B.E.Tel.E. 2nd YEAR REPEAT EXAMINATION, 2023
(1st Semester)
ELECTRO MAGNETIC THEORY

Time: Three hours   Full Marks 100

No. of   Marks
questions

Answer any *five* questions.
Consider $\varepsilon_0 = 8.854 \times 10^{-12}$ F/m and $\mu_0 = 4\pi \times 10^{-7}$ H/m
Values of other universal physical constants may be assumed, if necessary.

1.(a)	Show how would you convert a vector from rectangular coordinate system to spherical one?	10
(b)	Further prove that $\nabla X \nabla X \vec{A} = \nabla(\nabla \cdot \vec{A}) - \nabla^2 \vec{A}$	10
2.(a)	Determine the electric far field due to a static electric dipole of elemental length in spherical polar coordinates.	10
(b)	Why is its one component having zero value?	2
(c)	Obtain the net effective capacitance formed by two capacitances C_1 and C_2 connected in parallel.	8
3.(a)	State Biot Savart's Law.	2
(b)	Use it to obtain the magnetic field at the centre of a circular loop carrying a current I.	10
(c)	Discuss how cyclotron motion is created and find an appropriate expression for cyclotron frequency.	8
4.(a)	Evaluate the capacitance formed by two parallel rectangular conducting plates each of area A and separated by d in air.	10
(b)	Consider a solid cylindrical conductor of radius a. Current I is distributed uniformly over its cross-section. Obtain $\vec{H}$ at all points inside the conductor and outside it.	5+5
5.(a)	State and prove the boundary conditions on $\vec{E}$, $\vec{H}$, $\vec{D}$ and $\vec{B}$ as applied to Maxwell Heaviside equations.	5X4
6.(a)	Derive appropriate expressions for attenuation constant, phase shift constant and phase velocity for electromagnetic wave propagation through a good dielectric medium. Also briefly discuss their physical significances.	10
(b)	Repeat the same for the case of a good conductor.	10
7.(a)	Define polarization.	2
(b)	What are the different types of polarization and what is its most general form?	3
(c)	Discuss the conditions for generation of the different forms of polarization.	15
8.	Write notes on any two of the followings:	
(a)	Surface impedance	
(b)	Poynting vector	10X2
(c)	Retarded potential and gauge conditions	