Model paper

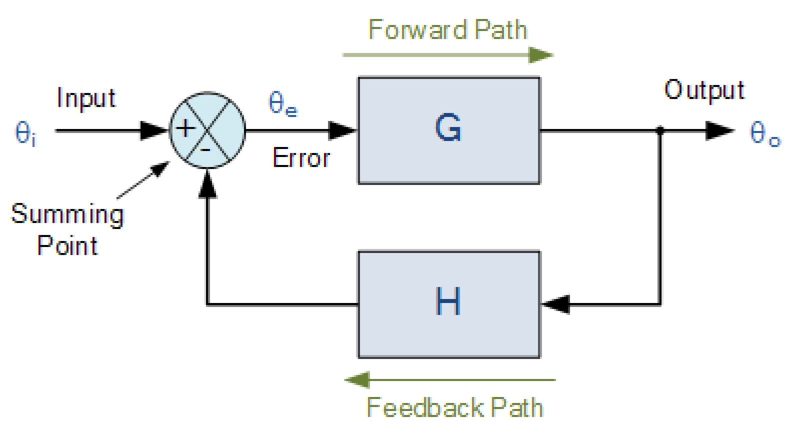
Sub- Electronic Measurement & Instrumentation

EL-203

Q.1 Explain closed loop system? Differentiate between close loop and open loop?

The **Transfer Function** of any electrical or electronic control system is the mathematical relationship between the systems input and its output, and hence describes the behaviour of the system. Note also that the ratio of the output of a particular device to its input represents its gain. Then we can correctly say that the output is always the transfer function of the system times the input. Consider the closed-loop system below.

Typical Closed-loop System Representation



Where: block G represents the open-loop gains of the controller or system and is the forward path, and block H represents the gain of the sensor, transducer or measurement system in the feedback path.

Feature	**Open Loop Control System**	**Closed Loop Control System**
Effect of Output on Input	No effect on input	The input signal affects the controller output into the system
Stability	Very Stable	The response changes as the input signal changes.
Response to external disturbances	No reaction to disturbances. The Open Loop control works on fixed output	The output of the controller adjusts itself in response to the input signal
Ease of	The controller is easy to	Controller is difficult to construct

Construction	construct	as it is complex
Cost	Cheap	Expensive
Bandwidth	Small Bandwidth	Large Bandwidth
Maintenance	Low Maintenance	More Maintenance is required.
Feedback	There is no Feedback	Feedback is always present.

Q.2 Explain series and shunt multiplier?

Ans. An **ammeter**, which is used for measuring current, offers a low level resistance (ideally 0) & must be connected in series with the circuit.

A **voltmeter**, which is used for measuring p.d., offers a high level of resistance (ideally I has infinite) & must be connected in parallel with the part of the circuit whose p.d. is required. There is no difference between the basic instrument used to measure current and voltage because both make of use a milliamp meter as their basic part. This is a sensitive instrument which gives f.s.d. for currents of just a few milli amperes. When an ammeter is needed to measure currents of having large magnitudes, a proportion of the current is diverted through a low-value resistance connected in parallel with the meter. Such a diverting type of resistor is referred to as **shunt**.

From Figure 10.4(a), $V_{PQ} = V_{RS}$. Hence $I_a r_a = I_S R_S$

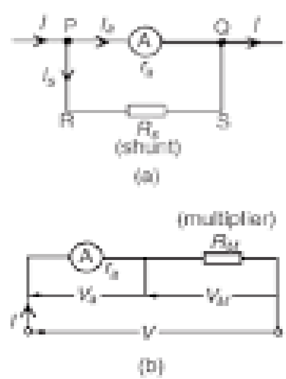


Figure 10.4

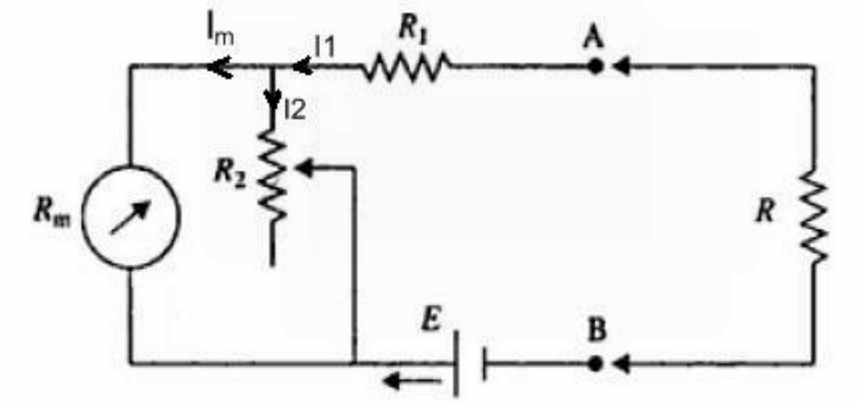
Thus the value of the shunt, $R_s = \frac{I_a r_a}{I_s}$ ohms

The milliammeter is converted into a voltmeter by connecting a high value resistance (called a **multiplier**)

Q.3 Explain series ohm-meter?

Ans. Series type ohmmeter circuit diagram:

Below circuit shows a series type ohmmeter.



Basic series type ohmmeter.

Basic series type ohmmeter

In the figure,

- Rm is the internal resistance of d'Arsonval movement
- E denotes an emf of internal battery
- R1 is the current limiting resistor
- R2 is a zero adjusting resistor

Series type ohmmeter working:

In figure, if you can see that a basic d'Arsonval movement Rm is connected in parallel with a shunting resistor R2. This parallel circuit is connected in series with a battery of emf E and resistance R1. This series circuit is connected to the terminals A and B of resistor Rx. Here Rx is an unknown resistor which we are going to calculate in next steps :).

We know that when any conductor has zero resistance, the current flow will be maximum through that conductor. Similarly, when the unknown resistance Rx is zero (that means there will be no resistor in the circuit, terminals A and B shorted) maximum current will flow through the meter. For this condition, adjust the resistor R2 so that the basic movement meter indicates full-scale current *Ifs*. The full-scale current position of the pointer is marked "0" on the scale.

On the other hand, we know that when resistance of a conductor is infinity (that means the two ends of conductor kept open), there will be no flow of current. In this case when Rx is removed from the circuit i.e. Rx = ∞ (that means when terminal A and B are kept open), the current in the meter will be zero and the basic movement indicates zero current which is the marked "∞".

In this way our ohmmeter will show infinite resistance at the zero current position and zero resistance at a full scale current position. Here zero resistance indicates that the current in the meter is the maximum and hence the pointer goes to the top mark.

When Rx is inserted at terminal A, B the current through the meter will be less and therefore the pointer will drop lower on the scale. Therefore the meter has "0" at the extreme right and "∞" at the extreme left position.

Now as we have the range for 0 and infinity resistance on our scale, we can mark intermediate scale by different known values of the resistance Rx to the ohmmeter.

When the pointer of a meter shows the resistance point exactly in the middle of 0 and infinity, this value of the resistance across terminals A and B is defined as the half scale position resistance Rh.