**1.** Two currents from different sources flow in opposite directions through a resistor. is measured as on a analog instrument witha an acuracy of of full scale. , determined as , is measured on a digital instrument with a accuracy. Calculate the maximum and minimum levels of the current in .

Assuming the direction of in the positive sense;

and,

thus;

and

**2.** Successive measurements of the temperature of a liquid over a period of time produed the following data:

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Determine:

(a) the average temperature;

(b) the mean deviation from average;

(c) standard deviation and;

(d) the probable measurement error.

**3.** A voltmeter is used to measure a known voltage of . Forty percent of the readings are within of the true value. Estimate the standard deviation for the meter. What is the probability of an error of ?

Thus;

**4.** A dc ammeter consists of Ayrton shunt in parallel with a PMMC instrument that has a coil resistance and FSD.The Ayrton shunt is made up of four series-connected resistors. Calculate the ammeter range at each setting of the shunt.

Then at ;

at ;

at ;

and at ;

**5.** A PMMC instrument with a coil resistance and an FSD of is to be used with a half-wave rectifier circuit as an ac voltmeter. Silicon diodes are used, and the minimum diode forward current is to be when the instrument indicates FSD. Calculate the shunt and multiplier resistance values required to give FSD.

At FSD;

So that

And

So

In case the question implied FSD as the rms value to be indicated; instead of what the deflection originally indicates, viz. the average value, then;

**6.** A series ohmmeter that has a standard internal resistance of uses a meter with FSD and . The meter shunt resisitance is , and the battery voltage is . Determine the resistance measured at , , ,, and of full-scale deflection.

And since

So at ;

So for the inequalities to be satisfied,

at ;

at ;

at ;

And at ;

This is not valid, and thus must be

**7.** An ammeter is connected in series with an unknown resistance () and a dc-supply. A voltmeter is connected directly across the supply. The ammeter resistance is , and the voltmeter sensitivity is . Determine , if the ammeter indicates and the voltmeter reading is .

**8.** A voltmeter is connected directly in parallel with an unknown resistance (), and an ammeter is directly in series with a dc supply connected to the resistance and voltmeter. The ammeter is on a range and its resistance is . The voltmeter, which has a sensitivity of , is on its range. Determine:

(a) the nominal resistance of and

(b) the maximum and minimum resistance of if the voltmeter and ammeter accuracies are .

[The indicated quantities are and .]

(a)

so

(b)

also

**9.** All four resistors in a Wheatstone bridge are , the galvanometer has a resistance and sensitivity, and the supply is . Determine the minimum change that can be detected in the measured resistance.

**10.** A special high-pressure U-tube manometer is constructed to measure pressure differential in air at and . When an oil having a specific gravity of is used as the fluid, calculate the differential pressure in pounds per square inch absolute that would be indicated by a reading.

**11.** A well-type manometer has the measurement leg inclined at from the horizontal. The diameter of the measurement column is and the diameter of the well is . An oil having a specific gravity of is used as the fluid. A differential pressure in air at and is made which produces a displacement in the measurement column of from the zero level. What is the differential pressure in pascals?

**12.** A special U-tube manometer is used to make a differential pressure measurement in air at and . The manometer fluid has a specific gravity of . The differential column height is . Calculate the pressure differential in pascals and its uncertainty.

**13.** A well-type manometer uses mercury for measuring a differential pressure in water at . The measuring column has a diameter of and the well diameter is . Calculate the differential pressure for a column height reading of from the zero level.

**14.** A Bridgman gage is to be employed for measurement of a pressure of using a Manganin element which has a resistance of at . Calculate the resistance of the gage under the high-pressure condition.

**15.** A measurement is made of air pressure in a tank. The gage indicates while the local barometer reading is . What is the absolute pressure in the tank?

**16.** Determine the following conversion factors: