B.Sc. Prog. / III   **AS**

PH–301 : PHYSICS

Physics of Materials & Electronics

Time : 3 hours   *Maximum Marks* : 75

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Attempt five questions in all, selecting at
least two questions from each Section.

SECTION A

1. (*a*) Define Miller indices. Sketch the (100), (010) and (111) planes of a simple cubic lattice.   6

   (*b*) Explain the following terms :

   (*i*) Primitive unit cell

   (*ii*) Lattice and its basis.   4

   (*c*) Prove that the direct lattice is reciprocal of its own reciprocal lattice.   5

2. (*a*) Obtain the dispersion relation for elastic waves in a linear monoatomic chain with nearest neighbour interaction.   10

   (*b*) Sketch and discuss the dispersion curve.   5

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3. (*a*) Obtain Clausius-Mosotti relation between polarizability and dieletric constant of a solid. 10

   (*b*) Draw and discuss energy band diagrams for insulators, semi-conductors and conductors. 5

4. (*a*) Discuss classical theory of diamagnetism and obtain the expression for magnetic susceptibility.

                                                   12

   (*b*) Explain Meissner Effect. 3

SECTION B

5. (*a*) Draw the circuit diagram for a half wave rectifier and explain its working. Obtain the expressions for its (*i*) d.c. load current, (*ii*) rms load current and (*iii*) rectification efficiency. 10

   (*b*) What is the difference between a positive clipper and a negative clipper? Explain with the help of circuit diagrams. 5

6. (*a*) With the help of a neat sketch, describe the construction of an *n*-channel JFET. Explain its principle of operation. 5

   (*b*) Draw and discuss its characteristic curves. 8

   (*c*) Give an elementary idea about MOSFET. 2

7. (*a*) Describe the working of R-C phase-shift oscillator with the help of the circuit diagram. 6

   (*b*) *Obtain the* expression for its frequency of oscillation and the condition of oscillation. 9

8. (a) What is amplitude modulation? Show that an AM wave can be represented by a carrier and two side frequencies for each frequency of modulation.   7

   (b) Sketch the circuit of a diode detector. Explain its operation.   8