J/L/TX

Reg. No: 23BEC0137

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of the UGC Act, 1956)

Final Assessment Test – November 2024

Course: BECE205L - Engineering Electromagnetics

Class NBR(s): 4078 / 4082 / 4084 / 4094 Slot: F2+TF2

Time: Three Hours Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

General Instructions : Smith charts need to be provided

Answer ALL Questions

(10 X 10 = 100 Marks)

1. (i) A spherical polar coordinate point is given by P (4, π/3, π/4) (the distance is in meter and the angles in radians). Express the point in Cartesian coordinates.

   (ii) Find the numerical value for the ∇. **D** at the point specified $\boldsymbol{D} = (2xyz-y^2)\,\boldsymbol{a}_x + (x^2z-2xy)\,\boldsymbol{a}_y + x^2y\,\boldsymbol{a}_z$ at $P_A(2,3,-1)$.

2. If the zero potential reference is at r = 10 m and a point charge Q = 0.5 nC is at the origin, find the potential at a radius r = 5 m and r = 15 m. Also, at what radius is the potential the same in magnitude as that at r = 5 m but opposite in sign.

3. The plane z = 0 makes the boundary between the free space and dielectric medium with a dielectric constant $\varepsilon_r = 40$. The electric field next to the interface in free space is $E = 13\,\bar{a}_x + 40\,\bar{a}_y + 50\,\bar{a}_z$ (V/m). Determine the electric field on the other side of the interface.

4.(a) A vector magnetic potential $\boldsymbol{A} = \frac{2\cos\theta}{r^3}\boldsymbol{a}_r + \frac{\sin\theta}{r^3}\boldsymbol{a}_\theta$ Wb/m exists in a free space.

   (i) Show that $\nabla . \boldsymbol{A} = 0$ or not

   (ii) Find **B** at point $T(1, 30^\circ, 60^\circ)$

OR

4.(b) Region 1, where $\mu_{r1} = 4$ is the side of the plane $y + z = 1$ containing the origin (refer to the following figure). In region 2, $\mu_{r2} = 6$. If, $B_1 = 2a_x + 1a_y\,(T)$. Find $\boldsymbol{B_2}$ and $\boldsymbol{H_2}$.