Basic Electrical Engineering
Worksheet-10
Magnetic Circuits

1. An iron specimen in the form of a closed ring has a 350-turn magnetizing winding through which is passed a current of 4A. The mean length of the magnetic path is 75 cm and its cross-sectional area is 1.5 cm2. Wound closely over the specimen is a secondary winding of 50 turns. This is connected to a ballistic galvanometer in series with the secondary coil of 9-mH mutual inductance and a limiting resistor. When the magnetising current is suddenly reversed, the galvanometer deflection is equal to that produced by the reversal of a current of 1.2 A in the primary coil of the mutual inductance. Calculate the *B* and *H* values for the iron under these conditions, deriving any formula used. **[1.44 Wb/m^2; 1865 AT/m]**
2. A moving-coil ballistic galvanometer of 150 Ω gives a throw of 75 divisions when the flux through a search coil, to which it is connected, is reversed. Find the flux density in which the reversal of the coil takes place, given that the galvanometer con- stant is 110 μ*C* per scale division and the search coil has 1400 turns, a mean are of 50 cm2 and a resistance of 20 Ω. [**0.1 Wb/m^2]**
3. A flux meter is connected to a search coil having 500 turns and mean area of 5 cm^2. The search coil is placed at the centre of a solenoid one metre long wound with 800 turns. When a current of 5 A is reversed, there is a deflection of 25 scale divisions on the fluxmeter. Calculate the flux-meter constant. **[10^{-4} Wb-turn/division]**
4. An iron ring of mean length 50 cms has an air gap of 1 mm and a winding of 200 turns. If the permeability of iron is 300 when a current of 1 A flows through the coil, find the flux density. [94.2 mWb/m^3]
5. An iron ring of mean length 100 cm with an air gap of 2 mm has a winding of 500 turns. The relative permeability of iron is 600. When a current of 3 A flows in the winding, determine the flux density. Neglect fringing. **[0.523 Wb/m^2]**
6. A coil is wound uniformly with 300 turns over a steel ring of relative permeability 900, having a mean circumference of 40 mm and cross-sectional area of 50 mm^2. If a current of 25 amps is passed through the coil, find (*i*) m.m.f. (*ii*) reluctance of the ring and (*iii*) flux. **[(*i*) 7500 AT (*ii*) 0.7 ◊ 10^6 AT/Wb (*iii*) 10.7 mWb]**
7. A specimen ring of transformer stampings has a mean circumference of 40 cm and is wound with a coil of 1,000 turns. When the currents through the coil are 0.25 A, 1 A and 4 A the flux densities in the stampings are 1.08, 1.36 and 1.64 Wb/m^2 respectively. Calculate the relative permeability for each current and explain the differences in the values obtained. **[1,375,434,131]**
8. A magnetic circuit consists of an iron ring of mean circumference 80 cm with cross-sectional area 12 cm^2 throughout. A current of 2A in the magnetising coil of 200 turns produces a total flux of 1.2 mWb in the iron. Calculate: (*a*) the flux density in the iron (*b*) the absolute and relative permeability of iron (*c*) the reluctance of the circuit **[1 Wb/m^2 ; 0.002, 1,590; 3.33 $\times$ 10^5 AT/Wb]**
9. A coil of 500 turns and resistance 20 Ωis wound uniformly on an iron ring of mean circumference 50 cm

and cross-sectional area 4 cm^2. It is connected to a 24-V d.c. supply. Under these conditions, the relative permeability of iron is 800. Calculate the values of: (*a*) the magneto-motive force of the coil (*b*) the magnetizing force (*c*) the total flux in the iron (*d*) the reluctance of the ring **[(*a*) 600 AT (*b*) 1,200 AT/m (*c*) 0.483 mWb (*d*) 1.24 ◊ 10^6 AT/Wb]**