MANIPAL ACADEMY of HIGHER EDUCATION
(Institution of Eminence Deemed to be University)

Reg.No.									

DEPARTMENT OF SCIENCES, III SEMESTER M.Sc. (PHYSICS)
END SEMESTER EXAMINATIONS, NOV/DEC 2023
Electromagnetic Theory [PHY 6102]
(CHOICE BASED CREDIT SYSTEM - 2020)

Time: 3 Hours Date: 30/11/2023 MAX. MARKS: 50

Note (i) Answer ALL questions
(ii) Draw diagrams, and write equations wherever necessary

Q No	Question	Marks	CO	BL
1A	For an arbitrary localized charge distribution, derive the expression for potential at some point P. Identify the first three terms by giving their physical meanings.	05	01	03
1B	Normally divergence theorem is valid. Think of a function where this theorem appears to fail. Categorize the source of the problem.	03	01	03
1C	Discuss cases when we need to use polarizability tensors.	02	01	02
2A	In the context of magnetostatics, derive the expressions for divergence and curl of magnetic field, **B**.	04	01	03
2B	Consider a magnetized object. Derive the expression for vector potential	04	01	03
2C	Elucidate the differences between magnetic susceptibility and permeability by giving appropriate mathematical expressions.	02	01	04
3A	Derive the Maxwell's equations inside matter. Explain the meaning of each term.	04	02	03
3B	Elucidate the potential formulations in electrodynamics.	03	02	03
3C	Write down Neumann formula. Illuminate two important things about mutual inductance.	03	02	01
4A	Let yz plane forms the boundary between two linear media. A plane wave of frequency ω, travelling in the x-direction and polarized in the y direction approaches the interface from the left. Derive the expressions for reflection and transmission coefficients.	05	03	03
4B	Setup the equation for polarization in case of an EM wave traveling in a non-conductor.	03	03	03
4C	Deliberate the frequency dependence of skin depth in case of EM waves traveling in conductors.	02	03	03
5A	Consider a loop of radius *a* around which we drive a sinusoidally varying current. Assuming that it is a perfect dipole, derive the expression for energy flux for magnetic dipole radiation.	05	03	03
5B	Elucidate the concept of Lienard- Wiechert potentials.	03	03	03
5C	Find the potential of a point charge moving with constant velocity.	02	03	02

****