

International Islamic University Chittagong (IIUC)

Department of Electronic and Telecommunication Engineering

Final Examination

Program: B.Sc. Engg.
Course Code: ETE - 2407
Full Marks: 50

Semester: Spring-2018

Course Title: Electromagnetic Fields and Waves

Time: 2 hours and 30 minutes

Group- A

[Answer any two sets of the following questions]

- (a) What is the source of EM field? 01
- (b) Derive the relation $\nabla \cdot \vec{j} = -\dot{\rho}_v$, where the symbols have their usual meaning. 04
- (c) Mention some characteristics of EM waves in free space. 02
- (d) Write the Maxwell's equations for static fields in differential and integral forms. 03
- (a) Propose short note on some applications of EM waves. 02
- (b) Write down the EM wave equations in free space. 02
- (c) Derive the general wave equations for a conducting medium. 04
- (d) Mention the conditions for uniform plane wave equations propagating in y-direction. 02
- (a) Prove that, $\vec{E} \cdot \vec{H} = 0$ only if the fields are perpendicular to each other. 03
- (b) Prove that, the attenuation constant for a good dielectric medium is 05
- $\alpha = \frac{\sigma}{2} \sqrt{\frac{\mu}{\epsilon}}$, dB/m, where the symbols have their usual meaning.
- (c) Identify frequency, phase constant when the electric field of an EM wave is given by $E = 5.0 \sin 10^8 t - 4.0x) \vec{a}_z$. Also find λ . 02

Group- B

[Answer any three sets of the following questions]

- (a) Explain your idea about polarization and its types of EM wave. 02
- (b) Discuss the nature of EM waves for normal incidence on a perfect conductor. 08
- (a) Propose your knowledge about perpendicular and parallel polarization of EM waves. 02
- (b) What is Brewster angle? Derive the equations for Brewster angle for parallel and perpendicular polarizations. 06
- (c) The magnetic field, \mathbf{H} of a plane wave has a magnitude of 6 mA/m in a medium defined by $\epsilon_r = 3, \mu_r = 1$. Determine the maximum energy density in the plane. 02
- (a) Write down the boundary conditions for \vec{E} and \vec{B} . 02
- (b) Prove the boundary conditions on \vec{B} and \vec{D} . 05
- (c) In a three-dimensional space, divided into region 1 ($x < 0$) and region 2 ($x > 0$), $\sigma_1 = \sigma_2 = 0$. $\vec{E}_1 = 1\vec{a}_x + 2\vec{a}_y + 3\vec{a}_z$. Find \vec{E}_2 and \vec{D}_2 . Consider $\epsilon_{r1} = 1$ and $\epsilon_{r2} = 2$. 03
- (a) What is transmission line? Derive the relation between reflection co-efficient, load and characteristic impedances of transmission line. How does reflection co efficient vary for: 06
- i) matched load ii) short circuited load iii) open circuited load
- Comment on the results obtained for these three conditions.
- (b) A lossless transmission line used in a TV receiver has a capacitance of 50pF/m and an inductance of 200nH/m. Find the characteristic impedance for sections of a line 10m long and 500m long. What do you understand from the results? 04