GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2020-2021

FIELD THEORY (BACKLOG)

EE302

TIME ALLOTTED: 3 Hours **FULL MARKS: 70**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable

GROUP – A

(Multiple Choice Type Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

		Marks	CO No
1(i)	The vector identity of $\nabla \times (\nabla \times \vec{A})$ (a) $\nabla(\nabla . \vec{A}) - \nabla^2 \vec{A}$ (b) $\nabla(\nabla \times \vec{A}) - \nabla^2 \vec{A}$ (c) $(\nabla \times \vec{A}) - \nabla^2 \vec{A}$ (d) $\nabla \times (\nabla . \vec{A}) - \nabla^2 \vec{A}$	1	CO1
1(ii)	The continuity equation for steady current is (a) $\nabla \times \vec{J} = 0$ (b) $\frac{\delta Q_v}{\delta t} = 0$ (c) $\nabla . \vec{J} = 0$ (d) None of these	1	CO3
1(iii)	Pointing vector has the unit of (a) Watt (b) Watt/ m (c) Watt/m^2 (d) Watt/m^3	1	CO4
1(iv)	For a lossless transmission line the characteristics impedance is given by (a) $\sqrt{\frac{C}{L}}$ (b) $\sqrt{\frac{L}{C}}$ (c) $2\pi\sqrt{\frac{C}{L}}$ (d)$2\pi\sqrt{\frac{L}{C}}$	1	CO4
1(v)	Curl of a gradient of a scalar field results (a) A scalar function with non-zero value (b) A vector function with non-zero value (c) A zero vector (d) A periodic function.	1	CO1

1(vi)	The magnetic field strength $\vec{H}$ produced by a conductor carrying current I at a distance 'r' is given by (a) $\vec{H}$= 2ΠrI (b) $\vec{H}= I/2\Pi r$ (c) $\vec{H} = I/4\Pi r$ (d) $\vec{H}$= 4Πr/I	1	CO2
1(vii)	Displacement current can flow through (a) Capacitor (b) Inductor (c) Resistor (d) None of these	1	CO3
1(viii)	Which of the following is not Maxwell's equation? (a) $\vec{\nabla}.\vec{D} = \rho$ (b)) $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ (c) $\vec{\nabla} \times \vec{H} = J + \frac{\partial \vec{D}}{\partial t}$ (d) $\vec{\nabla}.\vec{J} = -\frac{\partial \vec{\rho}}{\partial t}$	1	CO3
1(ix)	A transmission line of length $\frac{\lambda}{4}$ shorted at far end behaves like (a) Series resonant circuit (b) Parallel resonant circuit (c) Pure inductor (d) Pure capacitor	1	CO4
1(x)	The direction of propagation of electromagnetic waves is given by the direction of (a) $\vec{E}$ (b) $\vec{H}$ (c) $\vec{E} \times \vec{H}$ (d) None of these	1	CO4
1(xi)	Electric field in a region containing space charges can be found using (a) Laplace's equation (b) Poisson's equation (c) Coulombs law (d) Helmholtz equation	1	CO2
1(xii)	Stoke's theorem transforms the (a) Line to volume integral (b) Volume to surface integral (c) Surface to volume integral (d) Surface to line integral	1	CO1

GROUP – B
(Short Answer Type Questions)

(Answer any *three* of the following) **3 x 5 = 15**

		Marks	CO No
2.	Prove that $\nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$, the symbols having usual meaning.	5	CO3
3.	Starting from Gauss's theorem of electro-statics, derive the Poisson's and Laplace's equation.	5	CO2
4.	State and explain Helmholtz Theorem.	5	CO1
5.a)	Write down Magnetic scalar potential & magnetic vector potential.	3	CO2
5.b)	Find the location of the point (1, 2, 3) in cylindrical co-ordinates.	2	CO1
6.	Write down the primary and secondary parameters of a transmission line. Express the secondary parameters in terms of primary parameters.	5	CO4

GROUP – C
(Long Answer Type Questions)

(Answer any *three* of the following) **3 x 15 = 45**

		Marks	CO No
7. a)	Write and explain differential & integral forms of Maxwell's equations.	10	CO3
7. b)	Find the conduction and displacement current densities in a material having conductivity of 10^{-3}s/m and ε_r= 2.5 if the electric field in the material is $E = 5.0 \times 10^{-6} \sin(9.0 \times 10^9 t) v/m$	5	CO2
8.a)	Explain the significance of Transformer and Motional EMF.	8	CO3
8.b)	A transmission line operating at 500 MHz has $Z_o = 80\Omega$, α=0.04 Np/m, β=1.5 rad/m. Find the line parameters R, L, G & C	7	CO4
9.a)	Deduce boundary conditions on electric vector $\vec{E}$and $\vec{D}$ for dielectric-dielectric interface.	7	CO2
9.b)	A plane polarized wave is travelling along Z-axis. Show that $\frac{E_y}{H_z} = 377\Omega$	8	CO4
10.a)	What is Poynting Vector? Prove that Poynting vector gives the power flow per unit area of cross-section, at a point in the medium.	10	CO4
10.b)	Derive Biot-Savart's law from magnetic vector potential.	5	CO2
11.	Write short notes on any *three* of the following:		
11.a)	Faraday's law of electromagnetic induction	5	CO2
11.b)	Divergence and Curl	5	CO1
11.c)	Stoke's Theorem	5	CO1
11.d)	Coulombs law in vector form	5	CO2
11.e)	Displacement Current	5	CO3