

**B.sc 6<sup>th</sup> semester Sessional Examination 2021**

Subject : PHYSICS(Major)

Paper: 6.2

Full Marks : 30

Group –A

**(Mathematical Methods)**

1. Answer the following questions: 1x2=2

- a. Give an example of contravariant tensor of rank 2.
- b. Which of the following is a tensor of rank 0.

i.  $\vec{A} + \vec{B}$     ii.  $\vec{A} - \vec{B}$     iii.  $\vec{A} \cdot \vec{B}$     iv.  $\vec{A} \otimes \vec{B}$

2. Answer the following questions: 2x2=4

- a. Write inner product of the tensor  $A_{kl}^j B_{pq}^{nk}$ .
- b. Prove that  $A^\alpha B_\alpha$  is a scalar or invariant.

3. If a tensor of rank N is contracted 2 times, what would be its final rank ? Obtain a zero rank tensor from the 4<sup>th</sup> rank tensor  $R_{kh}^{ij}$ . 4

Group – B

**(Solid State Physics)**

4. Choose the correct answer from the following: 1x4=4

a. The number of atoms per unit cell in an f.c.c. lattice is

- i. 1            ii. 2            iii. 3            iv. 4

b. The type of bonding between layers of graphite is

- i. van der Waals    ii. Hydrogen bond    iii. Ionic    iv. Covalent

c. Near to absolute zero temperature, silicon is a/an

- i. Metal    ii. Semiconductor    iii. Insulator    iv. Semimetal

d. The very first super conductor discovered was –

- i. Hg    ii. Nb    iii. Pb    iv. Bi

5. Write the following questions: 2x3=6

- a. What are primitive and non-primitive unit cell?
- b. What are the characteristic properties of covalent solids ?
- c. What is the reason that most of the metals crystallize in f.c.c. form ?

6. Answer any two from the following:

5x2=10

a. What are Miller indices and how are they determined ? What are the Miller indices of faces of a cubic lattice ?

b. Illustrate on ionic bonding of solids ? Write the characteristic properties of ionic bonding .

c. Obtain the values packing fractions of b.c.c. lattices in closed packed structure .