Q. Code: 839070

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2023

Third Semester

EC18302 – ELECTROMAGNETIC FIELDS AND WAVES

(Electronics and Communication Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Apply different coordinate systems and vector calculus for understanding different concepts in electromagnetic Engineering.	**3**
CO 2	Evaluate the physical quantities of electromagnetic fields in different media.	**4**
CO 3	Design storage devices like capacitor, inductor used in electrical system and materials required to assemble energy storage devices.	**5**
CO 4	Justify concepts of electromagnetic waves means of transporting energy in the form of radio waves, TV signals, Radar beams.	**6**
CO 5	Determine the electromagnetic force exerted on charged particles, current elements, working principle of various electric and electromagnetic energy conversion devices are based on this force.	**3**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Two point charges Q_1=30uC and Q_2=15uC are located at (-1,2,3) m and (2,1,0) m respectively. Find force on Q_1.	**1**	**3**
2.	Give the relationship between gradient of potential and electric field.	**1**	**2**
3.	State the Amperes' Circuital Law.	**2**	**1**
4.	Write the expression for the magnetic field intensity on the axis of a rectangular loop carrying a current I.	**2**	**2**
5.	Calculate the capacitance of parallel plate capacitor if A=120cm^2 ,d=5mm and relative permittivity =12.	**3**	**3**
6.	Write the expression for energy stored in inductor.	**3**	**2**
7.	Brief about the Gauss law for electric field.	**4**	**2**
8.	Examine the importance of Faraday's law of electromagnetic induction.	**4**	**4**
9.	Write expressions for instantaneous and complex poynting vector.	**5**	**1**
10.	Calculate the intrinsic impedance of free space.	**5**	**2**

PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	Determine the electric field intensity of an infinitely long, straight, line charge of a uniform density ρ_L in air.	**(14)**	**1**	**3**

(OR)

		Marks	CO	RBT
(b)	State and prove Gauss's law for electrostatics. Also explain applications of Gauss's law.	**(14)**	**1**	**3**
12. (a)	Derive an expression for magnetic field intensity due to a linear conductors of finite and infinite length carrying current I at a distance point P. Assume R to be the distance between conductor and point P. Use Biot-Savart law.	**(14)**	**2**	**3**
	(OR)			
(b)	Derive the magnetic field intensity in the different regions of co-axial cable by applying Ampere's circuital law.	**(14)**	**2**	**3**
13. (a)	**(i)** Derive the expressions for Poisson's and Laplace Equation.	**(6)**	**3**	**4**
	(ii) Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of 6cm diameter .The length of the tube is 60cm and the solenoid is air.	**(8)**	**3**	**4**
	(OR)			
(b)	Use Laplace's equation to find the capacitance per unit length of a co-axial cable of inner radius 'a' m and outer radius 'b' m. Assume V=V0 at r=a and V=0 at r=b.	**(14)**	**3**	**4**
14. (a)	Derive the Maxwell's four equations in the integral and differential forms.	**(14)**	**4**	**5**
	(OR)			
(b)	An electric field in a medium which is source free is given by $E = 1.5\cos(10^8 t - \beta z)ax$ V/m. Find B,H and D. Assume $\varepsilon_r = 1, \mu_r = 1$ and $\sigma = 0$.	**(14)**	**4**	**5**
15. (a)	**(i)** State and prove Poynting theorem.	**(6)**	**5**	**3**
	(ii) Derive the wave equation for uniform plane waves.	**(8)**	**5**	**3**
	(OR)			
(b)	**(i)** Derive the relationship between Electric Field and Magnetic Field using Maxwell's Equations.	**(8)**	**5**	**3**
	(ii) Derive the wave equations for conducting medium in phasor form.	**(6)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	Find curl H and gradient of H, if $H=2r\cos\phi\ \hat{a}_r - 4r\sin\phi d^\wedge\ a_\phi + 3\ \hat{a}_z$	**(10)**	1	**4**

****