Department of Computer Science

Spring Semester 2020, Date: 24/June/2020

Final-term Exam

Course Title: Introduction to field, waves and antenna **Lecturer: Engr. Latif Jan**

Total Marks: 50 **Time Allowed:**

Note: Attempt all Questions. All three questions carry equal marks.

Q1) Answer the following short questions briefly. Each question carries equal marks. (2+2+2+2+2 marks)

1) Write down the Maxwell's' Equations? Maxwell's equations comprise the fundamental tenets of electromagnetic theory. Explain.
2) Explain the Coulombs Law? Also state it with the help of expressions.
3) What is the difference between convection and conduction currents?
4) State the principle of linear superposition as it applies to the electric field due to a distribution of electric charge.
5) What is ***Biot–Savart law?*** Also state it with the help of expression.

Q2) a: A 2mm diameter copper wire with conductivity of 5.8×107 S/m and electron mobility of 0.0032 (m2/V·s) is subjected to an electric field of 20 (mV/m). Find (a) the volume charge density of the free electrons, (b) the current density, (c) the current flowing in the wire, (d) the electron drift velocity, and (e) the volume density of the free electrons. **(7.5 marks)**

b: The *x*–*y* plane is a charge-free boundary separating two dielectric media with permittivities ϵ_1 and, ϵ_2 as shown in Fig. 4-19. If the electric field in medium 1 is **E**1 = ˆ**x***E*1*x* + ˆ**y***E*1*y* + ˆ**z***E*1*z*, find (a) the electric field **E**2 in medium 2 and (b) the angles ϑ1 and ϑ2. **(7.5 marks)**

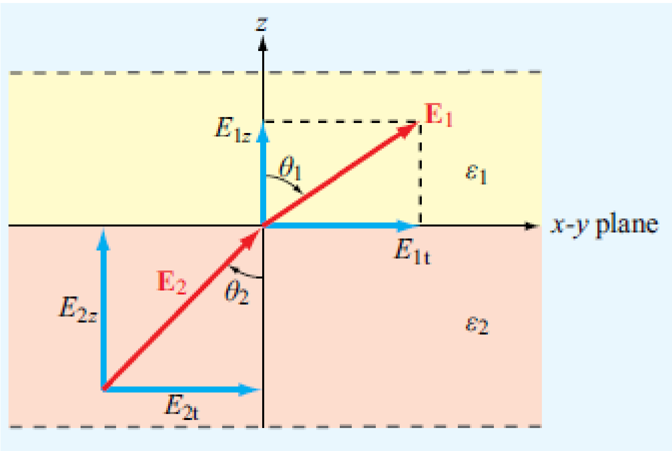

Figure 4-19 Application of boundary conditions at the interface between two dielectric media (Example 4-10).

Q3) a). The semi-circular conductor shown in Fig. 5-4 lies in the *x–y* plane and carries a current ***I*** . The closed circuit is exposed to a uniform magnetic field **B** = ˆ**y***B*o. Determine (a) the magnetic force **F**1 on the straight section of the wire and (b) the force **F**2 on the curved section. **(7.5 marks)**

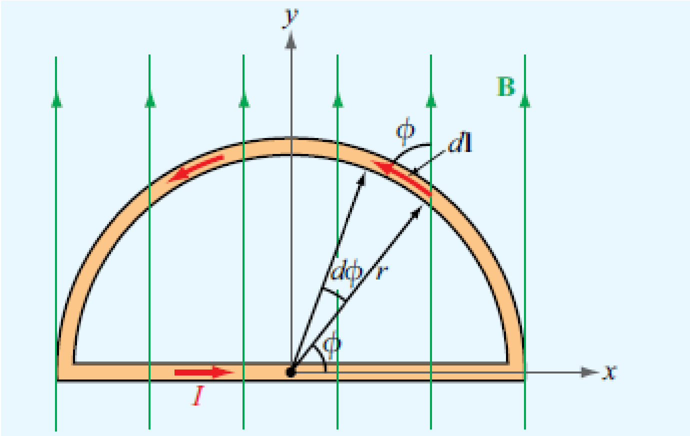

Figure 5-4 Semicircular conductor in a uniform field (Example 5-1).

