Week 0 Assignment 0

The due date for submitting this assignment has passed. As per our policy, you have not established this assignment.

Please note, this is a non-graded assignment, i.e., this will not be counted in the final evaluation.

1) Consider a two-dimensional plane having a uniform electric field of \( E = \frac{1}{2} \) V/m. Determine the dot product between the electric field and the vector joining the points (0,0) and (2, -4).
   
   \[ \text{Answer:} \quad 2 \text{ V} \cdot \text{m} \]

2) Consider a parallel plate capacitor with a non-conventional area of 1 \( \text{m}^2 \) and the distance between the plates is 5 \( \text{cm} \). Calculate the electric field density. \( \text{Answer:} \quad 7 \text{ V/m} \)

Note: \( \varepsilon_0 \) is the permittivity of free space.

3) To obtain a non-zero asset solution \( X \) for the matrix equation \( AX = B \), which of the following properties of \( A \) and \( B \) matrices are essential?
   
   \[ A \text{ should be a full rank matrix and } B \text{ should be a non-zero vector} \]

4) Calculate the current in the secondary winding of an ideal transformer whose primary winding turns and secondary winding turns are 10 and 20 respectively and the primary winding current is 3 A.
   
   \( I_2 = \frac{I_1 \cdot N_1}{N_2} \)
   \[ \text{Answer:} \quad 1.5 \text{ A} \]

5) Calculate the percentage of the slip of a four-pole induction motor operating at 30 Hz with rotor speed of 1495 rpm.
   
   \( \% \)

6) Which of the following three elements in Maxwell's equations represents point form of Faraday's Law?
   
   \( \nabla \times E = - \frac{\partial B}{\partial t} \)

7) Calculate the value of magnetic field intensity required to generate uniform magnetic flux density of 2 T in a magnetic material whose relative permeability is 1000.
   
   \( H = \frac{B}{\mu} \)
   \[ \text{Answer:} \quad 2000 \text{ A/m} \]

8) Consider a charged object moving with a velocity \( v \) in a space where uniform magnetic field distribution is \( B \). Calculate the dot product of pair velocity and magnetic force on the moving charge.
   
   \( \text{Zero} \)

9) Calculate the voltage induced in a coil if the time-varying flux linkage with the coil is defined as \( \psi(t) = \cos(\omega t) \).
   
   \( \varepsilon(t) = -\omega \cos(\omega t) \)

10) Solve the integral \( \int_{0}^{\pi/2} \sin^2 \theta \, d\theta \) for the above integral, \( \theta \) is the Dirac delta function.
   
   \[ \frac{\pi}{4} \]

   \( \text{Answer:} \quad \frac{\pi}{4} \)