

- Q.2 b. Two capacitors $150 \pm 2.4\mu\text{F}$ and $120 \pm 1.5\mu\text{F}$ are connected in parallel. Determine the limiting error of the resultant capacitance in μF and in percentage.**

Answer:

We have $u = 150 \pm 2.4\mu\text{F}$ and $v = 120 \pm 1.5\mu\text{F}$.

When the two capacitors are connected in parallel, the resultant capacitance is:

$$y = u + v \\ = (150 \pm 2.4) + (120 \pm 1.5) = (270 \pm 3.9) \mu\text{F}$$

Therefore, the limiting error is $\pm 3.9 \mu\text{F}$ (Ans)

Relative limiting error is

$$\frac{\delta y}{y} = \pm \frac{3.9}{270} = \pm 0.0144 \text{ or } \pm 1.44\%$$

- Q.3 b. A dielectric sheet of thickness 1mm is tested at 50Hz between two electrodes of 10 cm diameter. The Schering bridge employed has a standard compressed air capacitor C_3 of 100 pF; a non-inductive resistor R_4 of 350 Ω in parallel with a variable capacitor C_4 and a non-inductive variable resistor R_2 . At balance $C_4 = 0.4\mu\text{F}$, $R_2 = 250\Omega$. Calculate the power factor and the permittivity of the sheet.**

Answer:

$R_2 = 250 \Omega$, $C_3 = 100 \text{ pF} = 100 \times 10^{-12} \text{ F}$; $R_4 = 350\Omega$; $C_4 = 0.4 \times 10^{-6} \text{ F}$

Power factor of the specimen, $\sin\delta = \tan\delta = \omega C_4 R_4 = 2\pi \times 50 \times 0.4 \times 10^{-6} \times 350 = 0.04398$

ANS

Unknown Capacitance, $C_s = (R_4 / R_2) C_3 = (350 / 250) \times 100 \times 10^{-12} \text{ F} = 140\mu\text{F}$

Permittivity of the sheet = $C_s \times d / \text{absolute permittivity} \times A$

$$140 \times 10^{-12} \times 0.001 / 8.854 \times 10^{-12} \times \pi / 4 (0.1)^2 = 2 \text{ ANS.}$$

- Q.4 b. Write short notes on solid state voltmeter.**

Answer:

Resonating frequency, $f = 450 \text{ KHz} = 450 \times 10^3 \text{ Hz}$

Resonating capacitance, $c = 250 \text{ pF} = 250 \times 10^{-12} \text{ F}$

Resistance, $R_{sh} = 0.75\Omega$

$Q = 105$

Under resonant condition

Inductance of coil, $L = 1 / (2\pi f)^2 c$

$$= 1 / (2\pi \times 450 \times 10^3)^2 \times 250 \times 10^{-12}$$

$$= 500\mu\text{H}$$

$$\begin{aligned} \text{Resistance of the coil, } R &= \omega L / Q - R_{sh} = 2\pi \times 450 \times 10^3 \times 500 \times 10^{-6} / 105 - 0.75 \\ &= 12.76 \Omega \text{ ANS} \end{aligned}$$

Text Books

- 1. A Course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & Co , New Delhi, 18th Edition 2007**
- 2. Electronic Instrumentation, H.S. Kalsi, Tata Mc Graw Hill, II Edition 2004**