



61622

Sixth Semester B.Sc. Degree Examination, September/October 2022
(CBCS Scheme)

PHYSICS

Paper – VIII : Electronics, Magnetic Materials, Dielectrics and Quantum
Mechanics – II

Time : 3 Hours

Max. Marks : 70

Instruction : Answer **five** questions from **each** Part.

PART – A

Answer **any five** questions. **Each** question carries **eight** marks. (5×8=40)

1. a) What is meant by OP-AMP ? Draw the symbol of OP-AMP. 2
b) Derive an expression for voltage gain of an inverting amplifier with a neat circuit diagram using an op-amp and hence draw input and output waveforms. 6
2. Explain with a neat circuit diagram the operation of a first order low pass filter using an op-amp and hence derive an expression for the magnitude of voltage gain. 8
3. a) State De-Morgan's theorems. Write the theorems in logical form. 4
b) What is half adder ? Draw the circuit diagram of half adder using basic gates and hence draw the truth table. 4
4. State Curie-Weiss law and hence derive the expression for the same. 8
5. a) What is meant by piezoelectric effect ? Give one application of piezoelectric effect. 2
b) Derive an expression for electronic polarizability. 6
6. a) What is meant by eigen value and eigen function ? 2
b) Derive Schrodinger's time dependent equation for a non-relativistic particle. 6
7. Derive an expression for Schrodinger's wave function for a particle in one dimensional box of infinite height and hence obtain energy Eigen values. 8
8. Derive an expression for energy eigen value of one-dimensional linear harmonic oscillator and hence draw the vibrational transitions. 8

P.T.O.



PART – B

Solve **any five** problems. **Each** problem carries **four** marks. **(5×4=20)**

9. If an amplifier has a bandwidth of 100 kHz and voltage gain of 800, what will be the new band width and gain if 2 percent negative feedback is introduced ?
10. Calculate the frequency of Wein bridge oscillator. Given $R = 3.3 \text{ k}\Omega$ and $C = 0.01$ microfarad.
11. A magnetic material has a magnetization of 2300 A/m and produces a flux density of 0.00314 Wb/m^2 . Calculate the magnetizing force and relative permeability of the material.
12. A magnetic field strength of copper is 10^6 Am^{-1} . If the magnetic susceptibility of copper is -0.8×10^{-5} , calculate flux density and magnetization of copper.
13. The dielectric constant of sulphur is 3.4. Assuming cubic lattice for its structure, calculate the electronic polarizability of sulphur.
Given : Number of atoms/unit(N) = $3.88 \times 10^{28}/\text{m}^3$.
14. A parallel plate capacitor is made up of a dielectric of thickness 1 mm and dielectric constant 10. If the potential difference across the capacitor is 20 V. Calculate the polarization and dielectric displacement.
15. Find the energy of an electron confined to a one dimensional box of side 0.8 nm for the ground state and first excited state.
16. The energy of the linear harmonic oscillator in its second excited state is 0.15 eV. Calculate its frequency.

PART – C

17. Answer **any five** of the following. **Each** question carries **two** marks. **(5×2=10)**

- a) Does the input resistance of the amplifier increase with negative feedback ? Explain.
- b) Is an oscillator also an amplifier ? Explain.
- c) Why NAND gate and NOR gate are called universal gates ?
- d) Does an iron bar retain its magnetization when melted ? Explain.
- e) Is total polarizability of a material dependent on frequency ? Explain.
- f) Why the product $\psi\psi^*$ is taken to determine the probability ?
- g) What is the meaning of bound state in quantum mechanics ?
- h) Can a particle with zero energy exist in the box ? Explain.