

2020-22

Full Marks : 70

Time : 3 hours

Answer any **five** questions in which
Q.No.1 is compulsory.

The figures in the right-hand margin
indicate marks.

Candidates are required to give their answers
in their own words as far as practicable.

1. Answer any *four* of the following ques-
tions : 3.5 × 4

(a) Give an account of the electronic
specific heat of solids.

(b) What are low-temperature and high
temperature superconductors ?

(c) Explain ferrimagnetism is a special
case of antiferromagnetism.

(d) Distinguish between anti-ferroelec-
tricity and piezoelectricity.

(e) Briefly state the importance of the
Schottky diode.

(f) Discuss in brief T-type flip-flop.

2. Give the tight-binding approximation of
an electron in a crystal. Show how it
leads to the formation of energy bands in
a solid. 8+6

3. Obtain an expression for the Lorentz
electric field at an atomic site of a dielec-
tric medium and also deduce Clausius-
Mossotti relation. 10+4

4. Discuss the thermodynamics of super-
conducting transitions. How does it explain
the discontinuity in the variation of spe-
cific heat as a function of temperature ? 9+5

5. Discuss dc and ac Josephson's effects
and explain their importance. 6+6+2

(Turn Over)

VPG(3)-Phy(10)

(Continued)

- ✓ 6. What is the race around condition in the J-K flip-flop ? Describe construction and working of J-K Master-slave flip flop. 4+5+5
7. Give the construction and working of a ripple counter. 7+7
- ✓ 8. Describe the operation of CMOS as a NAND gate and NOR gate with the load. Gives its truth table also. 7+7
- ✓ 9. Derive continuity equation for an abrupt $p-n$ junction under forward and reverse bias. 10+2+2
10. Write short notes on any *two* of the following : 7 × 2
- (a) Magnetoresistance
 - (b) Heisenberg model of magnetism
 - (c) Gunn Diode
 - (d) Defects and dislocations