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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

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

Electronics and Communication Engineering
Third Semester

EC5302 & Electromagnetic Fields and Waves
(Regulation2019)

Time:3hrs

Max.Marks: 100

CO1	Understand basic laws and theorems applied in Electromagnetic waves and propagation analysis
CO2	Analyse static and dynamic electric and magnetic field and associated laws
CO3	Understand the EM wave propagation in a medium and through boundaries
CO4	Understand Maxwells equations and apply to solve electromagnetic problem
CO5	Understand the propagation of EM Waves in isotropic media

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	Show that the curl of the gradient is zero.	2	1	1
2	Two point charges Q1=50μC and Q2=10μC , are located at (-1,1,-3) m and (3,1,0)m ,respectively . find the force on Q1.	2	1	2
3	Three point charges Q1=30nC,Q2=150nC and Q3=-70nC ,are enclosed by surface S. what is the net flux croses S?	2	2	2
4	Prove that the electric field intensity is a gradient of V.	2	2	1
5	State Amperes circuital law.	2	3	2
6	Two metallic spheres radii a and b are connected by thin wire. The separation is large compared to their dimensions. A charge Q is put into the system. Find the capacitance of the system	2	3	2
7	State and prove laplace and posson s equation.	2	4	1
8	Electric field intensity in free space is $\mathbf{E}=10\cos(500\times t)\,\mathbf{a}_y$. Find displacement current density.	2	4	2
9	State poyntings theorem.	2	5	1
10	Write the properties of Uniform Plane Wave propagation.	2	5	1

PART- B(5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q.No	Questions	Marks	CO	BL
11 (a) (i)	State and derive divergence theorem.	5	1	2
(ii)	Four point charges ,each 20 μC ,are on the x and y axes at ±4m. Find the force on a 100μm.C point charges at (0,0,3)m.	8	1	3
	OR			
11 (b) (i)	State and derive stokes theorem	5	1	2
(ii)	The volume in cylindrical coordinates bwtween r=2m and r = 4m contains a uniform chagre density ρ(C/m³).Use Gauss's law to find D in all regions	8	1	3

12 (a) (i)	Show that the divergence of electric field is zero for the field of a uniform line charge.	6	2	2
(ii)	Using gauss law determine the electric flux density in a sheet of charge.	7	2	2
	OR			
12 (b) (i)	Show that the **D** field due to a point charge has a divergence of zero.	6	2	2
(ii)	Using gauss law determine the electric flux density in the uniformly charged sphere of radius A.	7	3	3
13 (a) (i)	Derive the vector magnetic potential from biot savart law and determine **H** for a solid cylindrical conductor of radius 'a', where the current 'I' is uniformly distributed over the cross section.	13	3	3
	OR			
13 (b) (i)	Determine the magnetic field of a infinitely long coaxial transmission line using Ampere's circuital law. Consider an infinitely long coaxial cable, if the conductor carries a current I =5A in the + z direction, a= 5cm and b= 3cm and t= 1cm. find **H**.	13	3	3
14 (a) (i)	Derive the boundary condtion of the electromagnetic field components in the interface between dielectic and good conductors	13	4	3
	OR			
14 (b) (i)	Describe the condition for the electromagenetic waves if it incident normal to good conductor at the interface and obliqually incident to the good conductor interface.	13	4	3
15 (a) (i)	Derive the poynting theorem and explain the propagtion waves in losssy dielectric	13	5	3
	OR			
15 (b) (i)	Derive the wave equation and explain the propagation of waves in good conductors .	13	5	3

PART- C(1x 15=15Marks)
(Q.No.16 is compulsory)

Q.No	Questions	Marks	CO	BL
16.	Derive the Maxwell's Equations from basic laws and express in differential form, integral form and time-harmonic forms and give its interpretation.	15	4	5