Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2024

ELECTRONICS AND COMMUNICATION ENGINEERING

EC5302 ELECTROMAGNETIC FIELDS AND WAVES

(Regulation2019)

Time:3hr Max.Marks: 100

CO1	Ability to apply mathematical concepts to EM laws and theorem
CO2	Ability to apply electromagnetic laws to static field
CO3	Ability to apply Maxwell's equation for static and magnetic fields
CO4	Ability to apply EM laws for electromagnetic fields
CO5	Ability to apply EM laws for the propagation of plane waves through different medium

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)

(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	What are the differences between static electric fields and dynamic electric fields?	2	1	L3
2	State Stroke's Theorem	2	1	L1
3	How is Gauss's law applied to calculate the electric field of a uniformly charged infinite plane sheet?	2	2	L3
4	Write Poisson's equation and Laplace's equation, and mention where they are applicable.	2	2	L2
5	State Ampere's Circuital Law in its integral form.	2	3	L3
6	Write the boundary conditions for magnetic fields at the interface of two different media.	2	3	L1
7	State Faraday's law of electromagnetic induction.	2	4	L1
8	Define time-harmonic fields and their significance in electromagnetic analysis.	2	4	L2
9	How is the skin depth calculated in a good conductor?	2	5	L3
10	Show the electric and magnetic field components always transverse to each other	2	5	L1

PART- B(5x 13=65Marks)

(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a)	Evaluate divergence theorem for the given $D= 2r z^2 a_r + r \cos^2\varphi a_z$ where r =3 and z=5.	13	1	L5
	OR			
11 (b)	(i)Write short notes on scalar and vector field. (4) (ii) What is unit vector? Discuss on the mathematical operations with vectors (9)	4+9=13	1	L4
12 (a)	(i)Determine which of the following potential field distribution satisfy Laplace's equation. a) $V = x^2+y^2-3z^2+10$ b) $V=e^y \sin(x)$	5+8=13	2	L5

	(ii) Using Gauss law, find the electric field intensity of a conductor sphere			
	OR			
12 (b)	Mention the importance of Poisson's and Laplace's equation in electromagnetic with necessary equations.	**13**	2	L1
13 (a)	Derive the equations for magnetic field intensity and magnetic flux density at the center of the square current loop using Biot-Savart's law.	**13**	3	L3
	OR			
13 (b)	(i) Derive the expression for vector magnetic potential (ii)Explain the Energy Stored in a Magnetic Field. Derive the expression for magnetic energy density.	**8+5=13**	3	L2
14 (a)	Derive the Maxwell's equation for a time varying are modified for time varying from fundamental laws of electric and magnetic fields.	**13**	4	L3
	OR			
14 (b)	Formulate the boundary conditions for an electromagnetic wave at the interface between two distinct media.Also, specify the boundary conditions for an electromagnetic wave at an air-conductor interface.	**13**	4	L3
15 (a)	Describe the intrinsic impedance of uniform, plane waves in lossy dielectric and lossy conductor.	**13**	5	L2
	OR			
15 (b)	Derive the expression for total electric and magnetic fieldcomponents for a uniform plane wave normally incident at a perfect conducting boundary.	**13**	5	L3

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	A solenoid with N_1=2000, r_1=2 cm and l_1= 100cm is concentric within a second coil of N_2= 4000, r_2= 4cm and l_2=100cm.Calculate mutual inductance assuming free space conditions.	**15**	3	L3