questions.

Q. No. 1

a). What is meant by the effective mass of an electron? Draw and Discuss the conditions when effective mass of an electron becomes positive, negative and infinity. (6 Marks)

b). Discuss the variation of the Fermi level with temperature for intrinsic and extrinsic semiconductor. (4 Marks)

Q.No.2

a). What are intrinsic and extrinsic semiconductor? Derive expression to Show that Fermi level lies middle of conduction and valence band in intrinsic semiconductor. (5 Marks)

b). Define mobility and conductivity of semiconductor. Derive expression for conductivity of intrinsic semiconductors. (3 Marks)

c) Draw the energy level diagram for n-type and p-type semiconductor and label it. (2 Marks)

Q.No.3

a). Distinguish between the characteristic features of diamagnetism, paramagnetism and ferromagnetism. (3 Marks)

b). Derive expression for paramagnetic susceptibility using Langevin's theory. (4 Marks)

c). Draw typical B-H loop and discuss the different magnetization processes which lead to the formation of B-H loop. (3 Marks)

DEPARTMENT OF PHYSICS

Government College University, Faisalabad

Name: Anu

Roll No: 19

Class: MSc-Physics 4th semester
Subject: Solid State Physics-II
Instructor: Dr. Muhammad Imran

Final Terminal Exam (spring, 2022)
Course code: PHY-606
Total Time: 2:00 hour
Total Marks: 30

Instructions:

- Attempt all questions.
- Draw diagrams where necessary
- State the unit of each quantity where applicable

Q. No. 1 (a) What do you understand about periodic potential? Discuss how Kronig Penny Model predicts the existence of electronic band structure in solids. 7

(b) How can you calculate the Ionization energy of impurity atoms in semiconductors? 3

Q. No. 2 (a) How can you find the position of Fermi Level in intrinsic and extrinsic semiconductor? 7

(b) How can you describe the effect of temperature on the Fermi level of intrinsic and extrinsic semiconductors? Provide its detailed description. 3

Q. No. 7 (a) What is diamagnetism? Explain it using Langevin classical theory in detail. 7

(b) What is Weiss theory of Ferromagnetism? Briefly discuss formation of Hysteresis loop. 3

GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD.

01/05/22

ROLL No. .....

Degree/ Discipline: BS (8th Semester M&E)
Course Code: PHY-606
Course Title: Solid State Physics-II

Time: 1 Hour
Exam: Mid Term Spring 2022

Total Marks: 18
Credit Hours: 3(3-0)

Note: Attempt all questions. CH# 5,6

Q. No. 1

A). Derive expression of wave function and energy for free electron in 1-D Box. Draw and discuss particle behavior and Density inside potential well. (4 Marks)

B). Explain Fermi-Dirac distribution function and discuss its behavior with change in temperature. (3 Marks)

C). What are the advantages of Hall effect? (2 Marks)

Q.No.2

A). State and prove the Bloch theorem. Discuss its importance results in the band theory. (4 Marks)

B). What are the failures of free electron theory? Discuss the Bragg's reflection in a crystal lead to the formation of energy gap in solid. (3 Marks)

C). Draw the periodic zone scheme, extended zone scheme and reduced zone scheme for representing E-K relationship. (2 Marks)

GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD.

ROLL No.....

Degree/ Discipline: BS (8th Semester M&E)
Course Code: PHY-606
Course Title: Solid State Physics-II

Time: 1 Hour
Exam: Mid Term Spring 2023

Total Marks: 18
Credit Hours: 3(3

Note: Attempt all questions.

Q. No. 1

A). Derive expression of wave function and energy for free electron in 1-D Box using Sommerfeld's Quantum theory. Draw and discuss particle behavior and Density inside potential well. (5 Marks)

B). Explain Fermi-Dirac distribution function and discuss its behavior with change in temperature. (3 Marks)

C). What is fermi energy and Fermi sphere? (2 Marks)

Q.No.2

A). Derive expression of wave function and energy for free electron gas in 3-D Box. (4 Marks)

B). Explain how quantum free electron theory solved problem of electronic heat capacity of metal. (3 Marks)

C). What are the advantages of Hall effect? (1 Marks)