ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

UNIT 3

Measurement of Parameters

Q-Meter

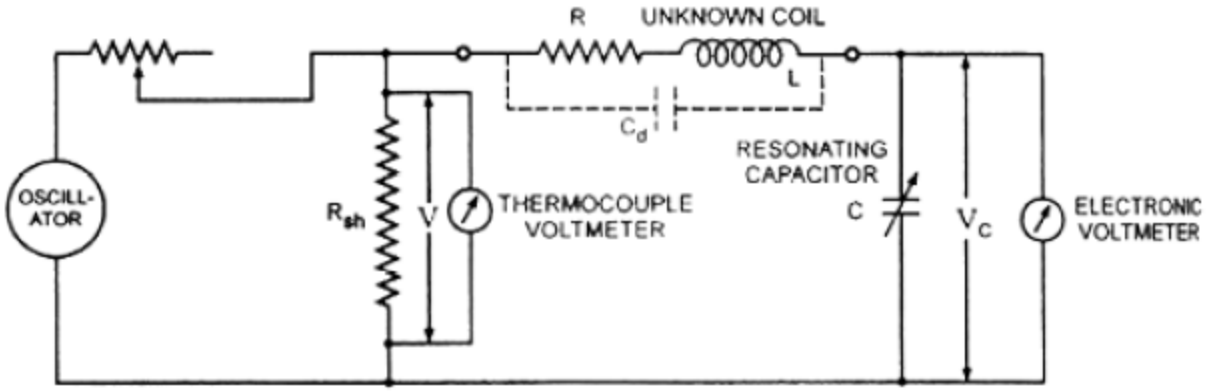
- Ratio of the inductive reactance to the effective resistance of the coil is called the quality factor or Q-factor of the coil.

So $Q = X_L / R = \omega L / R$

- High value of Q is always desirable and it means high inductive reactance and low resistance.
- A low value of Q means resistance component is relatively high and so there large loss of power
- Q-meter is designed for the measurement of Q-factor of the coil as well as for the measurement of electrical properties of coils and capacitors.
- This instrument operates on the principle of series resonance i.e. at resonate condition of an ac series circuit voltage across the capacitor is equal to the applied voltage times of Q of the circuit.
- If the voltage applied across the circuit is kept-constant then voltmeter connected across the capacitor can be

Circuit Diagram

- Frequency range from 50 kHz to 50 MHz is used as a power supply to the circuit.
- The output of the oscillator is shorted by a low-value resistance, Rsh usually of the order of 0.02 ohm.
- Introduces almost no resistance into the oscillatory circuit and represents a voltage source with a very small or of almost negligible internal resistance.



Q-Meter

- The voltage across the low-value shunt resistance Rsh, V is measured by a thermo-couple meter and the voltage across the capacitor, Vc is measured by an electronic voltmeter.
- Unknown coil is connected to the test terminals of the instrument, and the circuit is tuned to resonance either by varying the frequency of the oscillator or by varying the resonating capacitor C.
- Readings of voltages across capacitor C and shunt resistance Rsh are obtained and Q-factor of the coil is determined as follows :

By definition Q-factor of the coil,

$$\mathbf{Q = XL / R}$$

$$\mathbf{XL = XC \text{ Or } IXL = IXC = VC}$$

$$\mathbf{V = IR}$$

Q-factor

- This Q-factor is called the circuit Q because this measurement includes the losses of the resonating capacitor, voltmeter and the shunt resistor Rsh.
- The actual Q-factor of the coil will be somewhat greater than the calculated Q-factor.
- This difference is usually very small and maybe neglected, except when the resistance of the coil under test is relatively small in comparison to the shunt resistance Rsh.
- The inductance of the coil can also be computed from the known values of frequency f and resonating capacitor C.