SG – 264

Sixth Semester B.Sc. Examination, September/October 2021
(CBCS – Fresh + Repeaters) (2018-19 and Onwards)
PHYSICS – VIII
Electronics, Magnetic Materials, Dielectrics and Quantum Mechanics – II

Time : 3 Hours Max. Marks : 70

***Instruction** : Non-programmable scientific calculators are **permitted**.*

PART – A

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

1. a) What is an operational amplifier ? Mention any two characteristics of an ideal op-amp.
   b) Explain the working of an op-amp as a summing amplifier, with a diagram. Obtain an expression for the output voltage. **(3+5)**

2. a) What is Barkhausen criterion for oscillation ?
   b) Explain with circuit diagram, the working of Wein-bridge oscillator. Write the expression for frequency of oscillation. **(2+6)**

3. a) Where is sign bit used ? Explain.
   b) With illustration show that NOR gate as a universal gate. **(2+6)**

4. a) Distinguish between dia, para and ferro-magnetic substances.
   b) State Curie-Weiss law. Mention the condition in which it is valid. **(6+2)**

5. a) What are polar and non-polar dielectrics ?
   b) Explain electronic polarisation. Obtain an expression for electronic polarizability. **(2+6)**

6. a) Mention the conditions to be satisfied by wavefunction to be physically acceptable solution of Schrodinger wave equation.
   b) Explain an eigenvalue equation with an example. Mention the quantum mechanical operator for position and energy of a particle in one dimension. **(3+5)**

P.T.O.

7. a) Why do we normalise a wave function ?

   b) Arrive at Schrodinger time independent equation for a particle in one dimension. Write the equation for three dimensions. **(2+6)**

8. a) Write the expression for the wavefunction and energy eigenvalues of a particle trapped in a three dimensional cubical box. Explain the degeneracy of the first excited state of the particle.

   b) What is a rigid rotator ? Mention the expression for energy of a rigid rotator. **(6+2)**

PART – B

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

9. The gain of an amplifier is 100, with band width of 100 KHz. A negative feedback is applied. So that the gain reduces to 40, what is the new value of bandwidth ?

10. Design a high pass filter with cut off frequency of 10 KHz, with pass band gain A_V of 1 and capacitor of value 0.01 μF.

11. Reduce the following Boolean expression and draw the simplified logic diagram.

    $Y = ABC + \bar{A}B + BC$

12. A silicon material is subjected to a magnetic field of strength 1000 Am^{-1}. If the magnetic susceptability of silicon is -0.3×10^{-5}. Calculate its magnetisation and flux density inside the material.

13. The susceptability of paramagnetic salt is 3.7×10^{-3} at 27°C. What will be its value at 200 K and 500 K ?

14. An elemental solid dielectric medium has polarizability of 6×10^{-40} Fm^2. Assuming the internal field to be Lorentz field, determine the dielectric constant of material which has 2.5×10^{8} atoms ($\epsilon_0 = 8.854 \times 10^{-12}$ Fm^{-1}).

15. An eigenvalue of an electron confined to one-dimensional box of length 20 Å is 151 eV. What is the order of excited state ?

16. Calculate the zero point energy in eV and spacing of energy levels in eV in one-dimensional oscillator of frequency 3.0 KHz.

PART – C

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

a) Why is negative feedback called degenerative ? Explain.

b) Why three RC sections are used in a phase-shift oscillator ?

c) Why BCD is called a weighted code ?

d) Is the equation A + AB = A true ? Justify.

e) Does the magnetic susceptability of diamagnetic depends on temperature ? Explain.

f) What does the area of hysteresis loop reveal ?

g) Is dielectric constant for a material always a constant ? Explain.

h) Why is the expectation value of momentum of a particle in a box zero ? Explain.