RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, AUGUST 2021

FIRST YEAR [BATCH 2020-23]

Date : 14/08/2021 **PHYSICS (GENERAL)**

Time : 11.00 am - 1.00 pm **Paper : II** Full Marks : 50

Answer **any five** questions [5×10]

1. a) Find electric field near infinite plane sheet of charge.

   b) A particle with charge Q is placed at the centre of a cube with edges of L.

   i) What is the electric flux that passes through the entire cube?

   ii) Find the electric flux through one of the faces of the cube.

   iii) Calculate the electric field on one of the faces of the cube?

   c) Find a relation between $\vec{E}, \vec{P}$ and $\vec{D}$. The symbols have their conventional meaning. [2+1+2+1+4]

2. a) What is mutual inductance?

   b) Calculate magnetic energy density inside a solenoid carrying current *i* ampere.

   c) A positive charge particle with velocity $\vec{V} = x\hat{i} + y\hat{j}$ moves in a magnetic field $\vec{B} = y\hat{i} + x\hat{j}$. Find the magnitude of magnetic force. [2+4+4]

3. What are ***AC*** and ***DC***? What is the ripple factor? What are the equivalent impedances and phases in a series ***L-C-R AC*** circuit? How does impedance and current change with respect to frequency (explain with graphs)? [2+1+3+3]

4. What is the significant of zener diode in voltage regulations? Define graphically power, bandwidth and quality factor. What changes can be observed in resonance when resistance changes? [2+6+2]

5. What is the difference between ***S-R*** latch and ***S-R*** flip-flop (use ***NAND*** gate to explain)? What is reverse saturation current? How can you run a transistor in active mode? [4+2+4]

6. a) State the basic postulates of Einstein's special theory of relativity. Hence deduce Lorentz transformation equation.

   b) Establish Einstein's mass – energy relationship. Explain its significance. [5+5]

7. a) Explain de Broglie concept of matter waves. Determine the velocity and kinetic energy of a proton having the de Broglie wavelength equal to $2A^0$. Given mass of proton = 1.67×10^{-27} kg.

   b) Explain Heisenberg's uncertainty principle. Show from uncertainty principle that the existence of a free electron in the nucleus of an atom is an impossibility. [5+5]

8. a) What is Bragg's law for the diffraction of X-rays through a crystal. Explain the application of the law in analysing the structure of simple crystal.

   b) Explain : (i) Lattice structure (ii) Laue spots [4+(3+3)]

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