Ref. No: Ex/ET/T/211/2018(S)

B.E. (ETCE) 2nd YEAR EXAMINATION 2018
(1st Semester Supplementary)

ELECTRO MAGNETIC THEORY

Time: Three hours

Full Marks 100

Answer any *five* questions.
All questions carry equal marks.
Assume appropriate values for all universal physical constants.

1.	(a)	Convert $3\mathbf{a}_x+9\mathbf{a}_y+14\mathbf{a}_z$ to cylindrical and spherical coordinates.	12
	(b)	Discuss the physical significance of curl.	6
	(c)	In which coordinate system the direction of unit vectors never change?	2
2.	(a)	Two point charges in a dielectric medium where $\varepsilon_r=5.2$ interact with a force of $8.6\text{X}10^{-3}$N. What force could be expected if the charges were in free space?	4
	(b)	Define capacitance.	2
	(c)	Obtain the capacitance between two conducting plates of area A separated by a distance d.	6
	(d)	Determine all components of the electric field of an infinitesimal static electric dipole.	8
3.	(a)	Define magnetic potential. Why is it vector while electric potential is a scalar?	4
	(b)	Find magnetic field intensity at the centre of a square loop of side L carrying a current I.	8
	(c)	Find the magnetic field for a solid cylindrical conductor of radius r where the current I is uniformly distributed.	8
4.	(a)	Obtain appropriate expression for the density of stored energy in electrostatic field.	12
	(b)	Find the force on a particle of mass $1.7\text{X}10^{-27}$kg and charge $1.6\text{X}10^{-19}$C if it enters a field of B=5mT with an initial speed 83.5km/s.	8
5.	(a)	Write all Maxwell's equations in both integral and differential forms.	8
	(b)	Given $\mathbf{E}=E_m\sin(\omega t-\beta z)\mathbf{a}_y$ in free space. Find **D**, **B** and **H**.	6
	(c)	Sketch **E** and **H** at t=0.	2
	(d)	Determine the phase velocity for this wave motion.	4
6.	(a)	State and prove Poynting Theorem.	10
	(b)	Apply it to calculate the power flow through a coaxial cable.	10
7.	(a)	For a good conductor, determine α and β i.e. attenuation and phase constant as also the wave velocity for time harmonic fields and comment on the results.	12
	(b)	Hence discuss the concept of skin depth.	8
8.		Write short notes on (any *two*) i) Surface impedance ii) Wave equation for partially conducting medium iii) Lorentz gauge condition	10X2