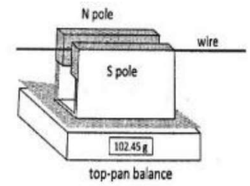
c) A straight horizontal rod of length 20 cm and mass 30 gm is placed in a uniform horizontal magnetic field perpendicular to the rod. If a current of 2A through the rod makes it self-supporting in the magnetic field, calculate the magnetic field. $(Ans: 0.75T)$

d) A horizontal straight wire 5 cm long weighing 1.2 gm^{-1} is placed perpendicular to a uniform horizontal magnetic field of flux density of 0.6 T. IF the resistance per unit length of the wire is 3.8 Ωm^{-1}, calculate the p.d. that has to be applied between the ends of the wire to make it just self-supporting. $(Ans: 3.7 \times 10^{-3}V)$

8. Figure shows a fixed horizontal wire passing centrally between the poles of a permanent magnet that is placed on a top- pan balance. With no current flowing, the balance records a mass of 102.45 g. When a current of 4.0 A flows in the wire, the balance records a mass of 101.06 g.



   a) Explain why the reading on the top-pan balance decreases when the current is switched on.
   b) State and explain the direction of the current flow in the wire.
   c) The length of the wire in the magnetic field is 5.0 cm. Calculate the average magnetic flux density between the poles of the magnet. $(Ans: 0.0696T)$

<u>Day-3 & 4</u>

9. a) Discuss the torque produced on a rectangular current carrying coil placed in a uniform magnetic field.
   b) Discuss the cases when the torque is maximum and minimum.
   c) The plane of a $5cm \times 8cm$ rectangular loop of wire is parallel to a $0.19T$ magnetic field. The loop carries a current of $6.2A$. What torque acts on the loop? $(Ans: 4.7 \times 10^{-3}Nm)$
10. What is the principle of moving coil galvanometer? In moving coil galvanometer,
    a) Cylindrical magnets are used, why?
    b) Radial magnetic field is used, why?
    c) What is the use of soft iron core?
11. Explain the working principle of galvanometer. Mention the factors that are associated to increase the current sensitivity and voltage sensitivity of the galvanometer.
12. The coil of a moving coil galvanometer has 50 turns and its resistance is 10Ω. It is replaced by a coil having 100 turns and resistance 50Ω. Find the factor by which voltage sensitivity changes. $(Ans: 2/5)$
13. Two galvanometer, which are otherwise identical, are fitted with different coils. One has a coil of 50 turns and resistance 10 Ω while the other has 500 turns and resistance of 600 Ω. What is the ratio of the deflection when each is connected in turns to a cell of emf 25 V and internal resistance 50 Ω. [13:12]

<u>Day-5 & 6</u>

14. The Hall effect in metal offered the first real proof that electric currents in metals are carried by moving electrons, not by protons.
    a) What is Hall effect? Deduce the expression for hall voltage.
    b) Hall voltage in a semiconductor is more than that in metals, why?
    c) A strip of metal is 10 mm wide and 2 mm thick. It carries a current of 6 A, and is placed so that a magnetic field of 0.09 T is passing at right angles through it surface. The metal has 8×10^{28} charge carriers per cubic meter. Calculate the velocity of the charge carriers, and the Hall voltage that would be produced. $(2.34 \times 10^{-6}m/s, 2.11nV)$
    d) A flat silver strip of width 1.5cm and thickness 1.5 mm carries a current of 150 A. A magnetic field of 2T is applied perpendicular to the flat face of the strip. The emf developed across the width of the strip is measured to be $17.9\mu V$. Calculate the free electron density in the silver. [$6.98 \times 10^{28} m^{-3}$]
    e) What causes the Hall voltage?
    The Hall voltage arises from the deflection of charge carriers (electrons or holes) due to the magnetic field. The Lorentz force acts on the moving charge carriers, pushing them to one side of the conductor. This accumulation of charge creates a voltage difference (Hall voltage) across the conductor, perpendicular to both the current and the magnetic field.
    f) Why is the Hall effect important in semiconductors?
    In semiconductors, the Hall effect is especially important because it helps determine:

- ***Carrier concentration (n or p):*** *By measuring the Hall voltage, we can calculate the density of charge carriers in the material.*
- ***Type of semiconductor (n-type or p-type):*** *The sign of the Hall voltage reveals whether the dominant carriers are electrons (n-type) or holes (p-type).*
- ***Mobility of carriers:*** *The drift velocity of the carriers, and thus their mobility, can be inferred by combining Hall effect measurements with conductivity data.*