

**CARMEL COLLEGE OF ARTS, SCIENCE & COMMERCE FOR WOMEN,
NUVEM - GOA.**

**SEMESTER END EXAMINATION, August 2020
B. Sc Semester: VI old course PHYSICS (Paper IV)
Electromagnetic Theory II and Relativity**

Total Marks:30 Date:11/08/2020 Duration: 2 Hours Total No of pages: 1

- Instructions:** 1) All questions are compulsory.
2) Figures to the right indicate marks.
3) Symbols have their usual meaning, unless otherwise stated.
4) Draw illustrated diagrams if necessary to support your answers.
5) Use of log tables and non-programmable calculators is allowed.
6) Permittivity of free space $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2/\text{N.m}^2$

Q 1. Answer any **five** of the following. **(5 x 2marks = 10)**

- a) Give the construction, and use of Helmholtz coil.
- b) Explain what is meant by spontaneous magnetization. Define Curie temperature.
- c) Classify magnetic materials on the basis of magnetic susceptibility. Does the magnetic susceptibility have any unit?
- d) Write the set of Maxwell's equation for time varying fields and give the physical significance of each.
- e) A stationary body explodes into two fragments each of rest mass 1 gm. They move apart at speeds of $0.6c$ relative to the original body where c is the velocity of light in air. Find the rest mass of the original body.
- f) State and explain the postulates of special theory of relativity.
- g) What is magnetization? How is it related to magnetic intensity? State Ampere's circuital law in terms of Magnetic Intensity.
- h) What are the properties of ferrites?

Q 2. Answer any four of the following. **(4 x 5 marks = 20)**

- a) Obtain an expression for magnetic vector potential at a point external to a circuit as a function of current density.
- b) Derive an expression for diamagnetic susceptibility, considering electron revolves in closed orbits.
- c) For a linear magnetic materials show that relative permeability is given by $K_m = 1 + \chi_m$ where χ_m is magnetic susceptibility.
- d) Briefly explain the concept of hysteresis loss in magnetic materials.
- e) Derive Einstein's mass –energy relation: $E = mc^2$.
- f) The length of a space ship measured by a stationary observer is exactly $\frac{3}{4}$ of its proper length. What is the speed of spaceship relative to observer's frame? Calculate the dilation of space ship's unit time.