PAPER ID-311110

Roll No: | | | | | | | | | | | | | |

B.TECH
(SEM III) THEORY EXAMINATION 2020-21
ELECTROMAGNETIC FIELD THEORY

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

Q no.	Question	Marks	CO
a.	Transform the point *P*(-2, 3, 4) into cylindrical coordinate system.	2	1
b.	Given two vectors as, P = (0,6,-9) and Q = (-2,0,3). Find projection of P on Q.	2	1
c.	Derive Poisson and Laplace equations.	2	2
d.	What are the time varying fields? Give example.	2	2
e.	Given, V = 4x3y2 – 3xyz. Determine the E at (3,-4,5).	2	3
f.	Define relaxation time.	2	3
g.	What is Lorentz force?	2	4
h.	Why the closed surface integration of magnetic flux density is zero and of electric flux density is equal to flux.	2	4
i.	Define skin depth.	2	5
j.	Given, η1 = 100 Ω, η2 = 300 Ω, = 100 V/m. Find .	2	5

SECTION B

2. Attempt any *three* of the following:

Q no.	Question	Marks	CO
a.	Verify the divergence theorem for the D = ρ2 cos2 φ aρ + z sin φ aφ over the closed surface of the cylinder $0 \leq z \leq 1$, ρ = 4.	10	1
b.	A wire of diameter 1 mm and conductivity 5 x 107 S/m has 1029 free electrons per cubic meter when an electric field of 10 mV/m is applied. Find:- (i) Charge density of free electrons (ii) Current density (iii) Current in the wire	10	2
c.	State Biot – Savart law and derive an expression for the magnetic field intensity due to infinite straight line current carrying conductor.	10	3
d.	Derive the expression for inductance per unit length of coaxial conductors.	10	4
e.	Show that the intrinsic impedance of free space is 377 or 120π.	10	5

SECTION C

3. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Given, four point charges of 1 μC each at (0,0,0), (0,1,0), (0,1,1), (0,0,1) respectively. Find **E** at (1,1,1).	10	1

b.	Derive the expression for energy and energy density in an electric field.	10	1

4. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Given the current density, $J = \frac{1}{r^2}(2 \cos \theta \, a_r + \sin \theta \, a_\theta)$ A/m^2, find current through a spherical shell of r = 10 cm.	10	2
b.	Derive electrostatic boundary conditions for conductor-dielectric interface.	10	2

5. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	A current of 10 A is flowing from origin to negative infinity along x axis. Find the magnetic field produced by it at (-2, 3, 0).	10	3
b.	Explain the significance of displacement current density.	10	3

6. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Derive the expression for magnetic force on a current carrying loop, kept within the magnetic field.	10	4
b.	Write a note on classification of magnetic materials.	10	4

7. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	What is Poynting vector? Derive the Poynting theorem & explain the physical meaning of each integral involved in it.	10	5
b.	The **E** of an EM wave in free space is given by $E = E_{y_0} e^{j\omega t(t-\frac{z}{v})} a_y$. Find the expression for the **H** by using Maxwell equations.	10	5