

II B.Tech I Semester Supplementary Examinations, November 2006
ELECTROMAGNETIC FIELDS
(Electrical & Electronic Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Derive $\nabla \cdot \mathbf{D} = \rho_v$ from fundamentals.
 (b) Four point charges of $Q, -2Q, 3Q$ and $4Q$ are located at the corners of a square of side 'd'. Find E at the center of the square. [6+10]
2. (a) Find electric potential due to electric dipole.
 (b) The potential difference between two concentric sphere of radii r_1 and r_2 ($r_2 > r_1$) is V_1 show that electric field E at the surface of inner sphere is minimum of $2V/r_1$ for $r_1 = r_2/2$. [8+8]
3. (a) Derive the integral form of continuity equation and also write its meaning.
 (b) What is the Capacitance of a Capacitor consisting of two parallel plates 30 cm by 30 cm, Separated by 5 mm in air. What is the energy stored by the capacitor if it is charged to a potential difference of 500 volts. [8+8]
4. A conductor is in the form of a Regular polygon of n sides inscribed in a circle of radius R . Show that the expression for \mathbf{B} at the center for a current is given by
 $|B| = \left(n\mu_o I / 2\pi R \right) \tan \pi/n$ [16]
5. A single-phase circuit comprises two parallel conductors A and B, each 1 cm diameter and spaced 1 m apart. The conductors carry current of +100 and -100 Amps. respectively. Determine the field intensity at the surface of each conductor and also in space exactly midway between A and B. [16]
6. Two mutually coupled coils are connected in series.
 $L_1 = 0.5 \text{ H}$ $L_2 = 0.6 \text{ H}$
 $M = 0.1 \text{ H}$
 A dc current of 2Amps is passed through this system in such a way that the current increases at a uniform rate of 1 Amp. per sec. What is the voltage developed across the end points if
 (a) the coils are connected in a magnetically aiding condition
 (b) the coils are connected in a magnetically opposing condition.
 Derive formula used. [16]
7. (a) Explain what is meant by the term displacement current. Deduce equation of continuity of current $\text{div}(\mathbf{J} + d\mathbf{D}/dt) = 0$.

- (b) Find the displacement current density within a parallel plate Capacitor where $\epsilon = 100\epsilon_0$, $a=0.01m^2$, $d=0.05$ mm and the capacitor Voltage is $100 \sin 200 \pi t$ volts? [8+8]
8. Assuming Maxwell's equations, show that the quantity given by the expression $\oint (\vec{E} \times \vec{H}) \cdot d\vec{s}$ is equal to the total power flowing out the volume enclosed by the closed surface \bar{S} surrounding the volume. [16]