b) A free-standing linear conductor of length *l* carries a current *I* along the *z* axis as shown in Fig. 5-10. Determine the magnetic flux density **B** at a point *P* located at a distance *r* in the *x–y* plane. **(7.5marks)**

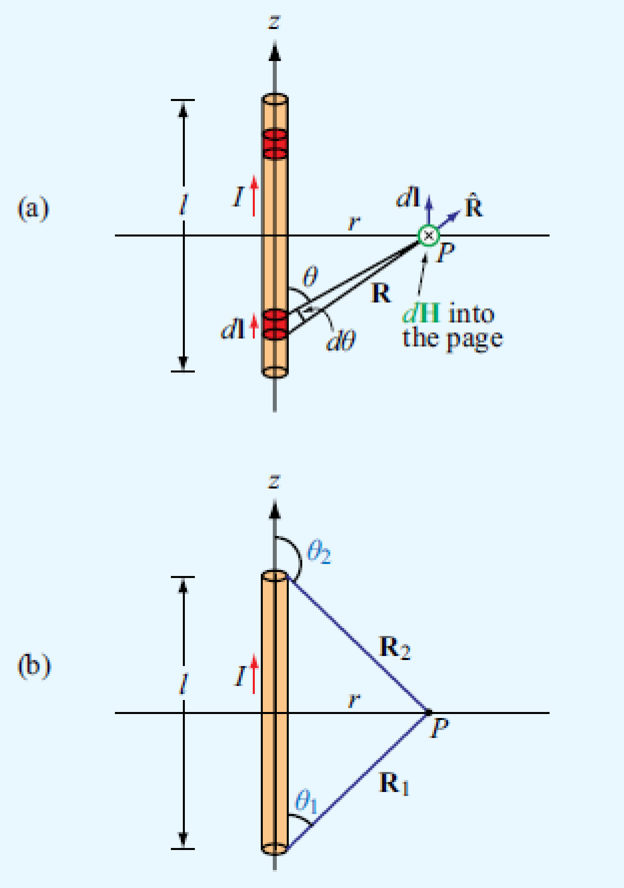

Figure 5-10 Linear conductor of length l carrying a current I. (a) The field $d\mathbf{H}$ at point P due to incremental current element $d\mathbf{l}$. (b) Limiting angles θ_1 and θ_2, each measured between vector $I\ d\mathbf{l}$ and the vector connecting the end of the conductor associated with that angle to point P (Example 5-2).

Q4) a). Explain the Faraday's Law? Also explain in brief its Differential and Integral Forms. **(5marks)**

b). Determine voltages $V1$ and $V2$ across the 2 Ω and 4 Ω resistors shown in Fig. 6-4. The loop is located in the x–y plane, its area is 4 m^2, the magnetic flux density is $\mathbf{B} = -\hat{\mathbf{z}}0.3t$ (T), and the internal resistance of the wire may be ignored. **(5marks)**

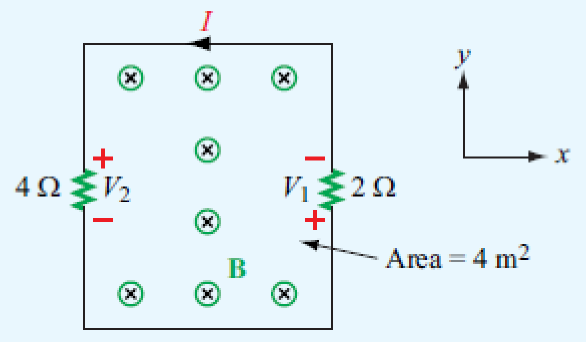

Figure 6-4 Circuit for Example 6-2.

☺ Best of Luck ☺