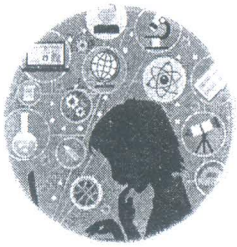

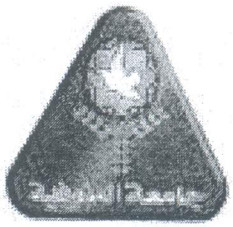

جامعة المنوفية
كلية الهندسة الالكترونية بمنوف
قسم :- هندسة الالكترونيات والاتصالات الكهربية
الفرقة :- الثالثة

أسم المادة :- الموجات الكهرومغناطيسية
زمن الامتحان :- ثلاث ساعات

Code ECE 312

تاريخ الامتحان: 12 / 1 / 2020

الفصل الدراسي الاول

Answer All Questions	Number of Questions: 4	Number of Pages: 2

Question No 1 : (22 Marks)

a) Let us defined the delta operator ∇ as a vector operator

$$\nabla = \frac{\partial}{\partial x}a_x + \frac{\partial}{\partial y}a_y + \frac{\partial}{\partial z}a_z$$

Find the value of the following when ∇ is operating on:

i) V is any scalar and

ii) Dot products of the unit vectors $\bar{D} = \left(D_x\,\bar{a}_x + D_y\,\bar{a}_y + D_z\,\bar{a}_z\right)$ (6 Marks)

b) Find Cross Product using rectangular components for the two vectors $\bar{E}$ and $\bar{H}$ in the direction of x, y, z. (6 Marks)

c) Obtain the Gradient for Scalar Field ∇V, Divergence of Vector Displacement $\nabla.\bar{D}$, laplacian of scalar field $\nabla^2 V = \nabla.\nabla V$ and Curl of Vector Field $\nabla \times \bar{E}$ for the following cases:

i) Cylindrical Coordinate Systems and

ii) Spherical Coordinate Systems. (10 Marks)

Question No 2 : (22 Marks)

a) Describe how electric and magnetic fields propagate, interact, and how they are influenced by objects in the integral and differential form of Maxwell's equations. (10 Marks)

b) Find the analytical treatment of the uniform plane wave to propagation in a dielectric of permittivity ε and permeability μ. The medium is assumed to be homogeneous (having constant μ and ε with position) and isotropic (in which μ and ε are invariant with field orientation) of the following cases:

i) The attenuation constant α and β phase constant and

ii) The wavelength λ, phase velocity v_p and the intrinsic impedance η. (12 Marks)

Question No 3: (22 Marks)

a) The plane wave propagating in fresh water with an operating frequency $1MHz$. At $1\,MHz$ the characteristics of the water, $\mu_r = 1$ and $\varepsilon_r' = 81$. Losses in water are negligible, which means that $\varepsilon'' = 0$ the impedance in free space $\eta_0 = 377$, find the following:

i) The phase constant and attenuation constant and

ii) The wavelength, phase velocity and intrinsic impedance. (10 Marks)

b) Draw the flow diagram chart of Transmission Line Matrix (TLM) program technique to obtain the components of electric and magnetic field for the microstrip in Fig. 1, and write the following:

i) The necessary equations for the total voltage impulse reflected along line n at time $(1+k)\Delta l$.

ii) The scattering matrix equations, power and impedance.

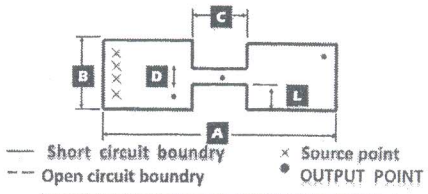

Fig . 1. Two dimensions waveguide.

(12 Marks)

Question No 4: (24 Marks)

a) Solving the rectangular cavity loaded with a dielectric stub shown in Fig.2, and show that the three-dimensional transmission line matrix using two-dimensional nodes can be verified. (12 Marks)

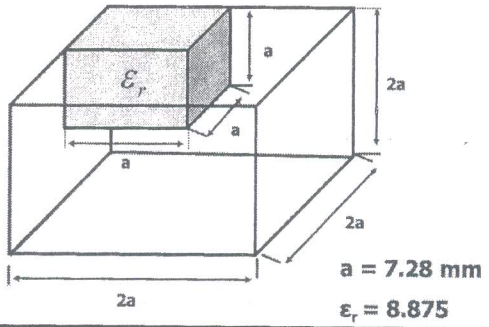

Fig. 2 Enclosed coupled pair of micro strip lines.

b) Drive the equations to discrete the representation of electric and magnetic field in the differential 3D time domain Maxwell's equations, in its common form with a central difference scheme in both time and space. (12 Marks)

Total: 90 Marks

توقيع أستاذ المادة :-

أ. د/ عبدالعزيز ابراهيم محمود حسنين