International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination Autumn-2018
Course Code: EEE 3621
Time: 2 hours 30 minutes

Program: B.Sc. Engg. (EEE)
Course Title: Engineering Electromagnetism
Full Marks: 50

Part A

[Answer any ***two*** questions from the followings; figures in the right margin indicate full marks.]

1(a). State the Ampere's circuital law. **02**

1(b). Explain with necessary diagram and equation that, magnetostatic fields have no sources or sinks. **04**

1(c). Find the magnetic flux density at point **P(0,0,z)** on the axis of a circular loop of radius **b** that carries a direct current **I**. **04**

2(a). For a source free region, write the Maxwell's equations and show that, **05**

$\nabla^2 E - \frac{1}{u^2}\frac{\partial^2 E}{\partial t^2} = 0$, where symbols have their usual meanings.

2(b). State Poynting Theorem. In a non-magnetic medium, **05**

$E = 4\sin(2\pi \times 10^7 - 0.8x)a_z\ V/m$. Find:

i. ε_r, η

ii. The time average power carried by the wave.

The total power crossing 100 cm^2 of plane 2x+y=5.

3(a). Define Lorentz law of force. **02**

3(b). What is meant by Plasmas? Show that, for ionized medium plasma frequency is, **04**

$f_p = \frac{1}{2\pi}\sqrt{\frac{Ne^2}{m\epsilon_0}}$ (Hz), where symbols have their usual meanings.

3(c). A sinusoidal electric intensity of amplitude of 50 V/m and frequency 1 GHz exists in a lossy dielectric medium that has a relative permittivity of 2.5 and loss tangent of 0.001. Find the average power dissipated in the medium per cubic meter. **04**

Part B

[Answer any ***three*** questions from the followings; figures in the right margin indicate full marks.]

4(a). Define-Brewster angle, standing wave ratio and anomalous dispersion of electromagnetic (EM) wave. **03**

4(b). For normal wave incidence at boundary, find the incident, reflected and transmitted wave equations of electric and magnetic field. **03**

4(c). Show that, $\Gamma = \frac{\eta_2 - \eta_1}{\eta_2 + \eta_1}$; where symbols have their usual meanings. **04**

5(a). Define Characteristics Impedance and Voltage Reflection Coefficient. **02**

5(b). Find propagation constant and characteristics impedance for Lossless and distortion less line. **03**

5(c). A 90 + j120-Ω load is connected to a 30-Ω lossless line. Find using **Smith chart**; **(a)** Γ, **(b)** s, **(c)** the load admittance Y_L, **(d)** Z_{in} at 0.4λ from the load, and **(e)** Z_{in} at 0.6λ from the generator. (where symbols have their usual meanings) **05**

6(a). Differentiate between transmission line and waveguide? Write some applications of waveguide? **03**

6(b). Why the TE_{10} mode is called the fundamental mode of waveguide? **03**

6(c). A w... ...ns a = 1 cm. and b = 0.7 cm, is to be used at 20 GHz. Determine the wave ...r the dominant mode when (a) the guide is empty. and (b) the guide is filled with polyethylene (whose $\varepsilon_r = 2.25$) **04**

7(a). Discuss the different mode categories that may exist in a waveguide. **03**

7(b). Explain the significance of Smith chart. **02**

7(c). Stripline consisting a thin metal strip se... ...om a conducting ground p... ...e by a dielectric substrate are used extensively in microwave ... ...ti... ...es and assuming the substrate to have a t... ...loss ... ...ric co... ...nt 2.25 determi... ...order f... ...ripline to have char... ...tics ... ... and (c) ... ...g the line. **05**

The Complete Smith Chart

Black Magic Design