Total No. of Pages 2

SEMESTER- IV

MID SEMESTER EXAMINATION

Roll No. ......

B.Tech. (ECE)

(MAR. 2019)

EE-262 ELECTROMAGNETICS

Time: 1 Hour 30 Minutes

Max. Marks: 25

Note: Answer *all* questions. Assume suitable missing data, if any.

Q1. (i) The circular current loop shown in Fig.1 is in the plane $z = h$, parallel to a uniform current sheet, $K = K_0 \hat{a}_y$, at $z = 0$.
(a) Express the force on a differential length of the loop. (2)
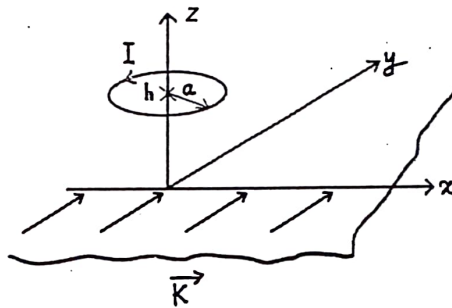(b) Calculate the total force on the loop. (1)

Fig.1

(ii) If $A = \rho cos\phi\, a_\rho + sin\phi\, a_\phi$, evaluate $\oint A.\,dl$ around the path shown in Fig.2 below using Stoke's theorem. (2)
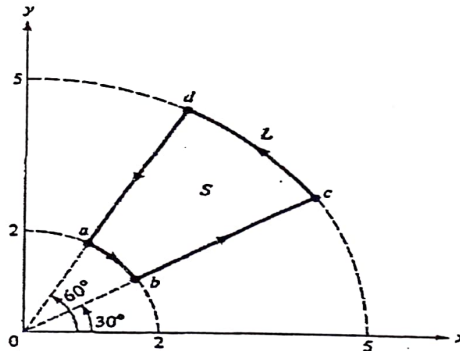

Fig.2

Q2. A spherically symmetric charge distribution is given by

$$\rho_v = \begin{cases} \rho_0 \left(1-\dfrac{r}{a}\right)^2, & r \le a \\ 0, & r \ge a \end{cases}$$

(i)   Find E and V for $r \ge a$. (2)
(ii) Find E and V for $r \le a$. (2)
(iii) Find the total charge. (1)

P.T.O.

Q3. A unit normal vector from region 2 ($\mu = 2\mu_0$) to region 1 ($\mu = \mu_0$) is
$a_{n21} = (6a_x + 2a_y - 3a_z)/7$. If $H_1 = 10a_x + a_y + 12a_z$ A/m and
$H_2 = H_{2x}a_x - 5a_y + 4a_z$ A/m. Determine

   (i) H_{2x} (2)
   (ii)   The surface current density **K** on the interface.   (2)
   (iii)   The angles B_1 and B_2 make with the normal to the interface.   (1)

Q4. A lossy dielectric has an intrinsic impedance of $200\angle 30^0 \, \Omega$ at a particular radian frequency ω. If, at that frequency, the plane wave propagating through the dielectric has the magnetic field component $H = 10e^{-\alpha x} \cos\left(\omega t - \frac{1}{2}x\right)a_y$ A/m. Find E and α. Also determine the skin depth.   (5)

Q5. In a nonmagnetic material, $E = 30\cos(2\pi \times 10^8 t - 6x)\,a_y$ mV/m. Determine

   (i)   the intrinsic impedance   (1)
   (ii)   the Poynting vector   (2)
   (iii) the time- average power crossing the surface $x = 1$, $0 < y < 2$, $0 < z < 3$ m.   (2)

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