7 - ELECTROMAGNETIC INDUCTION

1) The rate of change of current in one of the coils (a system formed by two coils) is 1.6 A /s. Due to this, induced emf in the other coil is 25.6×10^{3} μV. Find mutual inductance of the system formed by coils. (July, 2000)

(Ans: 16×10^{-3} H)

2) The number of turns in a coil is 10000 and area of each turn is 4 cm ^{2}. It is placed perpendicularly to the magnetic induction B. If the coil is rotated through 90 ° from this position, then find the charge induced. [$R = 10\,\Omega$, $B = 6$ Wb /m ^{2}] (March, 1998)

(Ans: 2.4 coulomb)

3) The total length of wings of an aeroplane is 15 m. Its horizontal velocity is 720 km /hr. Calculate the induced electromotive force between the two ends of its wings. The value of vertical component of earth's magnetic field is 4×10^{-5} Tesla. (October, 1997)

(Ans: 0.12 V)

4) There are 50 turns in the coil and the flux linked with each of its turn is 0.2 weber. If 5 ampere current passes through the coil, find self - inductance of the coil. (March, 1997)

(Ans: 2.0 H)

5) Number of turns of a coil is 50. Area of every turn is 100 cm ^{2}. The plane of the coil is perpendicular to the uniform magnetic field of 200×10^{-4} weber /m ^{2}. It is rotated so that the plane of the coil becomes parallel to the same magnetic field within 0.1 sec. Calculate the induced e.m.f. (October, 1996, March, 1992)

(Ans: 0.10 V)

6) A coil of 500 turns and area 10 cm^{2} is placed with its plane perpendicular to a magnetic field of 2×10^{-3} weber /m^{2}. If the field is uniformly reduced to zero in 10^{-2} s, what will be the e.m.f. induced in the coil? If the resistance of the coil is 50 ohm, calculate the values of the current and charge induced in the coil. (March, 1995)

(Ans: 0.1 volt, 0.002 A, 2×10^{-5} C)

7) A surface vector of area 60 m^{2} is parallel to and in a magnetic field. The intensity of this uniform magnetic field is 300 weber /m^{2} (tesla). If the surface rotates through 90° in 3 minutes, then find the induced e.m.f. (October, 1993)

(Ans: 100 volt)

8) In a uniform magnetic field of 600 tesla a surface-vector of area is placed parallel to it. From this position, if this surface rotates through 90° in 5 minutes producing the induced e.m.f. of 80 volt, then find the surface-vector area. (October, 1992)
(Ans: 40 m^2)

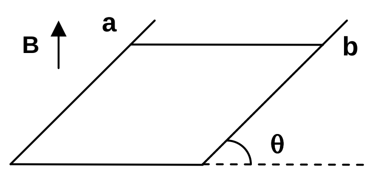
9) The two rails of railway track, insulated from each other, and the ground are connected to a milli-voltmeter. What will be the reading of the milli-voltmeter when a train travels at a speed of 180 km /hr along the track, if the vertical component of earth's magnetic field is 2×10^{-4} weber /m^2 and rails are separated by 1 m. (October, 1991)
(Ans: 1 mV)

10) The length of the wing of an air plane is 10 m. Its horizontal velocity is 200 m /s. If the vertical component of the earth's magnetic field is 5.0×10^{-5} weber /m^2, calculate the potential difference developed across the two ends of the wing. (October, 1989)
(Ans: 0.1 V)

11) A direct current of 2 A in a coil of 400 turns causes a flux of 10^{-4} weber to links of the coil. Compute the average counter e.m.f. induced in the coil if the current is interrupted in 0.08 s. Find the inductance of the coil. (October, 1986)
(Ans: 0.5 V, 0.02 H)

12) The length of a solenoid having 1000 turns is 10π cm. If its cross-sectional area is 10 cm^2, find its self-inductance. If a current of 10 A flows through it, what is the strength of magnetic field intensity inside it ? ($\mu_0 = 4\pi \times 10^{-7}$ tesla-m /A)
(Ans: 4×10^{-3} H, 0.04 tesla)

13) A wire ab of length l, mass m and resistance R slides on a pair of metallic rails joined at the bottom as shown in the figure. The plane of the rails makes an angle θ with the horizontal. The coefficient of kinetic friction between the wire and the rails is μ.. A vertical magnetic field B exists in the region. If the wire slides on the rails with a constant velocity v along the plane of the rails, then show that



$$B = \sqrt{\frac{mgR(\sin\theta - \mu\cos\theta)}{v l^2 \cos\theta\,(\cos\theta + \mu\sin\theta)}}$$