UNIVERSITY OF HYDERABAD
School of Physics

M.Sc. (Physics) & I.M.Sc. (Physics)
PY 452 & IP 452: Electromagnetic Theory-II
Minor Examination: 2
Date: April 27, 2023; Duration: 1 hr. 15 min.

Total Marks: 20
Answer <u>all</u> the questions.

N.B.: Symbols have their usual meaning.

- 1. By applying the Biot-Savart law, show that $\nabla \cdot \vec{B}(\vec{r}) = 0$ and $\nabla \times \vec{B}(\vec{r}) = \mu_0 \vec{J}(\vec{r})$.

  $2 + 3$

- 2. Show that the magnitude of a magnetic field $\vec{B}(\vec{r})$ in a static case can't have a local maximum in a source free region.

  5

- 3. Write down Faraday's law (Maxwell's equation) in differential form. Explain the meaning of induced emf in a current carrying loop by using this equation.

  $1 + 4$

- 4. Starting from the Lorentz force law prove Poynting's theorem in differential form $(-\frac{\partial u}{\partial t} = \nabla \cdot \vec{S} + \vec{J} \cdot \vec{E})$[1] for an electromagnetic field and localized charge and current distributions. What is the physical significance of this equation?

  $4 + 1$