SE – 153

Sixth Semester B.Sc. Examination, September 2020
(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) Define CMRR of an op-amp. What is its significance ?

   b) Give the general theory of feedback. Mention any two advantages of negative feedback. **(2+6)**

2. Explain with circuit diagram the operation of first order low pass filter using op-amp. Derive the expression for magnitude of voltage gain. **8**

3. a) Why BCD is called a weighted code ? Explain with an example.

   b) What is a half adder ? Explain with a logic diagram and truth table, the operation of half adder. **(3+5)**

4. a) Define magnetic permeability and susceptibility and obtain the relation between them.

   b) Distinguish between hard and soft magnetic materials. **(4+4)**

5. a) Derive Clausius-Mossotti equation.

   b) Explain the terms Dielectric strength and Dielectric breakdown. **(4+4)**

6. a) Discuss the Max Born's physical interpretation of the wave function.

   b) Set up the time dependent one dimensional Schrodinger wave equation. **(2+6)**

7. Set up the Schrodinger wave equation for a one dimensional harmonic oscillator and derive the expressions for energy eigenvalue. **8**

P.T.O.

8. a) What is meant by normalised wave function ? Explain.

   b) What are operators in quantum mechanics ? Define linear momentum operator and energy operator.

   c) Write the energy eigenvalue equation for hydrogen atom. **(3+3+2)**

PART – B

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

9. An amplifier has a gain of 750, when the feedback is applied the gain is reduced to 100. Find the feedback ratio.

10. An RC phase shift oscillator makes use of an amplifier with gain equal to 50,000 as an active element and three RC sections with R = 10 KΩ, C = 0.01 μF as feedback section. Calculate the frequency of oscillation.

11. a) Convert $(2\ AC.9)_{16}$ to octal.

    b) Convert $(10101)_2$ to gray code.

12. A magnetic material has a magnetisation of 2500 Am^{-1} and produces a flux density of 5.14×10^{-3} Wbm^{-2}, calculate the magnetising force and relative permeability of the material.

13. The susceptibility of paramagnetic salt is 3.7×10^{-3} at 300 K, what will be its value at 200 K ?

14. A parallel plate capacitor is made of a dielectric of thickness 0.5 mm and has a dielectric constant of 7.5. If the potential difference across the capacitor is 20 V. Calculate polarization.

15. An electron is trapped inside a box of side 1 nm. Calculate the first three eigen values of ev.

16. Consider one dimensional wave-function $\psi(x) = \sqrt{\frac{2}{a}} \sin\left(\frac{\pi x}{a}\right)$ for $0 < x < a$ and $\psi(x) = 0$ elsewhere. Calculate the probability of finding the particle in the range $0 < x < \frac{a}{2}$.

PART – C

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

a) Is input current into op-amp zero ? Explain.

b) For what value of A_v, the Barkhausen criteria $A_v\beta = 1$ is satisfied in Wein-bridge oscillator ?

c) Why do we call NOR gate a universal gate ? Explain.

d) Does the magnetic susceptibility of diamagnetic depends on temperature ? Explain.

e) Does the power loss in dielectrics depend on the application of ac or dc voltage ? Explain.

f) Does spin and orbital motion of electron contribute equally for magnetic moment ? Explain.

g) Does $\psi(xt) = A \sin(wt - kx)$ represent the moving particle ? Explain.

h) Is zero point energy of a harmonic oscillator zero ? Explain.
