ANNEXURE 2.2.2

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

III SESSIONAL TEST QUESTION PAPER 2021 – 22 ODD SEMESTER

USN | | | | | | | | | | |

SET – B

Degree : B.E
Branch : Electronics and Communication Engg
CourseTitle : ELECTROMAGNETIC WAVES
Duration : 90Minutes

Semester:V
CourseCode: 18EC55
Date: 27/1/2022
MaxMarks: 30

Note: Answer ONE full question from each part.

Q No.	Questions	Marks	CO Mapping	K-Level
	PART-A			
1(a)	I. **Utilize** the concepts of conduction current density to show that conduction current density is equal to the displacement current density for the applied voltage of $V(t) = V_o \cos\omega t$. II. **Solve** the amplitude of displacement current densityadjacent to an automobile antenna wheremagneticfield intensity of an FM signal is $H_x = 0.15 \cos [3.12(3 \times 10^8 t - y)]$ A/m.	6	CO5	Applying K3
(b)	Starting from fundamentals, **solve**Maxwell's equations in both point & integral form for time varying fields?	6	CO5	Applying K3
(c)	I. **Develop** an expression for skin depth for a uniform plane wave traveling in a good conductor? II. A plane wave is incident normally on a good conductor, which can be considered flat and non-magnetic. The velocity of the wave inside the conductor at a certain frequency is 3.142×10^5 m/s, while the skin depth for this conductor the same frequency is given as 0.04 mm. **Solve** i) the wavelength inside the medium and frequency of the wave. ii) The conductivity of the material, iii) The distance, the wave travels inside the conductor at 1.5 GHz before its field intensity gets reduced to 20 dB below its initial value.	6	CO5	Applying K3
	OR			
2(a)	**Develop** the expression of Maxwells second equation from the modification of Amperes Law.	6	CO5	Applying K3
(b)	I. **Utilize** the concepts of Maxwells equation to derive the wave equation in one dimension for an electromagnetic wave traveling in free space? II. The electric field amplitude of a uniform plane wave propagating in the a_z direction is 250 V/m, If $E = E_x a_x$ and $\omega = 1$ Mrad/s, **Solve**i) frequency, ii)wavelength, iii) period, iv) amplitude of H.	6	CO5	Applying K3
(c)	I. **Solve**the frequency at which conduction current density is equal to the displacement current in a medium with $\sigma = 2 \times 10^{-4}$ s/m and $\epsilon_r = 81$. II. In a certain dielectric medium, the relative permittivity is 5, conductivity is zero & displacement current density $J_d = 20\cos(1.5 \times 10^8 t - bx) a_y$ nA/m^2.**Solve** the electric flux density & Electric field intensity?	6	CO5	Applying K3
	PART-B			
3(a)	I. State Faraday's law of electromagnetic Induction? **Utilize the concepts** toDerive Maxwell's Equation. II. Write a note on Magnetic circuits?	6	CO4	Applying K3

(b)	**Solve** the magnetization in a magnetic material where i) $\mu = 1.8 \times 10^{-5}$ H/m & H = 120 A/m ii) B = 300 μT and $\chi_m = 15$	6	CO4	Applying K3
	OR			
4(a)	**Develop** the concepts of magnetic boundary conditions to derive the expressions for tangential and boundary conditions.	6	CO4	Applying K3
(b)	Within a certain region, $\acute{\varepsilon} = 10^{-11}$ F/m and $\mu = 10^{-5}$ H/m. If $B_x = 2 \times 10^{-4} \cos 10^5 t \sin 10^{-3} y$ T. i)**SolveE.** ii) **Solve** the total magnetic flux passing through the surface x = 0, 0 < y >40m, 0 < z < 2m at t = 1μs. iii) **Solve**the value of closed line integral of E around the perimeter of the given surface.	6	CO4	Applying K3

Signature of Course InchargeSignature of module coordinator **Signature of HOD EC**

Selected

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III SESSIONAL TEST QUESTION PAPER 2021 – 22 ODD SEMESTER

USN | | | | | | | | | | |

SET – A

Degree : B.E Semester: V

Branch : Electronics and Communication Engg CourseCode: 18EC55

CourseTitle : ELECTROMAGNETIC WAVES Date: 27/1/2022

Duration : 90Minutes MaxMarks: 30

Note: Answer ONE full question from each part.

Q No.	Questions	Marks	CO Mapping	K-Level
	PART-A			
1(a)	**Develop** the expression of Maxwells second equation from the modification of Amperes Law.	6	CO5	Applying K3
(b)	Starting from fundamentals, **develop**Maxwell's equations in both point & integral form for time varying fields?	6	CO5	Applying K3
(c)	I. **Develop** an expression for skin depth for a uniform plane wave traveling in a good conductor? II. A plane wave is incident normally on a good conductor, which can be considered flat and non-magnetic. The velocity of the wave inside the conductor at a certain frequency is 3.142×10^5 m/s, while the skin depth for this conductor the same frequency is given as 0.04 mm. **Solve** i) wavelength inside the medium and frequency of the wave. ii) conductivity of the material, iii) the distance, the wave travels inside conductor at 1.5 GHz before its field intensity gets reduced to 20 dB below its initial value.	6	CO5	Applying K3
	OR			
2(a)	I. **Utilize** the concepts of conduction current density to show that conduction current density is equal to the displacement current density for the applied voltage of $V(t) = V_o \cos\omega t$. II. **Solve** the amplitude of the displacement current density in the air space at a point within a large power distribution transformer where $B = 0.8 \cos [1.257 \times 10^{-6}t - x] a_y$ T	6	CO5	Applying K3
(b)	**Develop** the expressions ofwave equation in one dimension for an electromagnetic wave traveling in free space?	6	CO5	Applying K3
(c)	I. **Solve**the frequency at which conduction current density is equal to the displacement current in a medium with $\sigma = 2 \times 10^{-4}$ s/m and $\epsilon_r = 81$. II. A parallel plate capacitor with plate area 5 cm^2 and plate separation of 3 mm has a voltage of 50 sin 103t volts applied to its plate.**Solve** the displacement current assuming $\varepsilon = 2\,\varepsilon_0$.	6	CO5	Applying K3
	PART-B			
3(a)	I. State Faraday's law of electromagnetic Induction? **Utilize the concepts** to Derive Maxwell's Equation. II. Write a note on Magnetic circuits?	6	CO4	Applying K3
(b)	The magnetization in a magnetic material for which is given in a certain region as $150\,z^2\,a_z$ A/m. At z =4 cm, **Solve** the magnitude of the current density due to bound charges.	6	CO4	Applying K3
	OR			

4(a)	**Develop** the concepts of magnetic boundary conditions to derive the expressions for tangential and boundary conditions.	**6**	**CO4**	**Applying K3**
(b)	The unit vector $0.64a_x + 0.6\ a_y - 0.48\ a_z$ is directed from region2 ($\acute{\varepsilon}_{r2} = 2$, $\mu_{r2} = 3$, $\sigma_2 = 0$) toward region 1 ($\acute{\varepsilon}_{r1} = 4$, $\mu_{r1} = 2$, $\sigma_1 = 0$). If $B_1 = (a_x - 2a_y + 3a_z)\ \sin 300t$ T at point P in region 1 adjacent to the boundary, **Solve** amplitude at P of i) B_{N1} ii) B_{t1} iii) B_{N2} iv) B_2	**6**	**CO4**	**Applying K3**

Signature of Course Incharge **Signature of module coordinator** **Signature of HOD EC**